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36 Years

Roger Stevens Warehouse
1966 Roger Stevens Drive

Transportation Impact Assessment

Roger Stevens Warehouse

1966 Rogers Stevens Drive

Transportation Impact Assessment

Prepared By:

NOVATECH
Suite 200, 240 Michael Cowpland Drive
Ottawa, Ontario
K2M 1P6

July 12, 2019

Novatech File: 119018
Ref: 2019-115

NOVATECH
Engineers, Planners & Landscape Architects

July 12, 2019

City of Ottawa
Planning and Growth Management Department
110 Laurier Ave. W., 4th Floor,
Ottawa, Ontario K1P 1J1

Attention: **Mr. Jeff Ostafichuk**
Planner II, File Lead

Dear Mr. Ostafichuk:

Reference: **Roger Stevens Warehouse, 1966 Roger Stevens Drive**
Transportation Impact Assessment Report
Novatech File No. P18142

We are pleased to submit the following Transportation Impact Assessment report in support of an Official Plan Amendment and Zoning By-law Amendment Application for the above address. The structure and format of this report is in accordance with the MTO Traffic Impact Study Guidelines (2008) and the City of Ottawa Transportation Impact Assessment Guidelines (June 2017).

If you have any questions or comments regarding this report, please feel free to contact Jennifer Luong, or the undersigned.

Yours truly,

NOVATECH

Rochelle Fortier, B.Eng.
E.I.T. | Transportation/Traffic

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TIA Plan Reports

On 14 June 2017, the Council of the City of Ottawa adopted new Transportation Impact Assessment (TIA) Guidelines. In adopting the guidelines, Council established a requirement for those preparing and delivering transportation impact assessments and reports to sign a letter of certification.

Individuals submitting TIA reports will be responsible for all aspects of development-related transportation assessment and reporting, and undertaking such work, in accordance and compliance with the City of Ottawa's Official Plan, the Transportation Master Plan and the Transportation Impact Assessment (2017) Guidelines.

By submitting the attached TIA report (and any associated documents) and signing this document, the individual acknowledges that s/he meets the four criteria listed below.

CERTIFICATION

1. I have reviewed and have a sound understanding of the objectives, needs and requirements of the City of Ottawa's Official Plan, Transportation Master Plan and the Transportation Impact Assessment (2017) Guidelines;
2. I have a sound knowledge of industry standard practice with respect to the preparation of transportation impact assessment reports, including multi modal level of service review;
3. I have substantial experience (more than 5 years) in undertaking and delivering transportation impact studies (analysis, reporting and geometric design) with strong background knowledge in transportation planning, engineering or traffic operations; and
4. I am either a licensed[1] or registered[2] professional in good standing, whose field of expertise [check √ appropriate field(s)] is either transportation engineering ☑ or transportation planning ☐.

[1,2] License of registration body that oversees the profession is required to have a code of conduct and ethics guidelines that will ensure appropriate conduct and representation for transportation planning and/or transportation engineering works.

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Dated at Ottawa (City) this 12 day of July, 2019.

Name: Jennifer Luong, P.Eng. (Please Print)

Professional Title: Senior Project Manager, Transportation/Traffic.

Jennifer Luong

Signature of individual certifier that s/he meets the above four criteria

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EXECUTIVE SUMMARY

This Transportation Impact Assessment (TIA) report has been prepared in support of an Official Plan Amendment and Zoning By-law Amendment application for 1966 Roger Stevens Drive.

The subject lands are currently registered as a plan of subdivision (AM-1191), known as the Jordel Acres Industrial Subdivision.

The proposed development consists of a new warehouse, with a footprint of approximately 700,000 square feet. The proposed development will provide approximately 1,820 vehicular parking spaces, approximately 240 trailer drop spaces, and will be served by two all-movement employee accesses on Roger Stevens Drive, and one all-movement truck access on Roger Stevens Drive. The proposed development is anticipated to be completed in one phase, with full occupancy by the year 2021.

A typical warehouse facility of this size and nature could operate with two shifts with approximately 1,100 employees on site during each shift during the off-peak season and approximately 1,700 employees on site during each shift during the peak season. The peak season for a typical warehouse of this size and nature generally occurs from October to January, and the off-peak season from February to September. For the purpose of this report, the total traffic analysis will include the site traffic for the peak season.

The trip generation rates for the proposed development were determined using first principles. The owner provided typical hourly volumes for both employee and delivery truck movements to and from a warehouse of this size and nature. It was assumed that the peak hour for the site generated traffic occurs between 6:30am to 7:30am and 5:30pm to 6:30pm. The peak hours of site traffic are generally expected to coincide with the weekday AM and PM peak hours of the adjacent road traffic.

A 90% auto driver share was applied to all employee trips to account for 10% ride-sharing and no daily transit service. The proposed warehouse could generate approximately 1,950 vehicle trips (985 in, 965 out) during the AM peak hour, and 2,000 vehicle trips (975 in, 1,025 out) during the PM peak hour.

The main conclusions and recommendations of this TIA can be summarized as follows:

<u>Development Design & Parking</u>

- Pedestrian facilities will be provided between the parking lot and the main building entrances and will be reviewed at the Site Plan stage.
- A 2.5m paved shoulder is proposed on both sides of Roger Stevens Drive for the extents of the roadway modifications.
- A review of the Transportation Demand Management (TDM) – *Supportive Development Design and Infrastructure Checklist* has been conducted.
- Approximately 1,820 parking spaces are proposed in order to serve the employees and visitors at the warehouse, which will meet the minimum requirements of the Zoning By-Law. Bicycle parking is proposed and will be reviewed at the Site Plan stage.
- The ZBL identifies a requirement of 3 loading spaces for the proposed development. A total of 63 loading bays are proposed, and approximately 240 trailer drop spaces are proposed.
- Accessible parking spaces will be reviewed at the Site Plan stage and will be provided in accordance with the requirements.

Boundary Street Multi-Modal Level of Service (MMLOS)

- Roger Stevens Drive currently meets the target Truck Level of Service (TkLOS) and Vehicular Level of Service (Auto LOS), however does not meet the target Pedestrian Level of Service (PLOS) or Bicycle Level of Service (BLOS).
- Currently, along the frontage of the subject site there are gravel shoulders provided. Paved shoulders along the frontage of the subject site do not achieve the PLOS or BLOS targets, however given the rural context of the site they are recommended.

Access Design

- Three site accesses are proposed along Roger Stevens Drive: one westerly truck access, and two eastern accesses to employee parking.
- The truck access is located approximately 290m east of the Roger Stevens Drive/Third Line Road intersection, measured from centerline to centerline. The east employee access is located approximately 390m west of the Roger Stevens Drive/Highway 416 Southbound Off-Ramp, measured stop bar to stop bar. The west employee access is located approximately 160m west of the east employee access, measured centerline to centerline, and approximately 140m east of the truck access, measured centerline to centerline.
- The east employee access will be signalized and 15.5m in width and will include four 3.5m lanes with the ingress and egress separated by a 1.5m median. The west employee access will be 8.5m in width and will include two 4.25m lanes. The truck access will be 8.5m in width and will include two 4.25m lanes.
- The site accesses meet all requirements of the Private Approach By-Law.
- On an arterial roadway, the minimum clear throat length for a driveway to a large light industrial development is 60m. Clear throat lengths will be reviewed at the Site Plan stage.

Transportation Demand Management

- The TDM measures that could be considered for this development are:
  - Preferential carpool parking.
  - Ridesharing: potential carpoolers in Ottawa are served by www.OttawaRideMatch.com, an online service to help people find carpool partners. Employers can arrange for a dedicated portal where their employees can search for potential carpool partners only among their colleagues, if they desire. Some very large employers may establish internal ride matching services, to maximize employee uptake and corporate control. Ride matching service providers typically include a waiver to relieve employers of liability when their employees start carpooling through a ride matching service. Ridesharing with co-workers also tends to eliminate security concerns.
  - Vanpool service: Vanpools operate in the Toronto and Vancouver metropolitan areas, where vans that carry up to about ten occupants are driven by one of the vanpool members. Vanpools tend to operate on a cost-recovery basis and are most practical for long-distance commutes where transit is not an option. Current legislation in Ontario does not permit third-party (i.e. private or non-profit) vanpool services but does permit employers to operate internal vanpools.
  - Carshare vehicles & memberships: VRTUCAR and Zipcar both operate carsharing services in Ottawa, for use by the general public or by businesses as an alternative to corporate fleets. Carsharing services offer 24-hour access, self-serve reservation

systems, itemized monthly billings, and outsourcing of all financing, insurance, maintenance and administrative responsibilities.

Transit

- Currently, the site is not serviced by a regular bus route. As such, no transit modal share was applied to the trips generated by the development.

Network Concept

- Deficiencies are noted at the Highway 416 ramps with the addition of site traffic. However, the analysis is based on existing conditions, with one lane of travel. Additional lanes are recommended at the 416 Southbound Off-Ramp and the 416 Northbound On-Ramp to accommodate site traffic.

Intersection MMLOS

- Roger Stevens Drive/East Employee Access
    - The intersection is anticipated to meet the target Auto LOS and TkLOS but will not meet the targets for PLOS or BLOS.
    - Based on the Pedestrian Exposure to Traffic (PETSI) the intersection is operating with a PLOS E. A reduction in the crossing distance on all approaches would have the greatest improvement on the PETSI score and the Pedestrian Delay. However, given the projected traffic volumes, the westbound dual left turns and northbound dual right turns are required, and the intersection configuration is considered appropriate.
    - The intersection is anticipated to operate with a BLOS F, based on both left and right turn characteristics. Given the high turning movement traffic volumes, the proposed dual westbound left turn lanes and dual northbound right turn lanes are required. Paved shoulders are proposed along Roger Stevens Drive and given the rural context of the site, they are an appropriate cycling facility.
- Roger Stevens Drive/Highway 416 Southbound Ramps
    - The Roger Stevens Drive/Highway 416 Southbound Ramps intersection is anticipated to meet the target Auto LOS but will not meet the target PLOS and TkLOS.
    - Based on the PETSI, the intersection is operating with a PLOS F. A reduction in the crossing distance on the north approach would have the greatest improvement on the PETSI score and the Pedestrian Delay. However, based on projected traffic volumes, the proposed lane configuration is appropriate. Per MTO cross section design, a 10m median is required separating the on- and off-ramps.
    - BLOS has not been evaluated for the intersection as bikes are prohibited on 400 series highways. The ramp is under MTO jurisdiction and BLOS is not a consideration.
    - The intersection is anticipated to operate with a TkLOS E. The westbound right turn movement has one receiving lane on departure from this intersection. However, per MTO design for a single lane ramp, the on-ramp currently has a 4.75m wide lane with a right shoulder width of 2.5m and a left shoulder width of 1.0m. No changes are proposed to the configuration of the on-ramp as it currently accommodates trucks.
- Roger Stevens Drive/Highway 416 Northbound Ramps
    - The intersection is anticipated to meet the target Auto LOS and TkLOS but will not meet the target PLOS.

- Based on the PETSI, the intersection is operating with a PLOS F. A reduction in the crossing distance would have the greatest improvement on the PETSI score and the Pedestrian Delay. No north-south crossing is proposed at this intersection. As such, only the east-west crossing has been evaluated in terms of PLOS. Per MTO cross section design, a 10m median is required separating the on- and off-ramps and the proposed lane configuration is required for capacity therefore no reduction is recommended.
- BLOS has not been evaluated for the intersection as bikes are prohibited on 400 series highways. The ramp is under MTO jurisdiction and BLOS is not a consideration.

Existing Intersection Operations

- Under existing traffic conditions, all study area intersections are operating with a LOS C or better.
- Signals are not warranted at the Roger Stevens Drive/Highway 416 Northbound Ramps or the Roger Stevens Drive/Highway 416 Southbound ramps under existing traffic conditions.
- Currently, a westbound slip around lane is provided at the Roger Stevens Drive/Highway 416 Northbound Ramps, and an eastbound slip around lane is provided at the Roger Stevens Drive/Highway 416 Southbound Ramps. A review of the MTO Left Turn Lane Warrants suggests that a westbound left turn lane with a storage of 25m is warranted at the northbound on-ramp under existing traffic conditions. No eastbound left turn lane is warranted at the southbound on-ramp.

Background Intersection Operations

- Under background traffic conditions, all study area intersections are anticipated to operate with a LOS C or better.
- Under projected background traffic conditions in 2031, traffic signals are not warranted at the Roger Stevens Drive/Highway 416 Northbound Ramps or the Roger Stevens Drive/Highway 416 Southbound ramps.

2021 Total Intersection Operations

- With the addition of site traffic, traffic signals will be warranted at the intersections of Roger Stevens Drive/Highway 416 Northbound ramps, Roger Stevens Drive/Highway 416 Southbound ramps, and Roger Stevens Drive/East Employee Access in 2021. Traffic signals are 92% warranted at the Roger Stevens Drive/West Employee Access in the 2021 opening year.
- For the purposes of the analysis presented in this study, it has been assumed that traffic signals will be provided at the Roger Stevens Drive/Highway 416 Northbound ramps, Roger Stevens Drive/Highway 416 Southbound ramps, and Roger Stevens Drive/East Employee Access at buildout (2021). The Synchro and MTO warrant analysis completed as part of this study indicate that under these conditions, traffic signals are needed to ensure an adequate LOS during peak hours and will also be warranted based on peak hour traffic volumes. Actuated-coordinated signal timings are assumed.
- Under 2021 total traffic conditions, the Roger Stevens Drive/Highway 416 Southbound intersection is anticipated to operate with a v/c ratio of 0.91 and a LOS E during the AM peak hour. All other intersections are anticipated to operate with a LOS D or better.
- Maximum queue length for the eastbound through movement at the Highway 416 Southbound Ramps is anticipated to be approximately 290m during the AM peak. This queue length is not anticipated to extend past the Roger Stevens Drive/East Employee

Access intersection. Synchro identifies that the eastbound queue may take more than one cycle to clear the intersection during the peak hour. Due to space constraints at the Highway 416 overpass bridge to the east, a second eastbound through lane at the Roger Stevens Drive/Highway 416 Southbound Ramps could not be provided without widening the bridge.

- The eastbound queue at the northbound ramps is metered due to capacity constraints at the upstream intersection (southbound ramps). No further improvements are recommended due to the space constraints at the Highway 416 overpass bridge.
- The southbound queue at the southbound ramps is anticipated to be approximately 80m, and the northbound queue at the northbound ramps is anticipated to be approximately 70m.
- The maximum northbound queue length at the east employee access is anticipated to be approximately 30m. The maximum northbound queue length at the west employee access is anticipated to be approximately 20m. The maximum northbound queue length at the truck access is anticipated to be insignificant.
- The westbound queue at the east employee access is anticipated to be approximately 90m. This queue length is not anticipated to extend past the Roger Stevens Drive/Highway 416 Southbound intersection.

2026 Total Intersection Operations

- Under 2026 total traffic conditions, with adjusted signal timing, all intersections are anticipated to operate with a LOS D or better.
- Maximum queue length for the eastbound through movement at the Highway 416 Southbound Ramps is anticipated to be approximately 70m in the AM peak and 110m in the PM peak. This is an improvement from the projected AM queue of 290m under 2021 total traffic conditions. The improvement is due to the longer cycle length proposed under 2026 total traffic conditions. This eastbound queue length is not anticipated to extend past the Roger Stevens Drive/East Employee Access intersection. Synchro identifies that the eastbound queue may take more than one cycle to clear the intersection during the peak hour. Due to space constraints at the Highway 416 overpass bridge to the east, a second eastbound through lane at the Roger Stevens Drive/Highway 416 Southbound Ramps could not be provided without widening the bridge.
- The eastbound queue at the northbound ramps is metered due to capacity constraints at the upstream intersection (southbound ramps). No further improvements are recommended due to the space constraints at the Highway 416 overpass bridge.
- The southbound queue at the southbound ramps is anticipated to be approximately 90m, and the northbound queue at the northbound ramps is anticipated to be approximately 65m.
- The maximum northbound queue length at the east employee access is anticipated to be approximately 30m. The maximum northbound queue length at the west employee access is anticipated to be approximately 25m. The maximum northbound queue length at the truck access is anticipated to be insignificant.
- The westbound queue at the east employee access is anticipated to be approximately 85m. This queue length is not anticipated to extend past the Roger Stevens Drive/Highway 416 Southbound intersection.

2031 Total Intersection Operations

- Under 2031 total traffic conditions, all intersections are anticipated to operate with a LOS D or better.
- Maximum queue length for the eastbound through movement at the Highway 416 Southbound Ramps is anticipated to be approximately 290m in the AM peak and 280m in the PM peak hour. This queue length is not anticipated to extend past the Roger Stevens

Drive/East Employee Access intersection. Synchro identifies that the eastbound queue may take more than one cycle to clear the intersection during the peak hour. Due to space constraints at the Highway 416 overpass bridge to the east, a second eastbound through lane at the Roger Stevens Drive/Highway 416 Southbound Ramps could not be provided without widening the bridge.

- The eastbound queue at the northbound ramps is metered due to capacity constraints at the upstream intersection (southbound ramps). No further improvements are recommended due to the space constraints at the Highway 416 overpass bridge.
- The southbound queue at the southbound ramps is anticipated to be approximately 95m, and the northbound queue at the northbound ramps is anticipated to be approximately 80m.
- The maximum northbound queue length at the east employee access is anticipated to be approximately 30m. The maximum northbound queue length at the west employee access is anticipated to be approximately 25m. The maximum northbound queue length at the truck access is anticipated to be insignificant.
- The westbound queue at the east employee access is anticipated to be approximately 85m. This queue length is not anticipated to extend past the Roger Stevens Drive/Highway 416 Southbound intersection.

Functional Design

- Left and right turn deceleration lane requirements have been calculated using a design speed of 60km/h for Roger Stevens Drive. This is less than the posted speed of 80km/h.
- It is anticipated that the proposed modifications including signals, medians, and turn lanes will create additional side friction for motorists and reduce the operating speed along Roger Stevens Drive.
- A road modification approval (RMA) package for the proposed modifications to Roger Stevens Drive will be submitted under separate cover. A Provincial Class Environmental Assessment (EA) is required for the roadway modifications located within MTO's jurisdiction.

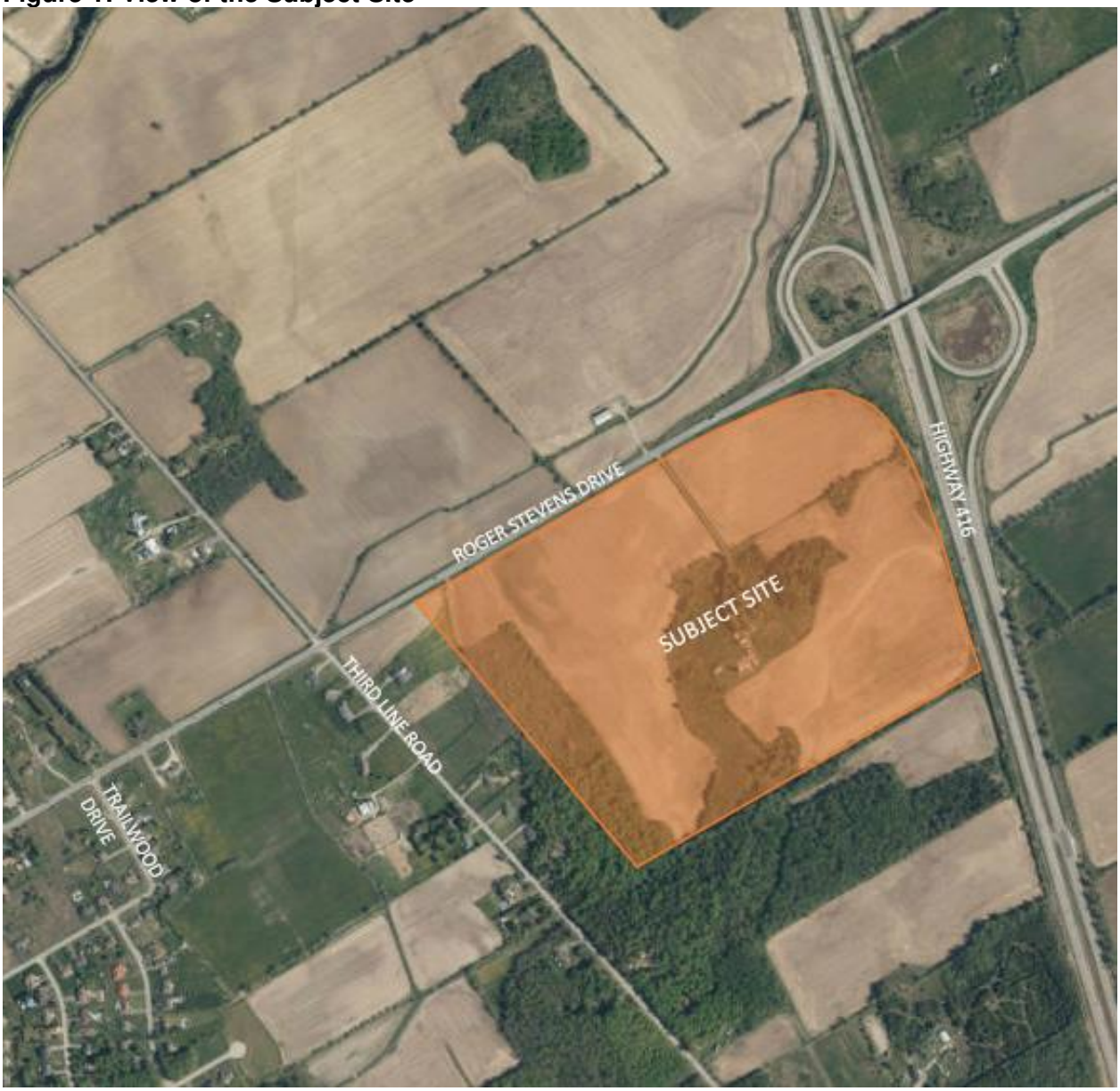
1.0 INTRODUCTION

This Transportation Impact Assessment (TIA) report has been prepared in support of an Official Plan Amendment and Zoning By-law Amendment application for 1966 Roger Stevens Drive. The subject site is currently vacant. The subject site is surrounded by the following:

- Roger Stevens Drive and agricultural property to the north;
- Highway 416 and agricultural property to the east;
- Residential properties and Third Line Road to the west; and
- Vacant land to the south.

A view of the subject site is provided in **Figure 1**.

Figure 1: View of the Subject Site



2.0 PROPOSED DEVELOPMENT

The subject lands are currently registered as a plan of subdivision (AM-1191), known as the Jordel Acres Industrial Subdivision.

The eastern portion of the subject site is designated 'Highway Commercial' whereas the remainder (west) is designated Industrial on Schedule 'A' of the North Gower Secondary Plan. It is currently zoned Rural Commercial 'RC', Rural General Commercial 'RG' and Rural Commercial exception 'RC[55r]'. A Zoning By-law amendment is required to remove the exception from the RC zone in order to permit a warehouse use.

The proposed development consists of a new warehouse, with a footprint of approximately 700,000 square feet. The proposed development will provide approximately 1,820 vehicular parking spaces, approximately 240 trailer drop spaces, and will be served by two all-movement employee accesses on Roger Stevens Drive, and one all-movement truck access on Roger Stevens Drive. The proposed development is anticipated to be completed in one phase, with full occupancy by the year 2021.

A copy of the site plan is included in **Appendix A**.

3.0 SCREENING

The City's 2017 TIA Guidelines identifies three triggers for completing a TIA report, including trip generation, location, and safety. The criteria for each trigger are outlined in the City's TIA Screening Form.

The trigger results are as follows:

- Trip Generation Trigger – the proposed development is anticipated to generate more than 60 person trips during the peak hour; further assessment is required based on this trigger.

- Location Trigger – the development proposes a new driveway to a boundary street that is designated as part of the City's Spine Bicycle Network; further assessment is required based on this trigger.

- Safety Trigger – the posted speed limit on a boundary road is 80km/hr; further assessment is required based on this trigger.

Based on the foregoing, the proposed development satisfies all three triggers for completing a TIA. A copy of the TIA screening form is included in **Appendix B**.

4.0 SCOPING

4.1 Existing Conditions

4.1.1 Roadways

Highway 416 falls under the jurisdiction of the Ministry of Transportation of Ontario (MTO). All other study area roadways fall under the jurisdiction of the City of Ottawa.

Highway 416 is a four-lane rural divided freeway. It has a north-south alignment extending from Highway 417 to the north to Highway 401 in the south. The posted speed is 100km/h.

Roger Stevens Drive (Ottawa Regional Road 6) is a two-lane undivided major arterial roadway with a rural cross section. It has an east-west alignment with a posted speed limit of 80km/h in the vicinity of the subject site. A speed survey, dated May 2018, obtained from the City of Ottawa indicates the 85th percentile motor vehicle operating speed along Roger Stevens Drive between Third Line Road and Highway 416 is approximately 100km/h. Roger Stevens Drive is classified as a truck route, allowing full loads. The existing ROW width is approximately 28m across the City's portion of the Roger Stevens Drive frontage.

Third Line Road is a two-lane undivided collector roadway with a rural cross section. Third Line Road is discontinuous: the northern stretch runs from Brophy Drive in the north, and terminates south of Carsonby Road, while the southern stretch picks up again at Phelan Road and terminates south of Dilworth Road. The regulatory speed limit along Third Line Road is 80km/h.

Trailwood Drive is a two-lane undivided local roadway with a rural cross section. The regulatory speed limit along Trailwood Drive is 50km/h.

4.1.2 Intersections

Roger Stevens Drive/Highway 416

- Partial cloverleaf interchange
- West ramps:
  - Stop-controlled T intersection, with free flow on Roger Stevens Drive
  - Southbound: one shared left/right turn lane
  - Eastbound: one through lane, one slip around lane
  - Westbound: one through lane and one right turn lane
- East ramps:
  - Stop-controlled T intersection, with free flow on Roger Stevens Drive
  - Northbound: one shared left/right turn lane
  - Eastbound: one through lane, one right turn lane
  - Westbound: one through lane, one slip around lane

Roger Stevens Drive/Third Line Road

- Stop controlled intersection, with free flow on Roger Stevens Drive
- One travel lane in all directions

Roger Stevens Drive/Trailwood Drive

- Stop controlled T intersection, with free flow on Roger Stevens Drive
- One travel lane in all directions

4.1.3 Driveways

In accordance with the City's 2017 TIA guidelines, a review of adjacent driveways along the boundary roads (within 200m of the subject site) was conducted. There is one driveway on the north side of Rogers Stevens Drive, providing access to the agricultural property at 1969 Rogers Stevens Drive.

4.1.4 Pedestrian and Cycling Facilities

Roger Stevens Drive is classified as a Spine Cycling Route in the City of Ottawa's Cycling Plan. Currently, there are gravel shoulders on Roger Stevens Drive along the City owned portion of the frontage of the subject site, with paved shoulders along the MTO portion of the frontage of Roger Stevens Drive.

No other designated pedestrian or cycling facilities are provided in the study area.

4.1.5 Transit

The nearest bus stops to the subject site are located at the Roger Stevens Drive/Third Line Road intersection. These bus stops serve OC Transpo Route 305, which is a Shopper Route. Shopper Routes are free to ride and are a convenient way for rural residents to get into town for shopping, appointments and more. These routes offer once-a-week service from rural communities to urban shopping destinations.

Route 305 travels from the communities of Kars, North Gower, and Manotick and arrives at the Barrhaven Center and Carlingwood Shopping Centers. It operates once a week on Fridays. The bus arrives at stop #2176 (on the south side of Roger Stevens Drive) at 9:39 AM and returns to stop #2177 (on the north side of Roger Stevens Drive) at 3:32 PM.

OC Transpo Route information is included in **Appendix C**.

4.1.6 Existing Area Traffic Management Measures

Currently, there are no existing Area Traffic Management (ATM) measures within the study area.

4.1.7 Existing Traffic Volumes

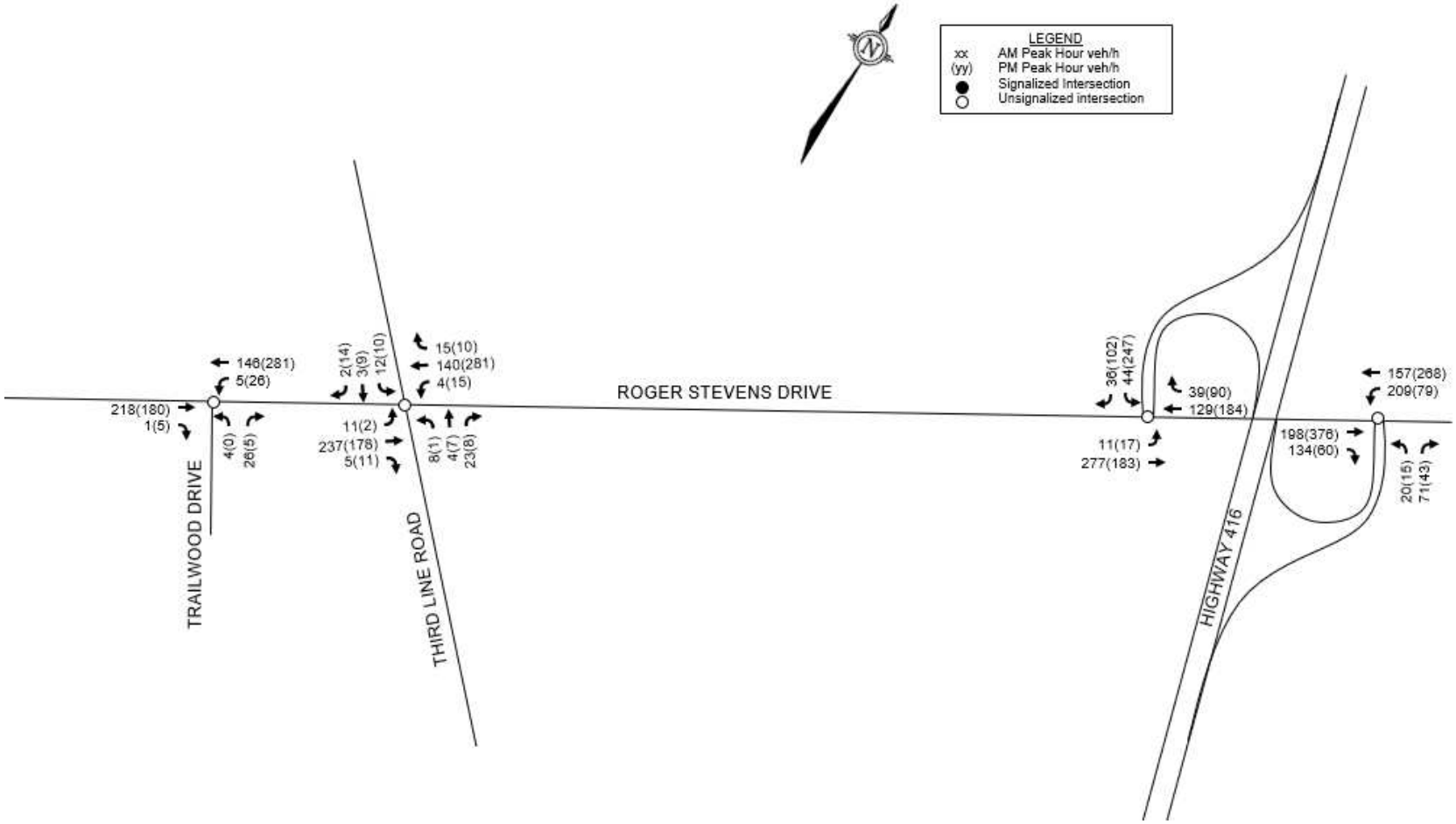
Traffic counts were completed at the study area intersections to determine the existing pedestrian, cyclist and vehicular traffic volumes.

Weekday counts were completed by Novatech at the Roger Stevens Drive/Third Line Road and Roger Stevens Drive/Trailwood Drive intersections. A weekday count was completed by the MTO, at the Roger Stevens Drive/Highway 416 Northbound and Southbound Ramps. The traffic counts were completed on the following dates:

- Roger Stevens Drive/Third Line Road — January 9, 2019 (Wednesday)
- Roger Stevens Drive/Trailwood Drive — January 9, 2019 (Wednesday)
- Roger Stevens Drive/416 Northbound Ramps — April 25, 2018 (Monday)
- Roger Stevens Drive/416 Southbound Ramps — May 25, 2018 (Friday)

Existing traffic volumes along the study area roadways are shown in **Figure 3**. Peak hour summary sheets of the above traffic counts are included in **Appendix D**.

Figure 2: Existing Traffic Volumes



4.1.8 Collision Records

Historical collision data from the last five years was obtained from the City's Public Works and Service Department for the study area. Copies of the collision summary reports are included in **Appendix E**.

The collision data has been evaluated to determine if there are any identifiable collision patterns. **Table 1** summarizes the number of collisions at each intersection from January 1, 2013 to December 31, 2017.

Table 1: Reported Collisions

Location	Number of Reported Collisions
Roger Stevens Drive/Third Line Road	3
Roger Stevens Drive between Third Line Road and Highway 416 Southbound Off-Ramp	2
Roger Stevens Drive between Highway 416 Northbound On-Ramp and Highway 416 Southbound On-Ramp	2
Highway 416 Southbound Off-Ramp between Highway 416 and Roger Stevens Drive	2
Highway 416 Northbound On-Ramp between Highway 416 and Roger Stevens Drive	2
Roger Stevens Drive/Highway 416 Northbound On-Ramp	1

Half of all collisions reported occurred under snowy or icy conditions, suggesting unfavourable environmental factors played a significant role in the collision history.

Based on the foregoing, no identifiable collision patterns exist in the study area.

4.2 Planned Conditions

The City of Ottawa's Transportation Master Plan (TMP) does not identify any roadway or transit projects along the boundary streets within its Affordable Road Network and Affordable Rapid Transit and Transit Priority Network.

Thirteen new residential lots are proposed as part of the Williams Farm Subdivision directly to the west of Trailwood Drive. Based on a review of the City's Development Application online tool, there appear to be no other developments under construction, approved, or in the approval process within the study area.

4.3 Study Area and Time Periods

The study area will include the intersections of Roger Stevens Drive/Third Line Road, Roger Stevens Drive/Trailwood Drive, Roger Stevens Drive/Highway 416 Northbound Ramps, Roger Stevens Drive/Highway 416 Southbound Ramps, and the site accesses.

The time periods chosen for analysis are the weekday AM and PM peak hours. Analysis will be performed for the operational year (2021), a five-year horizon (2026), and a ten-year horizon (2031).

4.4 Exemptions Review

This module reviews possible exemptions from the final TIA, as outlined in the TIA Guidelines. The applicable exemptions for this site are shown in **Table 2**.

Table 2: TIA Exemptions

Module	Element	Exemption Criteria	Exemption Applies
Design Review Component			
4.1 Development Design	*4.1.2* Circulation and Access	• Only required for site plans	Not Exempt
	4.1.3 New Street Networks	• Only required for plans of subdivision	Exempt
4.2 Parking	*4.2.1* Parking Supply	• Only required for site plans	Not Exempt
	4.2.2 Spillover Parking	• Only required for site plans where parking supply is 15% below unconstrained demand	Exempt
Network Impact Component			
4.5 Transportation Demand Management	*All elements*	• Not required for site plans expected to have fewer than 60 employees and/or students on location at any given time	Not Exempt
4.6 Neighbourhood Traffic Management	*4.6.1* Adjacent Neighbourhoods	• Only required when the development relies on local or collector streets for access and total volumes exceed ATM capacity thresholds	Exempt
4.8 Network Concept	*All elements*	• Only required when the proposed development generates more than 200 person-trips during the peak hour in excess of the equivalent volume permitted by the established zoning	Not Exempt

Trips generated by the established zoning have been estimated using local data. A traffic count was completed on June 25, 2019 at the Carp Road/Reis Road intersection in order to estimate site traffic at the Reis Industrial Park. Peak hour summary sheets from the traffic count have been included in **Appendix D**. This location was chosen as it is comprised of industrial uses of similar nature to the approved zoning for the Jordel Acres Industrial Subdivision. The traffic count was prorated based on the area of the properties that are currently occupied at the Reis Industrial Park (approximately 50 acres) compared to the total area of the 1966 Roger Stevens Drive

property (approximately 120 acres). It was estimated that the established zoning at the subject site would generate a two-way total of approximately 290 vehicles in the AM peak and 425 vehicles in the PM peak hour. As it is anticipated that the proposed warehouse will generate more than 200 person trips during the peak hour in excess of the equivalent volume permitted by the established zoning, the Network Concept (Module 4.8) is not exempt from the TIA analysis.

5.0 FORECASTING

5.1 Development-Generated Traffic

5.1.1 Trip Generation

A typical warehouse facility of this size and nature could operate with two shifts with approximately 1,100 employees on site during each shift during the off-peak season and approximately 1,700 employees on site during each shift during the peak season. The peak season for a typical warehouse of this size and nature generally occurs from October to January, and the off-peak season from February to September. For the purpose of this report, the total traffic analysis will include the site traffic for the peak season.

The trip generation rates for the proposed development were determined using first principles. The owner provided typical hourly volumes for both employee and delivery truck movements to and from a warehouse of this size and nature. It was assumed that the peak hour for the site generated traffic occurs between 6:30am to 7:30am and 5:30pm to 6:30pm. The peak hours of site traffic are generally expected to coincide with the weekday AM and PM peak hours of the adjacent road traffic.

A 90% auto driver share was applied to all employee trips to account for 10% ride-sharing and no daily transit service. The following table indicates an estimate of the number of employee vehicles and delivery trucks accessing the site during the peak hour of the peak season.

Table 3: Site Generated Traffic

Land Use	AM Peak			PM Peak		
	IN	OUT	TOTAL	IN	OUT	TOTAL
Employees	980	960	1,940	960	1,010	1,970
Trucks	5	5	10	15	15	30
TOTAL	**985**	**965**	**1,950**	**975**	**1,025**	**2,000**

Based on the foregoing, the proposed warehouse could generate approximately 1,950 trips (985 in, 965 out) during the AM peak hour, and 2,000 trips (975 in, 1,025 out) during the PM peak hour.

5.1.2 Trip Distribution and Assignment

Trip distribution assumptions are based on origin/destination data provided by the owner as well as population of surrounding communities, logical routing assumptions, and potential for future growth.

Employees
The trip distribution for employees is expected to be:

- 78% to/from the north (Kanata, Nepean, Barrhaven, Manotick)
- 15% to/from the south (North Grenville)
- 5% to/from the east (Kars, Osgoode)
- 2% to/from the west (North Gower)

Of the traffic arriving from/departing to the east, north, and south, two thirds have been assigned to the easterly employee access while the remaining one third has been assigned to the westerly employee access. Similarly, two thirds of traffic arriving from/departing to the west has been assigned to the westerly access, with the remainder assigned to the easterly access.

Trucks
The owner has indicated that all trucks accessing the warehouse would use Roger Stevens Drive to access Highway 416. It is anticipated that 50% of delivery trucks will travel to/from the north towards Ottawa, with the balance, 50% travelling to/from the south towards Highway 401.

Delivery trucks will access the site via the truck access along Roger Stevens Drive.

For analysis purposes, a nominal volume of 5 trucks per hour has been assigned to Roger Stevens Drive, west of the subject site, to test the sensitivity of the left-turn movements in and out of the truck access.

Site generated traffic volumes can be found in **Figure 3**.

5.2 Background Traffic

5.2.1 General Background Growth Rate

Historical traffic volume data was obtained from the MTO for the Roger Stevens Drive/Highway 416 Southbound Ramps and Roger Stevens Drive/Highway 416 Northbound Ramps. Traffic count information from 2011†, 2013, 2014, and 2018 indicate that traffic volumes have not increased significantly within the study area. Traffic count data can be found in **Appendix D**.

A review of the City of Ottawa's Long-Range TRANS model was conducted in order to determine a general background growth rate in the area. The model shows little to no growth in the study area. Screenshots from the Long-Range model can be found in **Appendix D**.

Conservatively, a nominal background traffic volume growth rate of 1% annually was applied to existing traffic volumes along Roger Stevens Drive and at the Highway 416 Ramps to obtain background traffic volumes.

† 2011 counts obtained from the MTO for the Roger Stevens/416 Northbound and Southbound ramps are high compared to 2013, 2014, and 2018 counts. Total intersection volumes at the Northbound ramps in 2011 are on average 15% higher and total intersection volumes at the Southbound ramps in 2011 are on average 22% higher than the data from 2013, 2014, and 2018. For this reason, the 2011 counts have been discounted as an anomaly for this report.

5.2.2 Other Area Development

A review of the City's Development Application online tool was conducted in order to account for traffic generated by other development within the vicinity of the subject site. Thirteen new residential lots are proposed as part of the Williams Farm Subdivision directly to west of Trailwood Drive. Traffic generated by these new residential lots is expected to be insignificant. No other developments are planned within the study area.

Background traffic volumes for the opening year (2021), the five-year horizon (2026), and the ten-year horizon (2031) can be found in **Figures 4**, **5**, and **6**.

Total traffic volumes have been calculated by adding the site generated traffic with the projected background traffic. The 2021, 2026, and 2031 total traffic volumes can be found in **Figures 7**, **8**, and **9**.

Figure 3: Site Generated Traffic Volumes

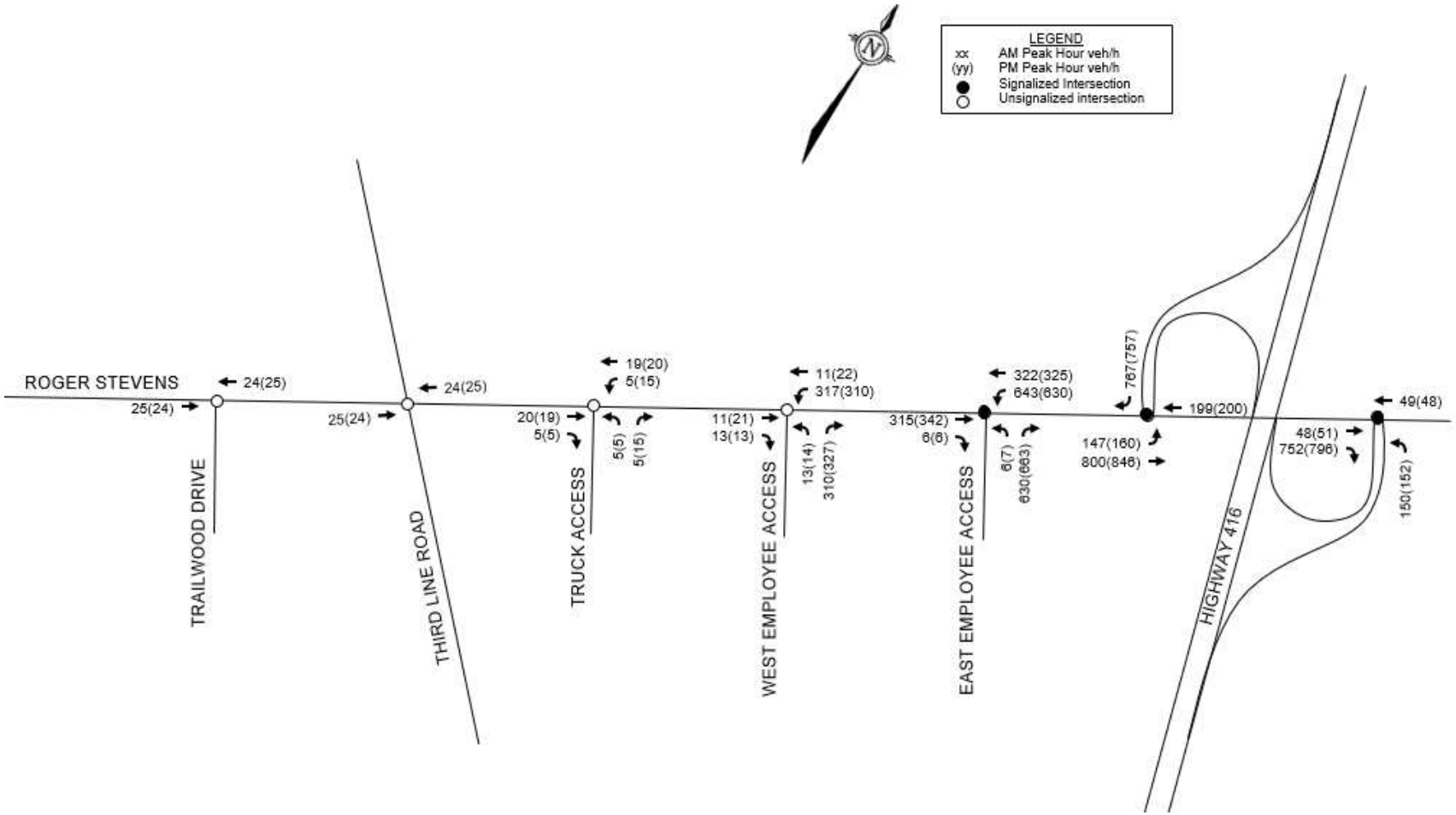


Figure 4: 2021 Background Traffic Volumes

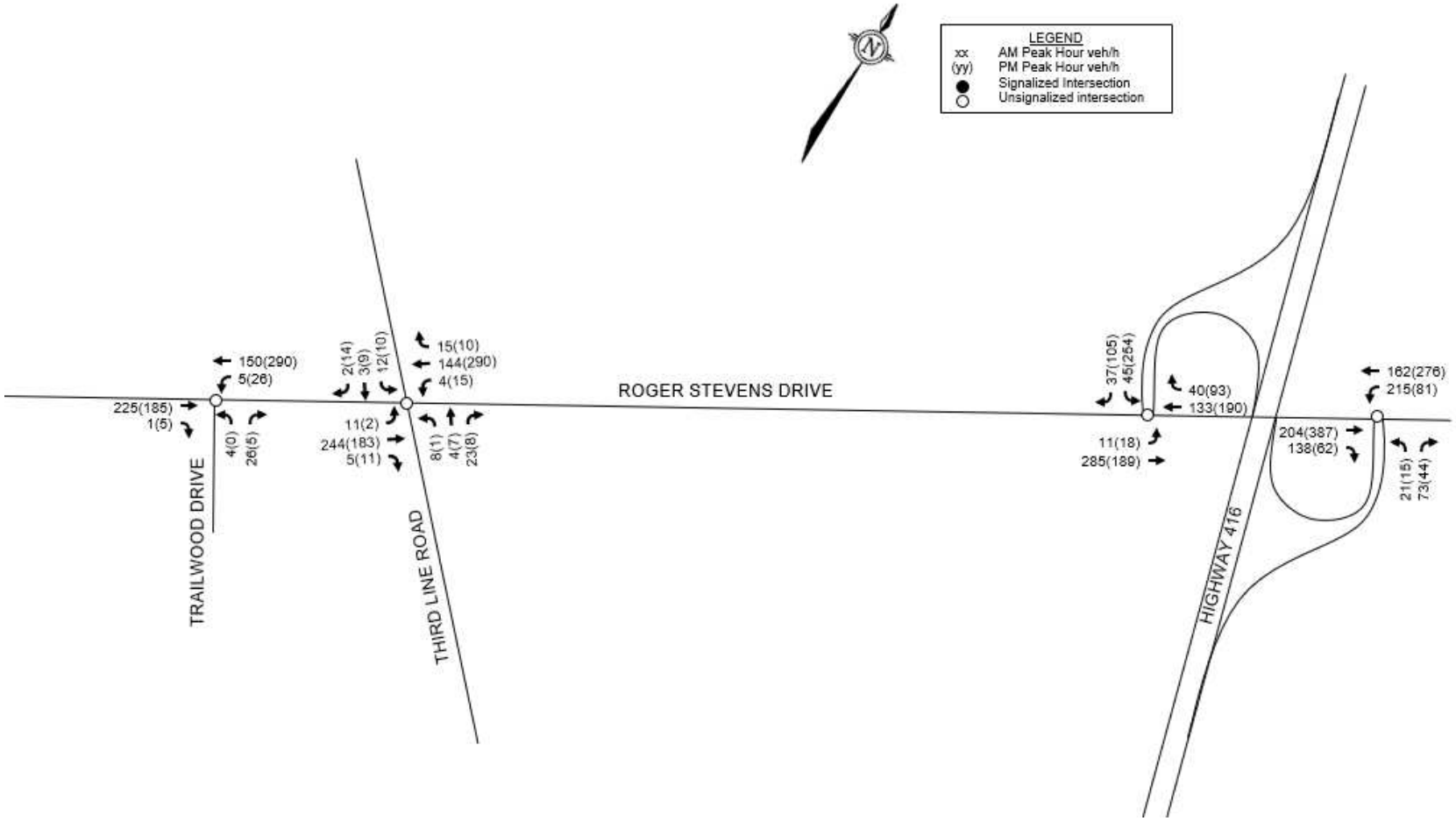


Figure 5: 2026 Background Traffic Volumes

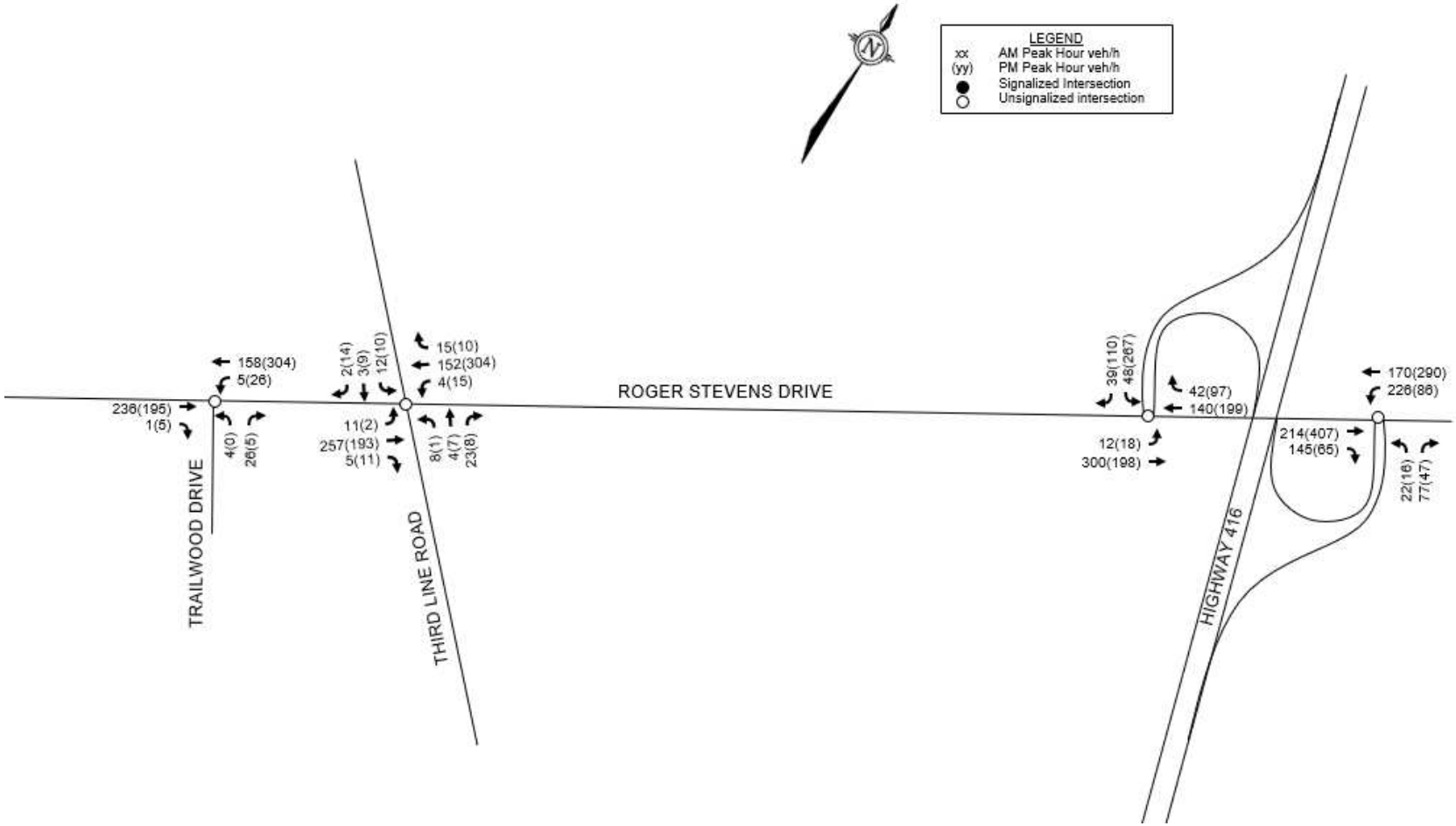


Figure 6: 2031 Background Traffic Volumes

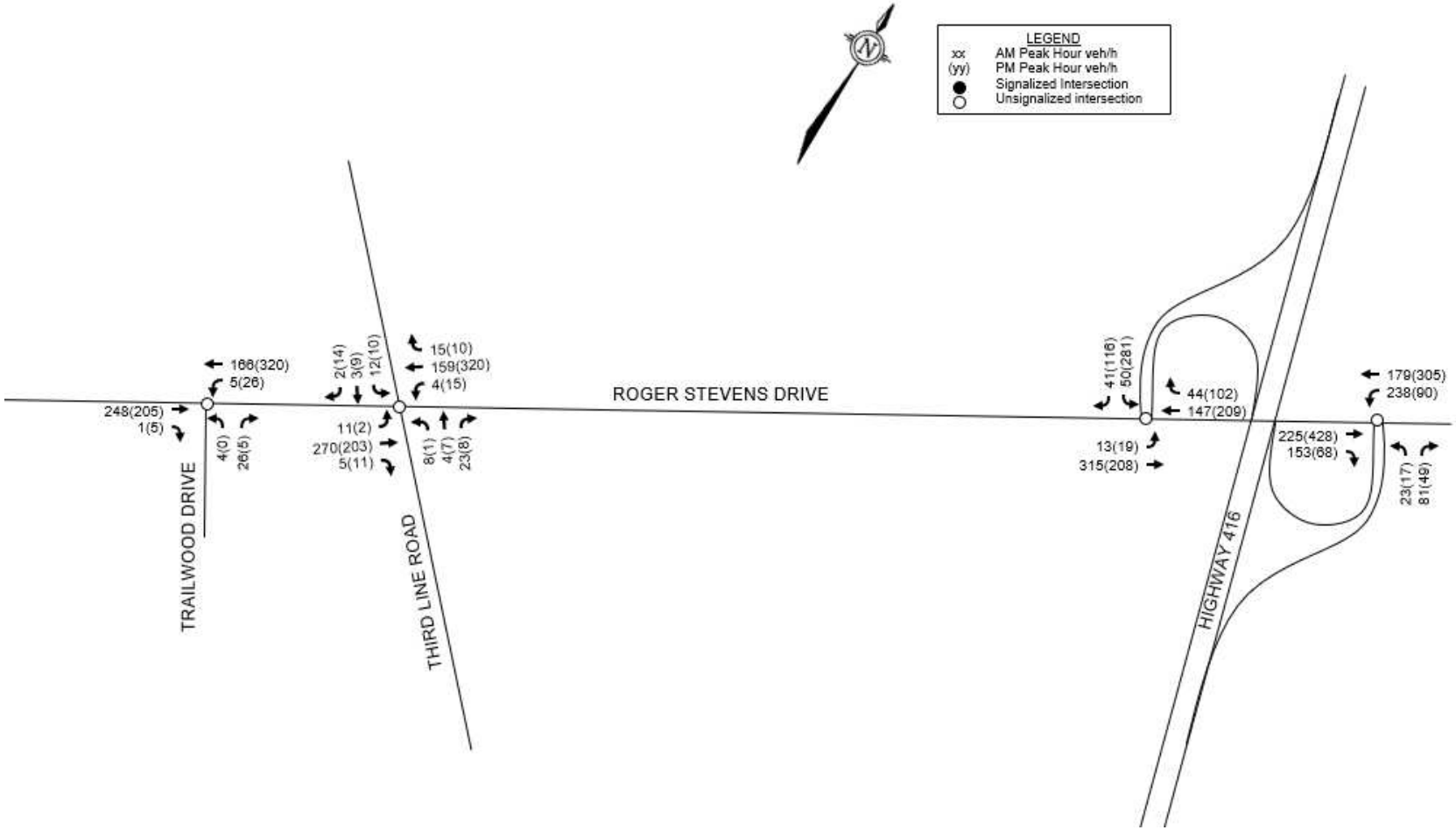


Figure 7: 2021 Total Traffic Volumes

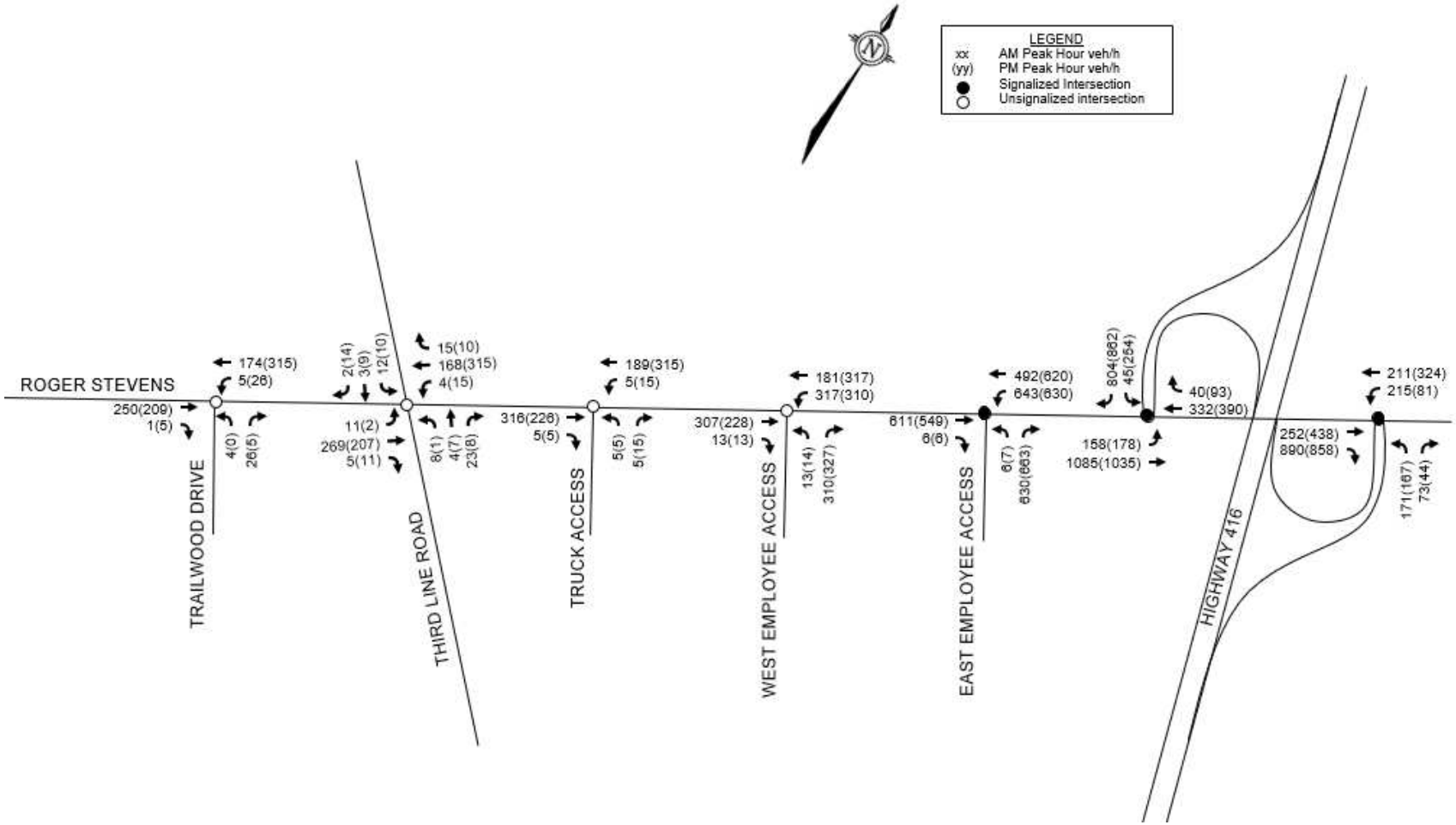


Figure 8: 2026 Total Traffic Volumes

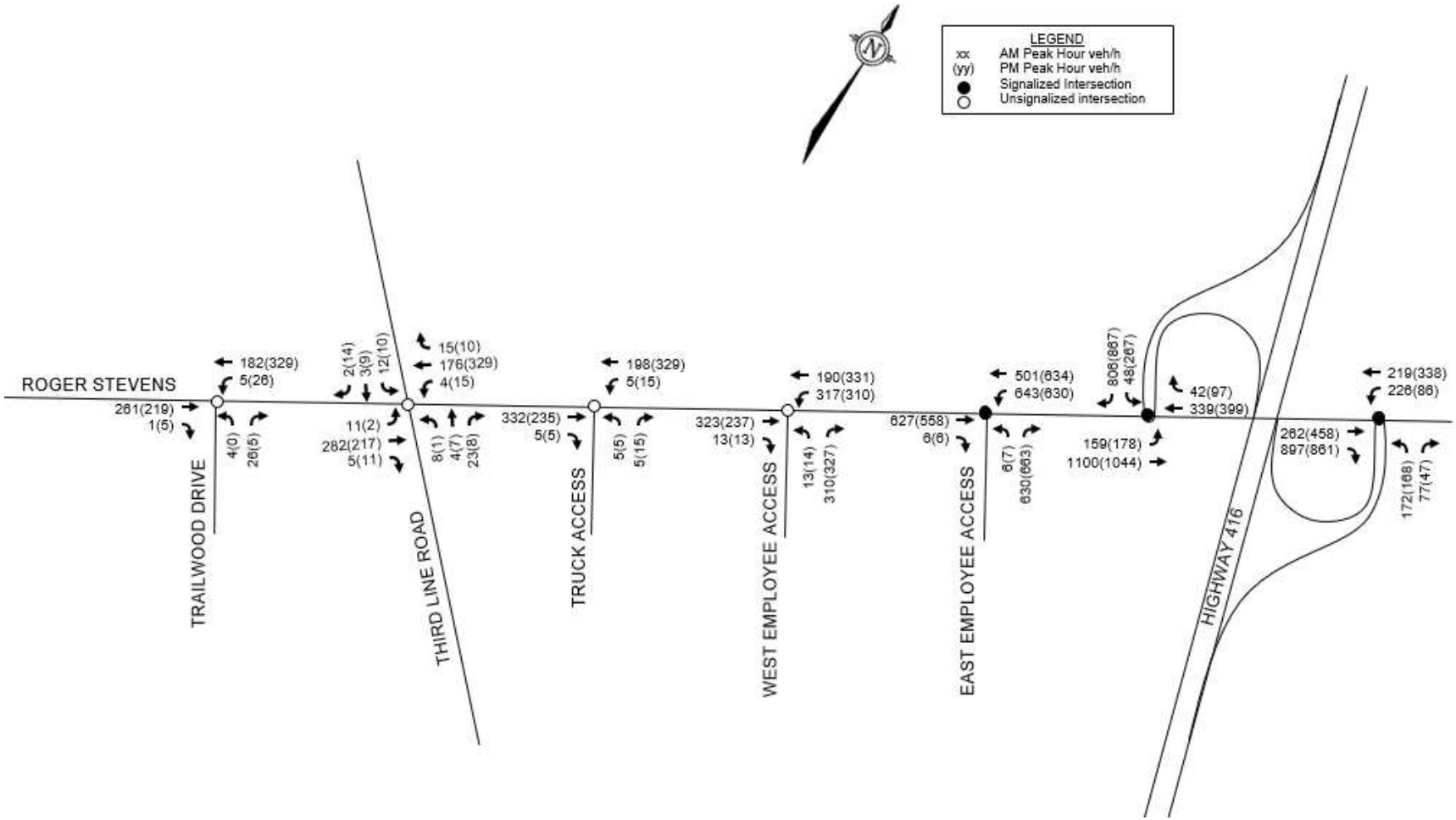
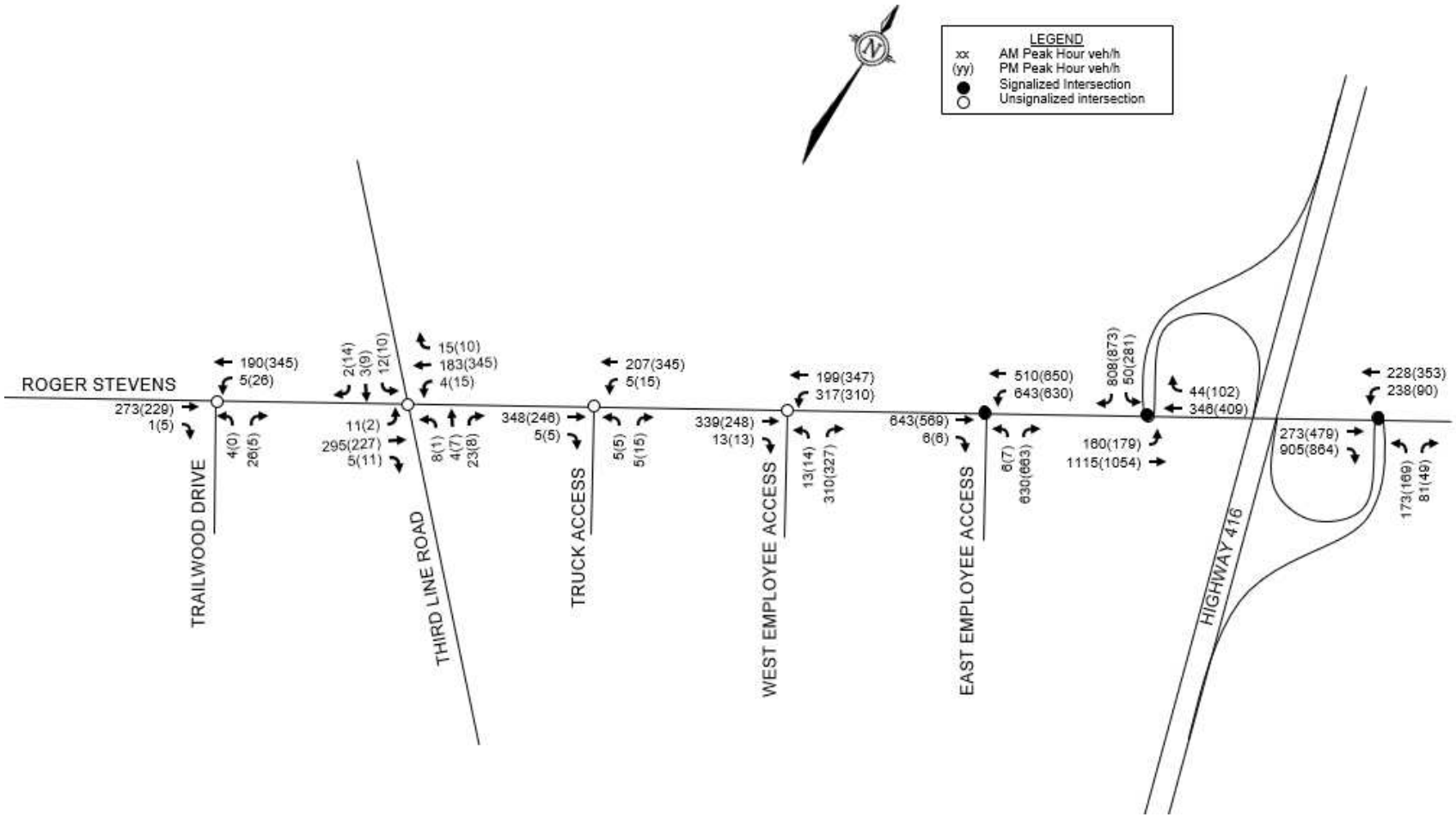


Figure 9: 2031 Total Traffic Volumes



6.0 ANALYSIS

6.1 Development Design

6.1.1 Design for Sustainable Modes

Pedestrian facilities will be provided between the parking lot and the main building entrances and will be reviewed at the Site Plan stage.

Bicycle parking will be provided, with the locations to be reviewed at the Site Plan stage. Bicycle parking requirements are outlined in Section 6.2.

A 2.5m paved shoulder is proposed on both sides of Roger Stevens Drive for the extents of the roadway modifications.

A review of the Transportation Demand Management (TDM) – *Supportive Development Design and Infrastructure Checklist* has been conducted. A copy of the TDM checklist is included in **Appendix F**.

6.1.2 Circulation and Access

The proposed development will be served by two all-movement employee accesses on Roger Stevens Drive and one all-movement truck access on Roger Stevens Drive.

The proposed fire route and garbage collection will be further reviewed at the Site Plan stage.

6.2 Parking

The subject site is located in Area D on Schedule 1 and Schedule 1A of the City of Ottawa's Official Plan. Minimum vehicular and bicycle parking rates for the proposed warehouse use are identified in the Zoning By-law (ZBL) and are summarized in the following table.

Table 4: Parking Requirements

Land Use	Rate	GFA	Requirement
Vehicle Parking			
Warehouse	0.8 per 100 m^2 of GFA	65,032 m^2	520
Bicycle Parking			
Warehouse	1 per 2000 m^2 of GFA	65,032 m^2	33

Based on the foregoing, 520 vehicular parking spaces and 33 bicycle parking spaces are required for the proposed development. Approximately 1,820 parking spaces are proposed in order to serve the employees and visitors at the warehouse. Bicycle parking is proposed and will be reviewed at the Site Plan stage.

The ZBL identifies a minimum requirement of 3 loading spaces per 25,000m^2 of gross floor area and over for a warehouse. A total of 63 loading bays are proposed, and approximately 240 trailer drop spaces are proposed.

As per AODA standards, for a parking lot providing 1,820 parking spaces, 29 accessible parking spaces are required. Accessible parking spaces will be reviewed at the Site Plan stage and will be provided in accordance with the requirements.

6.3 Boundary Street Design

This section provides a review of the boundary streets using complete streets principles. The Multi-Modal Level of Service (MMLOS) guidelines produced by IBI Group in 2015 were used to evaluate the LOS of the boundary roadways for each mode of transportation. Schedule 'A' of the City of Ottawa's Official Plan indicates Roger Stevens Drive is located at the boundary of an Agricultural Resource Area and a Village. As there are no MMLOS targets for Agricultural Resource Area (i.e. the 'All Other Designations' targets would apply), the MMLOS targets for Roger Stevens Drive have been based on the Village designation. Targets for pedestrian level of service (PLOS), bicycle level of service (BLOS), truck level of service (TkLOS), and vehicular level of service (Auto LOS) for Roger Stevens Drive adhere to those outlined for an arterial road located in a Village, as identified in Exhibit 22 of the MMLOS guidelines.

The transit level of service (TLOS) has been evaluated for Roger Stevens Drive, despite having no target, as there is a regular transit route.

6.3.1 Pedestrian Level of Service (PLOS)

Exhibit 4 of the MMLOS guidelines has been used to evaluate the segment PLOS of the boundary road. Exhibit 22 of the MMLOS guidelines suggest a target PLOS C for all road classes within a Village. The results of the segment PLOS analysis are summarized in the following table.

Table 5: PLOS Segment Analysis

Sidewalk Width	Boulevard Width	Avg. Daily Curb Lane Traffic Volume	Presence of On-Street Parking	Operating Speed[1]	Segment PLOS
Roger Stevens Drive					
No Sidewalk	N/A	N/A	N/A	90 km/h	F

1. Operating Speed identified as 10 km/h above the speed limit

6.3.2 Bicycle Level of Service (BLOS)

Exhibit 11 of the MMLOS guidelines has been used to evaluate the segment BLOS of the boundary roadway. Exhibit 22 of the MMLOS guidelines suggest a target BLOS C for Spine Routes located on an arterial road in a Village. The results of the segment BLOS analysis are in the following table.

Table 6: BLOS Segment Analysis

Road Class	Bike Route	Type of Bikeway	Travel Lanes	Operating Speed	Segment BLOS
Roger Stevens Drive					
Arterial	Spine Route	Mixed Traffic	2	90km/h	F

6.3.3 Transit Level of Service (TLOS)

Exhibit 15 of the MMLOS guidelines has been used to evaluate the segment TLOS of the boundary road. Roger Stevens Drive has been evaluated for TLOS despite having no target, as it currently serves transit. The results of the segment TLOS analysis are summarized in the following table.

Table 7: TLOS Segment Analysis

Facility Type	Level/Exposure to Congestion Delay, Friction and Incidents			Segment TLOS
	Congestion	Friction	Incident Potential	
Roger Stevens Drive				
Mixed Traffic	Yes	Low	Medium	D

6.3.4 Truck Level of Service (TkLOS)

Exhibit 20 of the MMLOS guidelines has been used to evaluate the segment TkLOS of the boundary road. Exhibit 22 of the MMLOS guidelines suggest a target TkLOS D for a Truck Route on an arterial road in a Village. The results of the segment TkLOS are in the following table.

Table 8: Truck Level of Service (TkLOS)

Curb Lane Width (m)	Number of Travel Lanes	TkLOS
Roger Stevens Drive		
≤3.5	Two (one in each direction)	C

6.3.5 Vehicular Level of Service (Auto LOS)

Exhibit 22 of the MMLOS guidelines suggest a target Auto LOS D for all roadways within a Village. The typical lane capacity along the study area roadways are based on the City's guidelines for the TRANS Long-Range Transportation Model. The lane capacity along the boundary streets has been estimated based on roadway classification and general characteristics (i.e. rural highway). The results of the Auto LOS analysis are summarized in the following table.

Table 9: Auto LOS Segment Analysis

Direction	Directional Capacity	Traffic Volumes		V/C Ratio and LOS			
		AM Peak	PM Peak	AM Peak		PM Peak	
				V/C	LOS	V/C	LOS
Roger Stevens Drive							
EB	1600	272	196	0.17	A	0.12	A
WB	1600	159	306	0.10	A	0.19	A

6.3.6 Segment MMLOS Summary

The results of the segment MMLOS analysis is summarized in the following table.

Table 10: Segment MMLOS Summary

Segment	PLOS	BLOS	TLOS	TkLOS	Auto LOS
Roger Stevens Drive	F	F	D	C	A
Target	**C**	**C**	**-**	**D**	**D**

Roger Stevens Drive currently meets the target TkLOS and Auto LOS, however does not meet the target PLOS or BLOS.

Currently, along the frontage of the subject site there are gravel shoulders provided.

The MMLOS guidelines suggest that paved shoulders may be appropriate pedestrian facilities in rural settings where pedestrian volumes are low. In recognition of this, paved shoulders may be evaluated based on the existing methodology as if they are sidewalks, but it is recommended that the resulting score be adjusted down one grade to recognize their differences (maintenance, lack of physical separation, potential blockage, accessibility, etc.).

The MMLOS guidelines suggest that paved shoulders in a rural context may be evaluated as bike lanes, although they are unlikely to score high due to the high operating speeds on rural roads. This reflects more experienced adult cyclists making use of these facilities, which may be appropriate in the rural context.

A 2m shoulder with no boulevard achieves a PLOS D and a BLOS E. Adjusting the scores down one grade, Roger Stevens would earn a PLOS E and BLOS F.

Paved shoulders along the frontage of the subject site do not achieve the PLOS or BLOS targets, however given the rural context of the site they are recommended.

6.4 Access Intersection Design

Three site accesses are proposed along Roger Stevens Drive: one westerly truck access, and two eastern accesses to employee parking.

The truck access is located approximately 290m east of the Roger Stevens Drive/Third Line Road intersection, measured from centerline to centerline. The east employee access is located approximately 390m west of the Roger Stevens Drive/Highway 416 Southbound Off-Ramp, measured stop bar to stop bar. The west employee access is located approximately 160m west of the east employee access, measured centerline to centerline, and approximately 140m east of the truck access, measured centerline to centerline.

Section 25 (a) of the City's *Private Approach By-Law* identifies a maximum number of private approaches that can be provided, based on the amount of frontage. For sites with 46m to 150m of frontage, one two-way private approach and two one-way private approaches or two two-way private approaches are permitted. For every additional 90m of frontage in excess of 150m, the by-law permits another two-way private approach or two one-way private approaches. The subject site has approximately 620m of frontage on Roger Stevens Drive. Therefore, the number of accesses serving the proposed development meets this requirement.

Section 25 (m) of the *Private Approach By-Law* identifies a requirement to provide a minimum distance of 60m at the street line between the private approach and the nearest intersecting street line.

Section 25 (p) of the *Private Approach By-Law* identifies a minimum spacing requirement of 3.0m between the nearest edge of a private approach and the property line, as measured at the street line.

Based on the proposed spacing described, the site accesses will meet the minimum spacing requirements of the *Private Approach By-Law*.

The east employee access will be signalized and 15.5m in width and will include four 3.5m lanes with the ingress and egress separated by a 1.5m median. The west employee access will be 8.5m in width and will include two 4.25m lanes. The truck access will be 8.5m in width and will include two 4.25m lanes.

Section 25 (d) of the *Private Approach By-Law* identifies a maximum width requirement of 9.0m for any two-way private approach, as measured at the street line, although an exception for wider accesses is permitted under Section 25 (e) for transport loading areas.

Section 107 (1)(a) of the *Zoning By-Law* identifies a minimum width requirement of 6.7m for a two-way driveway to a parking lot.

The Transportation Association of Canada (TAC) *Geometric Design Guide for Canadian Roads* suggests a minimum corner clearance of 70m for an access from a major intersection along an arterial roadway. Note that this minimum corner clearance is based on an operating speed of 50km/h, and higher values are desirable for higher speeds. Based on the spacing described above, the minimum corner clearance requirements are met.

The TAC *Geometric Design Guide for Canadian Roads* outlines minimum clear throat lengths for driveways based on land use, development size, and types of roadways. On an arterial roadway, the minimum clear throat length for a driveway to a large light industrial development is 60m. Clear throat lengths will be reviewed at the Site Plan stage.

6.5 Transportation Demand Management

The City's TIA guidelines require proponents of qualifying developments to assess the context, need and opportunity for transportation demand management (TDM) program measures at their development.

The TDM measures that could be considered for this development are:

- Preferential carpool parking.
- Ridesharing: potential carpoolers in Ottawa are served by www.OttawaRideMatch.com, an online service to help people find carpool partners. Employers can arrange for a dedicated portal where their employees can search for potential carpool partners only among their colleagues, if they desire. Some very large employers may establish internal ride matching services, to maximize employee uptake and corporate control. Ride matching service providers typically include a waiver to relieve employers of liability when their employees start carpooling through a ride matching service. Ridesharing with co-workers also tends to eliminate security concerns.
- Vanpool service: Vanpools operate in the Toronto and Vancouver metropolitan areas, where vans that carry up to about ten occupants are driven by one of the vanpool members. Vanpools tend to operate on a cost-recovery basis and are most practical for long-distance commutes where transit is not an option. Current legislation in Ontario does not permit third-party (i.e. private or non-profit) vanpool services but does permit employers to operate internal vanpools.
- Carshare vehicles & memberships: VRTUCAR and Zipcar both operate carsharing services in Ottawa, for use by the general public or by businesses as an alternative to corporate fleets. Carsharing services offer 24-hour access, self-serve reservation systems, itemized monthly billings, and outsourcing of all financing, insurance, maintenance and administrative responsibilities.

A copy of the TDM checklist for non-residential developments is included in **Appendix F**.

6.6 Transit

Currently, the site is not serviced by a regular bus route. As such, no transit modal share was applied to the trips generated by the development.

6.7 Network Concept

This module determines if changes to the Transportation Master Plan (TMP) concept for auto or transit networks are required to accommodate the development-generated travel demands.

Typical lane capacities on the major road network are established based on roadway classification and general characteristics (i.e. suburban with limited access, rural highway, urban with on-street parking, etc.). The typical lane capacities used in this study are based on the City's guidelines for the TRANS Long-Range Transportation Model. The TIA guidelines require the identification of mitigation measures in the form of additional lane capacity where the volume to capacity ratio exceeds 0.9, except in the Urban Core where 1.0 is acceptable.

The projected traffic volumes and lane capacities are summarized in the following table for the major study area roads during the weekday peak hours.

Table 11: Screenline Analysis

Road Segment	Direction	Directional Capacity (per lane)	Traffic Volumes		V/C Ratio and LOS			
			AM Peak	PM Peak	AM Peak		PM Peak	
					V/C	LOS	V/C	LOS
Existing Traffic								
Roger Stevens Drive (east of Highway 416)	EB	1600	269	419	0.17	A	0.26	A
	WB	1600	366	347	0.23	A	0.22	A
Roger Stevens Drive (west of Highway 416)	EB	1600	288	200	0.18	A	0.13	A
	WB	1600	165	286	0.10	A	0.18	A
416 Southbound Ramps	NB	1200	50	107	0.04	A	0.09	A
	SB	1200	80	349	0.07	A	0.29	A
416 Northbound Ramps	NB	1200	91	58	0.08	A	0.05	A
	SB	1200	343	139	0.29	A	0.12	A
2031 Background Traffic								
Roger Stevens Drive (east of Highway 416)	EB	1600	306	477	0.19	A	0.30	A
	WB	1600	417	395	0.26	A	0.25	A
Roger Stevens Drive (west of Highway 416)	EB	1600	328	227	0.21	A	0.14	A
	WB	1600	188	325	0.12	A	0.20	A
416 Southbound Ramps	NB	1200	57	121	0.05	A	0.10	A
	SB	1200	91	397	0.08	A	0.33	A
416 Northbound Ramps	NB	1200	104	66	0.09	A	0.10	A
	SB	1200	391	158	0.33	A	0.13	A
2031 Total Traffic								
Roger Stevens Drive (east of Highway 416)	EB	1600	354	528	0.22	A	0.33	A
	WB	1600	466	443	0.29	A	0.28	A
Roger Stevens Drive (west of Highway 416)	EB	1600	1272	1231	0.80	C	0.77	C
	WB	1600	1146	1279	0.72	C	0.80	C
416 Southbound Ramps	NB	1200	203	280	0.17	A	0.23	A
	SB	1200	852	1152	0.71	C	**0.96**	**E**
416 Northbound Ramps	NB	1200	252	217	0.21	A	0.18	A
	SB	1200	1141	953	**0.95**	**E**	0.79	C

Deficiencies are noted at the Highway 416 ramps with the addition of site traffic. However, this analysis is based on existing conditions, with one lane of travel. Additional lanes are recommended at the 416 Southbound Off-Ramp and the 416 Northbound On-Ramp, as noted in Section 6.8, to accommodate site traffic.

6.8 Intersection Design

6.8.1 Intersection MMLOS

This section provides a review of the study area intersections using the complete streets principles. The MMLOS guidelines produced by IBI Group in October 2015 were used to evaluate the LOS of all signalized study area intersections for each mode of transportation. Schedule 'A' of the City of Ottawa's Official Plan indicates Roger Stevens Drive west of Highway 416 is in a 'Village' and east of Highway 416 is in an 'Agricultural Resource Center'.

The functional design for the Roger Stevens Drive modifications is detailed in **Section 6.8.7** and is shown in **Appendix G**. New traffic control signals are proposed at the intersections of Roger Stevens Drive/East Employee Access, Roger Stevens Drive/Highway 416 Southbound Ramps, and Roger Stevens Drive/Highway 416 Northbound Ramps.

Target PLOS, BLOS, TLOS, TkLOS, and Auto LOS for the intersections of Roger Stevens Drive/East Employee Access and Roger Stevens Drive/Highway 416 Southbound Ramps are based on the Village designation, while the targets for the intersection of Roger Stevens Drive/Highway 416 Northbound Ramps are based on the 'All Other Designation' classification, as identified in Exhibit 22 of the MMLOS guidelines. The following table summarizes the finding of the MMLOS intersection analysis. Detailed intersection MMLOS calculations are included in **Appendix H.**

Table 12: Intersection MMLOS Summary

Intersection	PLOS	BLOS	TLOS	TkLOS	Auto LOS[1]
Roger Stevens Drive/East Employee Access	E	F	E	D	D
Roger Stevens Drive/Highway 416 Southbound Ramps	F	-	C	E	D
Target	**C**	**C**	**-**	**D**	**D**
Roger Stevens Drive/Highway 416 Northbound Ramps	F	-	C	C	B
Target	**D**	**C**	**-**	**D**	**D**

1 – Auto LOS results from 2031 total traffic conditions. See Section 6.8.6 for further details.

Roger Stevens Drive/East Employee Access

The Roger Stevens Drive/East Employee Access intersection is anticipated to meet the target Auto LOS and TkLOS but will not meet the targets for PLOS or BLOS.

Based on the Pedestrian Exposure to Traffic (PETSI) the Roger Stevens Drive/East Employee Access is operating with a PLOS E. A reduction in the crossing distance on all approaches would have the greatest improvement on the PETSI score and the Pedestrian Delay. However, given the projected traffic volumes, the westbound dual left turns and northbound dual right turns are required, and the intersection configuration is considered appropriate.

The Roger Stevens Drive/East Employee Access is anticipated to operate with a BLOS F, based on both left and right turn characteristics. Given the high turning movement traffic volumes, the proposed dual westbound left turn lanes and dual northbound right turn lanes are required. Paved shoulders are proposed along Roger Stevens Drive and given the rural context of the site, they are an appropriate cycling facility.

Roger Stevens Drive/Highway 416 Southbound Ramps
The Roger Stevens Drive/Highway 416 Southbound Ramps intersection is anticipated to meet the target Auto LOS but will not meet the target PLOS and TkLOS.

Based on the PETSI, the Roger Stevens Drive/Highway 416 Southbound Ramps intersection is operating with a PLOS F. A reduction in the crossing distance on the north approach would have the greatest improvement on the PETSI score and the Pedestrian Delay. However, based on projected traffic volumes, the proposed lane configuration is appropriate. Per MTO cross section design, a 10m median is required separating the on- and off-ramps.

BLOS has not been evaluated for the Roger Stevens Drive/Highway 416 Southbound intersection as bikes are prohibited on 400 series highways. The ramp is under MTO jurisdiction and BLOS is not a consideration.

The Roger Stevens Drive/Highway 416 Southbound Ramps intersection is anticipated to operate with a TkLOS E. The westbound right turn movement has one receiving lane on departure from this intersection. However, per MTO design for a single lane ramp, the on-ramp currently has a 4.75m wide lane with a right shoulder width of 2.5m and a left shoulder width of 1.0m. No changes are proposed to the configuration of the on-ramp as it currently accommodates trucks.

Roger Stevens Drive/Highway 416 Northbound Ramps
The Roger Stevens Drive/Highway 416 Northbound Ramps intersection is anticipated to meet the target Auto LOS and TkLOS but will not meet the target PLOS.

Based on PETSI, the Roger Stevens Drive/Highway 416 Northbound Ramps intersection is operating with a PLOS F. A reduction in the crossing distance would have the greatest improvement on the PETSI score. No north-south crossing is proposed at this intersection. As such, only the east-west crossing has been evaluated in terms of PLOS. Per MTO cross section design, a 10m median is required separating the on- and off-ramps and the proposed lane configuration is required for capacity therefore no reduction is recommended.

BLOS has not been evaluated for the Roger Stevens Drive/Highway 416 Northbound intersection as bikes are prohibited on 400 series highways. The ramp is under MTO jurisdiction and BLOS is not a consideration.

6.8.2 Existing Intersection Operations

Intersection capacity analysis has been completed for the existing traffic condition. The intersection parameters used in the analysis are consistent with the City's TIA guidelines (saturation flow rate: 1800 vphpl, PHF: 0.9). The results of the analysis are summarized in **Table 13** for the weekday AM and PM peak hours. Detailed reports are included in **Appendix J**.

Table 13: Existing Intersection Operations

Intersection	AM Peak			PM Peak		
	Max V/C or Delay	LOS	Mvmt	Max V/C or Delay	LOS	Mvmt
Existing Traffic						
Roger Stevens Drive/Trailwood Drive	10 sec.	A	NB	9 sec.	A	NB
Roger Stevens Drive/Third Line Road	13 sec.	B	SB	13 sec.	B	SB
Roger Stevens Drive/Highway 416 Southbound Ramps	11 sec.	B	SB	20 sec.	C	SB
Roger Stevens Drive/Highway 416 Northbound Ramps	13 sec.	B	NB	14 sec.	B	NB

Under existing traffic conditions, all study area intersections are operating with a LOS C or better.

The need for traffic control signal at the existing intersections along Roger Stevens Drive was reviewed according to the procedure outlined in the *Ontario Traffic Manual* Book 12. Traffic signal justifications are provided in **Appendix I**.

Based on the results of the warrant analysis, signals are not warranted at the Roger Stevens Drive/Highway 416 Northbound Ramps or the Roger Stevens Drive/Highway 416 Southbound ramps under existing traffic conditions.

Currently, a westbound slip around lane is provided at the Roger Stevens Drive/Highway 416 Northbound Ramps, and an eastbound slip around lane is provided at the Roger Stevens Drive/Highway 416 Southbound Ramps. A review of the MTO Left Turn Lane Warrants suggests that a westbound left turn lane with a storage of 25m is warranted at the northbound on-ramp under existing traffic conditions. No eastbound left turn lane is warranted at the southbound on-ramp. Left turn lane warrants are provided in **Appendix I**.

6.8.3 Background Intersection Operations

Intersection capacity analysis has been completed for the 2021, 2026, and 2031 background traffic conditions. The intersection parameters used in the analysis are consistent with the City's TIA guidelines (saturation flow rate: 1800 vphpl, PHF: 1.0). The results of the analysis are summarized in **Table 14** for the weekday AM and PM peak hours. Detailed reports are included in **Appendix J**.

Table 14: Background Intersection Operations

Intersection	AM Peak			PM Peak		
	Max V/C or Delay	LOS	Mvmt	Max V/C or Delay	LOS	Mvmt
2021 Background Traffic						
Roger Stevens Drive/Trailwood Drive	10 sec.	A	NB	9 sec.	A	NB
Roger Stevens Drive/Third Line Road	12 sec.	B	SB	12 sec.	B	SB
Roger Stevens Drive/Highway 416 Southbound Ramps	11 sec.	B	SB	17 sec.	C	SB
Roger Stevens Drive/Highway 416 Northbound Ramps	12 sec.	B	NB	13 sec.	B	NB
2026 Background Traffic						
Roger Stevens Drive/Trailwood Drive	10 sec.	A	NB	9 sec.	A	NB
Roger Stevens Drive/Third Line Road	12 sec.	B	SB	12 sec.	B	SB
Roger Stevens Drive/Highway 416 Southbound Ramps	11 sec.	B	SB	19 sec.	C	SB
Roger Stevens Drive/Highway 416 Northbound Ramps	13 sec.	B	NB	13 sec.	B	NB
2031 Background Traffic						
Roger Stevens Drive/Trailwood Drive	10 sec.	A	NB	9 sec.	A	NB
Roger Stevens Drive/Third Line Road	13 sec.	B	SB	13 sec.	B	SB
Roger Stevens Drive/Highway 416 Southbound Ramps	11 sec.	B	SB	21 sec.	C	SB
Roger Stevens Drive/Highway 416 Northbound Ramps	13 sec.	B	NB	14 sec.	B	NB

Under background traffic conditions, all study area intersections are anticipated to operate with a LOS C or better.

Note than some critical movements appear to operate slightly better under projected conditions than under existing conditions; this is a result of PHF of 1.0 for future conditions as per the City's TIA guidelines.

The need for traffic control signal at the existing intersections along Roger Stevens Drive was reviewed according to the procedure outlined in the *Ontario Traffic Manual* Book 12 for peak hour traffic demands. Average Hourly Volumes (AHV) were estimated by diving the sum of projected AM and PM peak hour volumes by four. Traffic signal justifications are provided in **Appendix I**.

Under projected background traffic conditions in 2031, traffic signals are not warranted at the Roger Stevens Drive/Highway 416 Northbound Ramps or the Roger Stevens Drive/Highway 416 Southbound ramps.

6.8.4 2021 Total Intersection Operations

Intersection capacity analysis has been completed for the 2021 total traffic conditions. The intersection parameters used in the analysis are consistent with the TIA guidelines (saturation flow rate: 1800 vphpl, PHF: 1.0). The results of the analysis are summarized in **Table 15** for the weekday AM and PM peak hours. Detailed reports are included in **Appendix J**.

With the addition of site traffic, traffic signals will be warranted at the intersections of Roger Stevens Drive/Highway 416 Northbound ramps, Roger Stevens Drive/Highway 416 Southbound ramps, and Roger Stevens Drive/East Employee Access in 2021. Traffic signals are 92% warranted at the Roger Stevens Drive/West Employee Access in the 2021 opening year. Traffic signal justifications are provided in **Appendix I**.

For the purposes of the analysis presented in this study, it has been assumed that traffic signals will be provided at the Roger Stevens Drive/Highway 416 Northbound ramps, Roger Stevens Drive/Highway 416 Southbound ramps, and Roger Stevens Drive/East Employee Access at buildout (2021). The Synchro and MTO warrant analysis completed as part of this study indicate that under these conditions, traffic signals are needed to ensure an adequate LOS during peak hours and will also be warranted based on peak hour traffic volumes. Actuated-coordinated signal timings are assumed.

Cycle lengths were modelled at 110 seconds in the AM and PM peak hours.

The functional design for the Roger Stevens Drive modifications is detailed in **Section 6.8.7** and is shown in **Appendix G**. The following summarizes the lane configurations assumed for the study area intersections:

- Roger Stevens/416 Northbound Ramps:
  - Northbound: one shared left/right turn lane
  - Eastbound: one through lane, one free flow channelized right turn lane
  - Westbound: one through lane, one left turn lane
- Roger Stevens/416 Southbound Ramps:
  - Southbound: one left turn lane, two right turn lanes
  - Eastbound: one left turn lane, one through lane
  - Westbound: one through lane, one right turn lane
- Roger Stevens/East Employee Access:
  - Northbound: one shared left/right turn lane, one right turn lane
  - Eastbound: one shared through/right turn lane
  - Westbound: two left turn lanes, one through lane
- Roger Stevens/West Employee Access:
  - Northbound: one shared left/right turn lane
  - Eastbound: one shared through/right turn lane
  - Westbound: one left turn lane, one through lane
- Roger Stevens Drive/Truck Access:
  - Northbound: one shared left/right turn lane
  - Eastbound: one shared through/right turn lane
  - Westbound: one left turn lane, one through lane
- Roger Stevens/Third Line Road: one travel lane in all directions
- Roger Stevens/Trailwood Drive: one travel lane in all directions

Table 15: 2021 Total Intersection Operations

Intersection	AM Peak			PM Peak		
	Max V/C or Delay	LOS	Mvmt	Max V/C or Delay	LOS	Mvmt
2021 Total Traffic – Unsignalized Intersections						
Roger Stevens Drive/Trailwood Drive	10 sec.	A	NB	9 sec.	A	NB
Roger Stevens Drive/Third Line Road	11 sec.	B	NB	13 sec.	B	SB
Roger Stevens Drive/West Employee Access	16 sec.	C	NB	15 sec.	C	NB
Roger Stevens Drive/Truck Access	13 sec.	B	NB	12 sec.	B	NB
2021 Total Traffic – Signalized Intersections						
Roger Stevens Drive/Highway 416 Southbound Ramps	**0.91**	**E**	**EBT**	0.87	D	EBT
Roger Stevens Drive/Highway 416 Northbound Ramps	0.69	B	EBR	0.66	B	EBR
Roger Stevens Drive/East Employee Access	0.82	D	WBL	0.82	D	WBL

Under 2021 total traffic conditions, the Roger Stevens Drive/Highway 416 Southbound intersection is anticipated to operate with a v/c ratio of 0.91 and a LOS E during the AM peak hour. All other intersections are anticipated to operate with a LOS D or better.

Maximum queue length for the eastbound through movement at the Highway 416 Southbound Ramps is anticipated to be approximately 290m during the AM peak. This queue length is not anticipated to extend past the Roger Stevens Drive/East Employee Access intersection. Synchro identifies that the eastbound queue may take more than one cycle to clear the intersection during the peak hour. Due to space constraints at the Highway 416 overpass bridge to the east, a second eastbound through lane at the Roger Stevens Drive/Highway 416 Southbound Ramps could not be provided without widening the bridge.

The eastbound queue at the northbound ramps is metered due to capacity constraints at the upstream intersection (southbound ramps). No further improvements are recommended due to the space constraints at the Highway 416 overpass bridge.

The southbound queue at the southbound ramps is anticipated to be approximately 80m, and the northbound queue at the northbound ramps is anticipated to be approximately 70m.

The maximum northbound queue length at the east employee access is anticipated to be approximately 30m. The maximum northbound queue length at the west employee access is anticipated to be approximately 20m. The maximum northbound queue length at the truck access is anticipated to be insignificant.

The westbound queue at the east employee access is anticipated to be approximately 90m. This queue length is not anticipated to extend past the Roger Stevens Drive/Highway 416 Southbound intersection.

6.8.5 2026 Total Intersection Operations

Intersection capacity analysis has been completed for the 2026 total traffic conditions. The intersection parameters used in the analysis are consistent with the TIA guidelines (saturation flow rate: 1800 vphpl, PHF: 1.0). The results of the analysis are summarized in **Table 16** for the weekday AM and PM peak hours. Detailed reports are included in **Appendix J**.

The assumptions listed in the 2021 total traffic conditions have been carried forward to the 2026 total traffic analysis. The analysis was completed using 2021 signal timing and modified 2026 traffic signal timing/phasing for the AM and PM peak hours.

The 2026 cycle lengths were modelled at 120 seconds in the AM peak hour and 110 seconds in the PM peak hour.

Table 16: 2026 Total Intersection Operations

Intersection	AM Peak			PM Peak		
	Max V/C or Delay	LOS	Mvmt	Max V/C or Delay	LOS	Mvmt
2026 Total Traffic – Unsignalized Intersections						
Roger Stevens Drive/Trailwood Drive	10 sec.	B	NB	9 sec.	A	NB
Roger Stevens Drive/Third Line Road	11 sec.	B	NB	13 sec.	B	SB
Roger Stevens Drive/West Employee Access	17 sec.	C	NB	15 sec.	C	NB
Roger Stevens Drive/Truck Access	14 sec.	B	NB	12 sec.	B	NB
2026 Total Traffic – Signalized Intersections (2021 Signal Timing)						
Roger Stevens Drive/Highway 416 Southbound Ramps	**0.92**	**E**	**EBT**	0.88	D	EBT
Roger Stevens Drive/Highway 416 Northbound Ramps	0.69	B	EBR	0.67	B	EBR
Roger Stevens Drive/East Employee Access	0.82	D	WBL	0.82	D	WBL
2026 Total Traffic – Signalized Intersections (2026 Signal Timing)						
Roger Stevens Drive/Highway 416 Southbound Ramps	0.89	D	EBT	0.88	D	EBT
Roger Stevens Drive/Highway 416 Northbound Ramps	0.69	B	EBR	0.67	B	EBR
Roger Stevens Drive/East Employee Access	0.84	D	WBL	0.82	D	WBL

Under 2026 total traffic conditions, with adjusted signal timing, all intersections are anticipated to operate with a LOS D or better.

Maximum queue length for the eastbound through movement at the Highway 416 Southbound Ramps is anticipated to be approximately 70m in the AM peak and 110m in the PM peak. This is an improvement from the projected AM queue of 290m under 2021 total traffic conditions. The improvement is due to the longer cycle length proposed under 2026 total traffic conditions. This

eastbound queue length is not anticipated to extend past the Roger Stevens Drive/East Employee Access intersection. Synchro identifies that the eastbound queue may take more than one cycle to clear the intersection during the peak hour. Due to space constraints at the Highway 416 overpass bridge to the east, a second eastbound through lane at the Roger Stevens Drive/Highway 416 Southbound Ramps could not be provided without widening the bridge.

The eastbound queue at the northbound ramps is metered due to capacity constraints at the upstream intersection (southbound ramps). No further improvements are recommended due to the space constraints at the Highway 416 overpass bridge.

The southbound queue at the southbound ramps is anticipated to be approximately 90m, and the northbound queue at the northbound ramps is anticipated to be approximately 65m.

The maximum northbound queue length at the east employee access is anticipated to be approximately 30m. The maximum northbound queue length at the west employee access is anticipated to be approximately 25m. The maximum northbound queue length at the truck access is anticipated to be insignificant.

The westbound queue at the east employee access is anticipated to be approximately 85m. This queue length is not anticipated to extend past the Roger Stevens Drive/Highway 416 Southbound intersection.

6.8.6 2031 Total Intersection Operations

Intersection capacity analysis has been completed for the 2031 total traffic conditions. The intersection parameters used in the analysis are consistent with the TIA guidelines (saturation flow rate: 1800 vphpl, PHF: 1.0). The results of the analysis are summarized in **Table 17** for the weekday AM and PM peak hours. Detailed reports are included in **Appendix J**.

The assumptions listed in the 2026 total traffic conditions have been carried forward to the 2031 total traffic analysis. The analysis was completed using 2026 traffic signal timing/phasing for the AM and PM peak hours.

Cycle lengths were modelled at 120 seconds in the AM peak hour and 110 seconds in the PM peak hour.

Table 17: 2031 Total Intersection Operations

Intersection	AM Peak			PM Peak		
	Max V/C or Delay	LOS	Mvmt	Max V/C or Delay	LOS	Mvmt
2031 Total Traffic – Unsignalized Intersections						
Roger Stevens Drive/Trailwood Drive	10 sec.	B	NB	10 sec.	A	NB
Roger Stevens Drive/Third Line Road	11 sec.	B	NB	13 sec.	B	SB
Roger Stevens Drive/West Employee Access	17 sec.	C	NB	16 sec.	C	NB
Roger Stevens Drive/Truck Access	14 sec.	B	NB	13 sec.	B	NB
2031 Total Traffic – Signalized Intersections (2026 Signal Timing)						
Roger Stevens Drive/Highway 416 Southbound Ramps	0.90	D	EBT	0.89	D	EBT
Roger Stevens Drive/Highway 416 Northbound Ramps	0.69	B	EBR	0.68	B	EBR
Roger Stevens Drive/East Employee Access	0.84	D	WBL	0.82	D	WBL

Under 2031 total traffic conditions, all intersections are anticipated to operate with a LOS D or better.

Maximum queue length for the eastbound through movement at the Highway 416 Southbound Ramps is anticipated to be approximately 290m in the AM peak and 280m in the PM peak hour. This queue length is not anticipated to extend past the Roger Stevens Drive/East Employee Access intersection. Synchro identifies that the eastbound queue may take more than one cycle to clear the intersection during the peak hour. Due to space constraints at the Highway 416 overpass bridge to the east, a second eastbound through lane at the Roger Stevens Drive/Highway 416 Southbound Ramps could not be provided without widening the bridge.

The eastbound queue at the northbound ramps is metered due to capacity constraints at the upstream intersection (southbound ramps). No further improvements are recommended due to the space constraints at the Highway 416 overpass bridge.

The southbound queue at the southbound ramps is anticipated to be approximately 95m, and the northbound queue at the northbound ramps is anticipated to be approximately 80m.

The maximum northbound queue length at the east employee access is anticipated to be approximately 30m. The maximum northbound queue length at the west employee access is anticipated to be approximately 25m. The maximum northbound queue length at the truck access is anticipated to be insignificant.

The westbound queue at the east employee access is anticipated to be approximately 85m. This queue length is not anticipated to extend past the Roger Stevens Drive/Highway 416 Southbound intersection.

6.8.7 Functional Design

The functional design for the Roger Stevens Drive modifications is included in **Appendix G**.

Left turn storage lane requirements have been calculated based on the greater of the TAC standard of 1.5 times the average number of arrivals per cycle in the heaviest hour or the projected 95th percentile queue lengths.

Left and right turn deceleration lane requirements have been calculated using a design speed of 60km/h for Roger Stevens Drive. This is less than the posted speed of 80km/h.

It is anticipated that the proposed modifications including signals, medians, and turn lanes will create additional side friction for motorists and reduce the operating speed along Roger Stevens Drive.

Approach and departure taper ratios of 27:1 were used and bay taper ratios of 11:1 were used as required for the turning lanes.

Storage lane and taper length requirements for the recommended turning lanes are summarized in the following table.

Table 18: Turn Lane Requirements

Intersection	Mvmt	Storage (m)	Taper (m)
Roger Stevens Drive/Highway 416 Southbound Ramps	EBL	60	100
	WBR[1]	30	40
	SBR	110	60
	SBL	110	60
Roger Stevens Drive/Highway 416 Northbound Ramps	WBL	85	100
	EBR[2]	0	70
Roger Stevens Drive/East Employee Access	Dual WBL	125	100
Roger Stevens Drive/West Employee Access	WBL	75	40
Roger Stevens Drive/Truck Access	WBL	30	40

1 – Existing condition
2 – Free Flow Channel recommended

A road modification approval (RMA) package for the proposed modifications to Roger Stevens Drive will be submitted under separate cover. A Provincial Class Environmental Assessment (EA) is required for the roadway modifications located within MTO's jurisdiction.

7.0 CONCLUSIONS AND RECOMMENDATIONS

Based on the foregoing, the conclusions and recommendations of this TIA can be summarized as follows:

Development Design & Parking

- Pedestrian facilities will be provided between the parking lot and the main building entrances and will be reviewed at the Site Plan stage.
- A 2.5m paved shoulder is proposed on both sides of Roger Stevens Drive for the extents of the roadway modifications.
- A review of the Transportation Demand Management (TDM) – *Supportive Development Design and Infrastructure Checklist* has been conducted.
- Approximately 1,820 parking spaces are proposed in order to serve the employees and visitors at the warehouse, which will meet the minimum requirements of the Zoning By-Law. Bicycle parking is proposed and will be reviewed at the Site Plan stage.
- The ZBL identifies a requirement of 3 loading spaces for the proposed development. A total of 63 loading bays are proposed, and approximately 240 trailer drop spaces are proposed.
- Accessible parking spaces will be reviewed at the Site Plan stage and will be provided in accordance with the requirements.

Boundary Street MMLOS

- Roger Stevens Drive currently meets the target TkLOS and Auto LOS, however does not meet the target PLOS or BLOS.
- Currently, along the frontage of the subject site there are gravel shoulders provided. Paved shoulders along the frontage of the subject site do not achieve the PLOS or BLOS targets, however given the rural context of the site they are recommended.

Access Design

- Three site accesses are proposed along Roger Stevens Drive: one westerly truck access, and two eastern accesses to employee parking.
- The truck access is located approximately 290m east of the Roger Stevens Drive/Third Line Road intersection, measured from centerline to centerline. The east employee access is located approximately 390m west of the Roger Stevens Drive/Highway 416 Southbound Off-Ramp, measured stop bar to stop bar. The west employee access is located approximately 160m west of the east employee access, measured centerline to centerline, and approximately 140m east of the truck access, measured centerline to centerline.
- The east employee access will be signalized and 15.5m in width and will include four 3.5m lanes with the ingress and egress separated by a 1.5m median. The west employee access will be 8.5m in width and will include two 4.25m lanes. The truck access will be 8.5m in width and will include two 4.25m lanes.
- The site accesses meet all requirements of the Private Approach By-Law.
- On an arterial roadway, the minimum clear throat length for a driveway to a large light industrial development is 60m. Clear throat lengths will be reviewed at the Site Plan stage.

Transportation Demand Management

- The TDM measures that could be considered for this development are:
  - Preferential carpool parking.

- Ridesharing: potential carpoolers in Ottawa are served by www.OttawaRideMatch.com, an online service to help people find carpool partners. Employers can arrange for a dedicated portal where their employees can search for potential carpool partners only among their colleagues, if they desire. Some very large employers may establish internal ride matching services, to maximize employee uptake and corporate control. Ride matching service providers typically include a waiver to relieve employers of liability when their employees start carpooling through a ride matching service. Ridesharing with co-workers also tends to eliminate security concerns.
- Vanpool service: Vanpools operate in the Toronto and Vancouver metropolitan areas, where vans that carry up to about ten occupants are driven by one of the vanpool members. Vanpools tend to operate on a cost-recovery basis and are most practical for long-distance commutes where transit is not an option. Current legislation in Ontario does not permit third-party (i.e. private or non-profit) vanpool services but does permit employers to operate internal vanpools.
- Carshare vehicles & memberships: VRTUCAR and Zipcar both operate carsharing services in Ottawa, for use by the general public or by businesses as an alternative to corporate fleets. Carsharing services offer 24-hour access, self-serve reservation systems, itemized monthly billings, and outsourcing of all financing, insurance, maintenance and administrative responsibilities.

Transit

- Currently, the site is not serviced by a regular bus route. As such, no transit modal share was applied to the trips generated by the development.

Network Concept

- Deficiencies are noted at the Highway 416 ramps with the addition of site traffic. However, this analysis is based on existing conditions, with one lane of travel. Additional lanes are recommended at the 416 Southbound Off-Ramp and the 416 Northbound On-Ramp to accommodate site traffic.

Intersection MMLOS

- Roger Stevens Drive/East Employee Access
  - The intersection is anticipated to meet the target Auto LOS and TkLOS but will not meet the targets for PLOS or BLOS.
  - Based on the Pedestrian Exposure to Traffic (PETSI) the intersection is operating with a PLOS E. A reduction in the crossing distance on all approaches would have the greatest improvement on the PETSI score and the Pedestrian Delay. However, given the projected traffic volumes, the westbound dual left turns and northbound dual right turns are required, and the intersection configuration is considered appropriate.
  - The intersection is anticipated to operate with a BLOS F, based on both left and right turn characteristics. Given the high turning movement traffic volumes, the proposed dual westbound left turn lanes and dual northbound right turn lanes are required. Paved shoulders are proposed along Roger Stevens Drive and given the rural context of the site, they are an appropriate cycling facility.

- Roger Stevens Drive/Highway 416 Southbound Ramps
    - The Roger Stevens Drive/Highway 416 Southbound Ramps intersection is anticipated to meet the target Auto LOS but will not meet the target PLOS and TkLOS.
    - Based on the PETSI, the intersection is operating with a PLOS F. A reduction in the crossing distance on the north approach would have the greatest improvement on the PETSI score and the Pedestrian Delay. However, based on projected traffic volumes, the proposed lane configuration is appropriate. Per MTO cross section design, a 10m median is required separating the on- and off-ramps.
    - BLOS has not been evaluated for the intersection as bikes are prohibited on 400 series highways. The ramp is under MTO jurisdiction and BLOS is not a consideration.
    - The intersection is anticipated to operate with a TkLOS E. The westbound right turn movement has one receiving lane on departure from this intersection. However, per MTO design for a single lane ramp, the on-ramp currently has a 4.75m wide lane with a right shoulder width of 2.5m and a left shoulder width of 1.0m. No changes are proposed to the configuration of the on-ramp as it currently accommodates trucks.
- Roger Stevens Drive/Highway 416 Northbound Ramps
    - The intersection is anticipated to meet the target Auto LOS and TkLOS but will not meet the target PLOS.
    - Based on the PETSI, the intersection is operating with a PLOS F. A reduction in the crossing distance would have the greatest improvement on the PETSI score and the Pedestrian Delay. No north-south crossing is proposed at this intersection. As such, only the east-west crossing has been evaluated in terms of PLOS. Per MTO cross section design, a 10m median is required separating the on- and off-ramps and the proposed lane configuration is required for capacity therefore no reduction is recommended.
    - BLOS has not been evaluated for the intersection as bikes are prohibited on 400 series highways. The ramp is under MTO jurisdiction and BLOS is not a consideration.

<u>Existing Intersection Operations</u>

- Under existing traffic conditions, all study area intersections are operating with a LOS C or better.
- Signals are not warranted at the Roger Stevens Drive/Highway 416 Northbound Ramps or the Roger Stevens Drive/Highway 416 Southbound ramps under existing traffic conditions.
- Currently, a westbound slip around lane is provided at the Roger Stevens Drive/Highway 416 Northbound Ramps, and an eastbound slip around lane is provided at the Roger Stevens Drive/Highway 416 Southbound Ramps. A review of the MTO Left Turn Lane Warrants suggests that a westbound left turn lane with a storage of 25m is warranted at the northbound on-ramp under existing traffic conditions. No eastbound left turn lane is warranted at the southbound on-ramp.

<u>Background Intersection Operations</u>

- Under background traffic conditions, all study area intersections are anticipated to operate with a LOS C or better.

- Under projected background traffic conditions in 2031, traffic signals are not warranted at the Roger Stevens Drive/Highway 416 Northbound Ramps or the Roger Stevens Drive/Highway 416 Southbound ramps.

2021 Total Intersection Operations

- With the addition of site traffic, traffic signals will be warranted at the intersections of Roger Stevens Drive/Highway 416 Northbound ramps, Roger Stevens Drive/Highway 416 Southbound ramps, and Roger Stevens Drive/East Employee Access in 2021. Traffic signals are 92% warranted at the Roger Stevens Drive/West Employee Access in the 2021 opening year.
- For the purposes of the analysis presented in this study, it has been assumed that traffic signals will be provided at the Roger Stevens Drive/Highway 416 Northbound ramps, Roger Stevens Drive/Highway 416 Southbound ramps, and Roger Stevens Drive/East Employee Access at buildout (2021). The Synchro and MTO warrant analysis completed as part of this study indicate that under these conditions, traffic signals are needed to ensure an adequate LOS during peak hours and will also be warranted based on peak hour traffic volumes. Actuated-coordinated signal timings are assumed.
- Under 2021 total traffic conditions, the Roger Stevens Drive/Highway 416 Southbound intersection is anticipated to operate with a v/c ratio of 0.91 and a LOS E during the AM peak hour. All other intersections are anticipated to operate with a LOS D or better.
- Maximum queue length for the eastbound through movement at the Highway 416 Southbound Ramps is anticipated to be approximately 290m during the AM peak. This queue length is not anticipated to extend past the Roger Stevens Drive/East Employee Access intersection. Synchro identifies that the eastbound queue may take more than one cycle to clear the intersection during the peak hour. Due to space constraints at the Highway 416 overpass bridge to the east, a second eastbound through lane at the Roger Stevens Drive/Highway 416 Southbound Ramps could not be provided without widening the bridge.
- The eastbound queue at the northbound ramps is metered due to capacity constraints at the upstream intersection (southbound ramps). No further improvements are recommended due to the space constraints at the Highway 416 overpass bridge.
- The southbound queue at the southbound ramps is anticipated to be approximately 80m, and the northbound queue at the northbound ramps is anticipated to be approximately 70m.
- The maximum northbound queue length at the east employee access is anticipated to be approximately 30m. The maximum northbound queue length at the west employee access is anticipated to be approximately 20m. The maximum northbound queue length at the truck access is anticipated to be insignificant.
- The westbound queue at the east employee access is anticipated to be approximately 90m. This queue length is not anticipated to extend past the Roger Stevens Drive/Highway 416 Southbound intersection.

2026 Total Intersection Operations

- Under 2026 total traffic conditions, with adjusted signal timing, all intersections are anticipated to operate with a LOS D or better.
- Maximum queue length for the eastbound through movement at the Highway 416 Southbound Ramps is anticipated to be approximately 70m in the AM peak and 110m in the PM peak. This is an improvement from the projected AM queue of 290m under 2021 total traffic conditions. The improvement is due to the longer cycle length proposed under 2026 total traffic conditions. This eastbound queue length is not anticipated to extend past

the Roger Stevens Drive/East Employee Access intersection. Synchro identifies that the eastbound queue may take more than one cycle to clear the intersection during the peak hour. Due to space constraints at the Highway 416 overpass bridge to the east, a second eastbound through lane at the Roger Stevens Drive/Highway 416 Southbound Ramps could not be provided without widening the bridge.

- The eastbound queue at the northbound ramps is metered due to capacity constraints at the upstream intersection (southbound ramps). No further improvements are recommended due to the space constraints at the Highway 416 overpass bridge.
- The southbound queue at the southbound ramps is anticipated to be approximately 90m, and the northbound queue at the northbound ramps is anticipated to be approximately 65m.
- The maximum northbound queue length at the east employee access is anticipated to be approximately 30m. The maximum northbound queue length at the west employee access is anticipated to be approximately 25m. The maximum northbound queue length at the truck access is anticipated to be insignificant.
- The westbound queue at the east employee access is anticipated to be approximately 85m. This queue length is not anticipated to extend past the Roger Stevens Drive/Highway 416 Southbound intersection.

2031 Total Intersection Operations

- Under 2031 total traffic conditions, all intersections are anticipated to operate with a LOS D or better.
- Maximum queue length for the eastbound through movement at the Highway 416 Southbound Ramps is anticipated to be approximately 290m in the AM peak and 280m in the PM peak hour. This queue length is not anticipated to extend past the Roger Stevens Drive/East Employee Access intersection. Synchro identifies that the eastbound queue may take more than one cycle to clear the intersection during the peak hour. Due to space constraints at the Highway 416 overpass bridge to the east, a second eastbound through lane at the Roger Stevens Drive/Highway 416 Southbound Ramps could not be provided without widening the bridge.
- The eastbound queue at the northbound ramps is metered due to capacity constraints at the upstream intersection (southbound ramps). No further improvements are recommended due to the space constraints at the Highway 416 overpass bridge.
- The southbound queue at the southbound ramps is anticipated to be approximately 95m, and the northbound queue at the northbound ramps is anticipated to be approximately 80m.
- The maximum northbound queue length at the east employee access is anticipated to be approximately 30m. The maximum northbound queue length at the west employee access is anticipated to be approximately 25m. The maximum northbound queue length at the truck access is anticipated to be insignificant.
- The westbound queue at the east employee access is anticipated to be approximately 85m. This queue length is not anticipated to extend past the Roger Stevens Drive/Highway 416 Southbound intersection.

Functional Design

- Left and right turn deceleration lane requirements have been calculated using a design speed of 60km/h for Roger Stevens Drive. This is less than the posted speed of 80km/h.

- It is anticipated that the proposed modifications including signals, medians, and turn lanes will create additional side friction for motorists and reduce the operating speed along Roger Stevens Drive.
- A road modification approval (RMA) package for the proposed modifications to Roger Stevens Drive will be submitted under separate cover. A Provincial Class Environmental Assessment (EA) is required for the roadway modifications located within MTO's jurisdiction.

NOVATECH

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APPENDIX A

Site Plan

ROGER STEVENS DRIVE

SWMF-1

LIGHT INDUSTRIAL WAREHOUSE

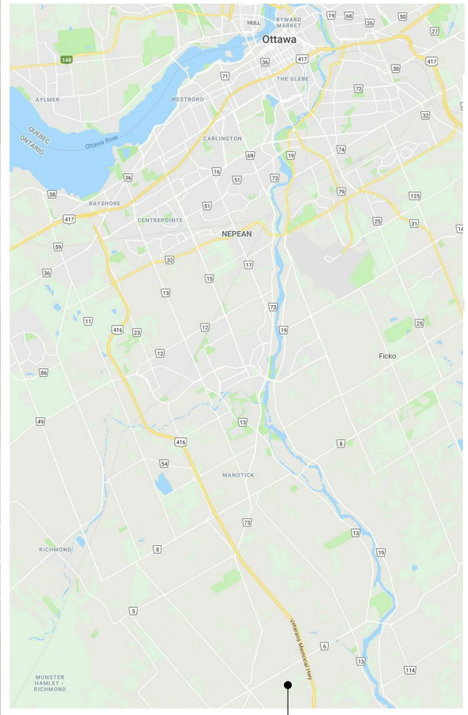
SWMF-2

VETERANS MEMORIAL HIGHWAY

PROJECT SUMMARY:

INDUSTRIAL BUILDING

LAND AREA	5,320,400± SF
GREEN SPACE AREA	3,203,100± SF
BUILDING AREA (GCA)	
BUILDING FOOTPRINT	700,000± SF
COVERAGE	13.1%
PARKING PROVIDED	1,820 STALLS
LOADING DOCKS	63 DOCKS
TRAILER DROPS	240 DROPS



DE19051 - VIPER Industrial Warehouse - Ottawa, ON

BROCCOLINI

Proposed Site Plan

4 July 2019

A100

APPENDIX B

TIA Screening Form

City of Ottawa 2017 TIA Guidelines Screening Form

1. Description of Proposed Development

Municipal Address	**1966 Roger Stevens Drive**
Description of Location	**Southwest of Roger Stevens Drive/Highway 416**
Land Use Classification	**Warehouse**
Development Size (units)	
Development Size (m^2)	**Approx. 65,000 m^2 (700,000 SF)**
Number of Accesses and Locations	**3 - two employee accesses, one service access**
Phase of Development	**1**
Buildout Year	**2021**

If available, please attach a sketch of the development or site plan to this form.

2. Trip Generation Trigger

Considering the Development's Land Use type and Size (as filled out in the previous section), please refer to the Trip Generation Trigger checks below.

Land Use Type	Minimum Development Size
Single-family homes	40 units
Townhomes or apartments	90 units
Office	3,500 m^2
Industrial	5,000 m^2
Fast-food restaurant or coffee shop	100 m^2
Destination retail	1,000 m^2
Gas station or convenience market	75 m^2

** If the development has a land use type other than what is presented in the table above, estimates of person-trip generation may be made based on average trip generation characteristics represented in the current edition of the Institute of Transportation Engineers (ITE) Trip Generation Manual.*

If the proposed development size is greater than the sizes identified above, the Trip Generation Trigger is satisfied.

3. Location Triggers

	Yes	No
Does the development propose a new driveway to a boundary street that is designated as part of the City's Transit Priority, Rapid Transit or Spine Bicycle Networks?	X	
Is the development in a Design Priority Area (DPA) or Transit-oriented Development (TOD) zone?*		X

**DPA and TOD are identified in the City of Ottawa Official Plan (DPA in Section 2.5.1 and Schedules A and B; TOD in Annex 6). See Chapter 4 for a list of City of Ottawa Planning and Engineering documents that support the completion of TIA).*

If any of the above questions were answered with 'Yes,' the Location Trigger is satisfied.

4. Safety Triggers

	Yes	No
Are posted speed limits on a boundary street 80 km/hr or greater?	X	
Are there any horizontal/vertical curvatures on a boundary street limits sight lines at a proposed driveway?		X
Is the proposed driveway within the area of influence of an adjacent traffic signal or roundabout (i.e. within 300 m of intersection in rural conditions, or within 150 m of intersection in urban/ suburban conditions)?		X
Is the proposed driveway within auxiliary lanes of an intersection?		X
Does the proposed driveway make use of an existing median break that serves an existing site?		X
Is there is a documented history of traffic operations or safety concerns on the boundary streets within 500 m of the development?		X
Does the development include a drive-thru facility?		X

If any of the above questions were answered with 'Yes,' the Safety Trigger is satisfied.

5. Summary

	Yes	No
Does the development satisfy the Trip Generation Trigger?	X	
Does the development satisfy the Location Trigger?	X	
Does the development satisfy the Safety Trigger?	X	

If none of the triggers are satisfied, the TIA Study is complete. If one or more of the triggers is satisfied, the TIA Study must continue into the next stage (Screening and Scoping).

APPENDIX C

OC Transpo System Information

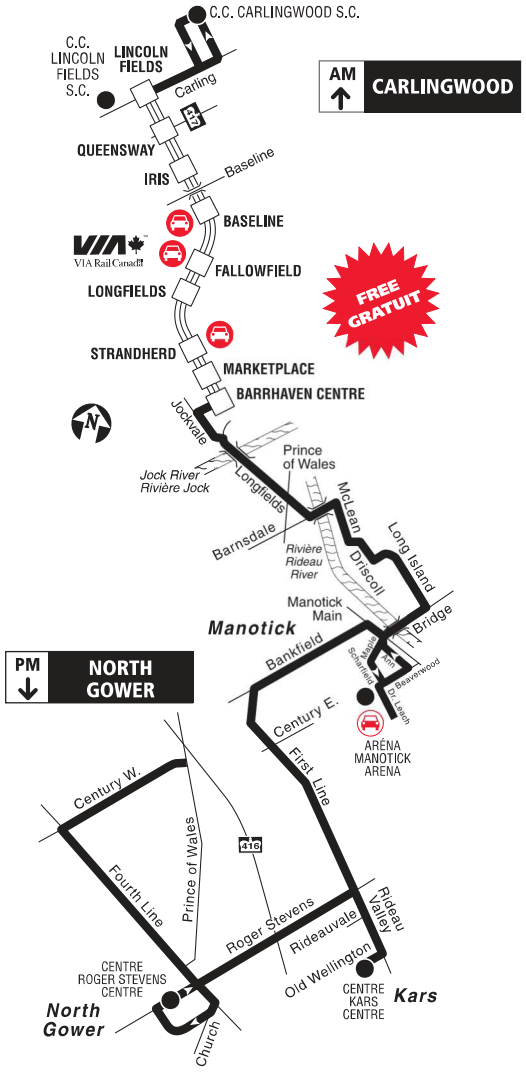
FORMER / ANCIEN 205

305 Local

CARLINGWOOD
NORTH GOWER
KARS

FRIDAY only / Vendredi seulement

Selected time periods
Périodes sélectionnées



Legend • *Légende*

Transitway & Stations

Parc & Ride / *Parc-o-bus*

2017.01

Schedule / Horaire.....613-560-1000
Text / Texto 560560

plus your four digit bus stop number / *plus* votre numéro d'arrêt à quatre chiffres

Customer Relations
Service à la clientèle **613-842-3600**

Lost and Found / Objets perdus..... **613-563-4011**

Security / Sécurité..... **613-741-2478**

Effective December 25, 2016
En vigueur 25 décembre 2016

OC Transpo

INFO 613-741-4390
octranspo.com

APPENDIX D

Traffic Count Data and Long-Range Snapshots

15 MIN REPORT

Intersection ID:491900000(--E--) **HWY 416 @ RMOC RD 6 - ROGER STEVENS DRIVE IC** **Municipality: Eastern** **Date: 25-Apr-2018**

	NORTH APPROACH										EAST APPROACH										SOUTH APPROACH										WEST APPROACH										
Time	Cars			Trucks			Heavies			Ped	Cars			Trucks			Heavies			Ped	Cars			Trucks			Heavies			Ped	Cars			Trucks			Heavies			Ped	Total
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right		Left	Thru	Right	Left	Thru	Right	Left	Thru	Right		Left	Thru	Right	Left	Thru	Right	Left	Thru	Right		Left	Thru	Right	Left	Thru	Right	Left	Thru	Right		
Period1																																								
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Period2																																								
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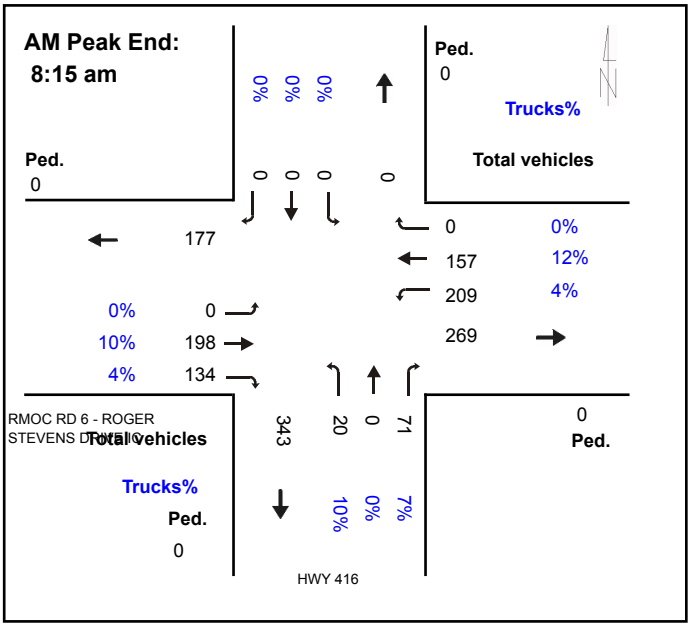
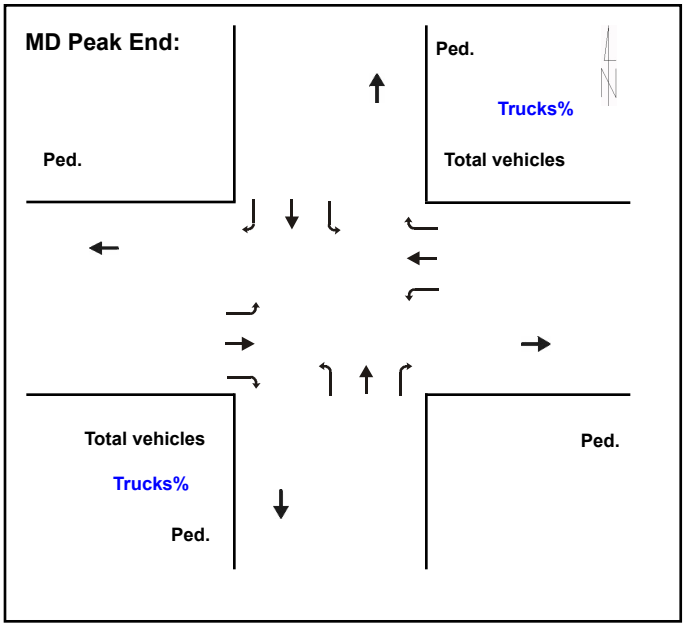
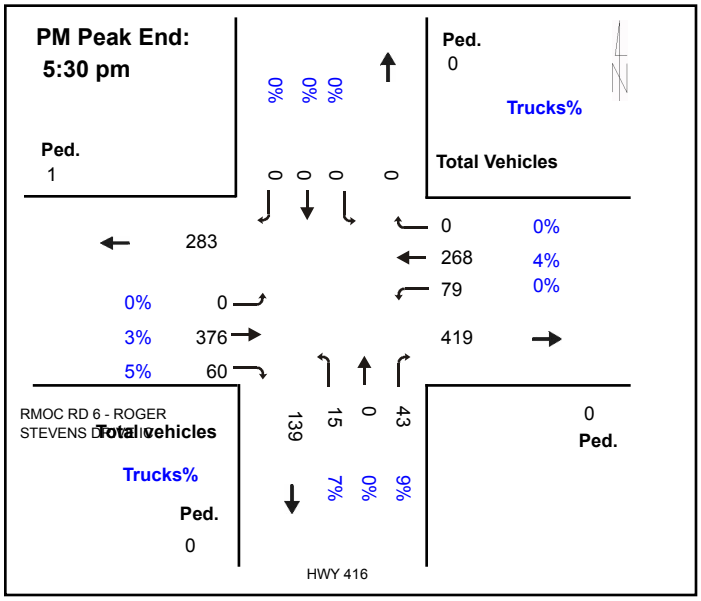
HWY 416 @ RMOC RD 6 - ROGER STEVENS DRIVE IC

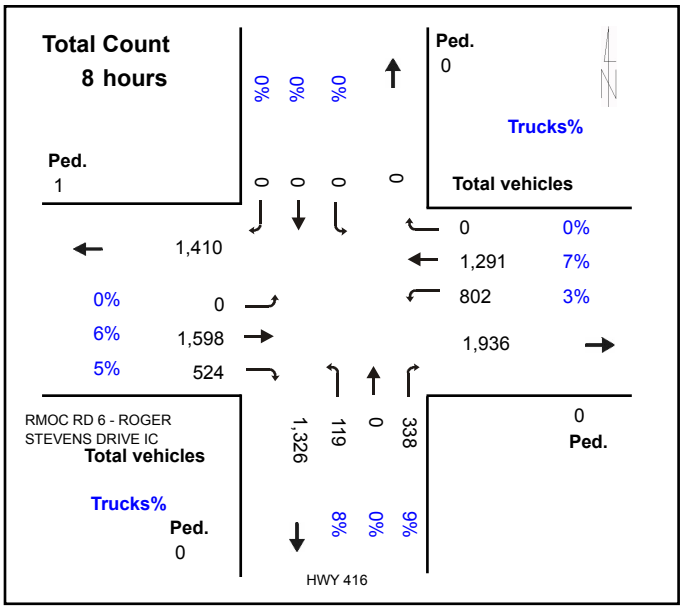
Eastern

Intersection ID:491900000(--E--) **Count Day: Wednesday** **Count Date: 25-Apr-2018**









15 MIN REPORT

Intersection ID:491900000(--W--) **HWY 416 @ RMOC RD 6 - ROGER STEVENS DRIVE IC** **Municipality: Eastern** **Date: 25-May-2018**

	NORTH APPROACH										EAST APPROACH										SOUTH APPROACH										WEST APPROACH										
Time	Cars			Trucks			Heavies			Ped	Cars			Trucks			Heavies			Ped	Cars			Trucks			Heavies			Ped	Cars			Trucks			Heavies			Ped	Total
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right		Left	Thru	Right	Left	Thru	Right	Left	Thru	Right		Left	Thru	Right	Left	Thru	Right	Left	Thru	Right		Left	Thru	Right	Left	Thru	Right	Left	Thru	Right		
Period1																																									
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Period2																																									
7:15	10	0	7	0	0	0	0	0	1	0	0	15	2	0	0	0	0	3	1	0	0	0	0	0	0	0	0	0	0	0	3	64	0	0	0	0	0	0	0	0	106
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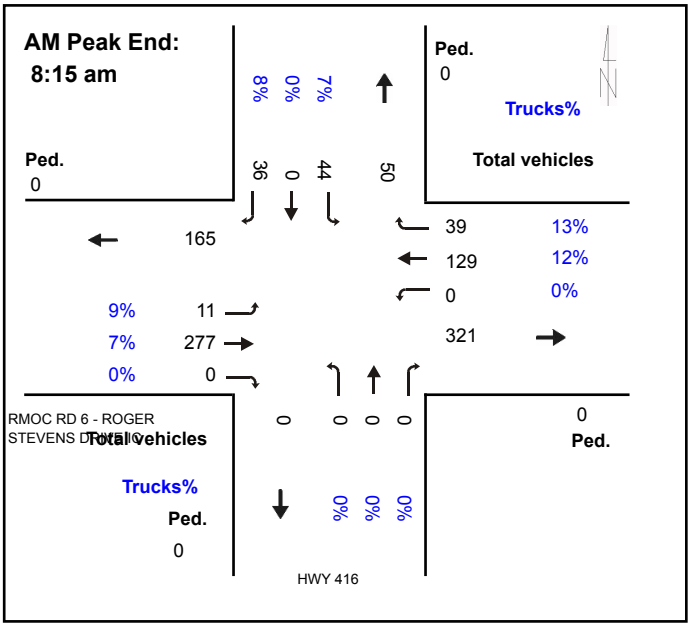
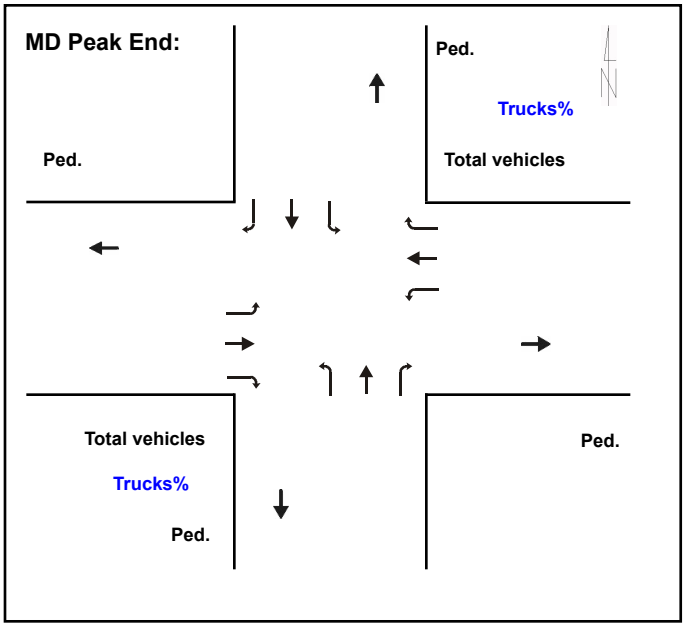
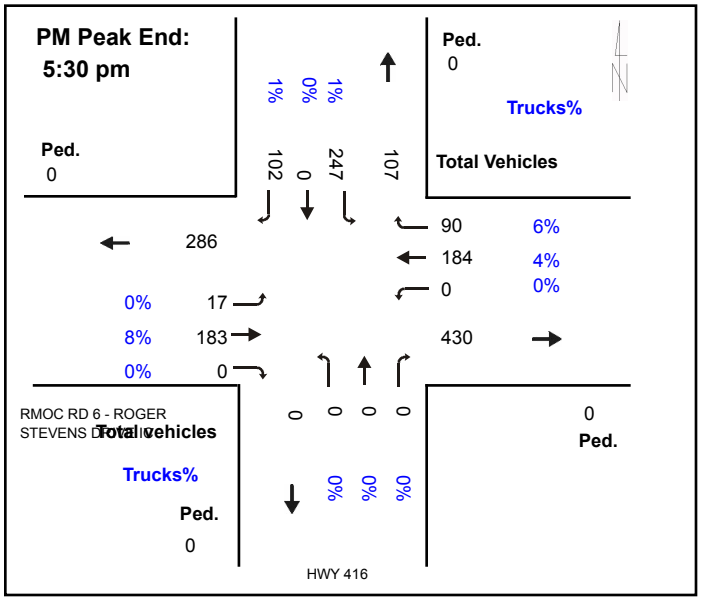
HWY 416 @ RMOC RD 6 - ROGER STEVENS DRIVE IC

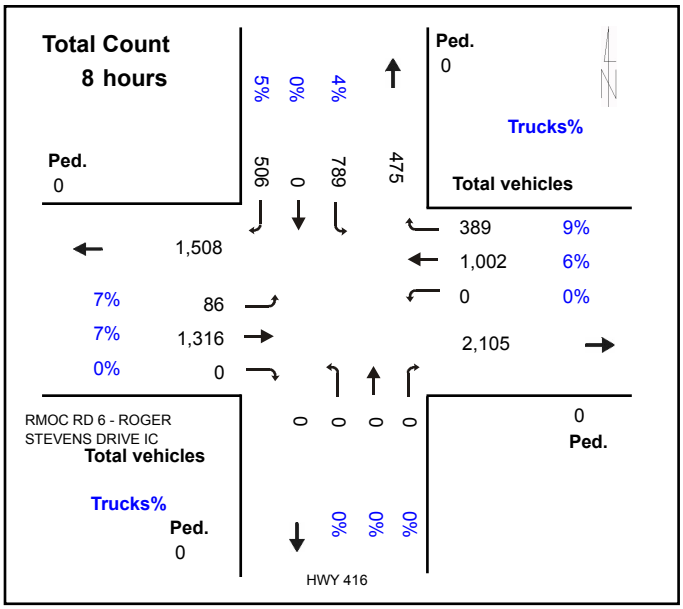
Eastern

Intersection ID:491900000(--W--) **Count Day: Friday** **Count Date: 25-May-2018**









NOVATECH
Engineers, Planners & Landscape Architects

Weather: Clear
Serial #: T12-1612
Counted by: Cameron Chown
Location: Roger Stevens&Third Line

File Name : Roger Stevens_Third Line
Site Code : 01814202
Start Date : 1/9/2019
Page No : 1

Groups Printed- Passenger Vehicles - Light Trucks - Heavy Trucks

	Third Line Road Southbound					Roger Stevens Drive Westbound					Third Line Road Northbound					Roger Stevens Drive Eastbound					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
07:00 AM	0	0	2	0	2	0	28	1	0	29	1	1	1	0	3	0	56	1	0	57	91
07:15 AM	0	1	0	0	1	6	20	0	0	26	6	1	4	0	11	1	69	4	0	74	112
07:30 AM	2	0	4	0	6	3	39	1	0	43	10	1	0	0	11	3	65	2	0	70	130
07:45 AM	0	1	3	0	4	4	38	2	0	44	5	2	3	0	10	0	59	2	0	61	119
Total	2	2	9	0	13	13	125	4	0	142	22	5	8	0	35	4	249	9	0	262	452
08:00 AM	0	1	5	0	6	2	43	1	0	46	2	0	1	0	3	1	44	3	0	48	103
08:15 AM	2	0	1	0	3	1	32	1	0	34	1	0	1	0	2	0	34	2	0	36	75
08:30 AM	0	0	1	0	1	1	24	4	0	29	0	2	2	0	4	1	40	1	0	42	76
08:45 AM	2	1	1	1	5	3	30	0	0	33	1	3	1	0	5	1	33	4	0	38	81
Total	4	2	8	1	15	7	129	6	0	142	4	5	5	0	14	3	151	10	0	164	335
09:00 AM	1	1	0	0	2	2	23	0	0	25	2	2	0	0	4	0	39	1	0	40	71
09:15 AM	2	0	4	0	6	0	29	0	0	29	0	0	0	0	0	1	43	0	0	44	79
09:30 AM	0	0	0	0	0	1	19	1	0	21	1	2	1	0	4	0	34	5	0	39	64
09:45 AM	0	0	0	0	0	1	20	3	0	24	2	4	0	0	6	1	28	2	0	31	61
Total	3	1	4	0	8	4	91	4	0	99	5	8	1	0	14	2	144	8	0	154	275
*** BREAK ***																					
11:30 AM	1	1	0	0	2	0	25	4	0	29	0	1	1	0	2	2	29	0	0	31	64
11:45 AM	1	0	2	0	3	1	21	1	0	23	5	0	1	0	6	0	19	1	0	20	52
Total	2	1	2	0	5	1	46	5	0	52	5	1	2	0	8	2	48	1	0	51	116
12:00 PM	1	0	4	0	5	2	23	0	0	25	2	2	1	0	5	1	27	2	0	30	65
12:15 PM	1	0	3	0	4	0	20	4	0	24	1	0	0	0	1	0	29	1	0	30	59
12:30 PM	1	0	2	0	3	0	20	1	0	21	1	1	1	0	3	0	30	0	0	30	57
12:45 PM	0	2	1	0	3	0	15	2	0	17	0	2	3	0	5	3	22	2	0	27	52
Total	3	2	10	0	15	2	78	7	0	87	4	5	5	0	14	4	108	5	0	117	233
01:00 PM	3	0	1	0	4	0	24	0	0	24	2	1	1	0	4	3	24	1	0	28	60
01:15 PM	3	1	3	0	7	1	25	1	0	27	0	1	0	0	1	0	22	0	0	22	57
*** BREAK ***																					
Total	6	1	4	0	11	1	49	1	0	51	2	2	1	0	5	3	46	1	0	50	117
*** BREAK ***																					
03:00 PM	2	1	1	0	4	2	39	0	0	41	4	1	1	0	6	1	32	1	0	34	85
03:15 PM	0	3	0	0	3	0	43	1	0	44	4	1	1	0	6	0	36	0	0	36	89
03:30 PM	1	3	2	0	6	1	51	1	0	53	6	1	1	0	8	1	35	3	0	39	106
03:45 PM	2	3	4	0	9	0	59	4	0	63	0	2	0	0	2	1	37	1	0	39	113
Total	5	10	7	0	22	3	192	6	0	201	14	5	3	0	22	3	140	5	0	148	393

NOVATECH
Engineers, Planners & Landscape Architects

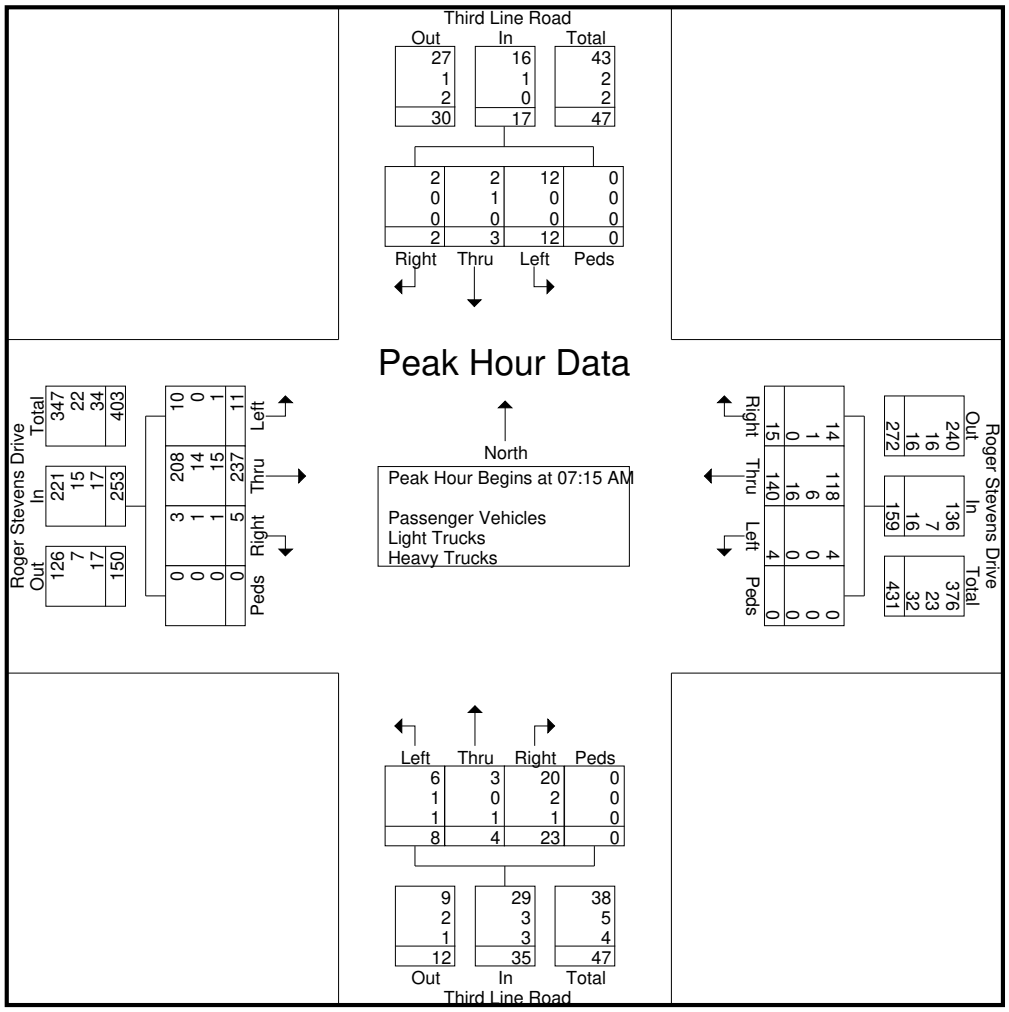
File Name : Roger Stevens_Third Line
Site Code : 01814202
Start Date : 1/9/2019
Page No : 2

Groups Printed- Passenger Vehicles - Light Trucks - Heavy Trucks

	Third Line Road Southbound					Roger Stevens Drive Westbound					Third Line Road Northbound					Roger Stevens Drive Eastbound					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
04:00 PM	7	1	4	0	12	1	48	1	0	50	0	0	0	0	0	0	43	3	0	46	108
04:15 PM	5	3	3	0	11	4	68	3	0	75	3	4	0	0	7	4	45	1	0	50	143
04:30 PM	2	1	1	0	4	2	74	8	0	84	2	1	1	0	4	3	43	0	0	46	138
04:45 PM	3	4	3	0	10	4	73	3	0	80	2	1	0	0	3	1	39	0	0	40	133
Total	17	9	11	0	37	11	263	15	0	289	7	6	1	0	14	8	170	4	0	182	522
05:00 PM	4	1	3	0	8	0	66	1	0	67	1	1	0	0	2	3	51	1	0	55	132
05:15 PM	1	6	2	0	9	4	56	3	0	63	2	0	0	0	2	1	32	4	0	37	111
05:30 PM	2	4	4	0	10	1	47	3	0	51	0	0	0	0	0	1	53	5	0	59	120
05:45 PM	1	6	2	0	9	2	47	1	0	50	1	0	0	0	1	0	30	0	0	30	90
Total	8	17	11	0	36	7	216	8	0	231	4	1	0	0	5	5	166	10	0	181	453
Grand Total	50	45	66	1	162	49	1189	56	0	1294	67	38	26	0	131	34	1222	53	0	1309	2896
Apprch %	30.9	27.8	40.7	0.6		3.8	91.9	4.3	0		51.1	29	19.8	0		2.6	93.4	4	0		
Total %	1.7	1.6	2.3	0	5.6	1.7	41.1	1.9	0	44.7	2.3	1.3	0.9	0	4.5	1.2	42.2	1.8	0	45.2	
Passenger Vehicles	46	43	65	1	155	45	1073	51	0	1169	57	36	18	0	111	29	1103	51	0	1183	2618
% Passenger Vehicles	92	95.6	98.5	100	95.7	91.8	90.2	91.1	0	90.3	85.1	94.7	69.2	0	84.7	85.3	90.3	96.2	0	90.4	90.4
Light Trucks	2	1	1	0	4	4	49	4	0	57	7	1	5	0	13	2	59	0	0	61	135
% Light Trucks	4	2.2	1.5	0	2.5	8.2	4.1	7.1	0	4.4	10.4	2.6	19.2	0	9.9	5.9	4.8	0	0	4.7	4.7
Heavy Trucks	2	1	0	0	3	0	67	1	0	68	3	1	3	0	7	3	60	2	0	65	143
% Heavy Trucks	4	2.2	0	0	1.9	0	5.6	1.8	0	5.3	4.5	2.6	11.5	0	5.3	8.8	4.9	3.8	0	5	4.9

NOVATECH
Engineers, Planners & Landscape Architects

File Name : Roger Stevens_Third Line
Site Code : 01814202
Start Date : 1/9/2019
Page No : 5



NOVATECH
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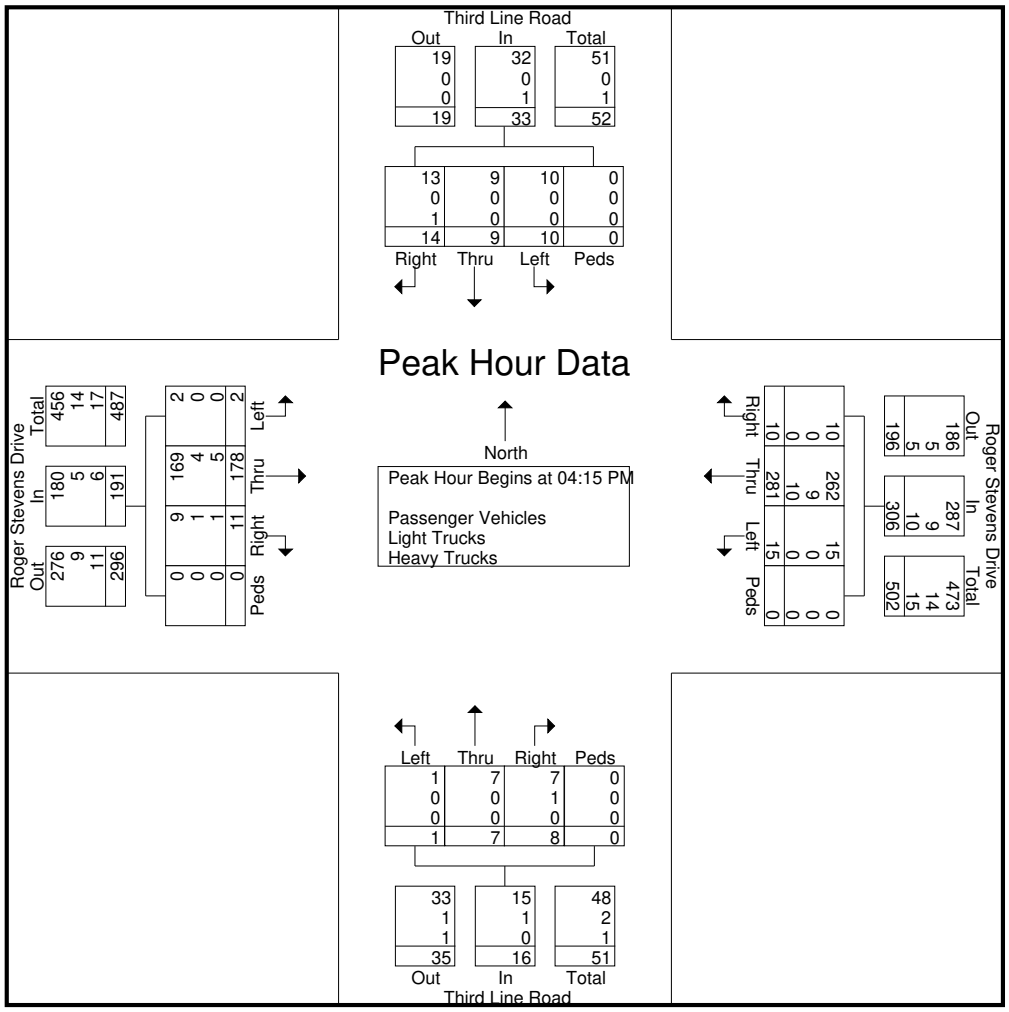
File Name : Roger Stevens_Third Line
Site Code : 01814202
Start Date : 1/9/2019
Page No : 9



NOVATECH
Engineers, Planners & Landscape Architects

Weather: Clear
Serial #: T12-1614
Counted by: Devin McRae
Location: Roger Stevens Dr&Trailwood Dr

File Name : Roger Stevens_Trailwood
Site Code : 01814201
Start Date : 1/9/2019
Page No : 1

Groups Printed- Passeneger Vehicles - Light Trucks - Heavy Trucks

	Roger Stevens Dr Westbound				Trailwood Dr Northbound				Roger Stevens Dr Eastbound				
Start Time	Thru	Left	Peds	App. Total	Right	Left	Peds	App. Total	Right	Thru	Peds	App. Total	Int. Total
07:00 AM	28	1	0	29	6	0	0	6	0	52	0	52	87
07:15 AM	25	1	0	26	7	2	0	9	0	65	0	65	100
07:30 AM	37	2	0	39	6	0	0	6	1	61	0	62	107
07:45 AM	41	1	0	42	10	2	0	12	0	49	0	49	103
Total	131	5	0	136	29	4	0	33	1	227	0	228	397
08:00 AM	43	1	0	44	3	0	0	3	0	43	0	43	90
08:15 AM	36	1	0	37	6	1	0	7	0	39	0	39	83
08:30 AM	22	1	0	23	4	1	0	5	0	36	0	36	64
08:45 AM	29	3	0	32	3	1	0	4	1	31	0	32	68
Total	130	6	0	136	16	3	0	19	1	149	0	150	305
09:00 AM	25	1	0	26	0	0	0	0	0	36	0	36	62
09:15 AM	30	0	0	30	3	0	0	3	1	43	0	44	77
09:30 AM	20	0	0	20	5	0	0	5	1	36	0	37	62
09:45 AM	21	0	0	21	4	0	0	4	0	24	0	24	49
Total	96	1	0	97	12	0	0	12	2	139	0	141	250
*** BREAK ***													
11:30 AM	25	2	0	27	0	1	0	1	1	30	0	31	59
11:45 AM	24	0	0	24	2	1	0	3	0	21	0	21	48
Total	49	2	0	51	2	2	0	4	1	51	0	52	107
12:00 PM	25	0	0	25	1	0	0	1	1	27	0	28	54
12:15 PM	19	3	0	22	5	0	0	5	0	27	0	27	54
12:30 PM	19	2	0	21	2	1	0	3	1	25	0	26	50
12:45 PM	18	0	0	18	3	0	0	3	3	25	0	28	49
Total	81	5	0	86	11	1	0	12	5	104	0	109	207
01:00 PM	28	3	0	31	1	0	0	1	0	22	0	22	54
01:15 PM	27	3	0	30	1	0	0	1	0	25	0	25	56
*** BREAK ***													
Total	55	6	0	61	2	0	0	2	0	47	0	47	110
*** BREAK ***													
03:00 PM	40	4	0	44	1	4	0	5	0	31	0	31	80
03:15 PM	37	0	0	37	2	0	0	2	0	24	0	24	63
03:30 PM	60	1	0	61	1	1	0	2	0	32	0	32	95
03:45 PM	59	2	0	61	2	1	0	3	2	36	0	38	102
Total	196	7	0	203	6	6	0	12	2	123	0	125	340

NOVATECH
Engineers, Planners & Landscape Architects

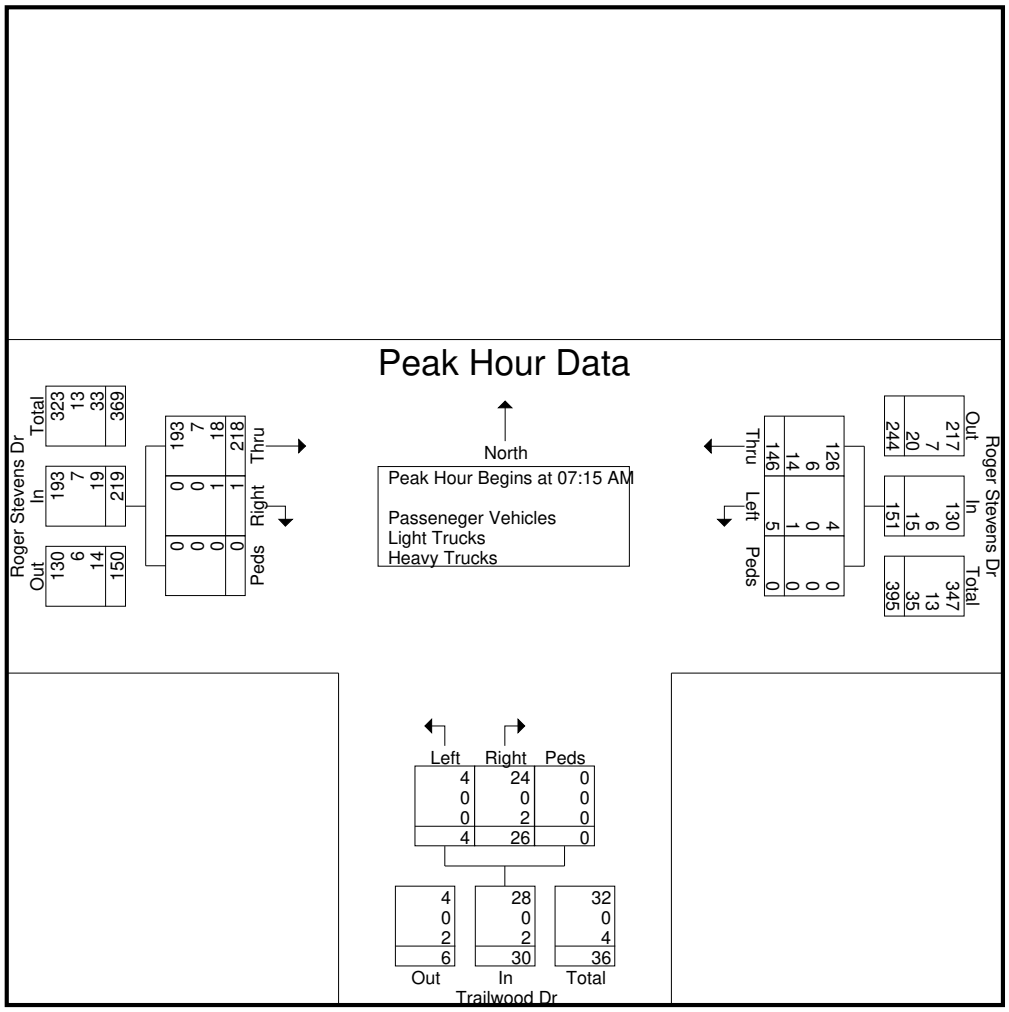
File Name : Roger Stevens_Trailwood
Site Code : 01814201
Start Date : 1/9/2019
Page No : 2

Groups Printed- Passeneger Vehicles - Light Trucks - Heavy Trucks

	Roger Stevens Dr Westbound				Trailwood Dr Northbound				Roger Stevens Dr Eastbound				
Start Time	Thru	Left	Peds	App. Total	Right	Left	Peds	App. Total	Right	Thru	Peds	App. Total	Int. Total
04:00 PM	48	7	0	55	2	0	0	2	1	41	0	42	99
04:15 PM	64	12	0	76	3	0	0	3	0	46	0	46	125
04:30 PM	77	4	0	81	0	0	0	0	3	46	0	49	130
04:45 PM	71	3	0	74	1	0	0	1	2	39	0	41	116
Total	260	26	0	286	6	0	0	6	6	172	0	178	470
05:00 PM	69	7	0	76	1	0	0	1	0	49	0	49	126
05:15 PM	45	12	0	57	2	0	0	2	1	27	0	28	87
05:30 PM	51	1	0	52	5	0	0	5	1	50	0	51	108
05:45 PM	44	2	0	46	4	0	0	4	0	26	0	26	76
Total	209	22	0	231	12	0	0	12	2	152	0	154	397
Grand Total	1207	80	0	1287	96	16	0	112	20	1164	0	1184	2583
Apprch %	93.8	6.2	0		85.7	14.3	0		1.7	98.3	0		
Total %	46.7	3.1	0	49.8	3.7	0.6	0	4.3	0.8	45.1	0	45.8	
Passeneger Vehicles	1103	74	0	1177	89	14	0	103	19	1072	0	1091	2371
% Passeneger Vehicles	91.4	92.5	0	91.5	92.7	87.5	0	92	95	92.1	0	92.1	91.8
Light Trucks	40	2	0	42	0	0	0	0	0	33	0	33	75
% Light Trucks	3.3	2.5	0	3.3	0	0	0	0	0	2.8	0	2.8	2.9
Heavy Trucks	64	4	0	68	7	2	0	9	1	59	0	60	137
% Heavy Trucks	5.3	5	0	5.3	7.3	12.5	0	8	5	5.1	0	5.1	5.3

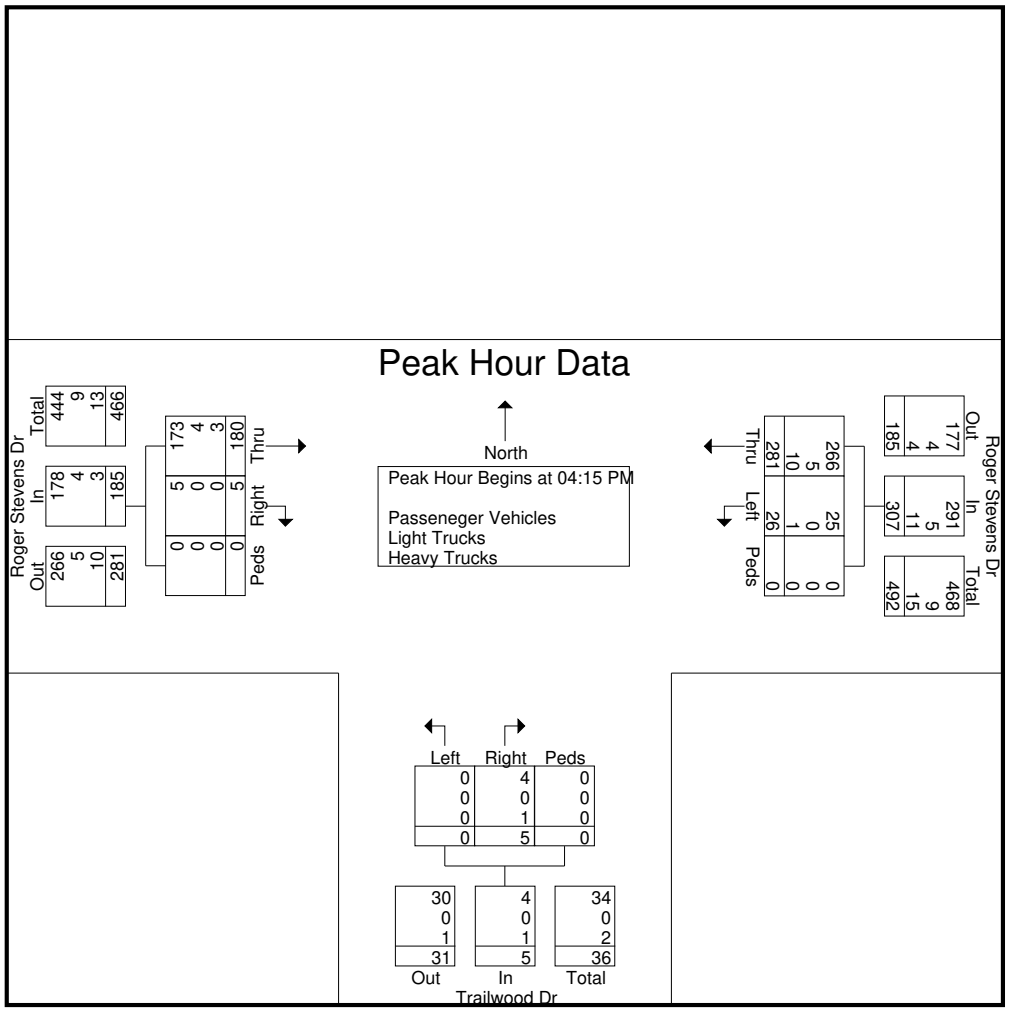
NOVATECH
Engineers, Planners & Landscape Architects

File Name : Roger Stevens_Trailwood
Site Code : 01814201
Start Date : 1/9/2019
Page No : 5



NOVATECH
Engineers, Planners & Landscape Architects

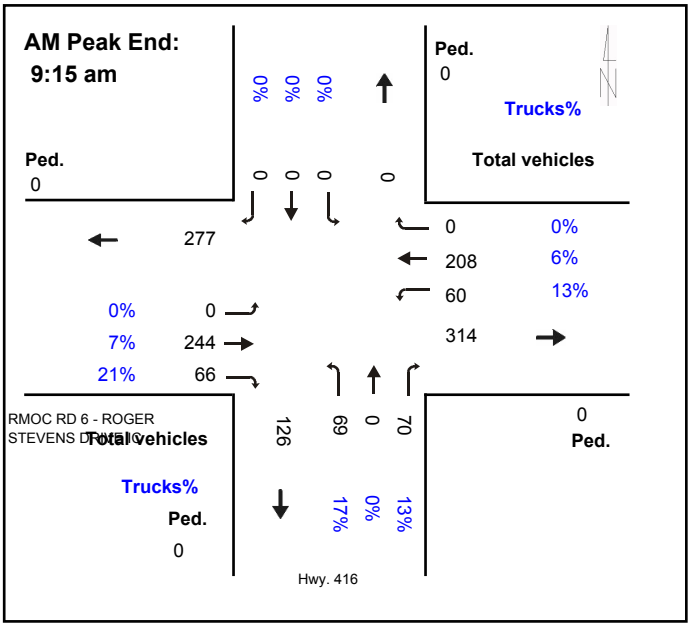
File Name : Roger Stevens_Trailwood
Site Code : 01814201
Start Date : 1/9/2019
Page No : 9

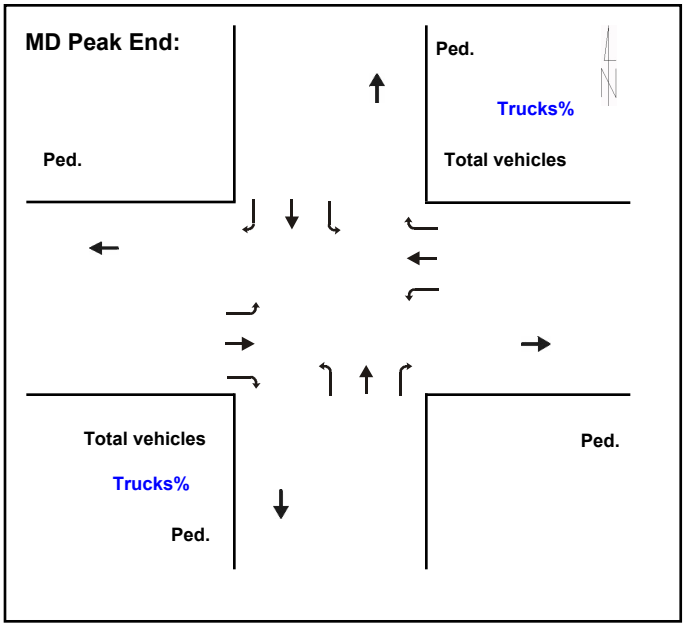


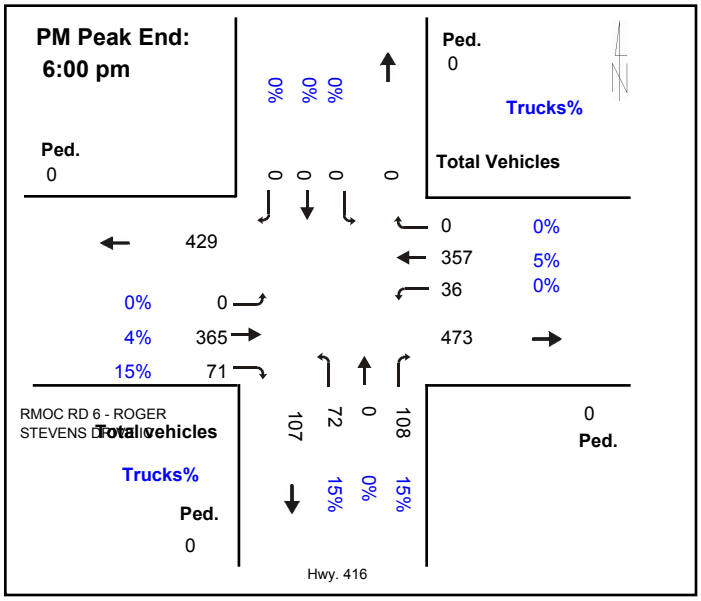
Hwy. 416 @ RMOC RD 6 - ROGER STEVENS DRIVE IC

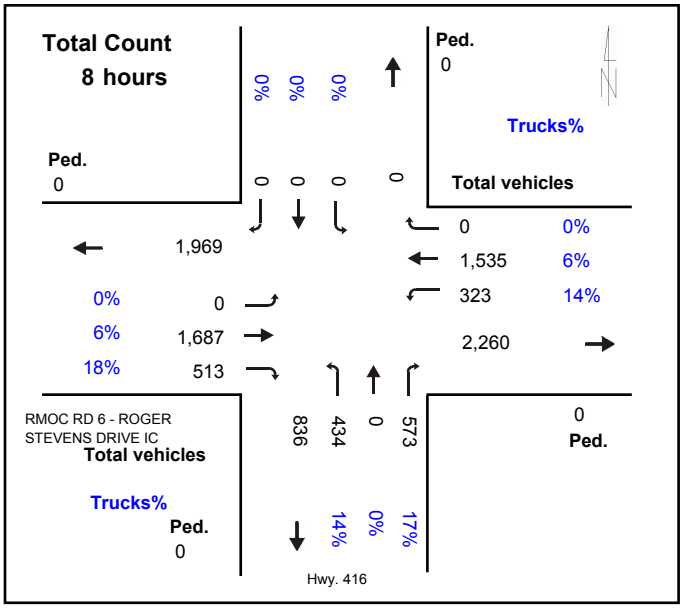
Eastern

Intersection ID:491900000(--E--) **Count Day: Thursday** **Count Date: 01-Sep-2011**





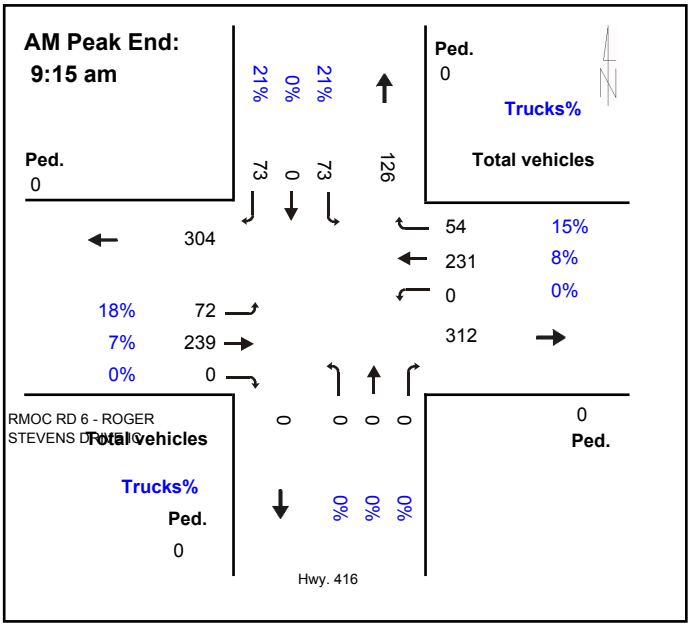


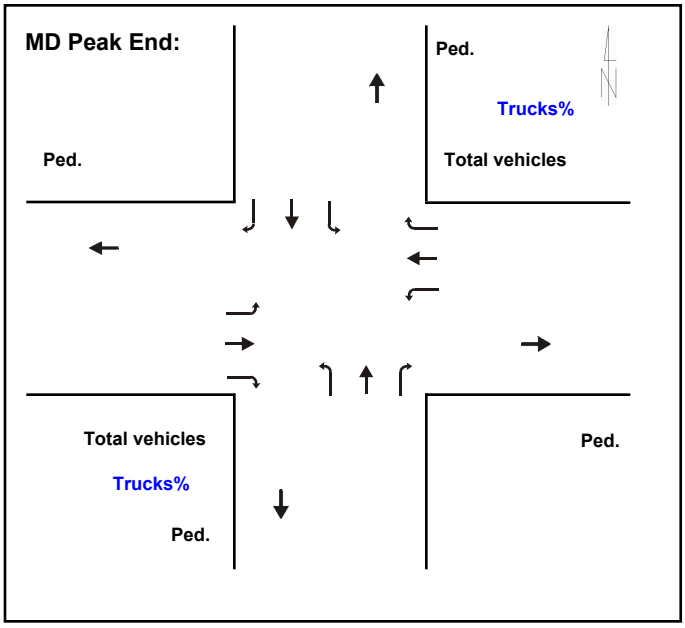


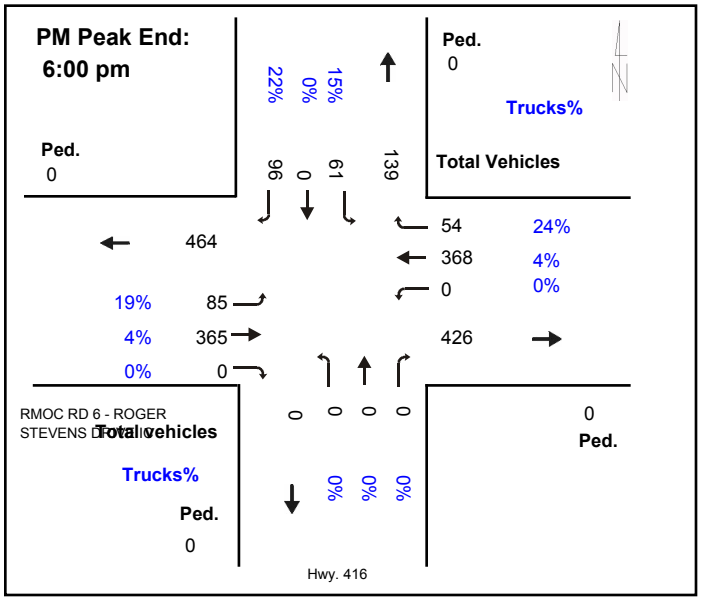
Hwy. 416 @ RMOC RD 6 - ROGER STEVENS DRIVE IC

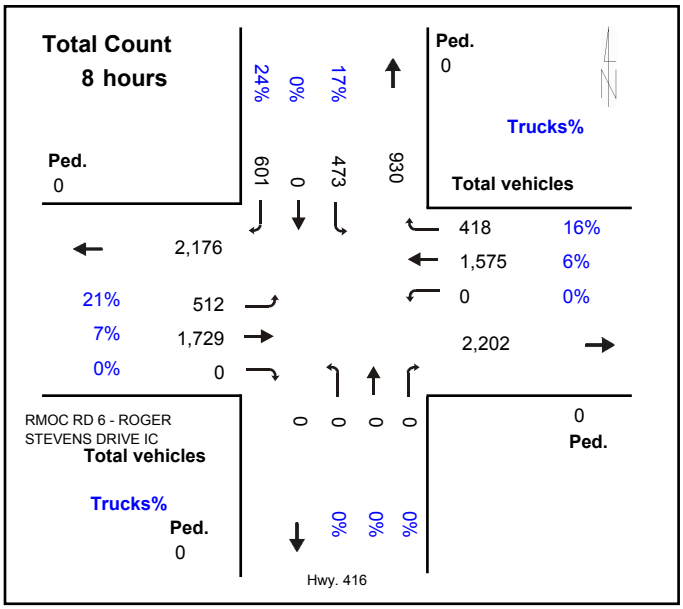
Eastern

Intersection ID:491900000(--W--) **Count Day: Thursday** **Count Date: 01-Sep-2011**





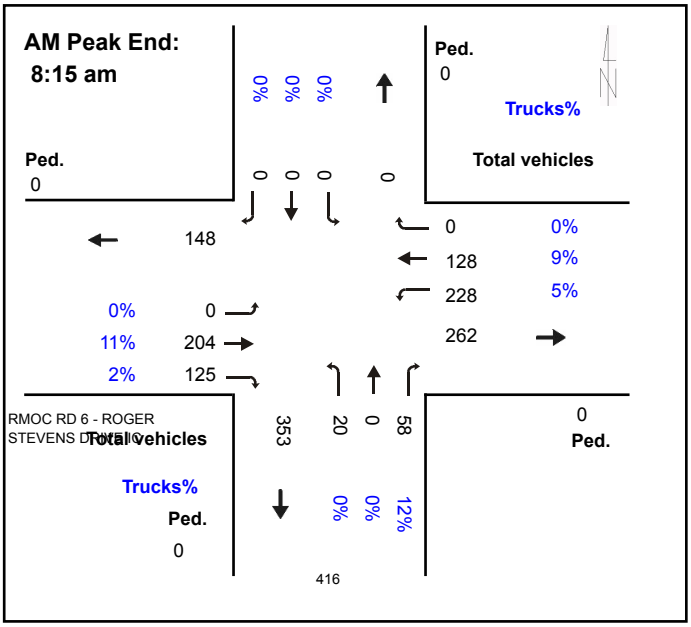


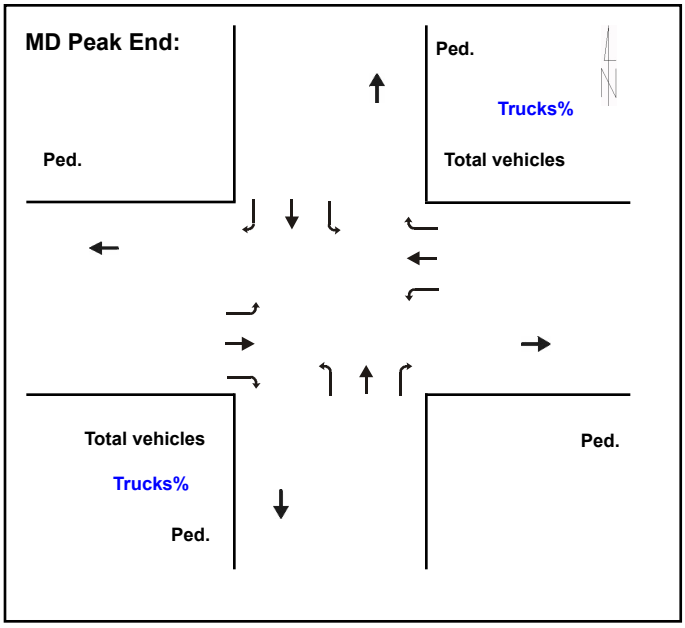


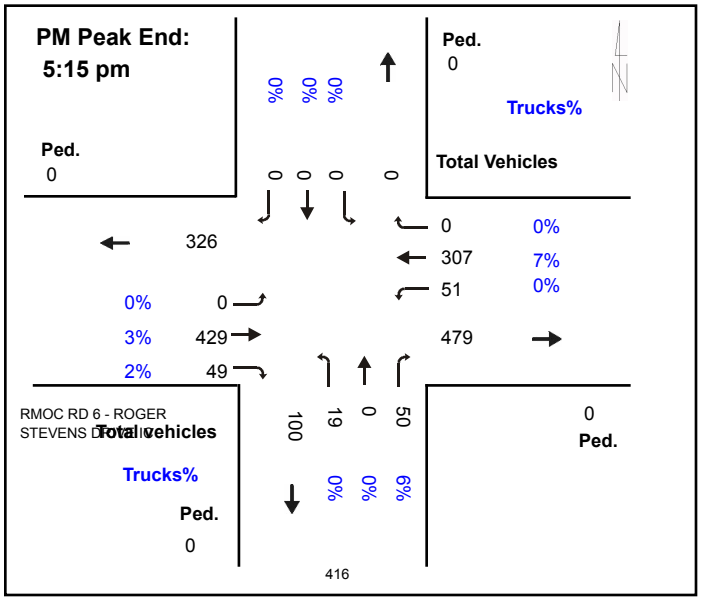
HWY 416 @ RMOC RD 6 - ROGER STEVENS DRIVE IC

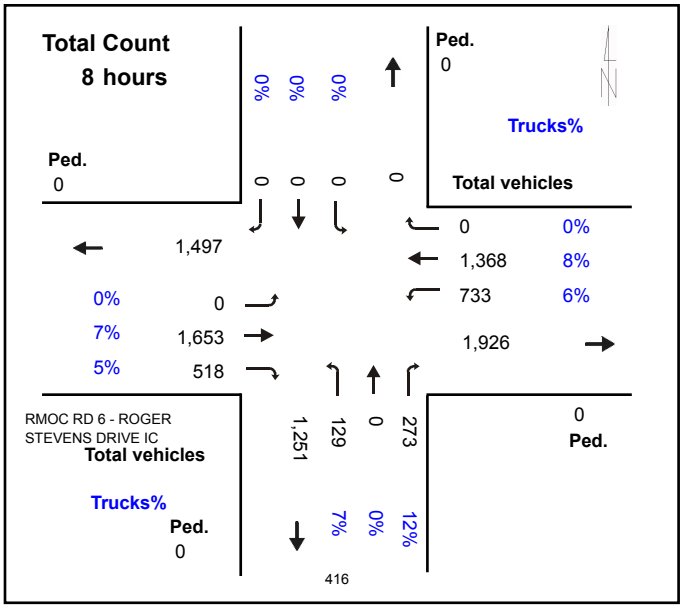
Eastern

Intersection ID:491900000(--E--) **Count Day: Thursday** **Count Date: 19-Sep-2013**





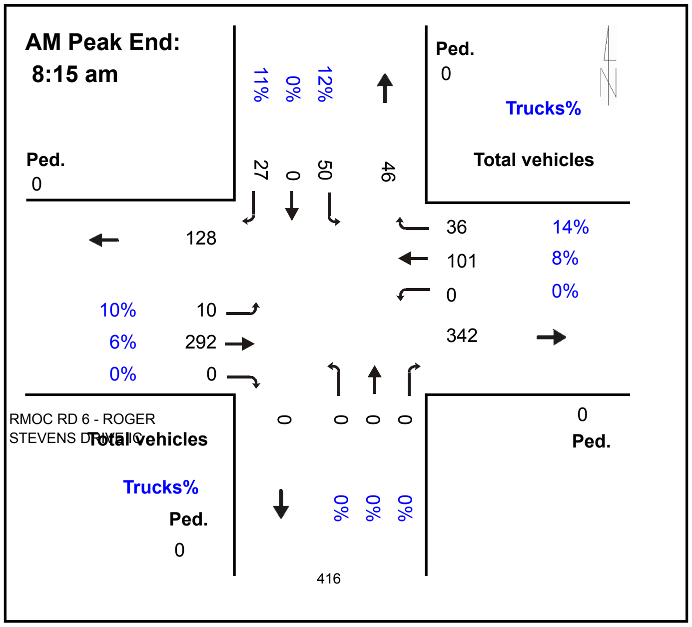


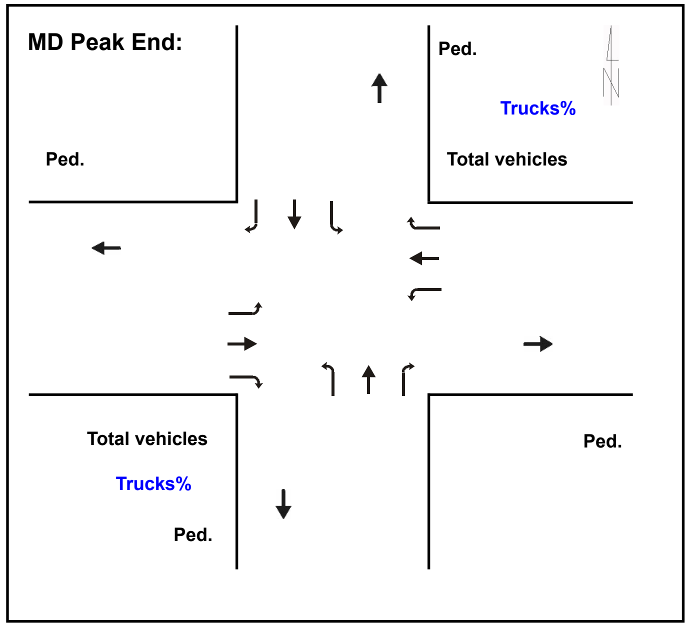


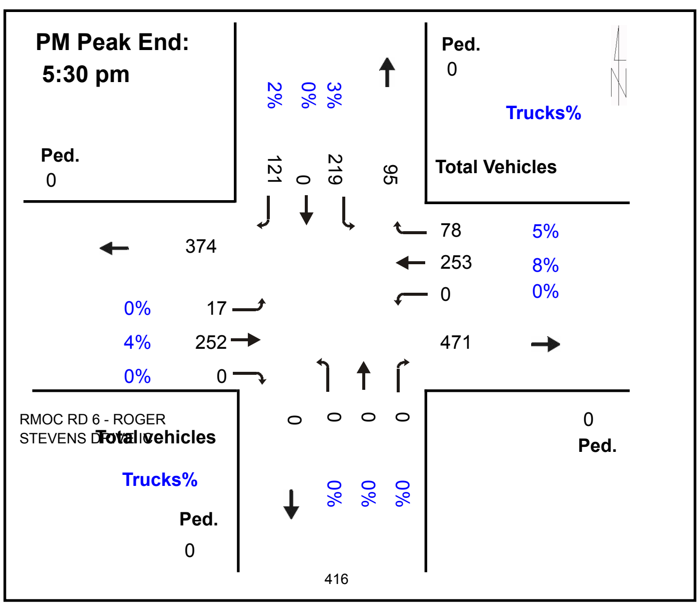
HWY 416 @ RMOC RD 6 - ROGER STEVENS DRIVE IC

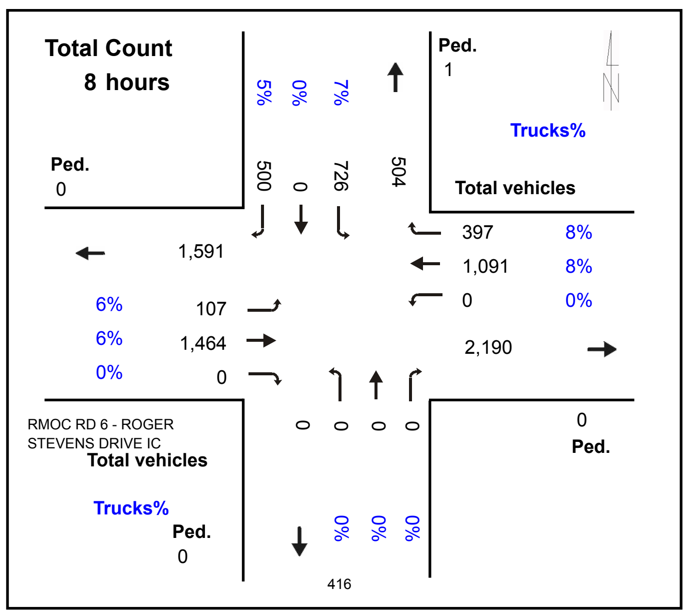
Eastern

Intersection ID:491900000(--W--) **Count Day: Thursday** **Count Date: 19-Sep-2013**





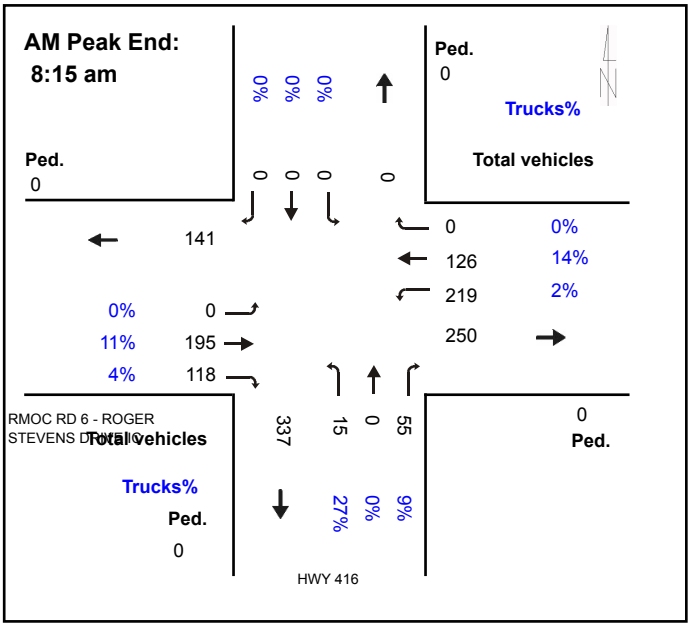


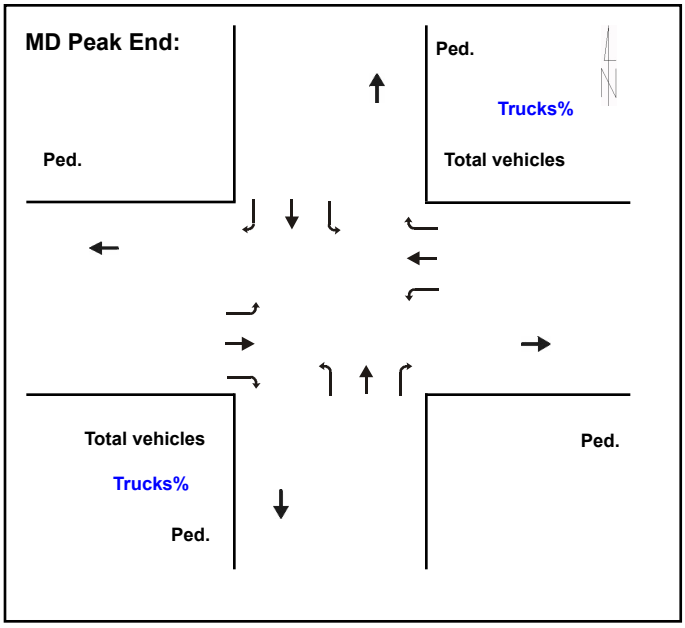


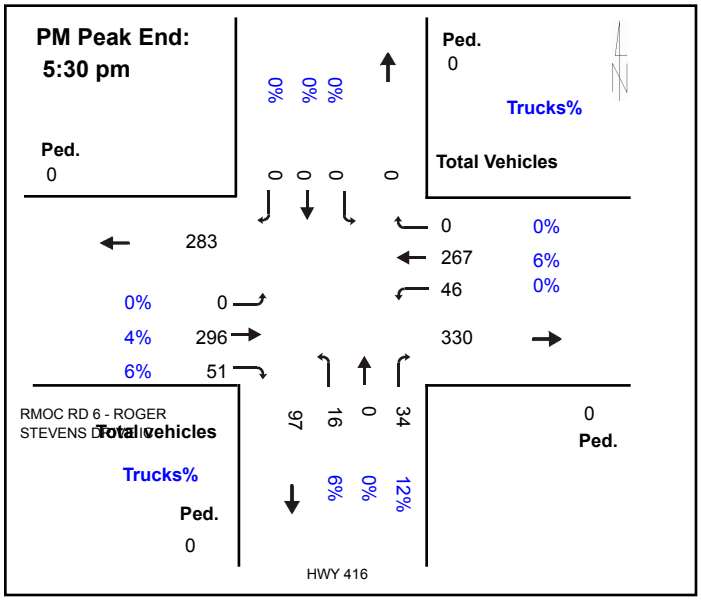
HWY 416 @ RMOC RD 6 - ROGER STEVENS DRIVE IC

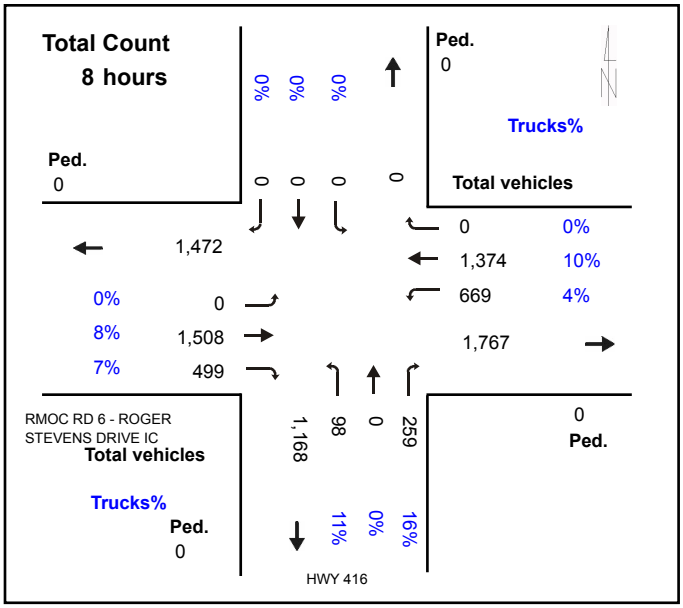
Eastern

Intersection ID:491900000(--E--) **Count Day: Thursday** **Count Date: 18-Sep-2014**





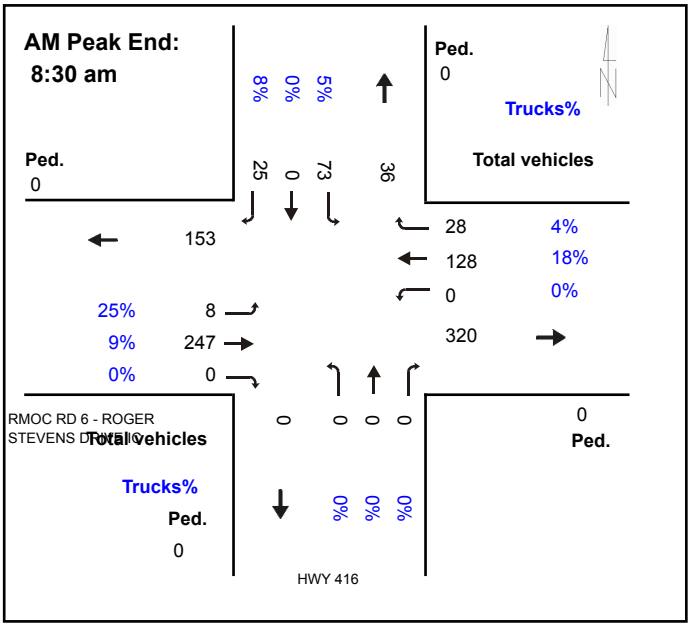


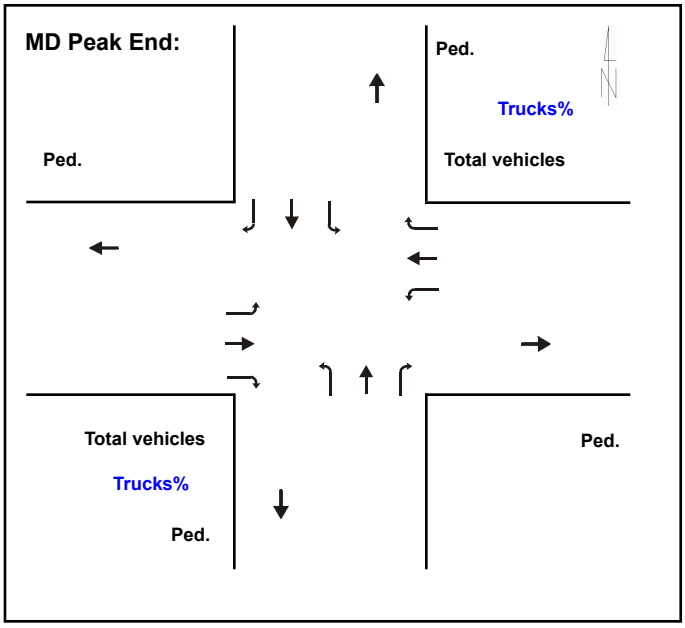


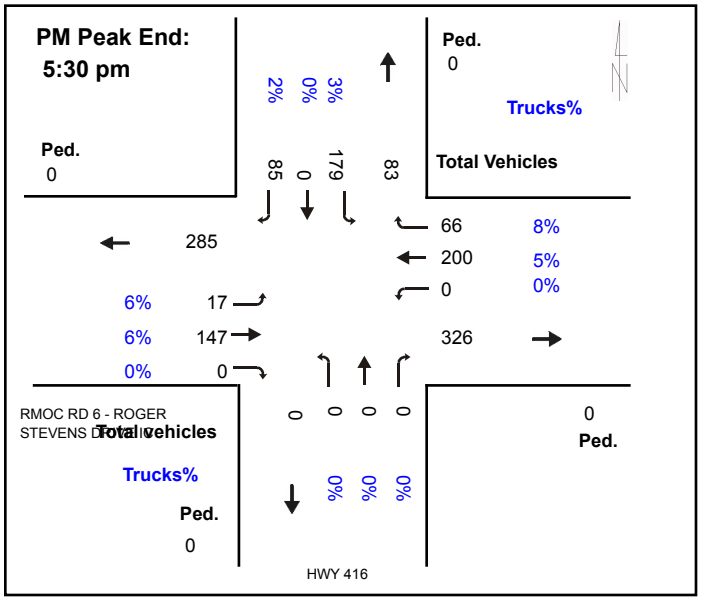
HWY 416 @ RMOC RD 6 - ROGER STEVENS DRIVE IC

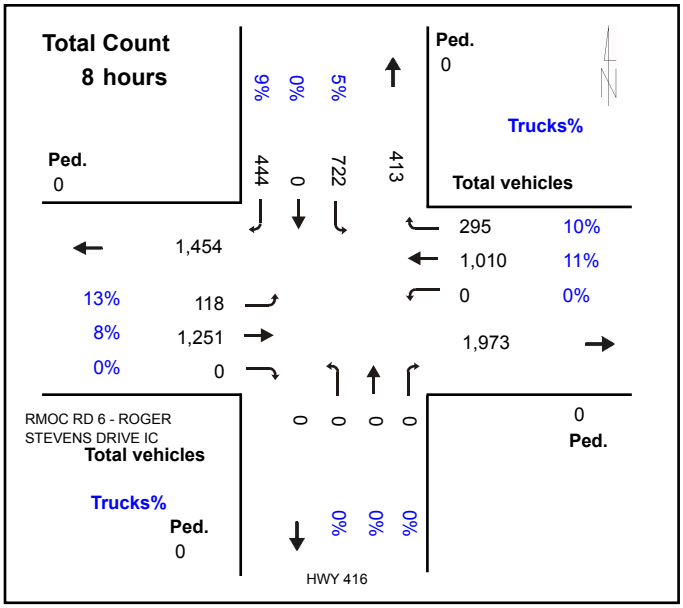
Eastern

Intersection ID:491900000(--W--) **Count Day: Monday** **Count Date: 22-Sep-2014**









ACCURATE TRUSTED TRAFFIC DATA

Turning Movement Count
Summary Report
AADT and Expansion Factors

Automobiles, Taxis, Light Trucks, Vans, SUV's, Motorcycles, Heavy Trucks, Buses, and School Buses

Carp Road & Reis Road — Carp, ON

Survey Date: Tuesday, 25 June 2019 **Start Time:** 0700 **AADT Factor:** 0.9
Weather AM: Overcast +14ºC **Survey Duration:** 6 Hrs. **Survey Hours:** 0700-1000 & 1500-1800
Weather PM: Partly Cloudy +28ºC **Surveyor(s):** Carmody

	N/A					Reis Rd.						Carp Rd.					Carp Rd.						
	Eastbound					Westbound						Northbound					Southbound						
Time Period	LT	ST	RT	UT	E/B Tot	LT	ST	RT	UT	W/B Tot	Street Total	LT	ST	RT	UT	N/B Tot	LT	ST	RT	UT	S/B Tot	Street Total	Grand Total
0700-0800	0	0	0	0	**0**	71	0	5	0	**76**	**76**	0	315	55	0	**370**	18	321	0	0	**339**	**709**	**785**
0800-0900	0	0	0	0	**0**	31	0	8	0	**39**	**39**	0	299	47	0	**346**	22	342	0	0	**364**	**710**	**749**
0900-1000	0	0	0	0	**0**	27	0	8	0	**35**	**35**	0	263	47	0	**310**	10	311	0	0	**321**	**631**	**666**
1500-1600	0	0	0	0	**0**	50	0	13	0	**63**	**63**	0	440	51	0	**491**	7	371	0	0	**378**	**869**	**932**
1600-1700	0	0	0	0	**0**	76	0	33	0	**109**	**109**	0	500	44	0	**544**	12	368	0	0	**380**	**924**	**1033**
1700-1800	0	0	0	0	**0**	63	0	11	0	**74**	**74**	0	418	39	0	**457**	9	322	0	0	**331**	**788**	**862**
Totals	**0**	**0**	**0**	**0**	**0**	**318**	**0**	**78**	**0**	**396**	**396**	**0**	**2235**	**283**	**0**	**2518**	**78**	**2035**	**0**	**0**	**2113**	**4631**	**5027**

Equivalent 12 & 24-hour Vehicle Volumes Including the Annual Average Daily Traffic (AADT) Factor Applicable to the Day and Month of the Turning Movement Count

Expansion factors are applied exclusively to standard weekday 8-hour turning movement counts conducted during the hours of 0700h - 1000h, 1130h - 1330h and 1500h - 1800h

Equivalent 12-hour vehicle volumes. These volumes are calculated by multiplying the 8-hour totals by the 8 ➡12 expansion factor of 1.39

Equ. 12 Hr	n/a	n/a	n/a	n/a	**n/a**	n/a	n/a	n/a	n/a	**n/a**	**n/a**	n/a	n/a	n/a	n/a	**n/a**	n/a	n/a	n/a	n/a	**n/a**	**n/a**	**n/a**

Average daily 12-hour vehicle volumes. These volumes are calculated by multiplying the equivalent 12-hour totals by the AADT factor of: 0.9

AADT 12-hr	n/a	n/a	n/a	n/a	**n/a**	n/a	n/a	n/a	n/a	**n/a**	**n/a**	n/a	n/a	n/a	n/a	**n/a**	n/a	n/a	n/a	n/a	**n/a**	**n/a**	**n/a**

24-Hour AADT. These volumes are calculated by multiplying the average daily 12-hour vehicle volumes by the 12 ➡24 expansion factor of 1.31

AADT 24 Hr	n/a	n/a	n/a	n/a	**n/a**	n/a	n/a	n/a	n/a	**n/a**	**n/a**	n/a	n/a	n/a	n/a	**n/a**	n/a	n/a	n/a	n/a	**n/a**	**n/a**	**n/a**

AADT and expansion factors provided by the City of Ottawa

AM Peak Hour Factor ➡					0.94	Highest Hourly Vehicle Volume Between 0700h & 1000h																	
AM Peak Hr	LT	ST	RT	UT	TOT	LT	ST	RT	UT	TOT	S.TOT	LT	ST	RT	UT	TOT	LT	ST	RT	UT	TOT	S.TOT	G.TOT
0745-0845	0	0	0	0	**0**	33	0	7	0	**40**	**40**	0	342	59	0	**401**	21	330	0	0	**351**	**752**	**792**

PM Peak Hour Factor ➡					0.92	Highest Hourly Vehicle Volume Between 1500h & 1800h																	
PM Peak Hr	LT	ST	RT	UT	TOT	LT	ST	RT	UT	TOT	S.TOT	LT	ST	RT	UT	TOT	LT	ST	RT	UT	TOT	S.TOT	G.TOT
1615-1715	0	0	0	0	**0**	87	0	29	0	**116**	**116**	0	497	46	0	**543**	15	373	0	0	**388**	**931**	**1047**

Comments:

No pedestrians observed during the traffic count.

Notes:

1. Includes all vehicle types except bicycles, electric bicycles, and electric scooters.
2. When expansion and AADT factors are applied, the results will differ slightly due to rounding.

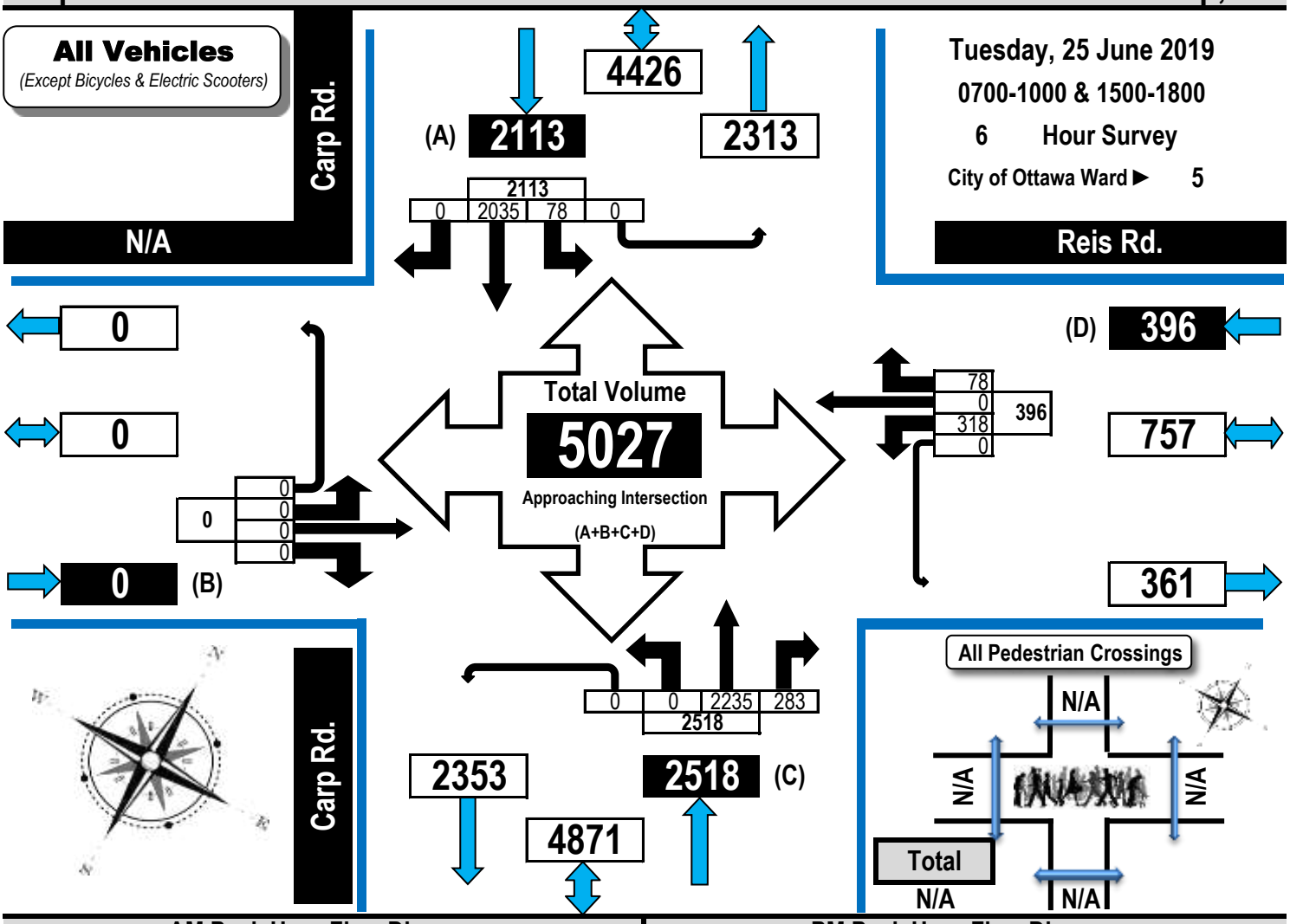
Turning Movement Count
Summary, AM and PM Peak Hour Flow Diagrams

Automobiles, Taxis, Light Trucks, Vans, SUV's, Motorcycles, Heavy Trucks, Buses, and School Buses

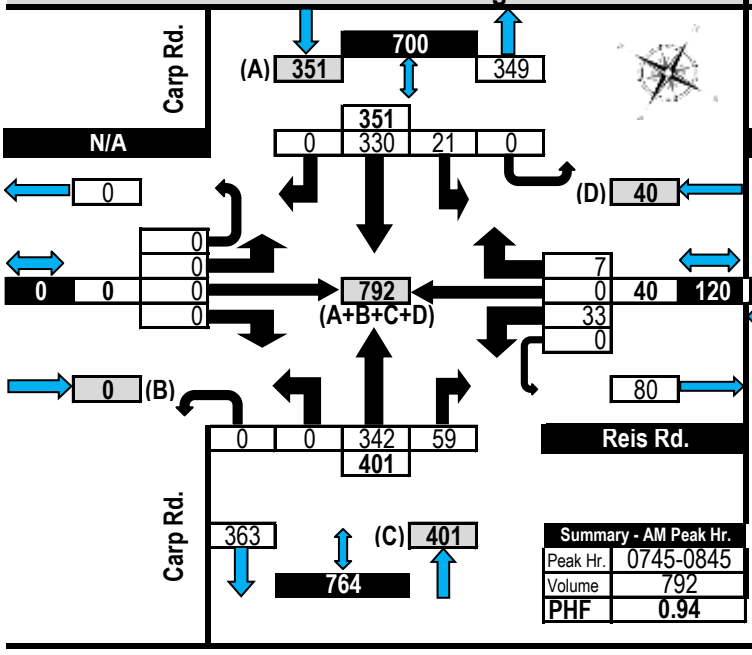
Carp Road & Reis Road — Carp, ON

All Vehicles
(Except Bicycles & Electric Scooters)

Tuesday, 25 June 2019
0700-1000 & 1500-1800
6 Hour Survey
City of Ottawa Ward ▶ 5

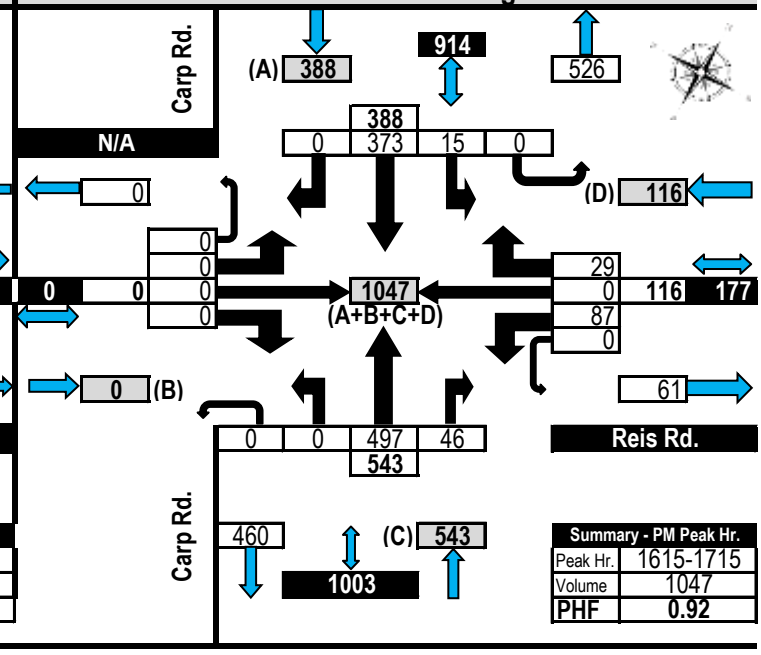


AM Peak Hour Flow Diagram



Summary - AM Peak Hr.	
Peak Hr.	0745-0845
Volume	792
PHF	0.94

PM Peak Hour Flow Diagram



Summary - PM Peak Hr.	
Peak Hr.	1615-1715
Volume	1047
PHF	0.92

TRANS Regional Model

Version 1.12 - last updated October 23, 2018

AM Peak Hour Total Traffic Volume

Roger Stevens - 416

2011 - Scenario 11119
Base Year General Scenario

Modifications from base version:
None

User Initials: SG

Legend

Peak Hour Total Traffic Volume

500 1000 1500 2000 2500

Distance (m)

200 400 600 800

N

TRANS Regional Model

Version 1.14 - last updated January 14, 2019

AM Peak Hour Total Traffic Volume

Roger Stevens - 416

2031 - Scenario 14311
TMP Affordable Road & Transit Network

Modifications from base version:

None

User Initials: SG

Legend

Peak Hour Total Traffic Volume

500 1000 1500 2000 2500

Distance (m)

200 400 600 800

N

APPENDIX E

Collision Records

City Operations - Transportation Services

Collision Details Report - Public Version

From: January 1, 2007 **To:** December 31, 2017

Location: HWY 416 ROGERSTE IC49R42 @ ROGER STEVENS DR

Traffic Control: No control **Total Collisions:** 1

Date/Day/Time	Environment	Impact Type	Classification	Surface Cond'n	Veh. Dir	Vehicle Manoeuver	Vehicle type	First Event	No. Ped
2017-Jun-14, Wed,20:30	Clear	SMV other	P.D. only	Dry	East	Turning right	Automobile, station wagon	Ran off road	

Location: HWY416 IC49 RAMP34 btwn HIGHWAY 416 & ROGER STEVENS DR

Traffic Control: No control **Total Collisions:** 2

Date/Day/Time	Environment	Impact Type	Classification	Surface Cond'n	Veh. Dir	Vehicle Manoeuver	Vehicle type	First Event	No. Ped
2013-Sep-29, Sun,07:40	Clear	SMV other	P.D. only	Dry	South	Going ahead	Automobile, station wagon	Ditch	
2017-Dec-12, Tue,15:55	Snow	SMV other	P.D. only	Loose snow	South	Going ahead	Automobile, station wagon	Skidding/sliding	

Location: HWY416 IC49 RAMP42 btwn HIGHWAY 416 & ROGER STEVENS DR

Traffic Control: No control **Total Collisions:** 2

Date/Day/Time	Environment	Impact Type	Classification	Surface Cond'n	Veh. Dir	Vehicle Manoeuver	Vehicle type	First Event	No. Ped
2013-Dec-14, Sat,09:20	Clear	SMV other	P.D. only	Dry	South	Going ahead	Automobile, station wagon	Other	
2014-Jan-05, Sun,15:20	Drifting Snow	SMV other	P.D. only	Ice	North	Going ahead	Pick-up truck	Skidding/sliding	

Location: ROGER STEVENS DR @ THIRD LINE RD

Traffic Control: Stop sign **Total Collisions:** 3

Date/Day/Time	Environment	Impact Type	Classification	Surface Cond'n	Veh. Dir	Vehicle Manoeuver	Vehicle type	First Event	No. Ped

2013-Dec-21, Sat,13:21	Freezing Rain	Rear end	P.D. only	Slush	West	Slowing or stopping	Pick-up truck	Skidding/sliding
					West	Stopped	Automobile, station wagon	Other motor vehicle
2014-Mar-29, Sat,14:14	Clear	Rear end	P.D. only	Dry	West	Going ahead	Automobile, station wagon	Other motor vehicle
					West	Turning left	Pick-up truck	Other motor vehicle
2017-Jan-05, Thu,10:48	Snow	Rear end	P.D. only	Slush	East	Going ahead	Automobile, station wagon	Other motor vehicle
					East	Turning left	Pick-up truck	Other motor vehicle

Location: ROGER STEVENS DR btwn HWY416 IC49 RAMP43 & HWY416 IC49 RAMP42

Traffic Control: No control

Total Collisions: 2

Date/Day/Time	Environment	Impact Type	Classification	Surface Cond'n	Veh. Dir	Vehicle Manoeuver	Vehicle type	First Event	No. Ped
2013-Jun-09, Sun,14:45	Clear	SMV other	P.D. only	Dry	West	Going ahead	Automobile, station wagon	Animal - wild	
2014-Mar-17, Mon,00:00	Clear	SMV other	P.D. only	Dry	East	Going ahead	Automobile, station wagon	Ran off road	

Location: ROGER STEVENS DR btwn THIRD LINE RD S & HWY416 IC49 RAMP34

Traffic Control: No control

Total Collisions: 2

Date/Day/Time	Environment	Impact Type	Classification	Surface Cond'n	Veh. Dir	Vehicle Manoeuver	Vehicle type	First Event	No. Ped
2015-Jan-16, Fri,07:07	Snow	SMV other	P.D. only	Loose snow	East	Going ahead	Automobile, station wagon	Ditch	
2017-Jun-12, Mon,07:19	Clear	Turning movement	P.D. only	Dry	East	Making "U" turn	Automobile, station wagon	Other motor vehicle	
					West	Going ahead	Automobile, station wagon	Other motor vehicle	

APPENDIX F

TDM Checklists

TDM-Supportive Development Design and Infrastructure Checklist:
Non-Residential Developments (office, institutional, retail or industrial)

Legend

REQUIRED	The Official Plan or Zoning By-law provides related guidance that must be followed
BASIC	The measure is generally feasible and effective, and in most cases would benefit the development and its users
BETTER	The measure could maximize support for users of sustainable modes, and optimize development performance

		TDM-supportive design & infrastructure measures: *Non-residential developments*	Check if completed & add descriptions, explanations or plan/drawing references
	1.	**WALKING & CYCLING: ROUTES**	
	1.1	**Building location & access points**	
BASIC	1.1.1	Locate building close to the street, and do not locate parking areas between the street and building entrances	☐
BASIC	1.1.2	Locate building entrances in order to minimize walking distances to sidewalks and transit stops/stations	☐
BASIC	1.1.3	Locate building doors and windows to ensure visibility of pedestrians from the building, for their security and comfort	☐
	1.2	**Facilities for walking & cycling**	
REQUIRED	1.2.1	Provide convenient, direct access to stations or major stops along rapid transit routes within 600 metres; minimize walking distances from buildings to rapid transit; provide pedestrian-friendly, weather-protected (where possible) environment between rapid transit accesses and building entrances; ensure quality linkages from sidewalks through building entrances to integrated stops/stations *(see Official Plan policy 4.3.3)*	☐ N/A
REQUIRED	1.2.2	Provide safe, direct and attractive pedestrian access from public sidewalks to building entrances through such measures as: reducing distances between public sidewalks and major building entrances; providing walkways from public streets to major building entrances; within a site, providing walkways along the front of adjoining buildings, between adjacent buildings, and connecting areas where people may congregate, such as courtyards and transit stops; and providing weather protection through canopies, colonnades, and other design elements wherever possible *(see Official Plan policy 4.3.12)*	☐ To be reviewed at Site Plan

TDM-supportive design & infrastructure measures: *Non-residential developments*			Check if completed & add descriptions, explanations or plan/drawing references
REQUIRED	1.2.3	Provide sidewalks of smooth, well-drained walking surfaces of contrasting materials or treatments to differentiate pedestrian areas from vehicle areas, and provide marked pedestrian crosswalks at intersection sidewalks *(see Official Plan policy 4.3.10)*	☐ To be reviewed at Site Plan
REQUIRED	1.2.4	Make sidewalks and open space areas easily accessible through features such as gradual grade transition, depressed curbs at street corners and convenient access to extra-wide parking spaces and ramps *(see Official Plan policy 4.3.10)*	☐ To be reviewed at Site Plan
REQUIRED	1.2.5	Include adequately spaced inter-block/street cycling and pedestrian connections to facilitate travel by active transportation. Provide links to the existing or planned network of public sidewalks, multi-use pathways and on-road cycle routes. Where public sidewalks and multi-use pathways intersect with roads, consider providing traffic control devices to give priority to cyclists and pedestrians *(see Official Plan policy 4.3.11)*	☐ To be reviewed at Site Plan
BASIC	1.2.6	Provide safe, direct and attractive walking routes from building entrances to nearby transit stops	☐ N/A
BASIC	1.2.7	Ensure that walking routes to transit stops are secure, visible, lighted, shaded and wind-protected wherever possible	☐ N/A
BASIC	1.2.8	Design roads used for access or circulation by cyclists using a target operating speed of no more than 30 km/h, or provide a separated cycling facility	☐
	1.3	**Amenities for walking & cycling**	
BASIC	1.3.1	Provide lighting, landscaping and benches along walking and cycling routes between building entrances and streets, sidewalks and trails	☐
BASIC	1.3.2	Provide wayfinding signage for site access (where required, e.g. when multiple buildings or entrances exist) and egress (where warranted, such as when directions to reach transit stops/stations, trails or other common destinations are not obvious)	☐

		TDM-supportive design & infrastructure measures: *Non-residential developments*	Check if completed & add descriptions, explanations or plan/drawing references
	2.	**WALKING & CYCLING: END-OF-TRIP FACILITIES**	
	2.1	**Bicycle parking**	
REQUIRED	2.1.1	Provide bicycle parking in highly visible and lighted areas, sheltered from the weather wherever possible *(see Official Plan policy 4.3.6)*	☐ To be reviewed at Site Plan
REQUIRED	2.1.2	Provide the number of bicycle parking spaces specified for various land uses in different parts of Ottawa; provide convenient access to main entrances or well-used areas *(see Zoning By-law Section 111)*	☐ To be reviewed at Site Plan
REQUIRED	2.1.3	Ensure that bicycle parking spaces and access aisles meet minimum dimensions; that no more than 50% of spaces are vertical spaces; and that parking racks are securely anchored *(see Zoning By-law Section 111)*	☐ To be reviewed at Site Plan
BASIC	2.1.4	Provide bicycle parking spaces equivalent to the expected number of commuter cyclists (assuming the cycling mode share target is met), plus the expected peak number of customer/visitor cyclists	☐
BETTER	2.1.5	Provide bicycle parking spaces equivalent to the expected number of commuter and customer/visitor cyclists, plus an additional buffer (e.g. 25 percent extra) to encourage other cyclists and ensure adequate capacity in peak cycling season	☐
	2.2	**Secure bicycle parking**	
REQUIRED	2.2.1	Where more than 50 bicycle parking spaces are provided for a single office building, locate at least 25% of spaces within a building/structure, a secure area (e.g. supervised parking lot or enclosure) or bicycle lockers *(see Zoning By-law Section 111)*	☐
BETTER	2.2.2	Provide secure bicycle parking spaces equivalent to the expected number of commuter cyclists (assuming the cycling mode share target is met)	☐
	2.3	**Shower & change facilities**	
BASIC	2.3.1	Provide shower and change facilities for the use of active commuters	☐
BETTER	2.3.2	In addition to shower and change facilities, provide dedicated lockers, grooming stations, drying racks and laundry facilities for the use of active commuters	☐
	2.4	**Bicycle repair station**	
BETTER	2.4.1	Provide a permanent bike repair station, with commonly used tools and an air pump, adjacent to the main bicycle parking area (or secure bicycle parking area, if provided)	☐

		TDM-supportive design & infrastructure measures: *Non-residential developments*	Check if completed & add descriptions, explanations or plan/drawing references
	3.	**TRANSIT**	
	3.1	**Customer amenities**	
BASIC	3.1.1	Provide shelters, lighting and benches at any on-site transit stops	☐
BASIC	3.1.2	Where the site abuts an off-site transit stop and insufficient space exists for a transit shelter in the public right-of-way, protect land for a shelter and/or install a shelter	☐
BETTER	3.1.3	Provide a secure and comfortable interior waiting area by integrating any on-site transit stops into the building	☐
	4.	**RIDESHARING**	
	4.1	**Pick-up & drop-off facilities**	
BASIC	4.1.1	Provide a designated area for carpool drivers (plus taxis and ride-hailing services) to drop off or pick up passengers without using fire lanes or other no-stopping zones	☐ To be reviewed at Site Plan
	4.2	**Carpool parking**	
BASIC	4.2.1	Provide signed parking spaces for carpools in a priority location close to a major building entrance, sufficient in number to accommodate the mode share target for carpools	☐ To be reviewed at Site Plan
BETTER	4.2.2	At large developments, provide spaces for carpools in a separate, access-controlled parking area to simplify enforcement	☐
	5.	**CARSHARING & BIKESHARING**	
	5.1	**Carshare parking spaces**	
BETTER	5.1.1	Provide carshare parking spaces in permitted non-residential zones, occupying either required or provided parking spaces *(see Zoning By-law Section 94)*	☐
	5.2	**Bikeshare station location**	
BETTER	5.2.1	Provide a designated bikeshare station area near a major building entrance, preferably lighted and sheltered with a direct walkway connection	☐

		TDM-supportive design & infrastructure measures: *Non-residential developments*	Check if completed & add descriptions, explanations or plan/drawing references
	6.	**PARKING**	
	6.1	**Number of parking spaces**	
REQUIRED	6.1.1	Do not provide more parking than permitted by zoning, nor less than required by zoning, unless a variance is being applied for	☐
BASIC	6.1.2	Provide parking for long-term and short-term users that is consistent with mode share targets, considering the potential for visitors to use off-site public parking	☐
BASIC	6.1.3	Where a site features more than one use, provide shared parking and reduce the cumulative number of parking spaces accordingly *(see Zoning By-law Section 104)*	☐
BETTER	6.1.4	Reduce the minimum number of parking spaces required by zoning by one space for each 13 square metres of gross floor area provided as shower rooms, change rooms, locker rooms and other facilities for cyclists in conjunction with bicycle parking *(see Zoning By-law Section 111)*	☐
	6.2	**Separate long-term & short-term parking areas**	
BETTER	6.2.1	Separate short-term and long-term parking areas using signage or physical barriers, to permit access controls and simplify enforcement (i.e. to discourage employees from parking in visitor spaces, and vice versa)	☐
	7.	**OTHER**	
	7.1	**On-site amenities to minimize off-site trips**	
BETTER	7.1.1	Provide on-site amenities to minimize mid-day or mid-commute errands	☐

TDM Measures Checklist:
Non-Residential Developments (office, institutional, retail or industrial)

Legend

BASIC — The measure is generally feasible and effective, and in most cases would benefit the development and its users

BETTER — The measure could maximize support for users of sustainable modes, and optimize development performance

★ — The measure is one of the most dependably effective tools to encourage the use of sustainable modes

		TDM measures: *Non-residential developments*	Check if proposed & add descriptions
		1. TDM PROGRAM MANAGEMENT	
		1.1 Program coordinator	
BASIC	★	1.1.1 Designate an internal coordinator, or contract with an external coordinator	☐
		1.2 Travel surveys	
BETTER		1.2.1 Conduct periodic surveys to identify travel-related behaviours, attitudes, challenges and solutions, and to track progress	☐
		2. WALKING AND CYCLING	
		2.1 Information on walking/cycling routes & destinations	
BASIC		2.1.1 Display local area maps with walking/cycling access routes and key destinations at major entrances	☐
		2.2 Bicycle skills training	
		Commuter travel	
BETTER	★	2.2.1 Offer on-site cycling courses for commuters, or subsidize off-site courses	☐
		2.3 Valet bike parking	
		Visitor travel	
BETTER		2.3.1 Offer secure valet bike parking during public events when demand exceeds fixed supply (e.g. for festivals, concerts, games)	☐

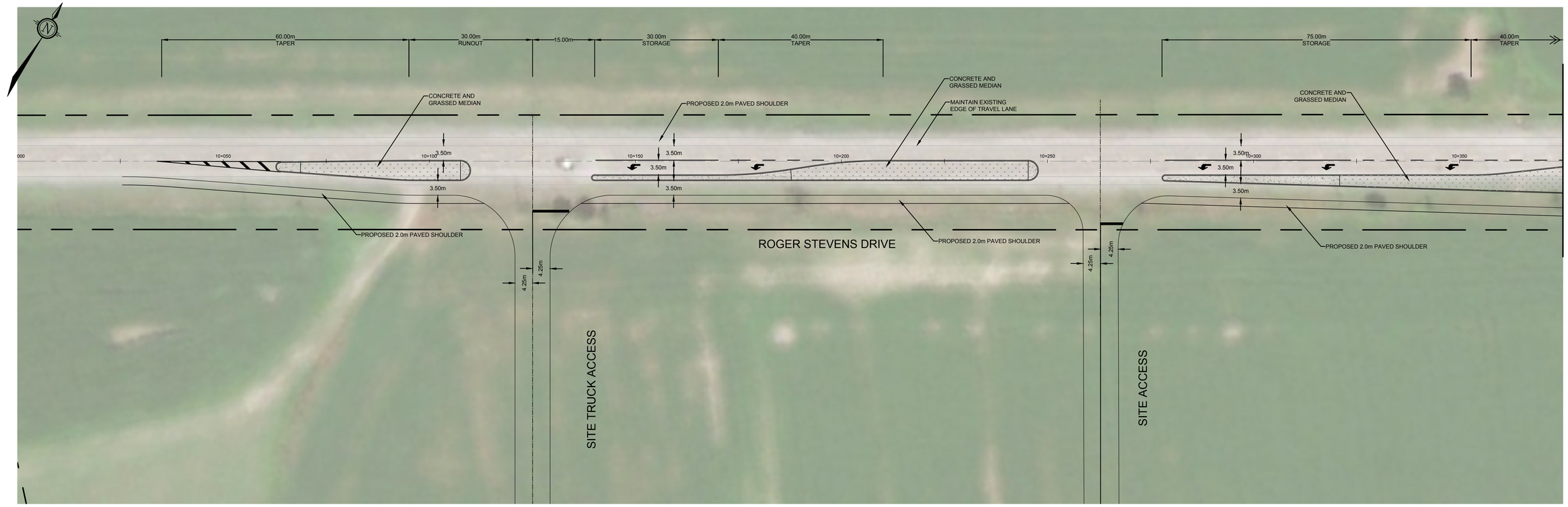
			TDM measures: *Non-residential developments*	Check if proposed & add descriptions
		3.	**TRANSIT**	
		3.1	**Transit information**	
BASIC		3.1.1	Display relevant transit schedules and route maps at entrances	☐
BASIC		3.1.2	Provide online links to OC Transpo and STO information	☐
BETTER		3.1.3	Provide real-time arrival information display at entrances	☐
		3.2	**Transit fare incentives**	
			Commuter travel	
BETTER		3.2.1	Offer preloaded PRESTO cards to encourage commuters to use transit	☐
BETTER	★	3.2.2	Subsidize or reimburse monthly transit pass purchases by employees	☐
			Visitor travel	
BETTER		3.2.3	Arrange inclusion of same-day transit fare in price of tickets (e.g. for festivals, concerts, games)	☐
		3.3	**Enhanced public transit service**	
			Commuter travel	
BETTER		3.3.1	Contract with OC Transpo to provide enhanced transit services (e.g. for shift changes, weekends)	☐
			Visitor travel	
BETTER		3.3.2	Contract with OC Transpo to provide enhanced transit services (e.g. for festivals, concerts, games)	☐
		3.4	**Private transit service**	
			Commuter travel	
BETTER		3.4.1	Provide shuttle service when OC Transpo cannot offer sufficient quality or capacity to serve demand (e.g. for shift changes, weekends)	☐
			Visitor travel	
BETTER		3.4.2	Provide shuttle service when OC Transpo cannot offer sufficient quality or capacity to serve demand (e.g. for festivals, concerts, games)	☐

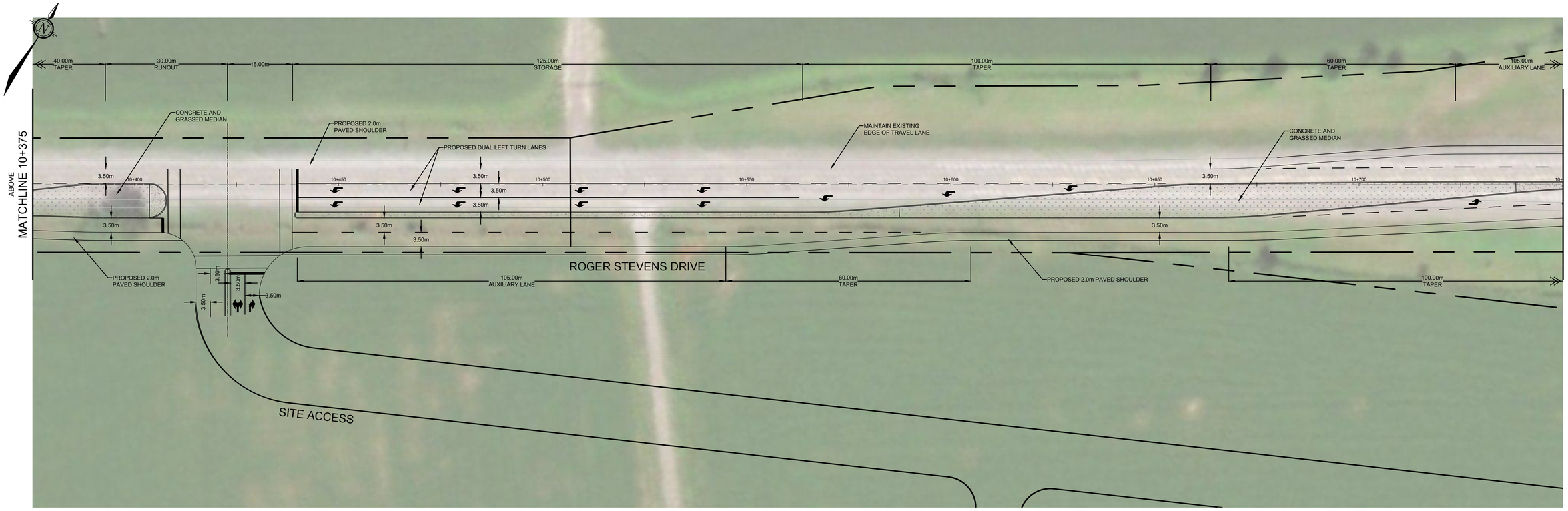
		TDM measures: *Non-residential developments*	Check if proposed & add descriptions
		4. RIDESHARING	
		4.1 Ridematching service	
		Commuter travel	
BASIC	★ 4.1.1	Provide a dedicated ridematching portal at OttawaRideMatch.com	☐
		4.2 Carpool parking price incentives	
		Commuter travel	
BETTER	4.2.1	Provide discounts on parking costs for registered carpools	☐
		4.3 Vanpool service	
		Commuter travel	
BETTER	4.3.1	Provide a vanpooling service for long-distance commuters	☐
		5. CARSHARING & BIKESHARING	
		5.1 Bikeshare stations & memberships	
BETTER	5.1.1	Contract with provider to install on-site bikeshare station for use by commuters and visitors	☐
		Commuter travel	
BETTER	5.1.2	Provide employees with bikeshare memberships for local business travel	☐
		5.2 Carshare vehicles & memberships	
		Commuter travel	
BETTER	5.2.1	Contract with provider to install on-site carshare vehicles and promote their use by tenants	☐
BETTER	5.2.2	Provide employees with carshare memberships for local business travel	☐
		6. PARKING	
		6.1 Priced parking	
		Commuter travel	
BASIC	★ 6.1.1	Charge for long-term parking (daily, weekly, monthly)	☐
BASIC	6.1.2	Unbundle parking cost from lease rates at multi-tenant sites	☐
		Visitor travel	
BETTER	6.1.3	Charge for short-term parking (hourly)	☐

		TDM measures: *Non-residential developments*	Check if proposed & add descriptions
		7. TDM MARKETING & COMMUNICATIONS	
		7.1 Multimodal travel information	
		Commuter travel	
BASIC	★	7.1.1 Provide a multimodal travel option information package to new/relocating employees and students	☐
		Visitor travel	
BETTER	★	7.1.2 Include multimodal travel option information in invitations or advertising that attract visitors or customers (e.g. for festivals, concerts, games)	☐
		7.2 Personalized trip planning	
		Commuter travel	
BETTER	★	7.2.1 Offer personalized trip planning to new/relocating employees	☐
		7.3 Promotions	
		Commuter travel	
BETTER		7.3.1 Deliver promotions and incentives to maintain awareness, build understanding, and encourage trial of sustainable modes	☐
		8. OTHER INCENTIVES & AMENITIES	
		8.1 Emergency ride home	
		Commuter travel	
BETTER	★	8.1.1 Provide emergency ride home service to non-driving commuters	☐
		8.2 Alternative work arrangements	
		Commuter travel	
BASIC	★	8.2.1 Encourage flexible work hours	☐
BETTER		8.2.2 Encourage compressed workweeks	☐
BETTER	★	8.2.3 Encourage telework	☐
		8.3 Local business travel options	
		Commuter travel	
BASIC	★	8.3.1 Provide local business travel options that minimize the need for employees to bring a personal car to work	☐
		8.4 Commuter incentives	
		Commuter travel	
BETTER		8.4.1 Offer employees a taxable, mode-neutral commuting allowance	☐
		8.5 On-site amenities	
		Commuter travel	
BETTER		8.5.1 Provide on-site amenities/services to minimize mid-day or mid-commute errands	☐

APPENDIX G

Functional Design – Roger Stevens Road Modifications





NOTE:
THE POSITION OF ALL POLE LINES, CONDUITS, WATERMAINS, SEWERS AND OTHER UNDERGROUND AND OVERGROUND UTILITIES AND STRUCTURES IS NOT NECESSARILY SHOWN ON THE CONTRACT DRAWINGS, AND WHERE SHOWN, THE ACCURACY OF THE POSITION OF SUCH UTILITIES AND STRUCTURES IS NOT GUARANTEED. BEFORE STARTING WORK, DETERMINE THE EXACT LOCATION OF ALL SUCH UTILITIES AND STRUCTURES AND ASSUME ALL LIABILITY FOR DAMAGE TO THEM.

No.	REVISION	DATE	BY
1.	ISSUED FOR REVIEW	JUL 11/19	JLL

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APPROVED JLL

FOR REVIEW ONLY

NOVATECH
Engineers, Planners & Landscape Architects
Suite 200, 240 Michael Cowpland Drive
Ottawa, Ontario, Canada K2M 1P6
Telephone (613) 254-9643
Facsimile (613) 254-5867
Website www.novatech-eng.com

LOCATION
CITY of OTTAWA
ROGER STEVENS DRIVE

DRAWING NAME
ROADWAY MODIFICATION
FUNCTIONAL DESIGN

PROJECT No. 119018-00
REV REV # 1
DRAWING No. 119018-FD1

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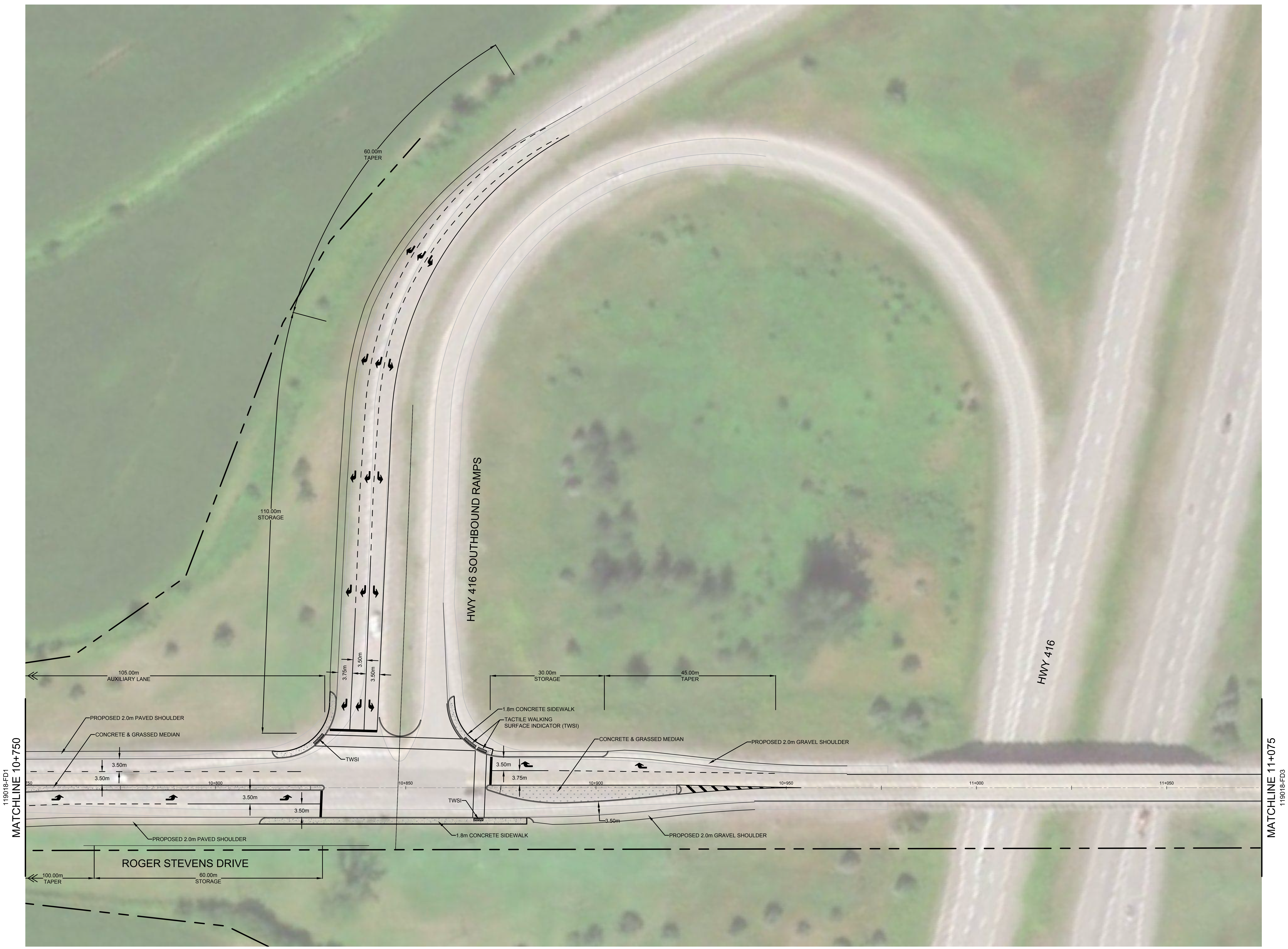

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NOTE:
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APPROVED	JLL

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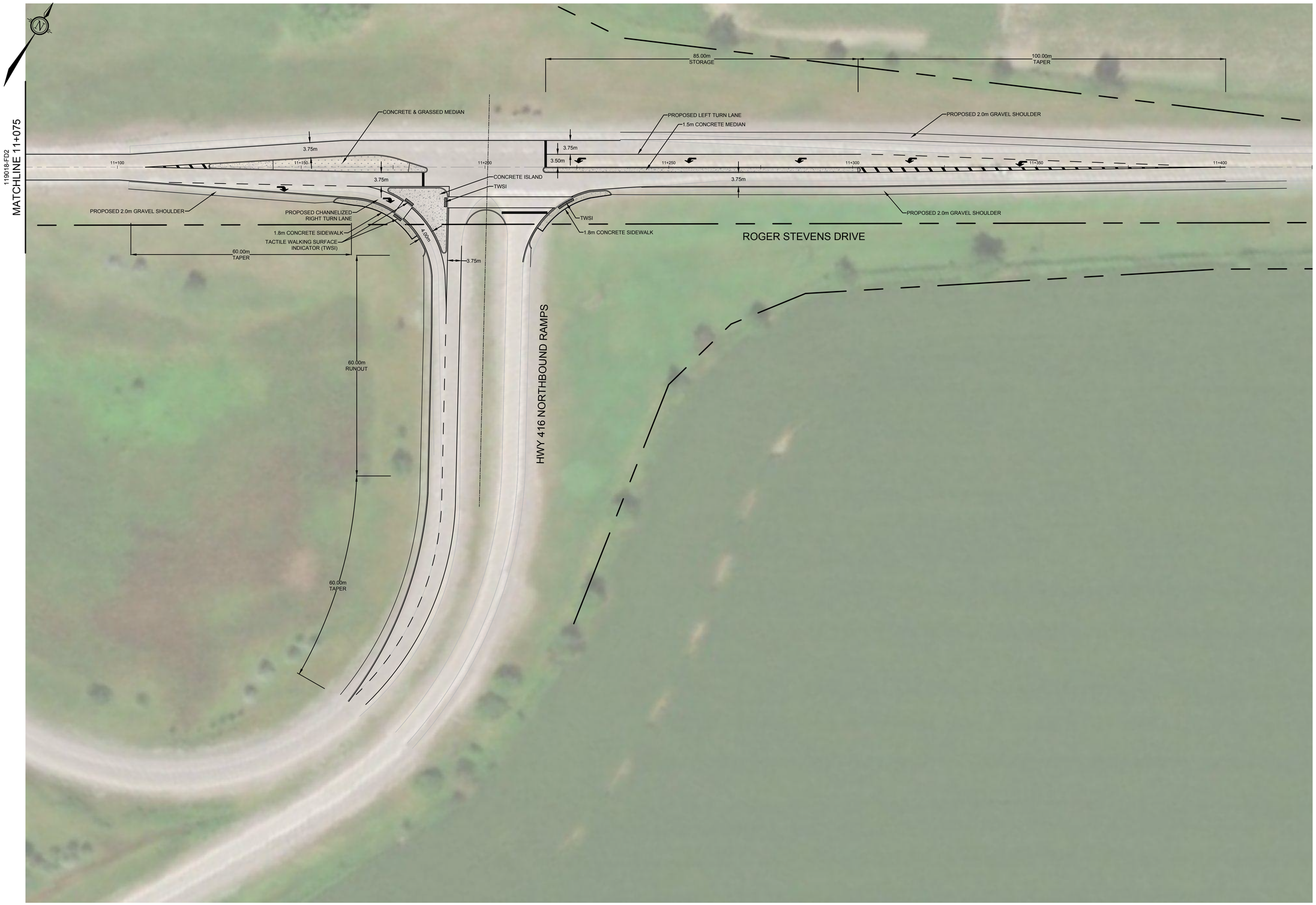
LOCATION
CITY of OTTAWA
ROGER STEVENS DRIVE

DRAWING NAME
ROADWAY MODIFICATION
FUNCTIONAL DESIGN

PROJECT No. 119018-00
REV # 1
DRAWING No. 119018-FD2



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No.	REVISION	DATE	BY
1.	ISSUED FOR REVIEW	JUL 11/19	JLL

SCALE
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LOCATION
CITY of OTTAWA
ROGER STEVENS DRIVE

DRAWING NAME
ROADWAY MODIFICATION
FUNCTIONAL DESIGN

PROJECT No. 119018-00
REV REV # 1
DRAWING No. 119018-FD3

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APPENDIX H

Intersection MMLOS Calculations

Pedestrian Level of Service (PLOS)

Exhibit 5 of the Addendum to the MMLOS guidelines has been used to evaluate the PLOS at the proposed signalized intersections of Roger Stevens Drive/East Employee Access, Roger Stevens Drive/Highway 416 Northbound Ramps, and Roger Stevens Drive/Highway 416 Southbound Ramps. Exhibit 22 of the MMLOS guidelines suggests a target PLOS C for all roadways within a Village, and a target POS D for all roadways within the 'All Other Designation' classification. The results of the intersection PLOS are summarized in the following tables. Traffic signal timing from the 2031 total traffic analysis was used.

PLOS Intersection Analysis – Roger Stevens Drive/East Employee Access

Criteria	South Approach		East Approach		West Approach	
Roger Stevens Drive/East Employee Access						
PETSI SCORE						
CROSSING DISTANCE CONDITIONS						
Median > 2.4m in Width	No	72	No	55	No	72
Lanes Crossed (3.5m Lane Width)	5		6		5	
SIGNAL PHASING AND TIMING						
Left Turn Conflict	Protected	0	No Left Turn/Prohibited	0	Permissive	-8
Right Turn Conflict	Permissive or Yield	-5	Permissive or Yield	-5	No Right Turn/Prohibited	0
Right Turn on Red	RTOR Allowed	-3	N/A	0	RTOR Allowed	-3
Leading Pedestrian Interval	No	-2	No	-2	No	-2
CORNER RADIUS						
Parallel Radius	> 5m to 10m	-5	> 10m to 15m	-6	No Right Turn	0
Parallel Right Turn Channel	No Right Turn Channel	-4	No Right Turn Channel	-4	No Right Turn	0
Perpendicular Radius	N/A	0	N/A	0	N/A	0
Perpendicular Right Turn Channel	N/A	0	N/A	0	N/A	0
CROSSING TREATMENT						
Treatment	Standard	-7	Standard	-7	Standard	-7
PETSI SCORE		**46**		**31**		**52**
LOS		**D**		**E**		**D**
DELAY SCORE						
Cycle Length		110		120		120
Pedestrian Walk Time		32.9		7		7
DELAY SCORE		**27**		**53.2**		**53.2**
LOS		**C**		**E**		**E**
OVERALL		**D**		**E**		**E**

PLOS Intersection Analysis – Roger Stevens/Highway 416 Southbound Ramps

Criteria	North Approach		East Approach	
Roger Stevens Drive/416 Southbound Ramps				
PETSI SCORE				
CROSSING DISTANCE CONDITIONS				
Median > 2.4m in Width	Yes	0	No	72
Lanes Crossed (3.5m Lane Width)	10 +		5	
SIGNAL PHASING AND TIMING				
Left Turn Conflict	Permissive	-8	Permissive	-8
Right Turn Conflict	Permissive or Yield	-5	No Right Turn/Prohibited	0
Right Turn on Red	RTOR Allowed	-3	RTOR Allowed	-3
Leading Pedestrian Interval	No	-2	No	-2
CORNER RADIUS				
Parallel Radius	> 10m to 15m	-6	No Right Turn	0
Parallel Right Turn Channel	lo Right Turn Channe	-4	No Right Turn	0
Perpendicular Radius	N/A	0	N/A	0
Perpendicular Right Turn Channel	N/A	0	N/A	0
CROSSING TREATMENT				
Treatment	Standard	-7	Standard	-7
PETSI SCORE		**-35**		**52**
LOS		**F**		**D**
DELAY SCORE				
Cycle Length		110		120
Pedestrian Walk Time		43.4		7.3
DELAY SCORE		**20.2**		**52.9**
LOS		**C**		**E**
OVERALL		**F**		**E**

PLOS Intersection Analysis – Roger Stevens/Highway 416 Northbound Ramps

Criteria	South Approach	
Roger Stevens Drive/416 Northbound Ramps		
PETSI SCORE		
CROSSING DISTANCE CONDITIONS		
Median > 2.4m in Width	Yes	0
Lanes Crossed (3.5m Lane Width)	10 +	
SIGNAL PHASING AND TIMING		
Left Turn Conflict	Permissive	-8
Right Turn Conflict	Permissive or Yield	-5
Right Turn on Red	RTOR Allowed	-3
Leading Pedestrian Interval	No	-2
CORNER RADIUS		
Parallel Radius	> 15m to 25m	-8
Parallel Right Turn Channel	Conventional with Receiving	-3
Perpendicular Radius	N/A	0
Perpendicular Right Turn Channel	N/A	0
CROSSING TREATMENT		
Treatment	Standard	-7
PETSI SCORE		**-36**
LOS		**F**
DELAY SCORE		
Cycle Length		120
Pedestrian Walk Time		53.4
DELAY SCORE		**18.5**
LOS		**B**
OVERALL		**F**

Bicycle Level of Service (BLOS)

Exhibit 12 of the MMLOS guidelines has been used to evaluate the BLOS at the proposed signalized intersection of Roger Stevens Drive/East Employee Access. BLOS was not evaluated at the Highway 416 ramps as bikes are prohibited on 400 series highways. The ramps are under MTO jurisdiction and BLOS is not a consideration. Exhibit 22 of the MMLOS guidelines suggests a target BLOS C for Spine Routes in a Village. The results of the intersection BLOS are summarized in the following table.

BLOS Intersection Analysis

Approach	Bikeway Facility Type	Criteria	Travel Lanes and/or Speed	BLOS
Roger Stevens Drive/East Employee Access				
South Approach	Mixed Traffic	Right Turn Lane Characteristics	Dual, Shared or Exclusive	F
		Left Turn Accommodation	No Lane Crossed, < 50km/h (No Designated Left Turn Lane)	B
East Approach	Paved Shoulder	Right Turn Lane Characteristics	No Right Turns	-
		Left Turn Accommodation	Dual Left Turn Lanes	F
West Approach	Paved Shoulder	Right Turn Lane Characteristics	Shared Through/Right Turn Lane	A
		Left Turn Accommodation	No Left Turn	-

Transit Level of Service (TLOS)

There are no TLOS targets identified in Exhibit 22 of the MMLOS guidelines for the study area intersections. However, a bus route currently utilizes Roger Stevens Drive and will travel through the proposed signals at Roger Stevens Drive/East Employee Access, Roger Stevens Drive/Highway 416 Northbound Ramps, and Roger Stevens Drive/Highway 416 Southbound Ramps. These intersections have been evaluated for TLOS despite having no target. The results of the intersection TLOS are summarized in the following table.

TLOS Intersection Analysis

Approach	Delay[1] (sec.)	TLOS
Roger Stevens Drive/East Employee Access		
East Approach	31.0	E
West Approach	28.4	D
South Approach	N/A	N/A
Roger Stevens Drive/Highway 416 Northbound Ramps		
East Approach	10.1	C
West Approach	3.7	B
South Approach	N/A	N/A
Roger Stevens Drive/Highway 416 Southbound Ramps		
East Approach	4.7	B
West Approach	16.2	C
North Approach	N/A	N/A

1. Delay based on outputs from 2031 Total Traffic Synchro analysis

Truck Level of Service (TkLOS)

Exhibit 21 of the MMLOS guidelines has been used to evaluate the existing TkLOS at the proposed signalized intersections of Roger Stevens Drive/East Employee Access, Roger Stevens Drive/Highway 416 Northbound Ramps, and Roger Stevens Drive/Highway 416 Southbound Ramps. Exhibit 22 of the MMLOS guidelines suggests a target TkLOS D for arterial truck routes in a Village and in 'All Other Designations'. The results of the intersection TkLOS are summarized in the following table.

TkLOS Intersection Analysis

Approach	Effective Corner Radius	Number of Receiving Lanes on Departure from Intersection	LOS
Roger Stevens Drive/East Employee Access			
South	10 – 15m	Two	B
West	< 10m	Two	D
Roger Stevens Drive/Highway 416 Southbound Ramps			
North	10 – 15m	Two	B
East	10 – 15m	One	E
Fallowfield Road/Highway 416 Northbound Ramps			
South	> 15m	One	C
West	> 15m	One	C

APPENDIX I

Traffic Signal Justifications and Turn Lane Warrants

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TRAFFIC SIGNAL JUSTIFICATION

LOCATION: Roger Stevens **at** 416 NB

DATE: 25 April, 2018

JUSTIFICATION 1 – Minimum Vehicular Volume

	MINIMUM REQUIREMENTS (80% SHOWN IN BRACKETS)				PERCENTAGE WARRANT								
APPROACH LANES	1		2 or MORE		HOUR ENDING								TOTAL ACROSS
FLOW CONDITION	FREE FLOW	RESTR FLOW	FREE FLOW	RESTR FLOW	8:00	9:00	10:00	11:00 ~~12:30~~	15:00 ~~13:30~~	16:00	17:00	18:00	
A.	480	720	600	900	764	612	437	366	451	570	735	738	
	(385)	(575)	(480)	(720)									
ALL APPROACHES	100% FULFILLED				100	100				100	100	100	500
	80% FULFILLED						80		80				160
	ACTUAL % IF BELOW 80% VALUE							76					76
												TOTAL DOWN:	736
												AVERAGE (TOTAL/8):	92 %

T Intersection Add 50%

	180	**255**	**180**	**255**									
	143	**203**	**143**	**203**									
B.	120	170	120	170	94	69	47	45	41	54	53	53	TOTAL ACROSS
	(95)	(135)	(95)	(135)									
MINOR STREET BOTH APPROACHES	100% FULFILLED												
	80% FULFILLED												
	ACTUAL % IF BELOW 80% VALUE				52	38	26	25	23	30	29	29	252
												TOTAL DOWN:	252
												AVERAGE (TOTAL/8):	32 %

JUSTIFICATION 2 – Delay To Cross Traffic

	MINIMUM REQUIREMENTS (80% SHOWN IN BRACKETS)				PERCENTAGE WARRANT								
APPROACH LANES	1		2 or MORE		HOUR ENDING								TOTAL ACROSS
FLOW CONDITION	FREE FLOW	RESTR FLOW	FREE FLOW	RESTR FLOW	8:00	9:00	10:00	11:00 ~~12:30~~	15:00 ~~13:30~~	16:00	17:00	18:00	
A.	480	720	600	900	670	543	390	321	410	516	682	685	
	(385)	(575)	(480)	(720)									
MAJOR STREET BOTH APPROACHES	100% FULFILLED				100	100				100	100	100	500
	80% FULFILLED						80		80				160
	ACTUAL % IF BELOW 80% VALUE							67					67
												TOTAL DOWN:	727
												AVERAGE (TOTAL/8):	91 %

B.	50	75	50	75	21	13	14	11	13	13	17	17	TOTAL ACROSS
	(40)	(60)	(40)	(60)									
TRAFFIC CROSSING MAJOR STREET	100% FULFILLED												
	80% FULFILLED												
	ACTUAL % IF BELOW 80% VALUE				42	26	28	22	26	26	34	34	238
												TOTAL DOWN:	238
												AVERAGE (TOTAL/8):	30 %

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TRAFFIC SIGNAL JUSTIFICATION SUMMARY TABLE

LOCATION: Roger Stevens **at** 416 NB

DATE: 25 April, 2018

JUSTIFICATION	DESCRIPTION	MINIMUM REQUIREMENT		COMPLIANCE	
		FREE FLOW	RESTRICTED FLOW	SECTIONAL %	ENTIRE % [2]
		OPERATING SPEED ≥ 70KM/H	OPERATING SPEED < 70 KM/H		
1. MINIMUM VEHICULAR WARRANT	A. Vehicle volume, all approaches for each of the heaviest 8 hours of an average day, and	480 600 (2 or more lane approach	720 900 (2 or more lane approach	92 %	32 %
	B. Vehicle volume, along minor street, for each of the same 8 hours.	120 180 (tee intersection)	170 255 (tee intersection)	32 %	
2. DELAY TO CROSS TRAFFIC	A. Vehicle volume, along major street for each for the heaviest 8 hours of an average day, and	480 600 (2 or more lane approach)	720 900 (2 or more lane approach	91 %	30 %
	B [1]. Combined vehicle and pedestrian volume crossing the major street for each of the same 8 hours	50	75	30 %	
3. VOLUME/DELAY COMBINATION	The above Justifications (1 and 2) both satisfied to the extent of 80% or more	Yes ☐		No ☒	
4. MINIMUM FOUR HOUR VEHICLE VOLUME	Plotted point representing hourly volume for minor approach vs. major approach for four highest hours of an average day fall above the applicable curve	Yes ☐		No ☒	
5. COLLISION EXPERIENCE	A. Total reported accidents of types susceptible to correction by a traffic signal, per 12 month period averaged over a 36 month period, and	5			
	B. Adequate trial of less restrictive remedies, where satisfactory observance and enforcement have failed to reduce the number of accidents	Yes ☐		No ☐	
6. PEDESTRIAN VOLUME AND DELAY	A. Plotted point representing 8 hour pedestrian volume vs. 8 hour vehicular volume fall in justified zone, and	Yes ☐		No ☐	
	B. Plotted point representing 8 hour volume of pedestrian experiencing delays of 10 s or more vs. 8 hour pedestrian volume fall in justified zone	Yes ☐		No ☐	

NOTES

1) For definition of crossing volume refer to the Ontario Traffic Manual Book 12, Section 4.5 (Nov. 2007).
2) The lowest sectional percentage governs the entire Justification.

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TRAFFIC SIGNAL JUSTIFICATION

LOCATION: Roger Stevens **at** 416 SB

DATE: 25 May, 2018

JUSTIFICATION 1 – Minimum Vehicular Volume

	MINIMUM REQUIREMENTS (80% SHOWN IN BRACKETS)				PERCENTAGE WARRANT								
APPROACH LANES	1		2 or MORE		HOUR ENDING								TOTAL ACROSS
FLOW CONDITION	FREE FLOW	RESTR FLOW	FREE FLOW	RESTR FLOW	8:00	9:00	10:00	11:00 ~~12:30~~	15:00 ~~13:30~~	16:00	17:00	18:00	
A.	480	720	600	900	503	437	358	306	427	591	746	720	
	(385)	(575)	(480)	(720)									
ALL APPROACHES	100% FULFILLED				100					100	100	100	400
	80% FULFILLED					80			80				160
	ACTUAL % IF BELOW 80% VALUE						75	64					139
											TOTAL DOWN:		699
											AVERAGE (TOTAL/8):		87 %

T Intersection Add 50%

	180	**255**	**180**	**255**									
	143	**203**	**143**	**203**									
B.	120	170	120	170	77	73	87	74	148	221	322	294	TOTAL ACROSS
	(95)	(135)	(95)	(135)									
MINOR STREET BOTH APPROACHES	100% FULFILLED									100	100	100	300
	80% FULFILLED								80				80
	ACTUAL % IF BELOW 80% VALUE				43	41	48	41					173
										TOTAL DOWN:			553
										AVERAGE (TOTAL/8):			69%

JUSTIFICATION 2 – Delay To Cross Traffic

	MINIMUM REQUIREMENTS (80% SHOWN IN BRACKETS)				PERCENTAGE WARRANT								
APPROACH LANES	1		2 or MORE		HOUR ENDING								TOTAL ACROSS
FLOW CONDITION	FREE FLOW	RESTR FLOW	FREE FLOW	RESTR FLOW	8:00	9:00	10:00	11:00 ~~12:30~~	15:00 ~~13:30~~	16:00	17:00	18:00	
A.	480	720	600	900	426	364	271	232	279	370	424	426	
	(385)	(575)	(480)	(720)									
MAJOR STREET BOTH APPROACHES	100% FULFILLED												
	80% FULFILLED				80						80	80	240
	ACTUAL % IF BELOW 80% VALUE					76	56	67	58	77			334
											TOTAL DOWN:		574
											AVERAGE (TOTAL/8):		72 %

B.	50	75	50	75	41	44	55	34	84	126	211	194	TOTAL ACROSS
	(40)	(60)	(40)	(60)									
TRAFFIC CROSSING MAJOR STREET	100% FULFILLED						100		100	100	100	100	500
	80% FULFILLED				80	80							160
	ACTUAL % IF BELOW 80% VALUE							68					68
										TOTAL DOWN:			728
										AVERAGE (TOTAL/8):			91 %

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TRAFFIC SIGNAL JUSTIFICATION SUMMARY TABLE

LOCATION: Roger Stevens **at** 416 SB

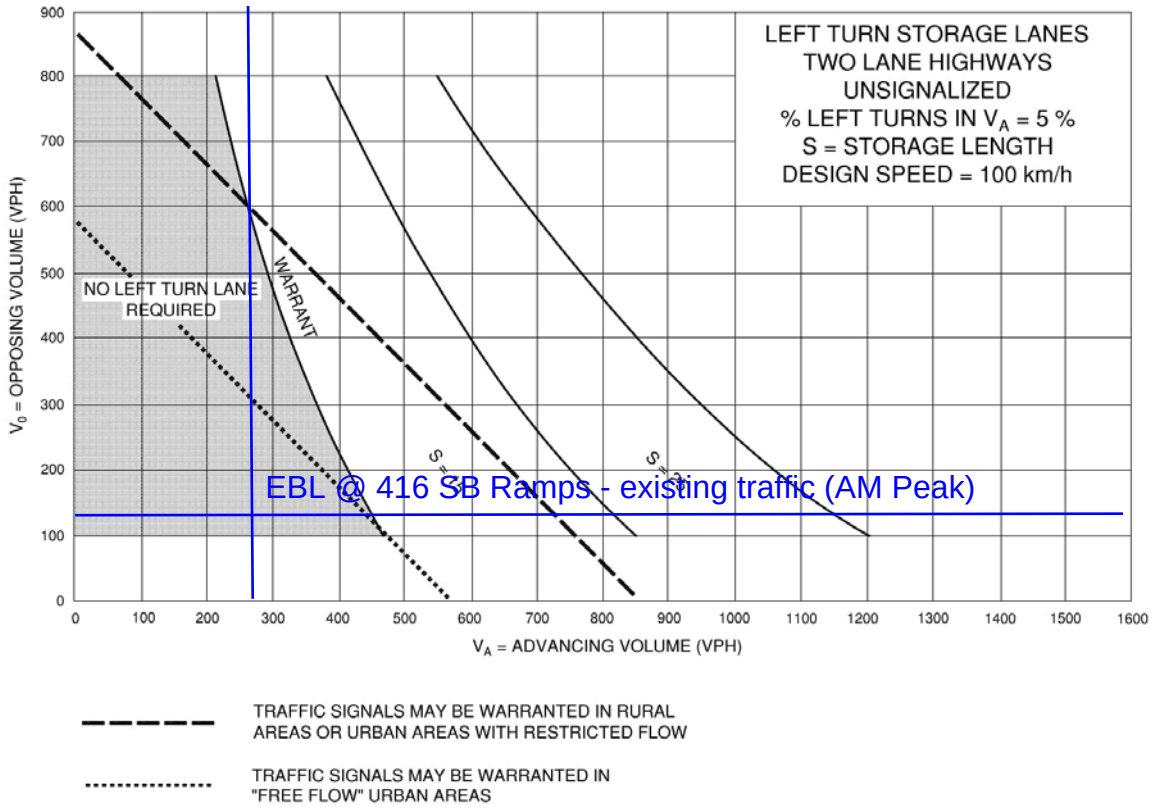
DATE: 25 May, 2018

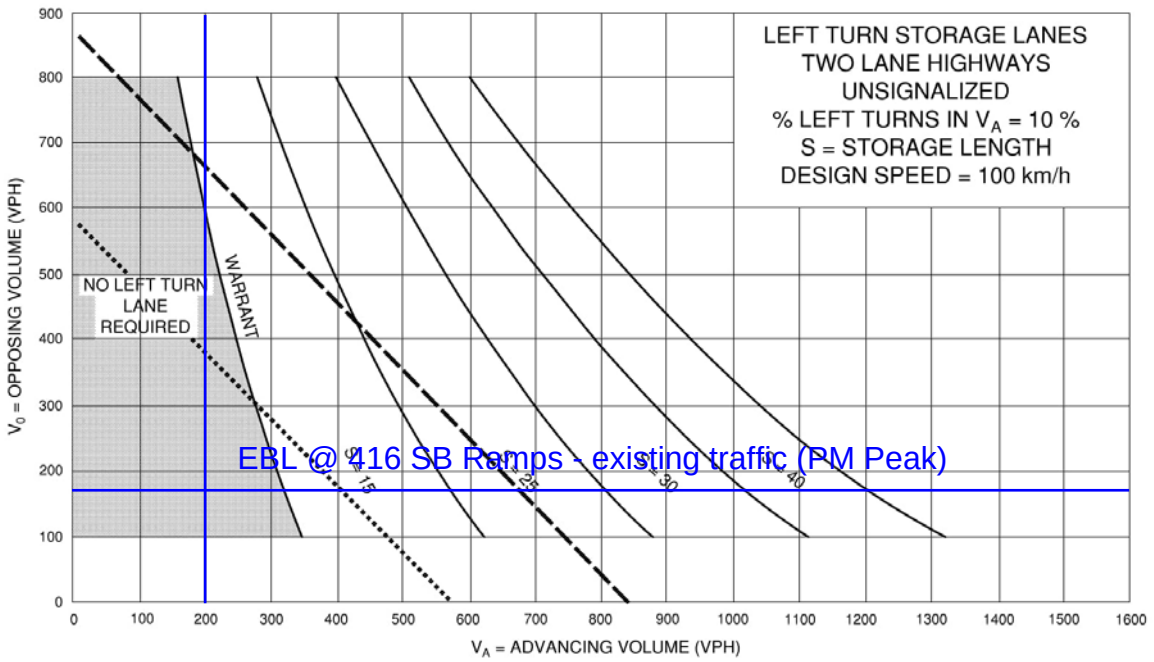
JUSTIFICATION	DESCRIPTION	MINIMUM REQUIREMENT		COMPLIANCE	
		FREE FLOW	RESTRICTED FLOW	SECTIONAL %	ENTIRE % [2]
		OPERATING SPEED ≥ 70KM/H	OPERATING SPEED < 70 KM/H		
1. MINIMUM VEHICULAR WARRANT	A. Vehicle volume, all approaches for each of the heaviest 8 hours of an average day, and	480 600 (2 or more lane approach	720 900 (2 or more lane approach	87 %	69 %
	B. Vehicle volume, along minor street, for each of the same 8 hours.	120 180 (tee intersection)	170 255 (tee intersection)	69 %	
2. DELAY TO CROSS TRAFFIC	A. Vehicle volume, along major street for each for the heaviest 8 hours of an average day, and	480 600 (2 or more lane approach)	720 900 (2 or more lane approach	72 %	72 %
	B [1]. Combined vehicle and pedestrian volume crossing the major street for each of the same 8 hours	50	75	91 %	
3. VOLUME/DELAY COMBINATION	The above Justifications (1 and 2) both satisfied to the extent of 80% or more	Yes ☐		No X	
4. MINIMUM FOUR HOUR VEHICLE VOLUME	Plotted point representing hourly volume for minor approach vs. major approach for four highest hours of an average day fall above the applicable curve	Yes ☐		No X	
5. COLLISION EXPERIENCE	A. Total reported accidents of types susceptible to correction by a traffic signal, per 12 month period averaged over a 36 month period, and	5			
	B. Adequate trial of less restrictive remedies, where satisfactory observance and enforcement have failed to reduce the number of accidents	Yes ☐		No ☐	
6. PEDESTRIAN VOLUME AND DELAY	A. Plotted point representing 8 hour pedestrian volume vs. 8 hour vehicular volume fall in justified zone, and	Yes ☐		No ☐	
	B. Plotted point representing 8 hour volume of pedestrian experiencing delays of 10 s or more vs. 8 hour pedestrian volume fall in justified zone	Yes ☐		No ☐	

NOTES

1) For definition of crossing volume refer to the Ontario Traffic Manual Book 12, Section 4.5 (Nov. 2007).
2) The lowest sectional percentage governs the entire Justification.

Exhibit 9A-22





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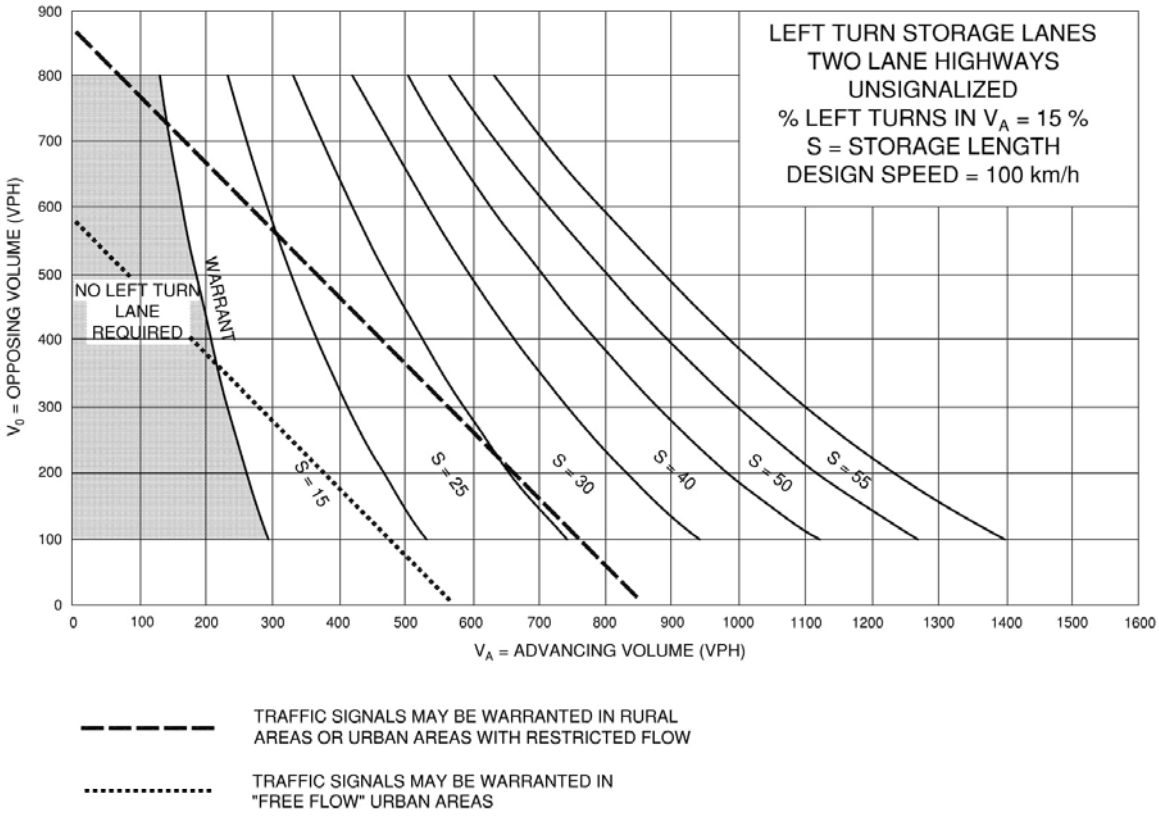

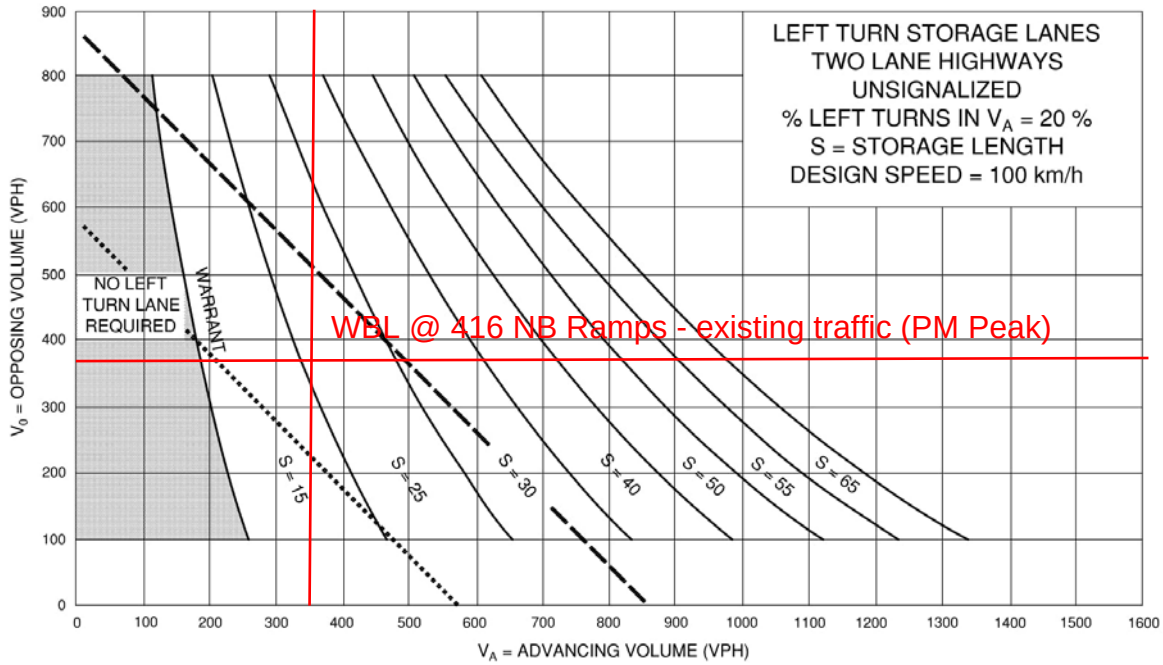

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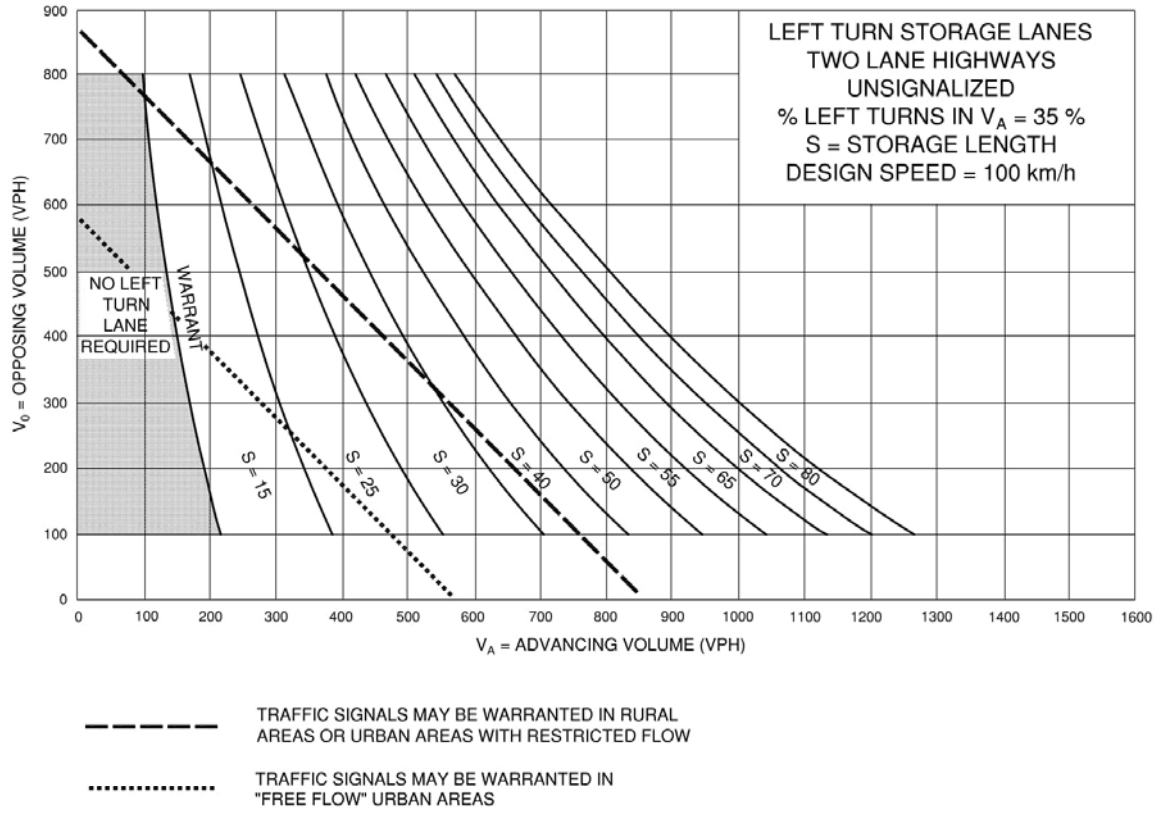

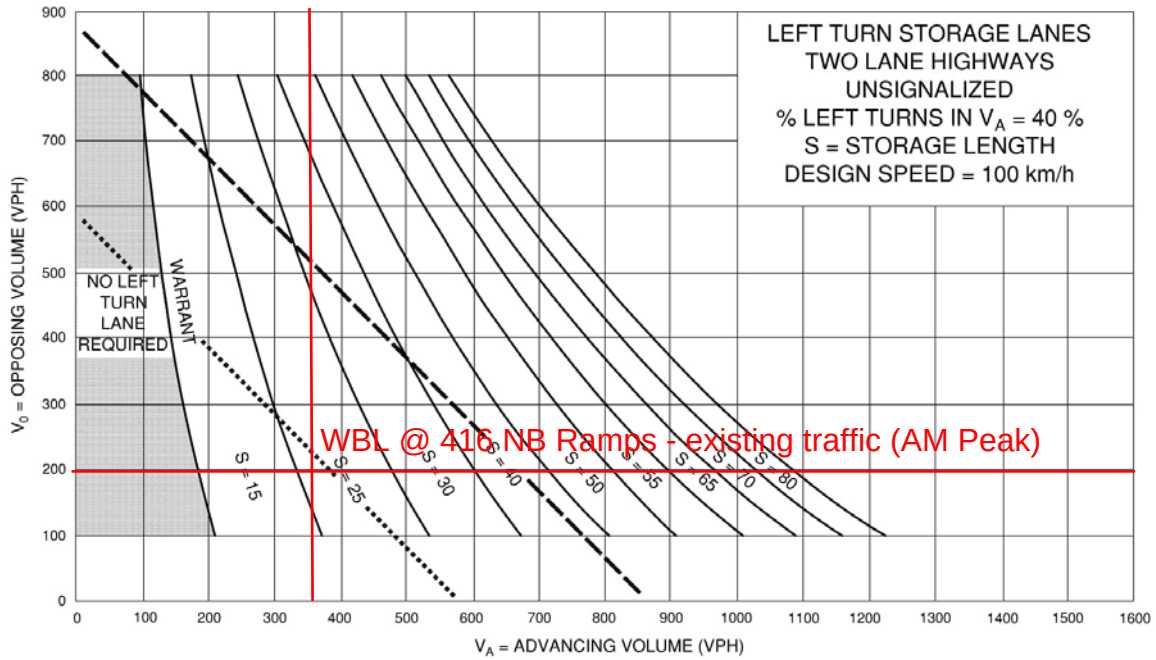

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TRAFFIC SIGNAL JUSTIFICATION USING PROJECTED VOLUMES

LOCATION: Roger Stevens **at** 416 NB

YEAR: 2021 total traffic

JUSTIFICATION	DESCRIPTION	MINIMUM REQUIREMENT		COMPLIANCE		
		FREE FLOW	RESTRICTED FLOW	SECTIONAL		ENTIRE % (2)
		OPERATING SPEED ≥ 70KM/H	OPERATING SPEED < 70 KM/H	NUMERICAL	PERCENT	
1. MINIMUM VEHICULAR WARRANT	A. Vehicle volume, all approaches (average hour)	480 600 (2 or more lane approach	720 900 (2 or more lane approach	930	194 %	63 %
	B. Vehicle volume along minor street (average hour)	120 180 (tee intersection)	170 255 (tee intersection)	113	63 %	
2. DELAY TO CROSS TRAFFIC	A. Vehicle volume along major street (average hour)	480 600 (2 or more lane approach)	720 900 (2 or more lane approach	817	170 %	168 %
	B (1). Combined vehicle and pedestrian volume crossing the major street (average hour)	50	75	84	168 %	

NOTES

1) For definition of crossing volume refer to the Ontario Traffic Manual Book 12, Section 4.5 (Nov. 2007).
2) The lowest sectional percentage governs the entire Justification.
3) Average hourly volumes estimated from peak hour volumes, AHV = PM / 2 or AHV = (AM + PM) / 4.

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TRAFFIC SIGNAL JUSTIFICATION USING PROJECTED VOLUMES

LOCATION: Roger Stevens **at** 416 SB

YEAR: 2021 total traffic

JUSTIFICATION	DESCRIPTION	MINIMUM REQUIREMENT		COMPLIANCE		
		FREE FLOW	RESTRICTED FLOW	SECTIONAL		ENTIRE % (2)
		OPERATING SPEED ≥ 70KM/H	OPERATING SPEED < 70 KM/H	NUMERICAL	PERCENT	
1. MINIMUM VEHICULAR WARRANT	A. Vehicle volume, all approaches (average hour)	480 600 (2 or more lane approach	720 900 (2 or more lane approach	1320	275 %	275 %
	B. Vehicle volume along minor street (average hour)	120 180 (tee intersection)	170 255 (tee intersection)	494	275 %	
2. DELAY TO CROSS TRAFFIC	A. Vehicle volume along major street (average hour)	480 600 (2 or more lane approach)	720 900 (2 or more lane approach	826	172 %	150 %
	B (1). Combined vehicle and pedestrian volume crossing the major street (average hour)	50	75	75	150 %	

NOTES

1) For definition of crossing volume refer to the Ontario Traffic Manual Book 12, Section 4.5 (Nov. 2007).
2) The lowest sectional percentage governs the entire Justification.
3) Average hourly volumes estimated from peak hour volumes, AHV = PM / 2 or AHV = (AM + PM) / 4.

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TRAFFIC SIGNAL JUSTIFICATION USING PROJECTED VOLUMES

LOCATION: Roger Stevens **at** East Employee Access

YEAR: 2021 total traffic

JUSTIFICATION	DESCRIPTION	MINIMUM REQUIREMENT		COMPLIANCE		
		FREE FLOW	RESTRICTED FLOW	SECTIONAL		ENTIRE % (2)
		OPERATING SPEED ≥ 70KM/H	OPERATING SPEED < 70 KM/H	NUMERICAL	PERCENT	
1. MINIMUM VEHICULAR WARRANT	A. Vehicle volume, all approaches (average hour)	480 600 (2 or more lane approach	720 900 (2 or more lane approach	1213	253 %	182 %
	B. Vehicle volume along minor street (average hour)	120 180 (tee intersection)	170 255 (tee intersection)	327	182 %	
2. DELAY TO CROSS TRAFFIC	A. Vehicle volume along major street (average hour)	480 600 (2 or more lane approach)	720 900 (2 or more lane approach	886	185 %	6 %
	B (1). Combined vehicle and pedestrian volume crossing the major street (average hour)	50	75	3	6 %	

NOTES

1) For definition of crossing volume refer to the Ontario Traffic Manual Book 12, Section 4.5 (Nov. 2007).
2) The lowest sectional percentage governs the entire Justification.
3) Average hourly volumes estimated from peak hour volumes, AHV = PM / 2 or AHV = (AM + PM) / 4.

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TRAFFIC SIGNAL JUSTIFICATION USING PROJECTED VOLUMES

LOCATION: Roger Stevens **at** West Employee Access

YEAR: 2021 total traffic

JUSTIFICATION	DESCRIPTION	MINIMUM REQUIREMENT		COMPLIANCE		
		FREE FLOW	RESTRICTED FLOW	SECTIONAL		ENTIRE % (2)
		OPERATING SPEED ≥ 70KM/H	OPERATING SPEED < 70 KM/H	NUMERICAL	PERCENT	
1. MINIMUM VEHICULAR WARRANT	A. Vehicle volume, all approaches (average hour)	480 600 (2 or more lane approach	720 900 (2 or more lane approach	586	122 %	92 %
	B. Vehicle volume along minor street (average hour)	120 180 (tee intersection)	170 255 (tee intersection)	166	92 %	
2. DELAY TO CROSS TRAFFIC	A. Vehicle volume along major street (average hour)	480 600 (2 or more lane approach)	720 900 (2 or more lane approach	420	88 %	14 %
	B (1). Combined vehicle and pedestrian volume crossing the major street (average hour)	50	75	7	14 %	

NOTES

1) For definition of crossing volume refer to the Ontario Traffic Manual Book 12, Section 4.5 (Nov. 2007).
2) The lowest sectional percentage governs the entire Justification.
3) Average hourly volumes estimated from peak hour volumes, AHV = PM / 2 or AHV = (AM + PM) / 4.

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TRAFFIC SIGNAL JUSTIFICATION USING PROJECTED VOLUMES

LOCATION: Roger Stevens **at** West Employee Access

YEAR: 2031 total traffic

JUSTIFICATION	DESCRIPTION	MINIMUM REQUIREMENT		COMPLIANCE		
		FREE FLOW	RESTRICTED FLOW	SECTIONAL		ENTIRE % (2)
		OPERATING SPEED ≥ 70KM/H	OPERATING SPEED < 70 KM/H	NUMERICAL	PERCENT	
1. MINIMUM VEHICULAR WARRANT	A. Vehicle volume, all approaches (average hour)	480 600 (2 or more lane approach	720 900 (2 or more lane approach	611	127 %	92 %
	B. Vehicle volume along minor street (average hour)	120 180 (tee intersection)	170 255 (tee intersection)	166	92 %	
2. DELAY TO CROSS TRAFFIC	A. Vehicle volume along major street (average hour)	480 600 (2 or more lane approach)	720 900 (2 or more lane approach	445	93 %	14 %
	B (1). Combined vehicle and pedestrian volume crossing the major street (average hour)	50	75	7	14 %	

NOTES

1) For definition of crossing volume refer to the Ontario Traffic Manual Book 12, Section 4.5 (Nov. 2007).
2) The lowest sectional percentage governs the entire Justification.
3) Average hourly volumes estimated from peak hour volumes, AHV = PM / 2 or AHV = (AM + PM) / 4.

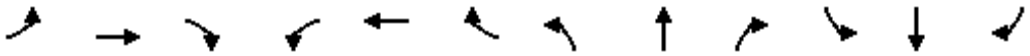
APPENDIX J

Synchro Reports

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	218	1	5	146	4	26
Future Volume (Veh/h)	218	1	5	146	4	26
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	242	1	6	162	4	29
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume			243		416	242
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			243		416	242
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			100		99	96
cM capacity (veh/h)			1323		590	796

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	243	168	33
Volume Left	0	6	4
Volume Right	1	0	29
cSH	1700	1323	764
Volume to Capacity	0.14	0.00	0.04
Queue Length 95th (m)	0.0	0.1	1.0
Control Delay (s)	0.0	0.3	9.9
Lane LOS		A	A
Approach Delay (s)	0.0	0.3	9.9
Approach LOS			A

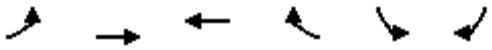
Intersection Summary			
Average Delay	0.9		
Intersection Capacity Utilization	22.4%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	11	237	5	4	140	15	8	4	23	12	3	2
Future Volume (Veh/h)	11	237	5	4	140	15	8	4	23	12	3	2
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	12	263	6	4	156	17	9	4	26	13	3	2
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	173			269			466	471	266	490	466	164
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	173			269			466	471	266	490	466	164
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	99			100			98	99	97	97	99	100
cM capacity (veh/h)	1404			1295			499	485	773	465	489	880

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	281	177	39	18
Volume Left	12	4	9	13
Volume Right	6	17	26	2
cSH	1404	1295	651	495
Volume to Capacity	0.01	0.00	0.06	0.04
Queue Length 95th (m)	0.2	0.1	1.5	0.9
Control Delay (s)	0.4	0.2	10.9	12.6
Lane LOS	A	A	B	B
Approach Delay (s)	0.4	0.2	10.9	12.6
Approach LOS			B	B

Intersection Summary				
Average Delay	1.5			
Intersection Capacity Utilization	29.0%	ICU Level of Service	A	
Analysis Period (min)	15			



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	11	277	129	39	44	36
Future Volume (Veh/h)	11	277	129	39	44	36
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	12	308	143	43	49	40
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	186				475	143
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	186				475	143
tC, single (s)	4.2				6.5	6.3
tC, 2 stage (s)						
tF (s)	2.3				3.6	3.4
p0 queue free %	99				91	95
cM capacity (veh/h)	1347				534	889

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	SB 1
Volume Total	12	308	143	43	89
Volume Left	12	0	0	0	49
Volume Right	0	0	0	43	40
cSH	1347	1700	1700	1700	651
Volume to Capacity	0.01	0.18	0.08	0.03	0.14
Queue Length 95th (m)	0.2	0.0	0.0	0.0	3.6
Control Delay (s)	7.7	0.0	0.0	0.0	11.4
Lane LOS	A				B
Approach Delay (s)	0.3		0.0		11.4
Approach LOS					B

Intersection Summary			
Average Delay	1.9		
Intersection Capacity Utilization	27.0%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	198	134	209	157	20	71
Future Volume (Veh/h)	198	134	209	157	20	71
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	220	149	232	174	22	79
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume			369		858	220
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			369		858	220
tC, single (s)			4.1		6.5	6.3
tC, 2 stage (s)						
tF (s)			2.2		3.6	3.4
p0 queue free %			80		91	90
cM capacity (veh/h)			1179		255	807

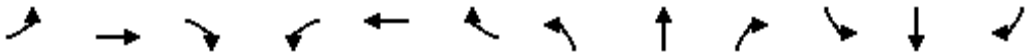
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1
Volume Total	220	149	232	174	101
Volume Left	0	0	232	0	22
Volume Right	0	149	0	0	79
cSH	1700	1700	1179	1700	548
Volume to Capacity	0.13	0.09	0.20	0.10	0.18
Queue Length 95th (m)	0.0	0.0	5.6	0.0	5.1
Control Delay (s)	0.0	0.0	8.8	0.0	13.0
Lane LOS			A		B
Approach Delay (s)	0.0		5.0		13.0
Approach LOS					B

Intersection Summary				
Average Delay	3.8			
Intersection Capacity Utilization	39.0%	ICU Level of Service		A
Analysis Period (min)	15			

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	180	5	26	281	0	5
Future Volume (Veh/h)	180	5	26	281	0	5
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	200	6	29	312	0	6
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume			206		573	203
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			206		573	203
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			98		100	99
cM capacity (veh/h)			1365		471	838

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	206	341	6
Volume Left	0	29	0
Volume Right	6	0	6
cSH	1700	1365	838
Volume to Capacity	0.12	0.02	0.01
Queue Length 95th (m)	0.0	0.5	0.2
Control Delay (s)	0.0	0.8	9.3
Lane LOS		A	A
Approach Delay (s)	0.0	0.8	9.3
Approach LOS			A

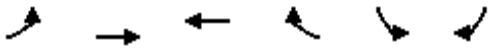
Intersection Summary			
Average Delay	0.6		
Intersection Capacity Utilization	40.8%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	2	178	11	15	281	10	1	7	8	10	9	14
Future Volume (Veh/h)	2	178	11	15	281	10	1	7	8	10	9	14
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	2	198	12	17	312	11	1	8	9	11	10	16
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	323			210			580	565	204	572	566	318
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	323			210			580	565	204	572	566	318
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			99			100	98	99	97	98	98
cM capacity (veh/h)	1237			1361			404	428	837	415	428	723

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	212	340	18	37
Volume Left	2	17	1	11
Volume Right	12	11	9	16
cSH	1237	1361	564	514
Volume to Capacity	0.00	0.01	0.03	0.07
Queue Length 95th (m)	0.0	0.3	0.8	1.8
Control Delay (s)	0.1	0.5	11.6	12.5
Lane LOS	A	A	B	B
Approach Delay (s)	0.1	0.5	11.6	12.5
Approach LOS			B	B

Intersection Summary				
Average Delay	1.4			
Intersection Capacity Utilization	38.4%	ICU Level of Service	A	
Analysis Period (min)	15			



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	17	183	184	90	247	102
Future Volume (Veh/h)	17	183	184	90	247	102
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	19	203	204	100	274	113
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	304				445	204
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	304				445	204
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	98				51	86
cM capacity (veh/h)	1257				562	837

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	SB 1
Volume Total	19	203	204	100	387
Volume Left	19	0	0	0	274
Volume Right	0	0	0	100	113
cSH	1257	1700	1700	1700	622
Volume to Capacity	0.02	0.12	0.12	0.06	0.62
Queue Length 95th (m)	0.3	0.0	0.0	0.0	32.8
Control Delay (s)	7.9	0.0	0.0	0.0	19.9
Lane LOS	A				C
Approach Delay (s)	0.7		0.0		19.9
Approach LOS					C

Intersection Summary			
Average Delay	8.6		
Intersection Capacity Utilization	42.6%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	376	60	79	268	15	43
Future Volume (Veh/h)	376	60	79	268	15	43
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	418	67	88	298	17	48
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume			485		892	418
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			485		892	418
tC, single (s)			4.1		6.5	6.3
tC, 2 stage (s)						
tF (s)			2.2		3.6	3.4
p0 queue free %			92		94	92
cM capacity (veh/h)			1078		281	620

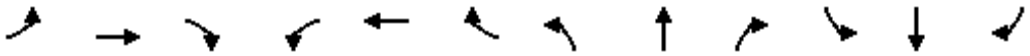
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1
Volume Total	418	67	88	298	65
Volume Left	0	0	88	0	17
Volume Right	0	67	0	0	48
cSH	1700	1700	1078	1700	472
Volume to Capacity	0.25	0.04	0.08	0.18	0.14
Queue Length 95th (m)	0.0	0.0	2.0	0.0	3.6
Control Delay (s)	0.0	0.0	8.6	0.0	13.9
Lane LOS			A		B
Approach Delay (s)	0.0		2.0		13.9
Approach LOS					B

Intersection Summary			
Average Delay	1.8		
Intersection Capacity Utilization	39.2%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	225	1	5	150	4	26
Future Volume (Veh/h)	225	1	5	150	4	26
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	225	1	5	150	4	26
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume			226		386	226
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			226		386	226
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			100		99	97
cM capacity (veh/h)			1342		615	814

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	226	155	30
Volume Left	0	5	4
Volume Right	1	0	26
cSH	1700	1342	780
Volume to Capacity	0.13	0.00	0.04
Queue Length 95th (m)	0.0	0.1	0.9
Control Delay (s)	0.0	0.3	9.8
Lane LOS		A	A
Approach Delay (s)	0.0	0.3	9.8
Approach LOS			A

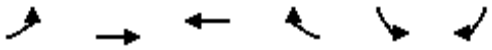
Intersection Summary			
Average Delay	0.8		
Intersection Capacity Utilization	22.6%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	11	244	5	4	144	15	8	4	23	12	3	2
Future Volume (Veh/h)	11	244	5	4	144	15	8	4	23	12	3	2
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	11	244	5	4	144	15	8	4	23	12	3	2
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	159			249			432	436	246	453	430	152
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	159			249			432	436	246	453	430	152
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	99			100			98	99	97	98	99	100
cM capacity (veh/h)	1420			1317			526	509	792	495	512	895

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	260	163	35	17
Volume Left	11	4	8	12
Volume Right	5	15	23	2
cSH	1420	1317	672	526
Volume to Capacity	0.01	0.00	0.05	0.03
Queue Length 95th (m)	0.2	0.1	1.3	0.8
Control Delay (s)	0.4	0.2	10.7	12.1
Lane LOS	A	A	B	B
Approach Delay (s)	0.4	0.2	10.7	12.1
Approach LOS			B	B

Intersection Summary				
Average Delay	1.5			
Intersection Capacity Utilization	29.4%	ICU Level of Service	A	
Analysis Period (min)	15			



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	11	285	133	40	45	37
Future Volume (Veh/h)	11	285	133	40	45	37
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	11	285	133	40	45	37
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	173				440	133
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	173				440	133
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	99				92	96
cM capacity (veh/h)	1404				570	916

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	SB 1
Volume Total	11	285	133	40	82
Volume Left	11	0	0	0	45
Volume Right	0	0	0	40	37
cSH	1404	1700	1700	1700	687
Volume to Capacity	0.01	0.17	0.08	0.02	0.12
Queue Length 95th (m)	0.2	0.0	0.0	0.0	3.1
Control Delay (s)	7.6	0.0	0.0	0.0	10.9
Lane LOS	A				B
Approach Delay (s)	0.3		0.0		10.9
Approach LOS					B

Intersection Summary			
Average Delay	1.8		
Intersection Capacity Utilization	27.5%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	204	138	215	162	21	73
Future Volume (Veh/h)	204	138	215	162	21	73
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	204	138	215	162	21	73
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume			342		796	204
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			342		796	204
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			82		93	91
cM capacity (veh/h)			1217		293	837

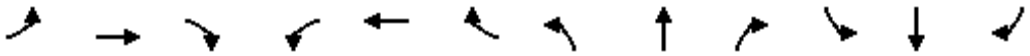
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1
Volume Total	204	138	215	162	94
Volume Left	0	0	215	0	21
Volume Right	0	138	0	0	73
cSH	1700	1700	1217	1700	592
Volume to Capacity	0.12	0.08	0.18	0.10	0.16
Queue Length 95th (m)	0.0	0.0	4.9	0.0	4.3
Control Delay (s)	0.0	0.0	8.6	0.0	12.2
Lane LOS			A		B
Approach Delay (s)	0.0		4.9		12.2
Approach LOS					B

Intersection Summary			
Average Delay	3.7		
Intersection Capacity Utilization	39.9%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	185	5	26	290	0	5
Future Volume (Veh/h)	185	5	26	290	0	5
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	185	5	26	290	0	5
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume			190		530	188
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			190		530	188
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			98		100	99
cM capacity (veh/h)			1384		500	855

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	190	316	5
Volume Left	0	26	0
Volume Right	5	0	5
cSH	1700	1384	855
Volume to Capacity	0.11	0.02	0.01
Queue Length 95th (m)	0.0	0.4	0.1
Control Delay (s)	0.0	0.8	9.2
Lane LOS		A	A
Approach Delay (s)	0.0	0.8	9.2
Approach LOS			A

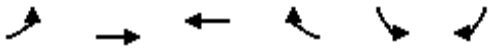
Intersection Summary			
Average Delay	0.6		
Intersection Capacity Utilization	41.6%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	2	183	11	1	290	10	1	7	8	10	9	14
Future Volume (Veh/h)	2	183	11	1	290	10	1	7	8	10	9	14
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	2	183	11	1	290	10	1	7	8	10	9	14
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	300			194			508	494	188	501	495	295
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	300			194			508	494	188	501	495	295
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			100			100	99	99	98	98	98
cM capacity (veh/h)	1261			1379			459	475	853	470	475	744

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	196	301	16	33
Volume Left	2	1	1	10
Volume Right	11	10	8	14
cSH	1261	1379	609	559
Volume to Capacity	0.00	0.00	0.03	0.06
Queue Length 95th (m)	0.0	0.0	0.6	1.4
Control Delay (s)	0.1	0.0	11.1	11.8
Lane LOS	A	A	B	B
Approach Delay (s)	0.1	0.0	11.1	11.8
Approach LOS			B	B

Intersection Summary				
Average Delay	1.1			
Intersection Capacity Utilization	29.5%	ICU Level of Service	A	
Analysis Period (min)	15			



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	18	189	190	93	254	105
Future Volume (Veh/h)	18	189	190	93	254	105
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	18	189	190	93	254	105
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	283				415	190
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	283				415	190
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	99				57	88
cM capacity (veh/h)	1279				586	852

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	SB 1
Volume Total	18	189	190	93	359
Volume Left	18	0	0	0	254
Volume Right	0	0	0	93	105
cSH	1279	1700	1700	1700	644
Volume to Capacity	0.01	0.11	0.11	0.05	0.56
Queue Length 95th (m)	0.3	0.0	0.0	0.0	26.2
Control Delay (s)	7.9	0.0	0.0	0.0	17.4
Lane LOS	A				C
Approach Delay (s)	0.7		0.0		17.4
Approach LOS					C

Intersection Summary			
Average Delay	7.5		
Intersection Capacity Utilization	44.1%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	387	62	81	276	15	44
Future Volume (Veh/h)	387	62	81	276	15	44
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	387	62	81	276	15	44
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume			449		825	387
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			449		825	387
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			93		95	93
cM capacity (veh/h)			1111		317	661

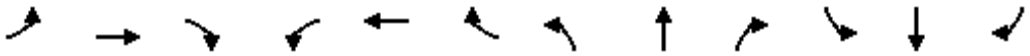
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1
Volume Total	387	62	81	276	59
Volume Left	0	0	81	0	15
Volume Right	0	62	0	0	44
cSH	1700	1700	1111	1700	518
Volume to Capacity	0.23	0.04	0.07	0.16	0.11
Queue Length 95th (m)	0.0	0.0	1.8	0.0	2.9
Control Delay (s)	0.0	0.0	8.5	0.0	12.8
Lane LOS			A		B
Approach Delay (s)	0.0		1.9		12.8
Approach LOS					B

Intersection Summary			
Average Delay	1.7		
Intersection Capacity Utilization	40.0%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	236	1	5	158	4	26
Future Volume (Veh/h)	236	1	5	158	4	26
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	236	1	5	158	4	26
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume			237		404	236
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			237		404	236
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			100		99	97
cM capacity (veh/h)			1330		600	802

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	237	163	30
Volume Left	0	5	4
Volume Right	1	0	26
cSH	1700	1330	768
Volume to Capacity	0.14	0.00	0.04
Queue Length 95th (m)	0.0	0.1	0.9
Control Delay (s)	0.0	0.3	9.9
Lane LOS		A	A
Approach Delay (s)	0.0	0.3	9.9
Approach LOS			A

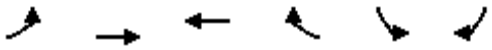
Intersection Summary			
Average Delay	0.8		
Intersection Capacity Utilization	23.2%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	11	257	5	4	152	15	8	4	23	12	3	2
Future Volume (Veh/h)	11	257	5	4	152	15	8	4	23	12	3	2
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	11	257	5	4	152	15	8	4	23	12	3	2
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	167			262			452	456	260	474	452	160
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	167			262			452	456	260	474	452	160
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	99			100			98	99	97	97	99	100
cM capacity (veh/h)	1411			1302			510	495	779	479	498	886

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	273	171	35	17
Volume Left	11	4	8	12
Volume Right	5	15	23	2
cSH	1411	1302	657	510
Volume to Capacity	0.01	0.00	0.05	0.03
Queue Length 95th (m)	0.2	0.1	1.3	0.8
Control Delay (s)	0.4	0.2	10.8	12.3
Lane LOS	A	A	B	B
Approach Delay (s)	0.4	0.2	10.8	12.3
Approach LOS			B	B

Intersection Summary				
Average Delay	1.5			
Intersection Capacity Utilization	30.2%	ICU Level of Service	A	
Analysis Period (min)	15			



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	12	300	140	42	48	39
Future Volume (Veh/h)	12	300	140	42	48	39
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	12	300	140	42	48	39
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	182				464	140
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	182				464	140
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	99				91	96
cM capacity (veh/h)	1393				552	908

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	SB 1
Volume Total	12	300	140	42	87
Volume Left	12	0	0	0	48
Volume Right	0	0	0	42	39
cSH	1393	1700	1700	1700	669
Volume to Capacity	0.01	0.18	0.08	0.02	0.13
Queue Length 95th (m)	0.2	0.0	0.0	0.0	3.4
Control Delay (s)	7.6	0.0	0.0	0.0	11.2
Lane LOS	A				B
Approach Delay (s)	0.3		0.0		11.2
Approach LOS					B

Intersection Summary				
Average Delay	1.8			
Intersection Capacity Utilization	28.7%	ICU Level of Service		A
Analysis Period (min)	15			

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	214	145	226	170	22	77
Future Volume (Veh/h)	214	145	226	170	22	77
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	214	145	226	170	22	77
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume			359		836	214
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			359		836	214
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			81		92	91
cM capacity (veh/h)			1200		274	826

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1
Volume Total	214	145	226	170	99
Volume Left	0	0	226	0	22
Volume Right	0	145	0	0	77
cSH	1700	1700	1200	1700	570
Volume to Capacity	0.13	0.09	0.19	0.10	0.17
Queue Length 95th (m)	0.0	0.0	5.3	0.0	4.7
Control Delay (s)	0.0	0.0	8.7	0.0	12.6
Lane LOS			A		B
Approach Delay (s)	0.0		5.0		12.6
Approach LOS					B

Intersection Summary				
Average Delay	3.8			
Intersection Capacity Utilization	41.4%	ICU Level of Service		A
Analysis Period (min)	15			

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	195	5	26	304	0	5
Future Volume (Veh/h)	195	5	26	304	0	5
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	195	5	26	304	0	5
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume			200		554	198
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			200		554	198
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			98		100	99
cM capacity (veh/h)			1372		484	844

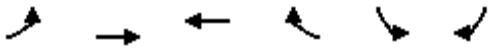
Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	200	330	5
Volume Left	0	26	0
Volume Right	5	0	5
cSH	1700	1372	844
Volume to Capacity	0.12	0.02	0.01
Queue Length 95th (m)	0.0	0.4	0.1
Control Delay (s)	0.0	0.8	9.3
Lane LOS		A	A
Approach Delay (s)	0.0	0.8	9.3
Approach LOS			A

Intersection Summary			
Average Delay	0.6		
Intersection Capacity Utilization	42.9%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	2	193	11	1	304	10	1	7	8	10	9	14
Future Volume (Veh/h)	2	193	11	1	304	10	1	7	8	10	9	14
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	2	193	11	1	304	10	1	7	8	10	9	14
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	314			204			532	518	198	525	519	309
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	314			204			532	518	198	525	519	309
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			100			100	98	99	98	98	98
cM capacity (veh/h)	1246			1368			442	460	843	453	460	731

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	206	315	16	33
Volume Left	2	1	1	10
Volume Right	11	10	8	14
cSH	1246	1368	593	543
Volume to Capacity	0.00	0.00	0.03	0.06
Queue Length 95th (m)	0.0	0.0	0.6	1.5
Control Delay (s)	0.1	0.0	11.2	12.1
Lane LOS	A	A	B	B
Approach Delay (s)	0.1	0.0	11.2	12.1
Approach LOS			B	B

Intersection Summary				
Average Delay	1.1			
Intersection Capacity Utilization	30.3%	ICU Level of Service	A	
Analysis Period (min)	15			



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	18	198	199	97	268	110
Future Volume (Veh/h)	18	198	199	97	268	110
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	18	198	199	97	268	110
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	296				433	199
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	296				433	199
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	99				53	87
cM capacity (veh/h)	1265				572	842

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	SB 1
Volume Total	18	198	199	97	378
Volume Left	18	0	0	0	268
Volume Right	0	0	0	97	110
cSH	1265	1700	1700	1700	631
Volume to Capacity	0.01	0.12	0.12	0.06	0.60
Queue Length 95th (m)	0.3	0.0	0.0	0.0	30.3
Control Delay (s)	7.9	0.0	0.0	0.0	18.9
Lane LOS	A				C
Approach Delay (s)	0.7		0.0		18.9
Approach LOS					C

Intersection Summary			
Average Delay	8.2		
Intersection Capacity Utilization	45.2%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	407	65	86	290	16	47
Future Volume (Veh/h)	407	65	86	290	16	47
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	407	65	86	290	16	47
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume			472		869	407
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			472		869	407
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			92		95	93
cM capacity (veh/h)			1090		297	644

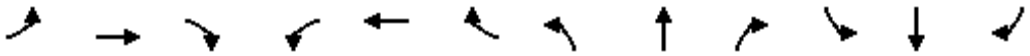
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1
Volume Total	407	65	86	290	63
Volume Left	0	0	86	0	16
Volume Right	0	65	0	0	47
cSH	1700	1700	1090	1700	497
Volume to Capacity	0.24	0.04	0.08	0.17	0.13
Queue Length 95th (m)	0.0	0.0	1.9	0.0	3.3
Control Delay (s)	0.0	0.0	8.6	0.0	13.3
Lane LOS			A		B
Approach Delay (s)	0.0		2.0		13.3
Approach LOS					B

Intersection Summary			
Average Delay	1.7		
Intersection Capacity Utilization	41.6%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	248	1	5	166	4	26
Future Volume (Veh/h)	248	1	5	166	4	26
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	248	1	5	166	4	26
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume			249		424	248
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			249		424	248
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			100		99	97
cM capacity (veh/h)			1317		584	790

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	249	171	30
Volume Left	0	5	4
Volume Right	1	0	26
cSH	1700	1317	755
Volume to Capacity	0.15	0.00	0.04
Queue Length 95th (m)	0.0	0.1	0.9
Control Delay (s)	0.0	0.3	10.0
Lane LOS		A	A
Approach Delay (s)	0.0	0.3	10.0
Approach LOS			A

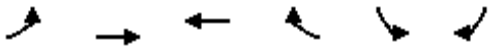
Intersection Summary			
Average Delay	0.8		
Intersection Capacity Utilization	23.8%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	11	270	5	4	159	15	8	4	23	12	3	2
Future Volume (Veh/h)	11	270	5	4	159	15	8	4	23	12	3	2
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	11	270	5	4	159	15	8	4	23	12	3	2
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	174			275			472	476	272	494	472	166
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	174			275			472	476	272	494	472	166
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	99			100			98	99	97	97	99	100
cM capacity (veh/h)	1403			1288			494	482	766	464	485	878

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	286	178	35	17
Volume Left	11	4	8	12
Volume Right	5	15	23	2
cSH	1403	1288	642	495
Volume to Capacity	0.01	0.00	0.05	0.03
Queue Length 95th (m)	0.2	0.1	1.3	0.8
Control Delay (s)	0.4	0.2	10.9	12.5
Lane LOS	A	A	B	B
Approach Delay (s)	0.4	0.2	10.9	12.5
Approach LOS			B	B

Intersection Summary				
Average Delay	1.4			
Intersection Capacity Utilization	31.1%	ICU Level of Service	A	
Analysis Period (min)	15			



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	13	315	147	44	50	41
Future Volume (Veh/h)	13	315	147	44	50	41
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	13	315	147	44	50	41
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	191				488	147
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	191				488	147
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	99				91	95
cM capacity (veh/h)	1383				534	900

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	SB 1
Volume Total	13	315	147	44	91
Volume Left	13	0	0	0	50
Volume Right	0	0	0	44	41
cSH	1383	1700	1700	1700	654
Volume to Capacity	0.01	0.19	0.09	0.03	0.14
Queue Length 95th (m)	0.2	0.0	0.0	0.0	3.7
Control Delay (s)	7.6	0.0	0.0	0.0	11.4
Lane LOS	A				B
Approach Delay (s)	0.3		0.0		11.4
Approach LOS					B

Intersection Summary			
Average Delay	1.9		
Intersection Capacity Utilization	29.7%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	225	153	238	179	23	81
Future Volume (Veh/h)	225	153	238	179	23	81
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	225	153	238	179	23	81
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume			378		880	225
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			378		880	225
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			80		91	90
cM capacity (veh/h)			1180		254	814

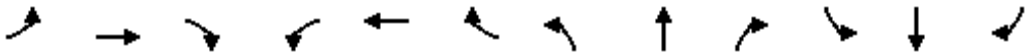
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1
Volume Total	225	153	238	179	104
Volume Left	0	0	238	0	23
Volume Right	0	153	0	0	81
cSH	1700	1700	1180	1700	547
Volume to Capacity	0.13	0.09	0.20	0.11	0.19
Queue Length 95th (m)	0.0	0.0	5.7	0.0	5.3
Control Delay (s)	0.0	0.0	8.8	0.0	13.1
Lane LOS			A		B
Approach Delay (s)	0.0		5.0		13.1
Approach LOS					B

Intersection Summary			
Average Delay	3.9		
Intersection Capacity Utilization	43.0%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	205	5	26	320	0	5
Future Volume (Veh/h)	205	5	26	320	0	5
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	205	5	26	320	0	5
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume			210		580	208
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			210		580	208
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			98		100	99
cM capacity (veh/h)			1361		468	833

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	210	346	5
Volume Left	0	26	0
Volume Right	5	0	5
cSH	1700	1361	833
Volume to Capacity	0.12	0.02	0.01
Queue Length 95th (m)	0.0	0.4	0.1
Control Delay (s)	0.0	0.7	9.3
Lane LOS		A	A
Approach Delay (s)	0.0	0.7	9.3
Approach LOS			A

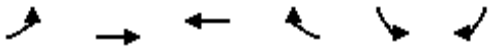
Intersection Summary			
Average Delay	0.5		
Intersection Capacity Utilization	44.3%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	2	203	11	1	320	10	1	7	8	10	9	14
Future Volume (Veh/h)	2	203	11	1	320	10	1	7	8	10	9	14
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	2	203	11	1	320	10	1	7	8	10	9	14
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	330			214			558	544	208	551	545	325
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	330			214			558	544	208	551	545	325
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			100			100	98	99	98	98	98
cM capacity (veh/h)	1229			1356			424	445	832	435	445	716

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	216	331	16	33
Volume Left	2	1	1	10
Volume Right	11	10	8	14
cSH	1229	1356	577	526
Volume to Capacity	0.00	0.00	0.03	0.06
Queue Length 95th (m)	0.0	0.0	0.6	1.5
Control Delay (s)	0.1	0.0	11.4	12.3
Lane LOS	A	A	B	B
Approach Delay (s)	0.1	0.0	11.4	12.3
Approach LOS			B	B

Intersection Summary				
Average Delay	1.0			
Intersection Capacity Utilization	31.2%	ICU Level of Service	A	
Analysis Period (min)	15			



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	19	208	209	102	281	116
Future Volume (Veh/h)	19	208	209	102	281	116
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	19	208	209	102	281	116
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	311				455	209
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	311				455	209
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	98				49	86
cM capacity (veh/h)	1249				555	831

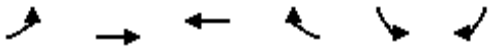
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	SB 1
Volume Total	19	208	209	102	397
Volume Left	19	0	0	0	281
Volume Right	0	0	0	102	116
cSH	1249	1700	1700	1700	614
Volume to Capacity	0.02	0.12	0.12	0.06	0.65
Queue Length 95th (m)	0.4	0.0	0.0	0.0	35.5
Control Delay (s)	7.9	0.0	0.0	0.0	20.9
Lane LOS	A				C
Approach Delay (s)	0.7		0.0		20.9
Approach LOS					C

Intersection Summary			
Average Delay	9.0		
Intersection Capacity Utilization	47.2%	ICU Level of Service	A
Analysis Period (min)	15		

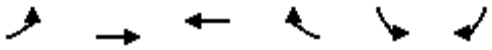
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	428	68	90	305	17	49
Future Volume (Veh/h)	428	68	90	305	17	49
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	428	68	90	305	17	49
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume			496		913	428
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			496		913	428
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			92		94	92
cM capacity (veh/h)			1068		278	627

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1
Volume Total	428	68	90	305	66
Volume Left	0	0	90	0	17
Volume Right	0	68	0	0	49
cSH	1700	1700	1068	1700	474
Volume to Capacity	0.25	0.04	0.08	0.18	0.14
Queue Length 95th (m)	0.0	0.0	2.1	0.0	3.7
Control Delay (s)	0.0	0.0	8.7	0.0	13.8
Lane LOS			A		B
Approach Delay (s)	0.0		2.0		13.8
Approach LOS					B

Intersection Summary				
Average Delay	1.8			
Intersection Capacity Utilization	43.2%	ICU Level of Service		A
Analysis Period (min)	15			



Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	158	1085	332	40	45	804
Future Volume (vph)	158	1085	332	40	45	804
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Storage Length (m)	60.0			30.0	110.0	110.0
Storage Lanes	1			1	1	1
Taper Length (m)	100.0				60.0	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	0.88
Frt				0.850		0.850
Flt Protected	0.950				0.950	
Satd. Flow (prot)	1695	1784	1784	1517	1695	2669
Flt Permitted	0.548				0.950	
Satd. Flow (perm)	978	1784	1784	1517	1695	2669
Right Turn on Red				Yes		Yes
Satd. Flow (RTOR)				40		804
Link Speed (k/h)		80	80		50	
Link Distance (m)		122.5	76.1		162.5	
Travel Time (s)		5.5	3.4		11.7	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	158	1085	332	40	45	804
Shared Lane Traffic (%)						
Lane Group Flow (vph)	158	1085	332	40	45	804
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Left	Left	Right	Left	Right
Median Width(m)		3.7	3.7		3.7	
Link Offset(m)		0.0	0.0		0.0	
Crosswalk Width(m)		1.6	1.6		1.6	
Two way Left Turn Lane						
Headway Factor	1.06	1.06	1.06	1.06	1.06	1.06
Turning Speed (k/h)	24			14	24	14
Number of Detectors	1	2	2	1	1	1
Detector Template	Left	Thru	Thru	Right	Left	Right
Leading Detector (m)	6.1	30.5	30.5	6.1	6.1	6.1
Trailing Detector (m)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Position(m)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Size(m)	6.1	1.8	1.8	6.1	6.1	6.1
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel						
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 2 Position(m)		28.7	28.7			
Detector 2 Size(m)		1.8	1.8			
Detector 2 Type		Cl+Ex	Cl+Ex			
Detector 2 Channel						
Detector 2 Extend (s)		0.0	0.0			
Turn Type	Perm	NA	NA	Perm	Perm	Perm
Protected Phases		2	6			
Permitted Phases	2			6	4	4
Detector Phase	2	2	6	6	4	4
Switch Phase						
Minimum Initial (s)	20.0	20.0	20.0	20.0	10.0	10.0
Minimum Split (s)	26.6	26.6	43.6	43.6	29.7	29.7
Total Split (s)	80.3	80.3	80.3	80.3	29.7	29.7
Total Split (%)	73.0%	73.0%	73.0%	73.0%	27.0%	27.0%
Maximum Green (s)	73.7	73.7	73.7	73.7	23.0	23.0
Yellow Time (s)	4.6	4.6	4.6	4.6	3.3	3.3
All-Red Time (s)	2.0	2.0	2.0	2.0	3.4	3.4
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.6	6.6	6.6	6.6	6.7	6.7
Lead/Lag						

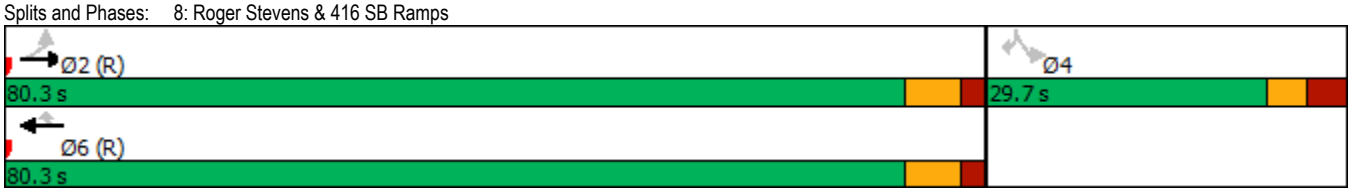


Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lead-Lag Optimize?						
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Recall Mode	C-Max	C-Max	C-Max	C-Max	Max	Max
Walk Time (s)			7.0	7.0	7.0	7.0
Flash Dont Walk (s)			30.0	30.0	16.0	16.0
Pedestrian Calls (#/hr)			0	0	0	0
Act Effct Green (s)	73.7	73.7	73.7	73.7	23.0	23.0
Actuated g/C Ratio	0.67	0.67	0.67	0.67	0.21	0.21
v/c Ratio	0.24	0.91	0.28	0.04	0.13	0.67
Control Delay	4.1	20.6	7.7	1.6	36.6	5.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	4.1	20.6	7.7	1.6	36.6	5.8
LOS	A	C	A	A	D	A
Approach Delay		18.5	7.0		7.5	
Approach LOS		B	A		A	
90th %ile Green (s)	73.7	73.7	73.7	73.7	23.0	23.0
90th %ile Term Code	Coord	Coord	Coord	Coord	MaxR	MaxR
70th %ile Green (s)	73.7	73.7	73.7	73.7	23.0	23.0
70th %ile Term Code	Coord	Coord	Coord	Coord	MaxR	MaxR
50th %ile Green (s)	73.7	73.7	73.7	73.7	23.0	23.0
50th %ile Term Code	Coord	Coord	Coord	Coord	MaxR	MaxR
30th %ile Green (s)	73.7	73.7	73.7	73.7	23.0	23.0
30th %ile Term Code	Coord	Coord	Coord	Coord	MaxR	MaxR
10th %ile Green (s)	73.7	73.7	73.7	73.7	23.0	23.0
10th %ile Term Code	Coord	Coord	Coord	Coord	MaxR	MaxR
Queue Length 50th (m)	5.5	218.2	36.9	1.3	7.9	0.0
Queue Length 95th (m)	m8.7	#288.3	48.3	m1.9	17.6	16.5
Internal Link Dist (m)		98.5	52.1		138.5	
Turn Bay Length (m)	60.0			30.0	110.0	110.0
Base Capacity (vph)	655	1195	1195	1029	354	1193
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.24	0.91	0.28	0.04	0.13	0.67

Intersection Summary

Area Type: Other
Cycle Length: 110
Actuated Cycle Length: 110
Offset: 0 (0%), Referenced to phase 2:EBTL and 6:WBT, Start of Green
Natural Cycle: 90
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.91
Intersection Signal Delay: 13.0 Intersection LOS: B
Intersection Capacity Utilization 79.7% ICU Level of Service D
Analysis Period (min) 15
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 8: Roger Stevens & 416 SB Ramps



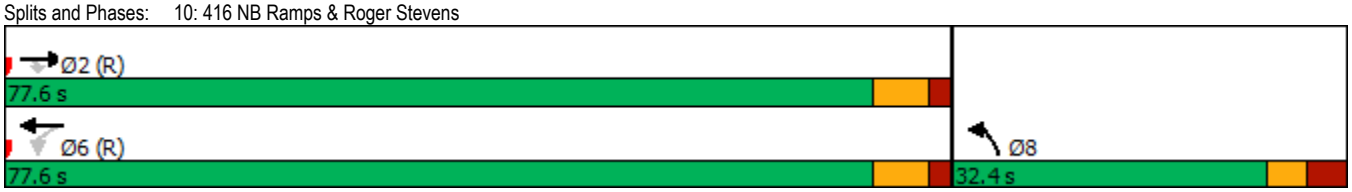
Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	252	890	215	211	171	73
Future Volume (vph)	252	890	215	211	171	73
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Storage Length (m)		30.0	85.0		0.0	0.0
Storage Lanes		1	1		1	0
Taper Length (m)			100.0		30.0	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.850			0.960	
Flt Protected			0.950		0.966	
Satd. Flow (prot)	1784	1517	1695	1784	1655	0
Flt Permitted			0.603		0.966	
Satd. Flow (perm)	1784	1517	1076	1784	1655	0
Right Turn on Red		Yes				Yes
Satd. Flow (RTOR)		890			18	
Link Speed (k/h)	80			80	50	
Link Distance (m)	73.7			234.6	117.8	
Travel Time (s)	3.3			10.6	8.5	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	252	890	215	211	171	73
Shared Lane Traffic (%)						
Lane Group Flow (vph)	252	890	215	211	244	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(m)	3.7			3.7	3.7	
Link Offset(m)	0.0			0.0	0.0	
Crosswalk Width(m)	1.6			1.6	1.6	
Two way Left Turn Lane						
Headway Factor	1.06	1.06	1.06	1.06	1.06	1.06
Turning Speed (k/h)		14	24		24	14
Number of Detectors	2	1	1	2	1	
Detector Template	Thru	Right	Left	Thru	Left	
Leading Detector (m)	30.5	6.1	6.1	30.5	6.1	
Trailing Detector (m)	0.0	0.0	0.0	0.0	0.0	
Detector 1 Position(m)	0.0	0.0	0.0	0.0	0.0	
Detector 1 Size(m)	1.8	6.1	6.1	1.8	6.1	
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	
Detector 1 Channel						
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0	
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0	
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0	
Detector 2 Position(m)	28.7			28.7		
Detector 2 Size(m)	1.8			1.8		
Detector 2 Type	Cl+Ex			Cl+Ex		
Detector 2 Channel						
Detector 2 Extend (s)	0.0			0.0		
Turn Type	NA	Perm	Perm	NA	Prot	
Protected Phases	2			6	8	
Permitted Phases		2	6			
Detector Phase	2	2	6	6	8	
Switch Phase						
Minimum Initial (s)	20.0	20.0	20.0	20.0	10.0	
Minimum Split (s)	38.6	38.6	26.6	26.6	22.5	
Total Split (s)	77.6	77.6	77.6	77.6	32.4	
Total Split (%)	70.5%	70.5%	70.5%	70.5%	29.5%	
Maximum Green (s)	71.0	71.0	71.0	71.0	25.7	
Yellow Time (s)	4.6	4.6	4.6	4.6	3.3	
All-Red Time (s)	2.0	2.0	2.0	2.0	3.4	
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	
Total Lost Time (s)	6.6	6.6	6.6	6.6	6.7	
Lead/Lag						

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lead-Lag Optimize?						
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Recall Mode	C-Max	C-Max	C-Max	C-Max	Max	
Walk Time (s)	7.0	7.0				
Flash Dont Walk (s)	25.0	25.0				
Pedestrian Calls (#/hr)	0	0				
Act Effct Green (s)	71.0	71.0	71.0	71.0	25.7	
Actuated g/C Ratio	0.65	0.65	0.65	0.65	0.23	
v/c Ratio	0.22	0.69	0.31	0.18	0.61	
Control Delay	5.5	2.4	10.1	8.3	42.3	
Queue Delay	0.0	0.0	0.0	0.0	0.0	
Total Delay	5.5	2.4	10.1	8.3	42.3	
LOS	A	A	B	A	D	
Approach Delay	3.1			9.2	42.3	
Approach LOS	A			A	D	
90th %ile Green (s)	71.0	71.0	71.0	71.0	25.7	
90th %ile Term Code	Coord	Coord	Coord	Coord	MaxR	
70th %ile Green (s)	71.0	71.0	71.0	71.0	25.7	
70th %ile Term Code	Coord	Coord	Coord	Coord	MaxR	
50th %ile Green (s)	71.0	71.0	71.0	71.0	25.7	
50th %ile Term Code	Coord	Coord	Coord	Coord	MaxR	
30th %ile Green (s)	71.0	71.0	71.0	71.0	25.7	
30th %ile Term Code	Coord	Coord	Coord	Coord	MaxR	
10th %ile Green (s)	71.0	71.0	71.0	71.0	25.7	
10th %ile Term Code	Coord	Coord	Coord	Coord	MaxR	
Queue Length 50th (m)	8.7	0.0	18.7	16.7	43.6	
Queue Length 95th (m)	m14.7	m0.0	31.5	26.5	69.9	
Internal Link Dist (m)	49.7			210.6	93.8	
Turn Bay Length (m)		30.0	85.0			
Base Capacity (vph)	1151	1294	694	1151	400	
Starvation Cap Reductn	0	0	0	0	0	
Spillback Cap Reductn	0	0	0	0	0	
Storage Cap Reductn	0	0	0	0	0	
Reduced v/c Ratio	0.22	0.69	0.31	0.18	0.61	

Intersection Summary			
Area Type:	Other		
Cycle Length: 110			
Actuated Cycle Length: 110			
Offset: 4 (4%), Referenced to phase 2:EBT and 6:WBTL, Start of Green			
Natural Cycle: 65			
Control Type: Actuated-Coordinated			
Maximum v/c Ratio: 0.69			
Intersection Signal Delay: 9.8		Intersection LOS: A	
Intersection Capacity Utilization 85.8%		ICU Level of Service E	
Analysis Period (min) 15			

m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 10: 416 NB Ramps & Roger Stevens

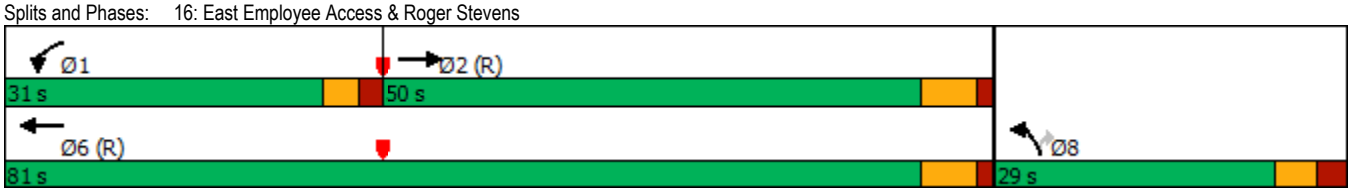


Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	611	6	643	492	6	630
Future Volume (vph)	611	6	643	492	6	630
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Storage Length (m)		0.0	125.0		0.0	0.0
Storage Lanes		0	2		1	1
Taper Length (m)			100.0		30.0	
Lane Util. Factor	1.00	1.00	0.97	1.00	1.00	0.95
Frt	0.999				0.853	0.850
Flt Protected			0.950		0.999	
Satd. Flow (prot)	1783	0	3288	1784	1520	1441
Flt Permitted			0.950		0.999	
Satd. Flow (perm)	1783	0	3288	1784	1520	1441
Right Turn on Red		Yes				Yes
Satd. Flow (RTOR)	1				315	315
Link Speed (k/h)	80			80	48	
Link Distance (m)	191.8			211.8	133.2	
Travel Time (s)	8.6			9.5	10.0	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	611	6	643	492	6	630
Shared Lane Traffic (%)						50%
Lane Group Flow (vph)	617	0	643	492	321	315
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(m)	7.4			7.4	3.7	
Link Offset(m)	0.0			0.0	0.0	
Crosswalk Width(m)	1.6			1.6	1.6	
Two way Left Turn Lane						
Headway Factor	1.06	1.06	1.06	1.06	1.06	1.06
Turning Speed (k/h)		14	24		24	14
Number of Detectors	2		1	2	1	1
Detector Template	Thru		Left	Thru	Left	Right
Leading Detector (m)	30.5		6.1	30.5	6.1	6.1
Trailing Detector (m)	0.0		0.0	0.0	0.0	0.0
Detector 1 Position(m)	0.0		0.0	0.0	0.0	0.0
Detector 1 Size(m)	1.8		6.1	1.8	6.1	6.1
Detector 1 Type	Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel						
Detector 1 Extend (s)	0.0		0.0	0.0	0.0	0.0
Detector 1 Queue (s)	0.0		0.0	0.0	0.0	0.0
Detector 1 Delay (s)	0.0		0.0	0.0	0.0	0.0
Detector 2 Position(m)	28.7			28.7		
Detector 2 Size(m)	1.8			1.8		
Detector 2 Type	Cl+Ex			Cl+Ex		
Detector 2 Channel						
Detector 2 Extend (s)	0.0			0.0		
Turn Type	NA		Prot	NA	Prot	Perm
Protected Phases	2		1	6	8	
Permitted Phases						8
Detector Phase	2		1	6	8	8
Switch Phase						
Minimum Initial (s)	20.0		5.0	20.0	10.0	10.0
Minimum Split (s)	26.1		14.5	26.1	29.0	29.0
Total Split (s)	50.0		31.0	81.0	29.0	29.0
Total Split (%)	45.5%		28.2%	73.6%	26.4%	26.4%
Maximum Green (s)	43.9		26.0	74.9	23.0	23.0
Yellow Time (s)	4.6		3.0	4.6	3.3	3.3
All-Red Time (s)	1.5		2.0	1.5	2.7	2.7
Lost Time Adjust (s)	0.0		0.0	0.0	0.0	0.0
Total Lost Time (s)	6.1		5.0	6.1	6.0	6.0
Lead/Lag	Lag		Lead			

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lead-Lag Optimize?						
Vehicle Extension (s)	3.0		3.0	3.0	3.0	3.0
Recall Mode	C-Max		None	C-Max	None	None
Walk Time (s)	7.0			7.0	7.0	7.0
Flash Dont Walk (s)	11.0			11.0	16.0	16.0
Pedestrian Calls (#/hr)	0			0	0	0
Act Effct Green (s)	54.5		26.3	85.8	12.1	12.1
Actuated g/C Ratio	0.50		0.24	0.78	0.11	0.11
v/c Ratio	0.70		0.82	0.35	0.72	0.72
Control Delay	28.4		48.0	3.6	15.1	14.8
Queue Delay	0.0		0.0	0.0	0.0	0.0
Total Delay	28.4		48.0	3.6	15.1	14.8
LOS	C		D	A	B	B
Approach Delay	28.4			28.8	14.9	
Approach LOS	C			C	B	
90th %ile Green (s)	43.9		30.2	79.1	18.8	18.8
90th %ile Term Code	Coord		Max	Coord	Gap	Gap
70th %ile Green (s)	52.1		29.0	86.1	11.8	11.8
70th %ile Term Code	Coord		Gap	Coord	Gap	Gap
50th %ile Green (s)	56.1		26.8	87.9	10.0	10.0
50th %ile Term Code	Coord		Gap	Coord	Min	Min
30th %ile Green (s)	58.5		24.4	87.9	10.0	10.0
30th %ile Term Code	Coord		Gap	Coord	Min	Min
10th %ile Green (s)	62.0		20.9	87.9	10.0	10.0
10th %ile Term Code	Coord		Gap	Coord	Min	Min
Queue Length 50th (m)	95.3		69.1	19.4	1.2	0.0
Queue Length 95th (m)	#183.9		77.0	32.7	26.4	26.2
Internal Link Dist (m)	167.8			187.8	109.2	
Turn Bay Length (m)			125.0			
Base Capacity (vph)	884		825	1391	566	550
Starvation Cap Reductn	0		0	0	0	0
Spillback Cap Reductn	0		0	0	0	0
Storage Cap Reductn	0		0	0	0	0
Reduced v/c Ratio	0.70		0.78	0.35	0.57	0.57

Intersection Summary			
Area Type:	Other		
Cycle Length: 110			
Actuated Cycle Length: 110			
Offset: 0 (0%), Referenced to phase 2:EBT and 6:WBT, Start of Green			
Natural Cycle: 90			
Control Type: Actuated-Coordinated			
Maximum v/c Ratio: 0.82			
Intersection Signal Delay: 25.0		Intersection LOS: C	
Intersection Capacity Utilization 82.0%		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: 16: East Employee Access & Roger Stevens



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	316	5	5	189	5	5
Future Volume (Veh/h)	316	5	5	189	5	5
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	316	5	5	189	5	5
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (m)				351		
pX, platoon unblocked						
vC, conflicting volume			321		518	318
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			321		518	318
tC, single (s)			5.1		7.4	7.2
tC, 2 stage (s)						
tF (s)			3.1		4.4	4.2
p0 queue free %			99		99	99
cM capacity (veh/h)			844		379	543

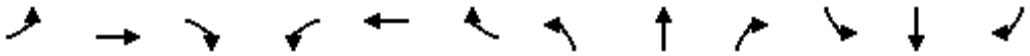
Direction, Lane #	EB 1	WB 1	WB 2	NB 1
Volume Total	321	5	189	10
Volume Left	0	5	0	5
Volume Right	5	0	0	5
cSH	1700	844	1700	446
Volume to Capacity	0.19	0.01	0.11	0.02
Queue Length 95th (m)	0.0	0.1	0.0	0.5
Control Delay (s)	0.0	9.3	0.0	13.3
Lane LOS		A		B
Approach Delay (s)	0.0	0.2		13.3
Approach LOS				B

Intersection Summary			
Average Delay	0.3		
Intersection Capacity Utilization	27.9%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	249	1	5	174	4	26
Future Volume (Veh/h)	249	1	5	174	4	26
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	249	1	5	174	4	26
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume			250		434	250
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			250		434	250
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			100		99	97
cM capacity (veh/h)			1316		577	789

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	250	179	30
Volume Left	0	5	4
Volume Right	1	0	26
cSH	1700	1316	752
Volume to Capacity	0.15	0.00	0.04
Queue Length 95th (m)	0.0	0.1	0.9
Control Delay (s)	0.0	0.2	10.0
Lane LOS		A	A
Approach Delay (s)	0.0	0.2	10.0
Approach LOS			A

Intersection Summary			
Average Delay	0.7		
Intersection Capacity Utilization	23.9%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	11	268	5	4	168	15	8	4	23	12	3	2
Future Volume (Veh/h)	11	268	5	4	168	15	8	4	23	12	3	2
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	11	268	5	4	168	15	8	4	23	12	3	2
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	183			273			480	484	270	501	478	176
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	183			273			480	484	270	501	478	176
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	99			100			98	99	97	97	99	100
cM capacity (veh/h)	1392			1290			489	478	768	459	481	868

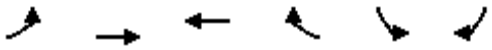
Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	284	187	35	17
Volume Left	11	4	8	12
Volume Right	5	15	23	2
cSH	1392	1290	640	490
Volume to Capacity	0.01	0.00	0.05	0.03
Queue Length 95th (m)	0.2	0.1	1.3	0.8
Control Delay (s)	0.4	0.2	10.9	12.6
Lane LOS	A	A	B	B
Approach Delay (s)	0.4	0.2	10.9	12.6
Approach LOS			B	B

Intersection Summary				
Average Delay	1.4			
Intersection Capacity Utilization	31.1%	ICU Level of Service	A	
Analysis Period (min)	15			

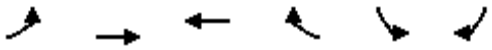
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	307	13	317	181	13	310
Future Volume (Veh/h)	307	13	317	181	13	310
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	307	13	317	181	13	310
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (m)				192		
pX, platoon unblocked						
vC, conflicting volume			320		1128	314
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			320		1128	314
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			74		92	57
cM capacity (veh/h)			1240		168	727

Direction, Lane #	EB 1	WB 1	WB 2	NB 1
Volume Total	320	317	181	323
Volume Left	0	317	0	13
Volume Right	13	0	0	310
cSH	1700	1240	1700	641
Volume to Capacity	0.19	0.26	0.11	0.50
Queue Length 95th (m)	0.0	7.8	0.0	21.6
Control Delay (s)	0.0	8.9	0.0	16.2
Lane LOS		A		C
Approach Delay (s)	0.0	5.7		16.2
Approach LOS				C

Intersection Summary			
Average Delay	7.1		
Intersection Capacity Utilization	67.4%	ICU Level of Service	C
Analysis Period (min)	15		



Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	178	1035	390	93	254	862
Future Volume (vph)	178	1035	390	93	254	862
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Storage Length (m)	60.0			30.0	110.0	110.0
Storage Lanes	1			1	1	1
Taper Length (m)	100.0				60.0	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	0.88
Frt				0.850		0.850
Flt Protected	0.950				0.950	
Satd. Flow (prot)	1695	1784	1784	1517	1695	2669
Flt Permitted	0.506				0.950	
Satd. Flow (perm)	903	1784	1784	1517	1695	2669
Right Turn on Red				Yes		Yes
Satd. Flow (RTOR)				93		862
Link Speed (k/h)		80	80		50	
Link Distance (m)		122.5	76.1		162.5	
Travel Time (s)		5.5	3.4		11.7	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	178	1035	390	93	254	862
Shared Lane Traffic (%)						
Lane Group Flow (vph)	178	1035	390	93	254	862
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Left	Left	Right	Left	Right
Median Width(m)		3.7	3.7		3.7	
Link Offset(m)		0.0	0.0		0.0	
Crosswalk Width(m)		1.6	1.6		1.6	
Two way Left Turn Lane						
Headway Factor	1.06	1.06	1.06	1.06	1.06	1.06
Turning Speed (k/h)	24			14	24	14
Number of Detectors	1	2	2	1	1	1
Detector Template	Left	Thru	Thru	Right	Left	Right
Leading Detector (m)	6.1	30.5	30.5	6.1	6.1	6.1
Trailing Detector (m)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Position(m)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Size(m)	6.1	1.8	1.8	6.1	6.1	6.1
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel						
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 2 Position(m)		28.7	28.7			
Detector 2 Size(m)		1.8	1.8			
Detector 2 Type		Cl+Ex	Cl+Ex			
Detector 2 Channel						
Detector 2 Extend (s)		0.0	0.0			
Turn Type	Perm	NA	NA	Perm	Perm	Perm
Protected Phases		2	6			
Permitted Phases	2			6	4	4
Detector Phase	2	2	6	6	4	4
Switch Phase						
Minimum Initial (s)	20.0	20.0	20.0	20.0	10.0	10.0
Minimum Split (s)	26.6	26.6	43.6	43.6	29.7	29.7
Total Split (s)	80.0	80.0	80.0	80.0	30.0	30.0
Total Split (%)	72.7%	72.7%	72.7%	72.7%	27.3%	27.3%
Maximum Green (s)	73.4	73.4	73.4	73.4	23.3	23.3
Yellow Time (s)	4.6	4.6	4.6	4.6	3.3	3.3
All-Red Time (s)	2.0	2.0	2.0	2.0	3.4	3.4
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.6	6.6	6.6	6.6	6.7	6.7
Lead/Lag						

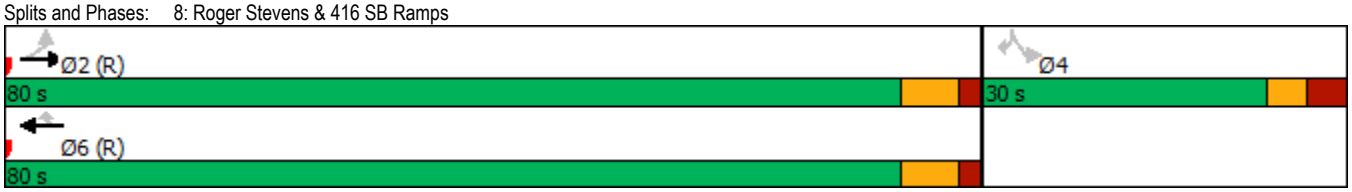


Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lead-Lag Optimize?						
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Recall Mode	C-Max	C-Max	C-Max	C-Max	Max	Max
Walk Time (s)			7.0	7.0	7.0	7.0
Flash Dont Walk (s)			30.0	30.0	16.0	16.0
Pedestrian Calls (#/hr)			0	0	0	0
Act Effct Green (s)	73.4	73.4	73.4	73.4	23.3	23.3
Actuated g/C Ratio	0.67	0.67	0.67	0.67	0.21	0.21
v/c Ratio	0.30	0.87	0.33	0.09	0.71	0.69
Control Delay	6.6	16.0	5.7	0.3	52.2	5.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	6.6	16.0	5.7	0.3	52.2	5.9
LOS	A	B	A	A	D	A
Approach Delay		14.6	4.7		16.4	
Approach LOS		B	A		B	
90th %ile Green (s)	73.4	73.4	73.4	73.4	23.3	23.3
90th %ile Term Code	Coord	Coord	Coord	Coord	MaxR	MaxR
70th %ile Green (s)	73.4	73.4	73.4	73.4	23.3	23.3
70th %ile Term Code	Coord	Coord	Coord	Coord	MaxR	MaxR
50th %ile Green (s)	73.4	73.4	73.4	73.4	23.3	23.3
50th %ile Term Code	Coord	Coord	Coord	Coord	MaxR	MaxR
30th %ile Green (s)	73.4	73.4	73.4	73.4	23.3	23.3
30th %ile Term Code	Coord	Coord	Coord	Coord	MaxR	MaxR
10th %ile Green (s)	73.4	73.4	73.4	73.4	23.3	23.3
10th %ile Term Code	Coord	Coord	Coord	Coord	MaxR	MaxR
Queue Length 50th (m)	7.3	54.7	17.2	0.0	50.9	0.0
Queue Length 95th (m)	19.3	#106.6	22.6	1.0	#80.4	16.7
Internal Link Dist (m)		98.5	52.1		138.5	
Turn Bay Length (m)	60.0			30.0	110.0	110.0
Base Capacity (vph)	602	1190	1190	1043	359	1244
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.30	0.87	0.33	0.09	0.71	0.69

Intersection Summary

Area Type: Other
Cycle Length: 110
Actuated Cycle Length: 110
Offset: 96 (87%), Referenced to phase 2:EBTL and 6:WBT, Start of Green
Natural Cycle: 90
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.87
Intersection Signal Delay: 13.6 Intersection LOS: B
Intersection Capacity Utilization 83.4% 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: 8: Roger Stevens & 416 SB Ramps



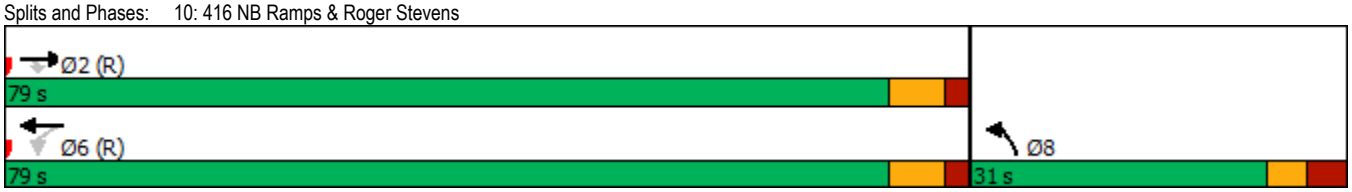
Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	438	858	81	324	167	44
Future Volume (vph)	438	858	81	324	167	44
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Storage Length (m)		30.0	85.0		0.0	0.0
Storage Lanes		1	1		1	0
Taper Length (m)			100.0		30.0	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.850			0.972	
Flt Protected			0.950		0.962	
Satd. Flow (prot)	1784	1517	1695	1784	1668	0
Flt Permitted			0.470		0.962	
Satd. Flow (perm)	1784	1517	839	1784	1668	0
Right Turn on Red		Yes				Yes
Satd. Flow (RTOR)		858			11	
Link Speed (k/h)	80			80	50	
Link Distance (m)	73.7			234.6	117.8	
Travel Time (s)	3.3			10.6	8.5	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	438	858	81	324	167	44
Shared Lane Traffic (%)						
Lane Group Flow (vph)	438	858	81	324	211	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(m)	3.7			3.7	3.7	
Link Offset(m)	0.0			0.0	0.0	
Crosswalk Width(m)	1.6			1.6	1.6	
Two way Left Turn Lane						
Headway Factor	1.06	1.06	1.06	1.06	1.06	1.06
Turning Speed (k/h)		14	24		24	14
Number of Detectors	2	1	1	2	1	
Detector Template	Thru	Right	Left	Thru	Left	
Leading Detector (m)	30.5	6.1	6.1	30.5	6.1	
Trailing Detector (m)	0.0	0.0	0.0	0.0	0.0	
Detector 1 Position(m)	0.0	0.0	0.0	0.0	0.0	
Detector 1 Size(m)	1.8	6.1	6.1	1.8	6.1	
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	
Detector 1 Channel						
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0	
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0	
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0	
Detector 2 Position(m)	28.7			28.7		
Detector 2 Size(m)	1.8			1.8		
Detector 2 Type	Cl+Ex			Cl+Ex		
Detector 2 Channel						
Detector 2 Extend (s)	0.0			0.0		
Turn Type	NA	Perm	Perm	NA	Prot	
Protected Phases	2			6	8	
Permitted Phases		2	6			
Detector Phase	2	2	6	6	8	
Switch Phase						
Minimum Initial (s)	20.0	20.0	20.0	20.0	10.0	
Minimum Split (s)	38.6	38.6	26.6	26.6	22.5	
Total Split (s)	79.0	79.0	79.0	79.0	31.0	
Total Split (%)	71.8%	71.8%	71.8%	71.8%	28.2%	
Maximum Green (s)	72.4	72.4	72.4	72.4	24.3	
Yellow Time (s)	4.6	4.6	4.6	4.6	3.3	
All-Red Time (s)	2.0	2.0	2.0	2.0	3.4	
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	
Total Lost Time (s)	6.6	6.6	6.6	6.6	6.7	
Lead/Lag						

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lead-Lag Optimize?						
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Recall Mode	C-Max	C-Max	C-Max	C-Max	Max	
Walk Time (s)	7.0	7.0				
Flash Dont Walk (s)	25.0	25.0				
Pedestrian Calls (#/hr)	0	0				
Act Effct Green (s)	72.4	72.4	72.4	72.4	24.3	
Actuated g/C Ratio	0.66	0.66	0.66	0.66	0.22	
v/c Ratio	0.37	0.66	0.15	0.28	0.56	
Control Delay	5.8	1.9	7.9	8.6	42.6	
Queue Delay	0.0	0.0	0.0	0.0	0.0	
Total Delay	5.8	1.9	7.9	8.6	42.6	
LOS	A	A	A	A	D	
Approach Delay	3.2			8.5	42.6	
Approach LOS	A			A	D	
90th %ile Green (s)	72.4	72.4	72.4	72.4	24.3	
90th %ile Term Code	Coord	Coord	Coord	Coord	MaxR	
70th %ile Green (s)	72.4	72.4	72.4	72.4	24.3	
70th %ile Term Code	Coord	Coord	Coord	Coord	MaxR	
50th %ile Green (s)	72.4	72.4	72.4	72.4	24.3	
50th %ile Term Code	Coord	Coord	Coord	Coord	MaxR	
30th %ile Green (s)	72.4	72.4	72.4	72.4	24.3	
30th %ile Term Code	Coord	Coord	Coord	Coord	MaxR	
10th %ile Green (s)	72.4	72.4	72.4	72.4	24.3	
10th %ile Term Code	Coord	Coord	Coord	Coord	MaxR	
Queue Length 50th (m)	20.4	6.6	6.0	26.5	38.4	
Queue Length 95th (m)	m26.5	m2.8	12.1	39.4	62.4	
Internal Link Dist (m)	49.7			210.6	93.8	
Turn Bay Length (m)		30.0	85.0			
Base Capacity (vph)	1174	1291	552	1174	377	
Starvation Cap Reductn	0	0	0	0	0	
Spillback Cap Reductn	0	0	0	0	0	
Storage Cap Reductn	0	0	0	0	0	
Reduced v/c Ratio	0.37	0.66	0.15	0.28	0.56	

Intersection Summary

Area Type: Other
Cycle Length: 110
Actuated Cycle Length: 110
Offset: 2 (2%), Referenced to phase 2:EBT and 6:WBTL, Start of Green
Natural Cycle: 65
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.66
Intersection Signal Delay: 8.7 Intersection LOS: A
Intersection Capacity Utilization 83.7% ICU Level of Service E
Analysis Period (min) 15
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 10: 416 NB Ramps & Roger Stevens



Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	549	5	630	620	7	663
Future Volume (vph)	549	5	630	620	7	663
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Storage Length (m)		0.0	125.0		0.0	0.0
Storage Lanes		0	2		1	1
Taper Length (m)			100.0		30.0	
Lane Util. Factor	1.00	1.00	0.97	1.00	1.00	0.95
Frt	0.999				0.853	0.850
Flt Protected			0.950		0.999	
Satd. Flow (prot)	1783	0	3288	1784	1520	1441
Flt Permitted			0.950		0.999	
Satd. Flow (perm)	1783	0	3288	1784	1520	1441
Right Turn on Red		Yes				Yes
Satd. Flow (RTOR)					332	331
Link Speed (k/h)	80			80	48	
Link Distance (m)	191.8			211.8	133.2	
Travel Time (s)	8.6			9.5	10.0	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	549	5	630	620	7	663
Shared Lane Traffic (%)						50%
Lane Group Flow (vph)	554	0	630	620	339	331
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(m)	7.4			7.4	3.7	
Link Offset(m)	0.0			0.0	0.0	
Crosswalk Width(m)	1.6			1.6	1.6	
Two way Left Turn Lane						
Headway Factor	1.06	1.06	1.06	1.06	1.06	1.06
Turning Speed (k/h)		14	24		24	14
Number of Detectors	2		1	2	1	1
Detector Template	Thru		Left	Thru	Left	Right
Leading Detector (m)	30.5		6.1	30.5	6.1	6.1
Trailing Detector (m)	0.0		0.0	0.0	0.0	0.0
Detector 1 Position(m)	0.0		0.0	0.0	0.0	0.0
Detector 1 Size(m)	1.8		6.1	1.8	6.1	6.1
Detector 1 Type	Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel						
Detector 1 Extend (s)	0.0		0.0	0.0	0.0	0.0
Detector 1 Queue (s)	0.0		0.0	0.0	0.0	0.0
Detector 1 Delay (s)	0.0		0.0	0.0	0.0	0.0
Detector 2 Position(m)	28.7			28.7		
Detector 2 Size(m)	1.8			1.8		
Detector 2 Type	Cl+Ex			Cl+Ex		
Detector 2 Channel						
Detector 2 Extend (s)	0.0			0.0		
Turn Type	NA		Prot	NA	Prot	Perm
Protected Phases	2		1	6	8	
Permitted Phases						8
Detector Phase	2		1	6	8	8
Switch Phase						
Minimum Initial (s)	20.0		5.0	20.0	10.0	10.0
Minimum Split (s)	26.1		14.5	26.1	29.0	29.0
Total Split (s)	50.0		31.0	81.0	29.0	29.0
Total Split (%)	45.5%		28.2%	73.6%	26.4%	26.4%
Maximum Green (s)	43.9		26.0	74.9	23.0	23.0
Yellow Time (s)	4.6		3.0	4.6	3.3	3.3
All-Red Time (s)	1.5		2.0	1.5	2.7	2.7
Lost Time Adjust (s)	0.0		0.0	0.0	0.0	0.0
Total Lost Time (s)	6.1		5.0	6.1	6.0	6.0
Lead/Lag	Lag		Lead			

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lead-Lag Optimize?						
Vehicle Extension (s)	3.0		3.0	3.0	3.0	3.0
Recall Mode	C-Max		None	C-Max	None	None
Walk Time (s)	7.0			7.0	7.0	7.0
Flash Dont Walk (s)	11.0			11.0	16.0	16.0
Pedestrian Calls (#/hr)	0			0	0	0
Act Effct Green (s)	54.9		25.8	85.7	12.2	12.2
Actuated g/C Ratio	0.50		0.23	0.78	0.11	0.11
v/c Ratio	0.62		0.82	0.45	0.73	0.73
Control Delay	25.7		49.9	4.6	15.2	14.8
Queue Delay	0.0		0.0	0.0	0.0	0.0
Total Delay	25.7		49.9	4.6	15.2	14.8
LOS	C		D	A	B	B
Approach Delay	25.7			27.5	15.0	
Approach LOS	C			C	B	
90th %ile Green (s)	43.9		29.8	78.7	19.2	19.2
90th %ile Term Code	Coord		Max	Coord	Gap	Gap
70th %ile Green (s)	52.4		28.5	85.9	12.0	12.0
70th %ile Term Code	Coord		Gap	Coord	Gap	Gap
50th %ile Green (s)	56.6		26.3	87.9	10.0	10.0
50th %ile Term Code	Coord		Gap	Coord	Min	Min
30th %ile Green (s)	59.0		23.9	87.9	10.0	10.0
30th %ile Term Code	Coord		Gap	Coord	Min	Min
10th %ile Green (s)	62.5		20.4	87.9	10.0	10.0
10th %ile Term Code	Coord		Gap	Coord	Min	Min
Queue Length 50th (m)	80.4		69.3	27.6	1.4	0.0
Queue Length 95th (m)	145.7		86.6	47.8	27.1	26.9
Internal Link Dist (m)	167.8			187.8	109.2	
Turn Bay Length (m)			125.0			
Base Capacity (vph)	889		816	1389	580	563
Starvation Cap Reductn	0		0	0	0	0
Spillback Cap Reductn	0		0	0	0	0
Storage Cap Reductn	0		0	0	0	0
Reduced v/c Ratio	0.62		0.77	0.45	0.58	0.59

Intersection Summary			
Area Type:	Other		
Cycle Length: 110			
Actuated Cycle Length: 110			
Offset: 0 (0%), Referenced to phase 2:EBT and 6:WBT, Start of Green			
Natural Cycle: 90			
Control Type: Actuated-Coordinated			
Maximum v/c Ratio: 0.82			
Intersection Signal Delay: 23.7		Intersection LOS: C	
Intersection Capacity Utilization 78.9%		ICU Level of Service D	
Analysis Period (min) 15			

Splits and Phases: 16: East Employee Access & Roger Stevens

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	226	5	15	315	5	15
Future Volume (Veh/h)	226	5	15	315	5	15
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	226	5	15	315	5	15
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (m)				351		
pX, platoon unblocked						
vC, conflicting volume			231		574	228
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			231		574	228
tC, single (s)			5.1		7.4	7.2
tC, 2 stage (s)						
tF (s)			3.1		4.4	4.2
p0 queue free %			98		99	98
cM capacity (veh/h)			923		344	618

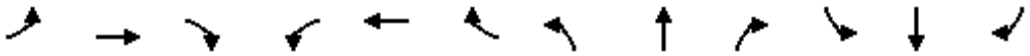
Direction, Lane #	EB 1	WB 1	WB 2	NB 1
Volume Total	231	15	315	20
Volume Left	0	15	0	5
Volume Right	5	0	0	15
cSH	1700	923	1700	516
Volume to Capacity	0.14	0.02	0.19	0.04
Queue Length 95th (m)	0.0	0.4	0.0	0.9
Control Delay (s)	0.0	9.0	0.0	12.3
Lane LOS		A		B
Approach Delay (s)	0.0	0.4		12.3
Approach LOS				B

Intersection Summary			
Average Delay	0.7		
Intersection Capacity Utilization	27.5%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	209	5	25	315	0	5
Future Volume (Veh/h)	209	5	25	315	0	5
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	209	5	25	315	0	5
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume			214		576	212
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			214		576	212
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			98		100	99
cM capacity (veh/h)			1356		470	829

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	214	340	5
Volume Left	0	25	0
Volume Right	5	0	5
cSH	1700	1356	829
Volume to Capacity	0.13	0.02	0.01
Queue Length 95th (m)	0.0	0.4	0.1
Control Delay (s)	0.0	0.7	9.4
Lane LOS		A	A
Approach Delay (s)	0.0	0.7	9.4
Approach LOS			A

Intersection Summary			
Average Delay	0.5		
Intersection Capacity Utilization	44.2%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	2	207	11	15	315	10	1	7	8	10	9	14
Future Volume (Veh/h)	2	207	11	15	315	10	1	7	8	10	9	14
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	2	207	11	15	315	10	1	7	8	10	9	14
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	325			218			585	572	212	578	572	320
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	325			218			585	572	212	578	572	320
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			99			100	98	99	98	98	98
cM capacity (veh/h)	1235			1352			404	425	828	414	425	721

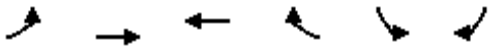
Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	220	340	16	33
Volume Left	2	15	1	10
Volume Right	11	10	8	14
cSH	1235	1352	559	509
Volume to Capacity	0.00	0.01	0.03	0.06
Queue Length 95th (m)	0.0	0.3	0.7	1.6
Control Delay (s)	0.1	0.4	11.6	12.6
Lane LOS	A	A	B	B
Approach Delay (s)	0.1	0.4	11.6	12.6
Approach LOS			B	B

Intersection Summary				
Average Delay	1.3			
Intersection Capacity Utilization	40.5%	ICU Level of Service	A	
Analysis Period (min)	15			

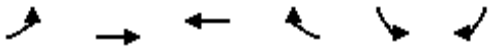
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	228	13	310	317	14	327
Future Volume (Veh/h)	228	13	310	317	14	327
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	228	13	310	317	14	327
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (m)				192		
pX, platoon unblocked						
vC, conflicting volume			241		1172	234
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			241		1172	234
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			77		91	59
cM capacity (veh/h)			1326		163	805

Direction, Lane #	EB 1	WB 1	WB 2	NB 1
Volume Total	241	310	317	341
Volume Left	0	310	0	14
Volume Right	13	0	0	327
cSH	1700	1326	1700	693
Volume to Capacity	0.14	0.23	0.19	0.49
Queue Length 95th (m)	0.0	6.9	0.0	20.8
Control Delay (s)	0.0	8.5	0.0	15.1
Lane LOS		A		C
Approach Delay (s)	0.0	4.2		15.1
Approach LOS				C

Intersection Summary			
Average Delay	6.5		
Intersection Capacity Utilization	63.8%	ICU Level of Service	B
Analysis Period (min)	15		



Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	159	1100	339	42	48	806
Future Volume (vph)	159	1100	339	42	48	806
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Storage Length (m)	60.0			30.0	110.0	110.0
Storage Lanes	1			1	1	1
Taper Length (m)	100.0				60.0	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	0.88
Frt				0.850		0.850
Flt Protected	0.950				0.950	
Satd. Flow (prot)	1695	1784	1784	1517	1695	2669
Flt Permitted	0.543				0.950	
Satd. Flow (perm)	969	1784	1784	1517	1695	2669
Right Turn on Red				Yes		Yes
Satd. Flow (RTOR)				42		806
Link Speed (k/h)		80	80		50	
Link Distance (m)		122.5	76.1		162.5	
Travel Time (s)		5.5	3.4		11.7	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	159	1100	339	42	48	806
Shared Lane Traffic (%)						
Lane Group Flow (vph)	159	1100	339	42	48	806
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Left	Left	Right	Left	Right
Median Width(m)		3.7	3.7		3.7	
Link Offset(m)		0.0	0.0		0.0	
Crosswalk Width(m)		1.6	1.6		1.6	
Two way Left Turn Lane						
Headway Factor	1.06	1.06	1.06	1.06	1.06	1.06
Turning Speed (k/h)	24			14	24	14
Number of Detectors	1	2	2	1	1	1
Detector Template	Left	Thru	Thru	Right	Left	Right
Leading Detector (m)	6.1	30.5	30.5	6.1	6.1	6.1
Trailing Detector (m)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Position(m)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Size(m)	6.1	1.8	1.8	6.1	6.1	6.1
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel						
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 2 Position(m)		28.7	28.7			
Detector 2 Size(m)		1.8	1.8			
Detector 2 Type		Cl+Ex	Cl+Ex			
Detector 2 Channel						
Detector 2 Extend (s)		0.0	0.0			
Turn Type	Perm	NA	NA	Perm	Perm	Perm
Protected Phases		2	6			
Permitted Phases	2			6	4	4
Detector Phase	2	2	6	6	4	4
Switch Phase						
Minimum Initial (s)	20.0	20.0	20.0	20.0	10.0	10.0
Minimum Split (s)	26.6	26.6	43.6	43.6	29.7	29.7
Total Split (s)	80.3	80.3	80.3	80.3	29.7	29.7
Total Split (%)	73.0%	73.0%	73.0%	73.0%	27.0%	27.0%
Maximum Green (s)	73.7	73.7	73.7	73.7	23.0	23.0
Yellow Time (s)	4.6	4.6	4.6	4.6	3.3	3.3
All-Red Time (s)	2.0	2.0	2.0	2.0	3.4	3.4
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.6	6.6	6.6	6.6	6.7	6.7
Lead/Lag						

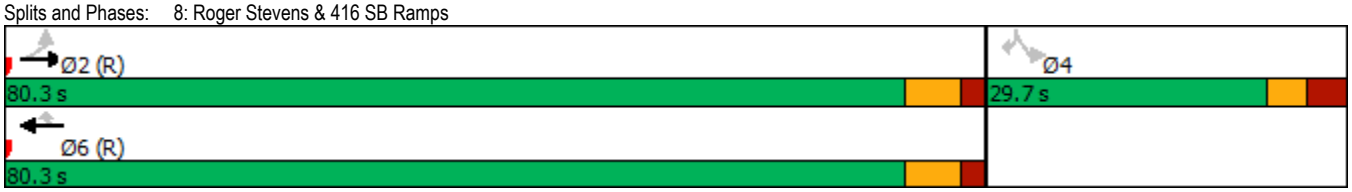


Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lead-Lag Optimize?						
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Recall Mode	C-Max	C-Max	C-Max	C-Max	Max	Max
Walk Time (s)			7.0	7.0	7.0	7.0
Flash Dont Walk (s)			30.0	30.0	16.0	16.0
Pedestrian Calls (#/hr)			0	0	0	0
Act Effct Green (s)	73.7	73.7	73.7	73.7	23.0	23.0
Actuated g/C Ratio	0.67	0.67	0.67	0.67	0.21	0.21
v/c Ratio	0.24	0.92	0.28	0.04	0.14	0.67
Control Delay	4.1	21.8	7.6	1.5	36.7	5.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	4.1	21.8	7.6	1.5	36.7	5.8
LOS	A	C	A	A	D	A
Approach Delay		19.6	6.9		7.6	
Approach LOS		B	A		A	
90th %ile Green (s)	73.7	73.7	73.7	73.7	23.0	23.0
90th %ile Term Code	Coord	Coord	Coord	Coord	MaxR	MaxR
70th %ile Green (s)	73.7	73.7	73.7	73.7	23.0	23.0
70th %ile Term Code	Coord	Coord	Coord	Coord	MaxR	MaxR
50th %ile Green (s)	73.7	73.7	73.7	73.7	23.0	23.0
50th %ile Term Code	Coord	Coord	Coord	Coord	MaxR	MaxR
30th %ile Green (s)	73.7	73.7	73.7	73.7	23.0	23.0
30th %ile Term Code	Coord	Coord	Coord	Coord	MaxR	MaxR
10th %ile Green (s)	73.7	73.7	73.7	73.7	23.0	23.0
10th %ile Term Code	Coord	Coord	Coord	Coord	MaxR	MaxR
Queue Length 50th (m)	5.5	226.7	37.3	1.2	8.5	0.0
Queue Length 95th (m)	m8.5	#295.7	47.6	m1.9	18.6	16.5
Internal Link Dist (m)		98.5	52.1		138.5	
Turn Bay Length (m)	60.0			30.0	110.0	110.0
Base Capacity (vph)	649	1195	1195	1030	354	1195
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.24	0.92	0.28	0.04	0.14	0.67

Intersection Summary			
Area Type:	Other		
Cycle Length: 110			
Actuated Cycle Length: 110			
Offset: 0 (0%), Referenced to phase 2:EBTL and 6:WBT, Start of Green			
Natural Cycle: 90			
Control Type: Actuated-Coordinated			
Maximum v/c Ratio: 0.92			
Intersection Signal Delay: 13.5		Intersection LOS: B	
Intersection Capacity Utilization 80.5%		ICU Level of Service D	
Analysis Period (min) 15			

\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 8: Roger Stevens & 416 SB Ramps



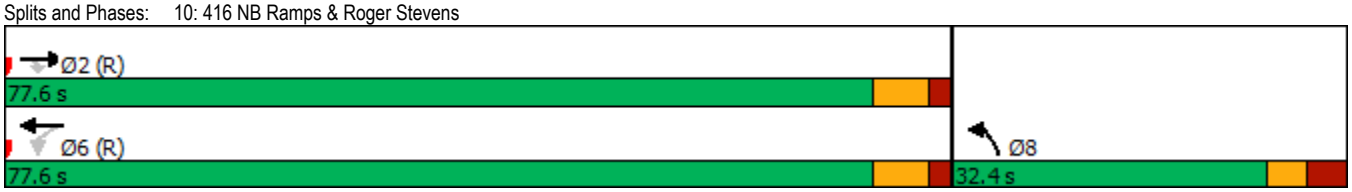
Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	262	897	226	219	172	77
Future Volume (vph)	262	897	226	219	172	77
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Storage Length (m)		30.0	85.0		0.0	0.0
Storage Lanes		1	1		1	0
Taper Length (m)			100.0		30.0	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.850			0.958	
Flt Protected			0.950		0.967	
Satd. Flow (prot)	1784	1517	1695	1784	1653	0
Flt Permitted			0.597		0.967	
Satd. Flow (perm)	1784	1517	1065	1784	1653	0
Right Turn on Red		Yes				Yes
Satd. Flow (RTOR)		897			19	
Link Speed (k/h)	80			80	50	
Link Distance (m)	73.7			234.6	117.8	
Travel Time (s)	3.3			10.6	8.5	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	262	897	226	219	172	77
Shared Lane Traffic (%)						
Lane Group Flow (vph)	262	897	226	219	249	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(m)	3.7			3.7	3.7	
Link Offset(m)	0.0			0.0	0.0	
Crosswalk Width(m)	1.6			1.6	1.6	
Two way Left Turn Lane						
Headway Factor	1.06	1.06	1.06	1.06	1.06	1.06
Turning Speed (k/h)		14	24		24	14
Number of Detectors	2	1	1	2	1	
Detector Template	Thru	Right	Left	Thru	Left	
Leading Detector (m)	30.5	6.1	6.1	30.5	6.1	
Trailing Detector (m)	0.0	0.0	0.0	0.0	0.0	
Detector 1 Position(m)	0.0	0.0	0.0	0.0	0.0	
Detector 1 Size(m)	1.8	6.1	6.1	1.8	6.1	
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	
Detector 1 Channel						
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0	
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0	
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0	
Detector 2 Position(m)	28.7			28.7		
Detector 2 Size(m)	1.8			1.8		
Detector 2 Type	Cl+Ex			Cl+Ex		
Detector 2 Channel						
Detector 2 Extend (s)	0.0			0.0		
Turn Type	NA	Perm	Perm	NA	Prot	
Protected Phases	2			6	8	
Permitted Phases		2	6			
Detector Phase	2	2	6	6	8	
Switch Phase						
Minimum Initial (s)	20.0	20.0	20.0	20.0	10.0	
Minimum Split (s)	38.6	38.6	26.6	26.6	22.5	
Total Split (s)	77.6	77.6	77.6	77.6	32.4	
Total Split (%)	70.5%	70.5%	70.5%	70.5%	29.5%	
Maximum Green (s)	71.0	71.0	71.0	71.0	25.7	
Yellow Time (s)	4.6	4.6	4.6	4.6	3.3	
All-Red Time (s)	2.0	2.0	2.0	2.0	3.4	
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	
Total Lost Time (s)	6.6	6.6	6.6	6.6	6.7	
Lead/Lag						

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lead-Lag Optimize?						
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Recall Mode	C-Max	C-Max	C-Max	C-Max	Max	
Walk Time (s)	7.0	7.0				
Flash Dont Walk (s)	25.0	25.0				
Pedestrian Calls (#/hr)	0	0				
Act Effct Green (s)	71.0	71.0	71.0	71.0	25.7	
Actuated g/C Ratio	0.65	0.65	0.65	0.65	0.23	
v/c Ratio	0.23	0.69	0.33	0.19	0.62	
Control Delay	5.6	2.5	10.4	8.4	42.6	
Queue Delay	0.0	0.0	0.0	0.0	0.0	
Total Delay	5.6	2.5	10.4	8.4	42.6	
LOS	A	A	B	A	D	
Approach Delay	3.2			9.4	42.6	
Approach LOS	A			A	D	
90th %ile Green (s)	71.0	71.0	71.0	71.0	25.7	
90th %ile Term Code	Coord	Coord	Coord	Coord	MaxR	
70th %ile Green (s)	71.0	71.0	71.0	71.0	25.7	
70th %ile Term Code	Coord	Coord	Coord	Coord	MaxR	
50th %ile Green (s)	71.0	71.0	71.0	71.0	25.7	
50th %ile Term Code	Coord	Coord	Coord	Coord	MaxR	
30th %ile Green (s)	71.0	71.0	71.0	71.0	25.7	
30th %ile Term Code	Coord	Coord	Coord	Coord	MaxR	
10th %ile Green (s)	71.0	71.0	71.0	71.0	25.7	
10th %ile Term Code	Coord	Coord	Coord	Coord	MaxR	
Queue Length 50th (m)	9.8	0.0	20.0	17.4	44.5	
Queue Length 95th (m)	m15.2	m0.0	33.3	27.4	71.0	
Internal Link Dist (m)	49.7			210.6	93.8	
Turn Bay Length (m)		30.0	85.0			
Base Capacity (vph)	1151	1297	687	1151	400	
Starvation Cap Reductn	0	0	0	0	0	
Spillback Cap Reductn	0	0	0	0	0	
Storage Cap Reductn	0	0	0	0	0	
Reduced v/c Ratio	0.23	0.69	0.33	0.19	0.62	

Intersection Summary			
Area Type:	Other		
Cycle Length: 110			
Actuated Cycle Length: 110			
Offset: 4 (4%), Referenced to phase 2:EBT and 6:WBTL, Start of Green			
Natural Cycle: 65			
Control Type: Actuated-Coordinated			
Maximum v/c Ratio: 0.69			
Intersection Signal Delay: 10.0		Intersection LOS: A	
Intersection Capacity Utilization 86.3%		ICU Level of Service E	
Analysis Period (min) 15			

m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 10: 416 NB Ramps & Roger Stevens

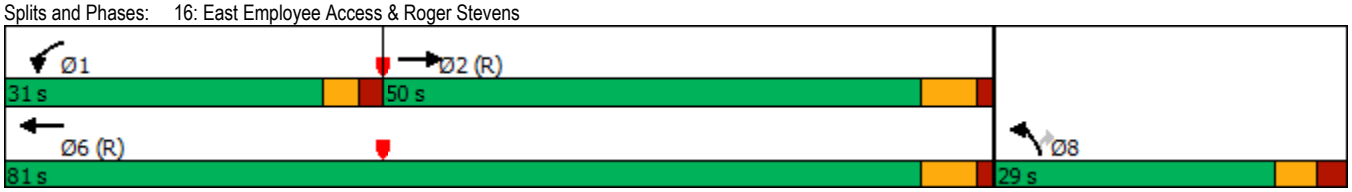


Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	627	6	643	501	6	630
Future Volume (vph)	627	6	643	501	6	630
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Storage Length (m)		0.0	125.0		0.0	0.0
Storage Lanes		0	2		1	1
Taper Length (m)			100.0		30.0	
Lane Util. Factor	1.00	1.00	0.97	1.00	1.00	0.95
Frt	0.999				0.853	0.850
Flt Protected			0.950		0.999	
Satd. Flow (prot)	1783	0	3288	1784	1520	1441
Flt Permitted			0.950		0.999	
Satd. Flow (perm)	1783	0	3288	1784	1520	1441
Right Turn on Red		Yes				Yes
Satd. Flow (RTOR)	1				315	315
Link Speed (k/h)	80			80	48	
Link Distance (m)	191.8			211.8	133.2	
Travel Time (s)	8.6			9.5	10.0	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	627	6	643	501	6	630
Shared Lane Traffic (%)						50%
Lane Group Flow (vph)	633	0	643	501	321	315
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(m)	7.4			7.4	3.7	
Link Offset(m)	0.0			0.0	0.0	
Crosswalk Width(m)	1.6			1.6	1.6	
Two way Left Turn Lane						
Headway Factor	1.06	1.06	1.06	1.06	1.06	1.06
Turning Speed (k/h)		14	24		24	14
Number of Detectors	2		1	2	1	1
Detector Template	Thru		Left	Thru	Left	Right
Leading Detector (m)	30.5		6.1	30.5	6.1	6.1
Trailing Detector (m)	0.0		0.0	0.0	0.0	0.0
Detector 1 Position(m)	0.0		0.0	0.0	0.0	0.0
Detector 1 Size(m)	1.8		6.1	1.8	6.1	6.1
Detector 1 Type	Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel						
Detector 1 Extend (s)	0.0		0.0	0.0	0.0	0.0
Detector 1 Queue (s)	0.0		0.0	0.0	0.0	0.0
Detector 1 Delay (s)	0.0		0.0	0.0	0.0	0.0
Detector 2 Position(m)	28.7			28.7		
Detector 2 Size(m)	1.8			1.8		
Detector 2 Type	Cl+Ex			Cl+Ex		
Detector 2 Channel						
Detector 2 Extend (s)	0.0			0.0		
Turn Type	NA		Prot	NA	Prot	Perm
Protected Phases	2		1	6	8	
Permitted Phases						8
Detector Phase	2		1	6	8	8
Switch Phase						
Minimum Initial (s)	20.0		5.0	20.0	10.0	10.0
Minimum Split (s)	26.1		14.5	26.1	29.0	29.0
Total Split (s)	50.0		31.0	81.0	29.0	29.0
Total Split (%)	45.5%		28.2%	73.6%	26.4%	26.4%
Maximum Green (s)	43.9		26.0	74.9	23.0	23.0
Yellow Time (s)	4.6		3.0	4.6	3.3	3.3
All-Red Time (s)	1.5		2.0	1.5	2.7	2.7
Lost Time Adjust (s)	0.0		0.0	0.0	0.0	0.0
Total Lost Time (s)	6.1		5.0	6.1	6.0	6.0
Lead/Lag	Lag		Lead			

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lead-Lag Optimize?						
Vehicle Extension (s)	3.0		3.0	3.0	3.0	3.0
Recall Mode	C-Max		None	C-Max	None	None
Walk Time (s)	7.0			7.0	7.0	7.0
Flash Dont Walk (s)	11.0			11.0	16.0	16.0
Pedestrian Calls (#/hr)	0			0	0	0
Act Effct Green (s)	54.5		26.3	85.8	12.1	12.1
Actuated g/C Ratio	0.50		0.24	0.78	0.11	0.11
v/c Ratio	0.72		0.82	0.36	0.72	0.72
Control Delay	29.2		47.9	3.7	15.1	14.8
Queue Delay	0.0		0.0	0.0	0.0	0.0
Total Delay	29.2		47.9	3.7	15.1	14.8
LOS	C		D	A	B	B
Approach Delay	29.2			28.6	14.9	
Approach LOS	C			C	B	
90th %ile Green (s)	43.9		30.2	79.1	18.8	18.8
90th %ile Term Code	Coord		Max	Coord	Gap	Gap
70th %ile Green (s)	52.1		29.0	86.1	11.8	11.8
70th %ile Term Code	Coord		Gap	Coord	Gap	Gap
50th %ile Green (s)	56.1		26.8	87.9	10.0	10.0
50th %ile Term Code	Coord		Gap	Coord	Min	Min
30th %ile Green (s)	58.5		24.4	87.9	10.0	10.0
30th %ile Term Code	Coord		Gap	Coord	Min	Min
10th %ile Green (s)	62.0		20.9	87.9	10.0	10.0
10th %ile Term Code	Coord		Gap	Coord	Min	Min
Queue Length 50th (m)	99.1		69.2	19.9	1.2	0.0
Queue Length 95th (m)	#191.6		77.1	33.6	26.4	26.2
Internal Link Dist (m)	167.8			187.8	109.2	
Turn Bay Length (m)			125.0			
Base Capacity (vph)	884		825	1391	566	550
Starvation Cap Reductn	0		0	0	0	0
Spillback Cap Reductn	0		0	0	0	0
Storage Cap Reductn	0		0	0	0	0
Reduced v/c Ratio	0.72		0.78	0.36	0.57	0.57

Intersection Summary			
Area Type:	Other		
Cycle Length: 110			
Actuated Cycle Length: 110			
Offset: 0 (0%), Referenced to phase 2:EBT and 6:WBT, Start of Green			
Natural Cycle: 90			
Control Type: Actuated-Coordinated			
Maximum v/c Ratio: 0.82			
Intersection Signal Delay: 25.1		Intersection LOS: C	
Intersection Capacity Utilization 82.9%		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: 16: East Employee Access & Roger Stevens



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	332	5	5	198	5	5
Future Volume (Veh/h)	332	5	5	198	5	5
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	332	5	5	198	5	5
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (m)				351		
pX, platoon unblocked						
vC, conflicting volume			337		542	334
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			337		542	334
tC, single (s)			5.1		7.4	7.2
tC, 2 stage (s)						
tF (s)			3.1		4.4	4.2
p0 queue free %			99		99	99
cM capacity (veh/h)			830		365	530

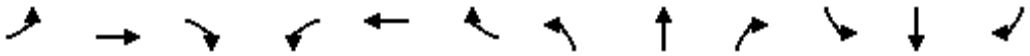
Direction, Lane #	EB 1	WB 1	WB 2	NB 1
Volume Total	337	5	198	10
Volume Left	0	5	0	5
Volume Right	5	0	0	5
cSH	1700	830	1700	432
Volume to Capacity	0.20	0.01	0.12	0.02
Queue Length 95th (m)	0.0	0.1	0.0	0.5
Control Delay (s)	0.0	9.4	0.0	13.5
Lane LOS		A		B
Approach Delay (s)	0.0	0.2		13.5
Approach LOS				B

Intersection Summary			
Average Delay	0.3		
Intersection Capacity Utilization	28.8%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	261	1	5	182	4	26
Future Volume (Veh/h)	261	1	5	182	4	26
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	261	1	5	182	4	26
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume			262		454	262
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			262		454	262
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			100		99	97
cM capacity (veh/h)			1302		562	777

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	262	187	30
Volume Left	0	5	4
Volume Right	1	0	26
cSH	1700	1302	739
Volume to Capacity	0.15	0.00	0.04
Queue Length 95th (m)	0.0	0.1	1.0
Control Delay (s)	0.0	0.2	10.1
Lane LOS		A	B
Approach Delay (s)	0.0	0.2	10.1
Approach LOS			B

Intersection Summary			
Average Delay	0.7		
Intersection Capacity Utilization	24.6%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	11	282	5	4	176	15	8	4	23	12	3	2
Future Volume (Veh/h)	11	282	5	4	176	15	8	4	23	12	3	2
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	11	282	5	4	176	15	8	4	23	12	3	2
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	191			287			502	506	284	523	500	184
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	191			287			502	506	284	523	500	184
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	99			100			98	99	97	97	99	100
cM capacity (veh/h)	1383			1275			473	464	754	444	467	859

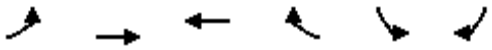
Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	298	195	35	17
Volume Left	11	4	8	12
Volume Right	5	15	23	2
cSH	1383	1275	625	475
Volume to Capacity	0.01	0.00	0.06	0.04
Queue Length 95th (m)	0.2	0.1	1.4	0.8
Control Delay (s)	0.4	0.2	11.1	12.9
Lane LOS	A	A	B	B
Approach Delay (s)	0.4	0.2	11.1	12.9
Approach LOS			B	B

Intersection Summary				
Average Delay	1.4			
Intersection Capacity Utilization	31.9%	ICU Level of Service	A	
Analysis Period (min)	15			

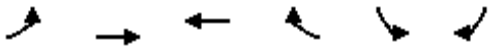
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	323	13	317	190	13	310
Future Volume (Veh/h)	323	13	317	190	13	310
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	323	13	317	190	13	310
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (m)				192		
pX, platoon unblocked						
vC, conflicting volume			336		1154	330
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			336		1154	330
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			74		92	56
cM capacity (veh/h)			1223		162	712

Direction, Lane #	EB 1	WB 1	WB 2	NB 1
Volume Total	336	317	190	323
Volume Left	0	317	0	13
Volume Right	13	0	0	310
cSH	1700	1223	1700	626
Volume to Capacity	0.20	0.26	0.11	0.52
Queue Length 95th (m)	0.0	7.9	0.0	22.5
Control Delay (s)	0.0	9.0	0.0	16.7
Lane LOS		A		C
Approach Delay (s)	0.0	5.6		16.7
Approach LOS				C

Intersection Summary			
Average Delay	7.1		
Intersection Capacity Utilization	68.3%	ICU Level of Service	C
Analysis Period (min)	15		



Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	159	1100	339	42	48	806
Future Volume (vph)	159	1100	339	42	48	806
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Storage Length (m)	60.0			30.0	110.0	110.0
Storage Lanes	1			1	1	1
Taper Length (m)	100.0				60.0	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	0.88
Frt				0.850		0.850
Flt Protected	0.950				0.950	
Satd. Flow (prot)	1695	1784	1784	1517	1695	2669
Flt Permitted	0.544				0.950	
Satd. Flow (perm)	971	1784	1784	1517	1695	2669
Right Turn on Red				Yes		Yes
Satd. Flow (RTOR)				42		806
Link Speed (k/h)		80	80		50	
Link Distance (m)		122.5	76.1		162.5	
Travel Time (s)		5.5	3.4		11.7	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	159	1100	339	42	48	806
Shared Lane Traffic (%)						
Lane Group Flow (vph)	159	1100	339	42	48	806
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Left	Left	Right	Left	Right
Median Width(m)		3.7	3.7		3.7	
Link Offset(m)		0.0	0.0		0.0	
Crosswalk Width(m)		1.6	1.6		1.6	
Two way Left Turn Lane						
Headway Factor	1.06	1.06	1.06	1.06	1.06	1.06
Turning Speed (k/h)	24			14	24	14
Number of Detectors	1	2	2	1	1	1
Detector Template	Left	Thru	Thru	Right	Left	Right
Leading Detector (m)	6.1	30.5	30.5	6.1	6.1	6.1
Trailing Detector (m)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Position(m)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Size(m)	6.1	1.8	1.8	6.1	6.1	6.1
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel						
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 2 Position(m)		28.7	28.7			
Detector 2 Size(m)		1.8	1.8			
Detector 2 Type		Cl+Ex	Cl+Ex			
Detector 2 Channel						
Detector 2 Extend (s)		0.0	0.0			
Turn Type	Perm	NA	NA	Perm	Perm	Perm
Protected Phases		2	6			
Permitted Phases	2			6	4	4
Detector Phase	2	2	6	6	4	4
Switch Phase						
Minimum Initial (s)	20.0	20.0	20.0	20.0	10.0	10.0
Minimum Split (s)	26.6	26.6	43.6	43.6	29.7	29.7
Total Split (s)	90.0	90.0	90.0	90.0	30.0	30.0
Total Split (%)	75.0%	75.0%	75.0%	75.0%	25.0%	25.0%
Maximum Green (s)	83.4	83.4	83.4	83.4	23.3	23.3
Yellow Time (s)	4.6	4.6	4.6	4.6	3.3	3.3
All-Red Time (s)	2.0	2.0	2.0	2.0	3.4	3.4
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.6	6.6	6.6	6.6	6.7	6.7
Lead/Lag						



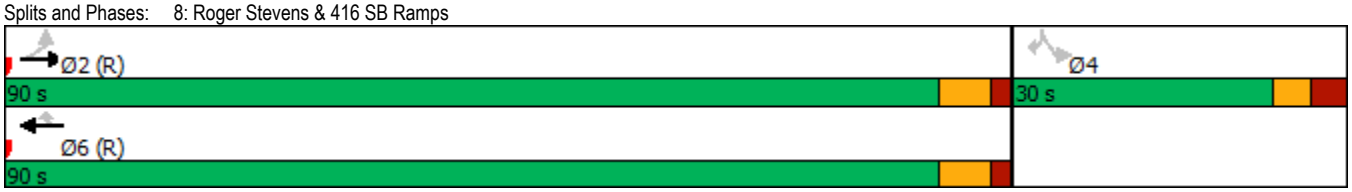
Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lead-Lag Optimize?						
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Recall Mode	C-Max	C-Max	C-Max	C-Max	Max	Max
Walk Time (s)			7.0	7.0	7.0	7.0
Flash Dont Walk (s)			30.0	30.0	16.0	16.0
Pedestrian Calls (#/hr)			0	0	0	0
Act Effct Green (s)	83.4	83.4	83.4	83.4	23.3	23.3
Actuated g/C Ratio	0.70	0.70	0.70	0.70	0.19	0.19
v/c Ratio	0.24	0.89	0.27	0.04	0.15	0.69
Control Delay	3.9	17.8	4.9	0.3	41.6	6.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	3.9	17.8	4.9	0.3	41.6	6.3
LOS	A	B	A	A	D	A
Approach Delay		16.0	4.4		8.3	
Approach LOS		B	A		A	
90th %ile Green (s)	83.4	83.4	83.4	83.4	23.3	23.3
90th %ile Term Code	Coord	Coord	Coord	Coord	MaxR	MaxR
70th %ile Green (s)	83.4	83.4	83.4	83.4	23.3	23.3
70th %ile Term Code	Coord	Coord	Coord	Coord	MaxR	MaxR
50th %ile Green (s)	83.4	83.4	83.4	83.4	23.3	23.3
50th %ile Term Code	Coord	Coord	Coord	Coord	MaxR	MaxR
30th %ile Green (s)	83.4	83.4	83.4	83.4	23.3	23.3
30th %ile Term Code	Coord	Coord	Coord	Coord	MaxR	MaxR
10th %ile Green (s)	83.4	83.4	83.4	83.4	23.3	23.3
10th %ile Term Code	Coord	Coord	Coord	Coord	MaxR	MaxR
Queue Length 50th (m)	5.6	227.3	13.9	0.0	9.5	0.0
Queue Length 95th (m)	m9.5	#68.2	21.0	m0.3	20.1	17.3
Internal Link Dist (m)		98.5	52.1		138.5	
Turn Bay Length (m)	60.0			30.0	110.0	110.0
Base Capacity (vph)	674	1239	1239	1067	329	1167
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.24	0.89	0.27	0.04	0.15	0.69

Intersection Summary			
Area Type:	Other		
Cycle Length: 120			
Actuated Cycle Length: 120			
Offset: 102 (85%), Referenced to phase 2:EBTL and 6:WBT, Start of Green			
Natural Cycle: 90			
Control Type: Actuated-Coordinated			
Maximum v/c Ratio: 0.89			
Intersection Signal Delay: 11.6		Intersection LOS: B	
Intersection Capacity Utilization 80.5%		ICU Level of Service D	
Analysis Period (min) 15			

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

m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 8: Roger Stevens & 416 SB Ramps



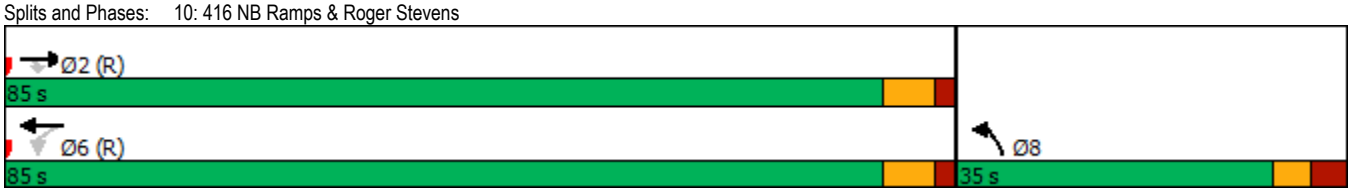
Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	262	897	226	219	172	77
Future Volume (vph)	262	897	226	219	172	77
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Storage Length (m)		30.0	85.0		0.0	0.0
Storage Lanes		1	1		1	0
Taper Length (m)			100.0		30.0	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.850			0.958	
Flt Protected			0.950		0.967	
Satd. Flow (prot)	1784	1517	1695	1784	1653	0
Flt Permitted			0.594		0.967	
Satd. Flow (perm)	1784	1517	1060	1784	1653	0
Right Turn on Red		Yes				Yes
Satd. Flow (RTOR)		897			18	
Link Speed (k/h)	80			80	50	
Link Distance (m)	73.7			234.6	117.8	
Travel Time (s)	3.3			10.6	8.5	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	262	897	226	219	172	77
Shared Lane Traffic (%)						
Lane Group Flow (vph)	262	897	226	219	249	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(m)	3.7			3.7	3.7	
Link Offset(m)	0.0			0.0	0.0	
Crosswalk Width(m)	1.6			1.6	1.6	
Two way Left Turn Lane						
Headway Factor	1.06	1.06	1.06	1.06	1.06	1.06
Turning Speed (k/h)		14	24		24	14
Number of Detectors	2	1	1	2	1	
Detector Template	Thru	Right	Left	Thru	Left	
Leading Detector (m)	30.5	6.1	6.1	30.5	6.1	
Trailing Detector (m)	0.0	0.0	0.0	0.0	0.0	
Detector 1 Position(m)	0.0	0.0	0.0	0.0	0.0	
Detector 1 Size(m)	1.8	6.1	6.1	1.8	6.1	
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	
Detector 1 Channel						
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0	
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0	
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0	
Detector 2 Position(m)	28.7			28.7		
Detector 2 Size(m)	1.8			1.8		
Detector 2 Type	Cl+Ex			Cl+Ex		
Detector 2 Channel						
Detector 2 Extend (s)	0.0			0.0		
Turn Type	NA	Perm	Perm	NA	Prot	
Protected Phases	2			6	8	
Permitted Phases		2	6			
Detector Phase	2	2	6	6	8	
Switch Phase						
Minimum Initial (s)	20.0	20.0	20.0	20.0	10.0	
Minimum Split (s)	38.6	38.6	26.6	26.6	22.5	
Total Split (s)	85.0	85.0	85.0	85.0	35.0	
Total Split (%)	70.8%	70.8%	70.8%	70.8%	29.2%	
Maximum Green (s)	78.4	78.4	78.4	78.4	28.3	
Yellow Time (s)	4.6	4.6	4.6	4.6	3.3	
All-Red Time (s)	2.0	2.0	2.0	2.0	3.4	
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	
Total Lost Time (s)	6.6	6.6	6.6	6.6	6.7	
Lead/Lag						

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lead-Lag Optimize?						
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Recall Mode	C-Max	C-Max	C-Max	C-Max	Max	
Walk Time (s)	7.0	7.0				
Flash Dont Walk (s)	25.0	25.0				
Pedestrian Calls (#/hr)	0	0				
Act Effct Green (s)	78.4	78.4	78.4	78.4	28.3	
Actuated g/C Ratio	0.65	0.65	0.65	0.65	0.24	
v/c Ratio	0.22	0.69	0.33	0.19	0.62	
Control Delay	2.8	1.7	10.7	8.7	45.6	
Queue Delay	0.0	0.0	0.0	0.0	0.0	
Total Delay	2.8	1.7	10.7	8.7	45.6	
LOS	A	A	B	A	D	
Approach Delay	1.9			9.7	45.6	
Approach LOS	A			A	D	
90th %ile Green (s)	78.4	78.4	78.4	78.4	28.3	
90th %ile Term Code	Coord	Coord	Coord	Coord	MaxR	
70th %ile Green (s)	78.4	78.4	78.4	78.4	28.3	
70th %ile Term Code	Coord	Coord	Coord	Coord	MaxR	
50th %ile Green (s)	78.4	78.4	78.4	78.4	28.3	
50th %ile Term Code	Coord	Coord	Coord	Coord	MaxR	
30th %ile Green (s)	78.4	78.4	78.4	78.4	28.3	
30th %ile Term Code	Coord	Coord	Coord	Coord	MaxR	
10th %ile Green (s)	78.4	78.4	78.4	78.4	28.3	
10th %ile Term Code	Coord	Coord	Coord	Coord	MaxR	
Queue Length 50th (m)	4.2	0.0	21.6	18.8	48.9	
Queue Length 95th (m)	m7.3	m0.0	35.2	29.0	76.5	
Internal Link Dist (m)	49.7			210.6	93.8	
Turn Bay Length (m)		30.0	85.0			
Base Capacity (vph)	1165	1302	692	1165	403	
Starvation Cap Reductn	0	0	0	0	0	
Spillback Cap Reductn	0	0	0	0	0	
Storage Cap Reductn	0	0	0	0	0	
Reduced v/c Ratio	0.22	0.69	0.33	0.19	0.62	

Intersection Summary			
Area Type:	Other		
Cycle Length: 120			
Actuated Cycle Length: 120			
Offset: 118 (98%), Referenced to phase 2:EBT and 6:WBTL, Start of Green			
Natural Cycle: 65			
Control Type: Actuated-Coordinated			
Maximum v/c Ratio: 0.69			
Intersection Signal Delay: 9.7		Intersection LOS: A	
Intersection Capacity Utilization 86.3%		ICU Level of Service E	
Analysis Period (min) 15			

m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 10: 416 NB Ramps & Roger Stevens

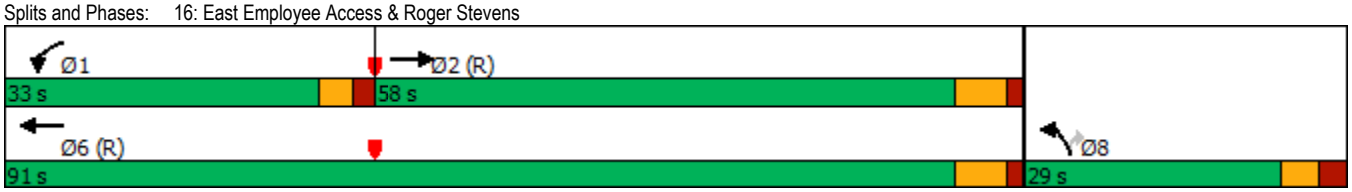


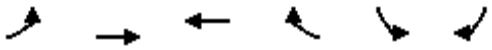
Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	627	6	643	501	6	630
Future Volume (vph)	627	6	643	501	6	630
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Storage Length (m)		0.0	125.0		0.0	0.0
Storage Lanes		0	2		1	1
Taper Length (m)			100.0		30.0	
Lane Util. Factor	1.00	1.00	0.97	1.00	1.00	0.95
Frt	0.999				0.853	0.850
Flt Protected			0.950		0.999	
Satd. Flow (prot)	1783	0	3288	1784	1520	1441
Flt Permitted			0.950		0.999	
Satd. Flow (perm)	1783	0	3288	1784	1520	1441
Right Turn on Red		Yes				Yes
Satd. Flow (RTOR)	1				315	315
Link Speed (k/h)	80			80	48	
Link Distance (m)	191.8			211.8	133.2	
Travel Time (s)	8.6			9.5	10.0	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	627	6	643	501	6	630
Shared Lane Traffic (%)						50%
Lane Group Flow (vph)	633	0	643	501	321	315
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(m)	7.4			7.4	3.7	
Link Offset(m)	0.0			0.0	0.0	
Crosswalk Width(m)	1.6			1.6	1.6	
Two way Left Turn Lane						
Headway Factor	1.06	1.06	1.06	1.06	1.06	1.06
Turning Speed (k/h)		14	24		24	14
Number of Detectors	2		1	2	1	1
Detector Template	Thru		Left	Thru	Left	Right
Leading Detector (m)	30.5		6.1	30.5	6.1	6.1
Trailing Detector (m)	0.0		0.0	0.0	0.0	0.0
Detector 1 Position(m)	0.0		0.0	0.0	0.0	0.0
Detector 1 Size(m)	1.8		6.1	1.8	6.1	6.1
Detector 1 Type	Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel						
Detector 1 Extend (s)	0.0		0.0	0.0	0.0	0.0
Detector 1 Queue (s)	0.0		0.0	0.0	0.0	0.0
Detector 1 Delay (s)	0.0		0.0	0.0	0.0	0.0
Detector 2 Position(m)	28.7			28.7		
Detector 2 Size(m)	1.8			1.8		
Detector 2 Type	Cl+Ex			Cl+Ex		
Detector 2 Channel						
Detector 2 Extend (s)	0.0			0.0		
Turn Type	NA		Prot	NA	Prot	Perm
Protected Phases	2		1	6	8	
Permitted Phases						8
Detector Phase	2		1	6	8	8
Switch Phase						
Minimum Initial (s)	20.0		5.0	20.0	10.0	10.0
Minimum Split (s)	26.1		14.5	26.1	29.0	29.0
Total Split (s)	58.0		33.0	91.0	29.0	29.0
Total Split (%)	48.3%		27.5%	75.8%	24.2%	24.2%
Maximum Green (s)	51.9		28.0	84.9	23.0	23.0
Yellow Time (s)	4.6		3.0	4.6	3.3	3.3
All-Red Time (s)	1.5		2.0	1.5	2.7	2.7
Lost Time Adjust (s)	0.0		0.0	0.0	0.0	0.0
Total Lost Time (s)	6.1		5.0	6.1	6.0	6.0
Lead/Lag	Lag		Lead			

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lead-Lag Optimize?						
Vehicle Extension (s)	3.0		3.0	3.0	3.0	3.0
Recall Mode	C-Max		None	C-Max	None	None
Walk Time (s)	7.0			7.0	7.0	7.0
Flash Dont Walk (s)	11.0			11.0	16.0	16.0
Pedestrian Calls (#/hr)	0			0	0	0
Act Effct Green (s)	62.5		28.1	95.6	12.3	12.3
Actuated g/C Ratio	0.52		0.23	0.80	0.10	0.10
v/c Ratio	0.68		0.84	0.35	0.73	0.73
Control Delay	27.7		52.4	3.6	16.3	16.0
Queue Delay	0.0		0.0	0.0	0.2	0.2
Total Delay	27.7		52.4	3.6	16.5	16.2
LOS	C		D	A	B	B
Approach Delay	27.7			31.0	16.3	
Approach LOS	C			C	B	
90th %ile Green (s)	51.9		31.6	88.5	19.4	19.4
90th %ile Term Code	Coord		Max	Coord	Gap	Gap
70th %ile Green (s)	59.6		31.2	95.8	12.1	12.1
70th %ile Term Code	Coord		Gap	Coord	Gap	Gap
50th %ile Green (s)	64.1		28.8	97.9	10.0	10.0
50th %ile Term Code	Coord		Gap	Coord	Min	Min
30th %ile Green (s)	66.6		26.3	97.9	10.0	10.0
30th %ile Term Code	Coord		Gap	Coord	Min	Min
10th %ile Green (s)	70.3		22.6	97.9	10.0	10.0
10th %ile Term Code	Coord		Gap	Coord	Min	Min
Queue Length 50th (m)	103.3		76.5	19.9	1.3	0.0
Queue Length 95th (m)	#180.3		82.5	36.7	27.7	27.8
Internal Link Dist (m)	167.8			187.8	109.2	
Turn Bay Length (m)			125.0			
Base Capacity (vph)	929		808	1421	545	530
Starvation Cap Reductn	0		0	0	0	0
Spillback Cap Reductn	0		0	0	19	18
Storage Cap Reductn	0		0	0	0	0
Reduced v/c Ratio	0.68		0.80	0.35	0.61	0.62

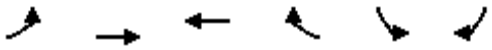
Intersection Summary			
Area Type:	Other		
Cycle Length: 120			
Actuated Cycle Length: 120			
Offset: 104 (87%), Referenced to phase 2:EBT and 6:WBT, Start of Green			
Natural Cycle: 90			
Control Type: Actuated-Coordinated			
Maximum v/c Ratio: 0.84			
Intersection Signal Delay: 26.3		Intersection LOS: C	
Intersection Capacity Utilization 82.9%		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: 16: East Employee Access & Roger Stevens





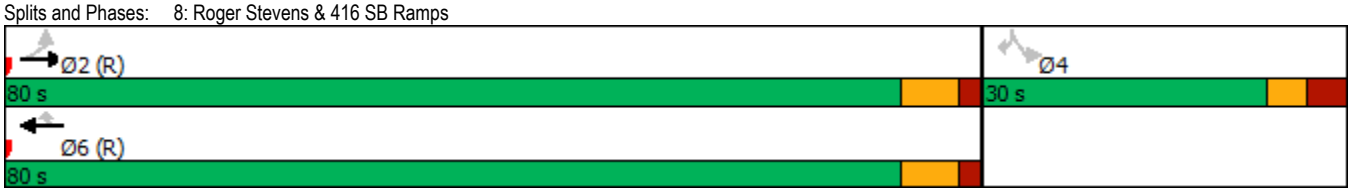
Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	178	1044	399	97	267	867
Future Volume (vph)	178	1044	399	97	267	867
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Storage Length (m)	60.0			30.0	110.0	110.0
Storage Lanes	1			1	1	1
Taper Length (m)	100.0				60.0	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	0.88
Frt				0.850		0.850
Flt Protected	0.950				0.950	
Satd. Flow (prot)	1695	1784	1784	1517	1695	2669
Flt Permitted	0.500				0.950	
Satd. Flow (perm)	892	1784	1784	1517	1695	2669
Right Turn on Red				Yes		Yes
Satd. Flow (RTOR)				97		867
Link Speed (k/h)		80	80		50	
Link Distance (m)		122.5	76.1		162.5	
Travel Time (s)		5.5	3.4		11.7	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	178	1044	399	97	267	867
Shared Lane Traffic (%)						
Lane Group Flow (vph)	178	1044	399	97	267	867
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Left	Left	Right	Left	Right
Median Width(m)		3.7	3.7		3.7	
Link Offset(m)		0.0	0.0		0.0	
Crosswalk Width(m)		1.6	1.6		1.6	
Two way Left Turn Lane						
Headway Factor	1.06	1.06	1.06	1.06	1.06	1.06
Turning Speed (k/h)	24			14	24	14
Number of Detectors	1	2	2	1	1	1
Detector Template	Left	Thru	Thru	Right	Left	Right
Leading Detector (m)	6.1	30.5	30.5	6.1	6.1	6.1
Trailing Detector (m)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Position(m)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Size(m)	6.1	1.8	1.8	6.1	6.1	6.1
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel						
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 2 Position(m)		28.7	28.7			
Detector 2 Size(m)		1.8	1.8			
Detector 2 Type		Cl+Ex	Cl+Ex			
Detector 2 Channel						
Detector 2 Extend (s)		0.0	0.0			
Turn Type	Perm	NA	NA	Perm	Perm	Perm
Protected Phases		2	6			
Permitted Phases	2			6	4	4
Detector Phase	2	2	6	6	4	4
Switch Phase						
Minimum Initial (s)	20.0	20.0	20.0	20.0	10.0	10.0
Minimum Split (s)	26.6	26.6	43.6	43.6	29.7	29.7
Total Split (s)	80.0	80.0	80.0	80.0	30.0	30.0
Total Split (%)	72.7%	72.7%	72.7%	72.7%	27.3%	27.3%
Maximum Green (s)	73.4	73.4	73.4	73.4	23.3	23.3
Yellow Time (s)	4.6	4.6	4.6	4.6	3.3	3.3
All-Red Time (s)	2.0	2.0	2.0	2.0	3.4	3.4
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.6	6.6	6.6	6.6	6.7	6.7
Lead/Lag						



Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lead-Lag Optimize?						
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Recall Mode	C-Max	C-Max	C-Max	C-Max	Max	Max
Walk Time (s)			7.0	7.0	7.0	7.0
Flash Dont Walk (s)			30.0	30.0	16.0	16.0
Pedestrian Calls (#/hr)			0	0	0	0
Act Effct Green (s)	73.4	73.4	73.4	73.4	23.3	23.3
Actuated g/C Ratio	0.67	0.67	0.67	0.67	0.21	0.21
v/c Ratio	0.30	0.88	0.34	0.09	0.74	0.69
Control Delay	6.5	16.5	5.9	0.3	54.5	5.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	6.5	16.5	5.9	0.3	54.5	5.9
LOS	A	B	A	A	D	A
Approach Delay		15.0	4.8		17.3	
Approach LOS		B	A		B	
90th %ile Green (s)	73.4	73.4	73.4	73.4	23.3	23.3
90th %ile Term Code	Coord	Coord	Coord	Coord	MaxR	MaxR
70th %ile Green (s)	73.4	73.4	73.4	73.4	23.3	23.3
70th %ile Term Code	Coord	Coord	Coord	Coord	MaxR	MaxR
50th %ile Green (s)	73.4	73.4	73.4	73.4	23.3	23.3
50th %ile Term Code	Coord	Coord	Coord	Coord	MaxR	MaxR
30th %ile Green (s)	73.4	73.4	73.4	73.4	23.3	23.3
30th %ile Term Code	Coord	Coord	Coord	Coord	MaxR	MaxR
10th %ile Green (s)	73.4	73.4	73.4	73.4	23.3	23.3
10th %ile Term Code	Coord	Coord	Coord	Coord	MaxR	MaxR
Queue Length 50th (m)	7.2	54.9	17.2	0.1	54.0	0.0
Queue Length 95th (m)	19.1	#109.8	24.2	1.0	#89.3	16.8
Internal Link Dist (m)		98.5	52.1		138.5	
Turn Bay Length (m)	60.0			30.0	110.0	110.0
Base Capacity (vph)	595	1190	1190	1044	359	1248
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.30	0.88	0.34	0.09	0.74	0.69

Intersection Summary			
Area Type:	Other		
Cycle Length: 110			
Actuated Cycle Length: 110			
Offset: 96 (87%), Referenced to phase 2:EBTL and 6:WBT, Start of Green			
Natural Cycle: 90			
Control Type: Actuated-Coordinated			
Maximum v/c Ratio: 0.88			
Intersection Signal Delay: 14.2		Intersection LOS: B	
Intersection Capacity Utilization 84.7%		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: 8: Roger Stevens & 416 SB Ramps



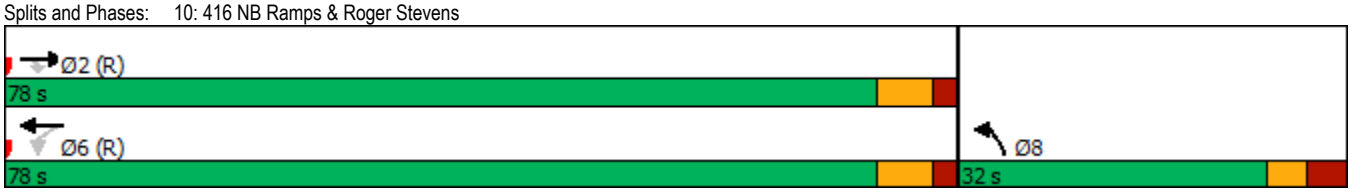
Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	458	861	86	338	168	47
Future Volume (vph)	458	861	86	338	168	47
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Storage Length (m)		30.0	85.0		0.0	0.0
Storage Lanes		1	1		1	0
Taper Length (m)			100.0		30.0	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.850			0.970	
Flt Protected			0.950		0.962	
Satd. Flow (prot)	1784	1517	1695	1784	1665	0
Flt Permitted			0.453		0.962	
Satd. Flow (perm)	1784	1517	808	1784	1665	0
Right Turn on Red		Yes				Yes
Satd. Flow (RTOR)		861			12	
Link Speed (k/h)	80			80	50	
Link Distance (m)	73.7			234.6	117.8	
Travel Time (s)	3.3			10.6	8.5	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	458	861	86	338	168	47
Shared Lane Traffic (%)						
Lane Group Flow (vph)	458	861	86	338	215	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(m)	3.7			3.7	3.7	
Link Offset(m)	0.0			0.0	0.0	
Crosswalk Width(m)	1.6			1.6	1.6	
Two way Left Turn Lane						
Headway Factor	1.06	1.06	1.06	1.06	1.06	1.06
Turning Speed (k/h)		14	24		24	14
Number of Detectors	2	1	1	2	1	
Detector Template	Thru	Right	Left	Thru	Left	
Leading Detector (m)	30.5	6.1	6.1	30.5	6.1	
Trailing Detector (m)	0.0	0.0	0.0	0.0	0.0	
Detector 1 Position(m)	0.0	0.0	0.0	0.0	0.0	
Detector 1 Size(m)	1.8	6.1	6.1	1.8	6.1	
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	
Detector 1 Channel						
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0	
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0	
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0	
Detector 2 Position(m)	28.7			28.7		
Detector 2 Size(m)	1.8			1.8		
Detector 2 Type	Cl+Ex			Cl+Ex		
Detector 2 Channel						
Detector 2 Extend (s)	0.0			0.0		
Turn Type	NA	Perm	Perm	NA	Prot	
Protected Phases	2			6	8	
Permitted Phases		2	6			
Detector Phase	2	2	6	6	8	
Switch Phase						
Minimum Initial (s)	20.0	20.0	20.0	20.0	10.0	
Minimum Split (s)	38.6	38.6	26.6	26.6	22.5	
Total Split (s)	78.0	78.0	78.0	78.0	32.0	
Total Split (%)	70.9%	70.9%	70.9%	70.9%	29.1%	
Maximum Green (s)	71.4	71.4	71.4	71.4	25.3	
Yellow Time (s)	4.6	4.6	4.6	4.6	3.3	
All-Red Time (s)	2.0	2.0	2.0	2.0	3.4	
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	
Total Lost Time (s)	6.6	6.6	6.6	6.6	6.7	
Lead/Lag						

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lead-Lag Optimize?						
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Recall Mode	C-Max	C-Max	C-Max	C-Max	Max	
Walk Time (s)	7.0	7.0				
Flash Dont Walk (s)	25.0	25.0				
Pedestrian Calls (#/hr)	0	0				
Act Effct Green (s)	71.4	71.4	71.4	71.4	25.3	
Actuated g/C Ratio	0.65	0.65	0.65	0.65	0.23	
v/c Ratio	0.40	0.67	0.16	0.29	0.55	
Control Delay	6.5	1.9	8.5	9.2	41.3	
Queue Delay	0.0	0.0	0.0	0.0	0.0	
Total Delay	6.5	1.9	8.5	9.2	41.3	
LOS	A	A	A	A	D	
Approach Delay	3.5			9.0	41.3	
Approach LOS	A			A	D	
90th %ile Green (s)	71.4	71.4	71.4	71.4	25.3	
90th %ile Term Code	Coord	Coord	Coord	Coord	MaxR	
70th %ile Green (s)	71.4	71.4	71.4	71.4	25.3	
70th %ile Term Code	Coord	Coord	Coord	Coord	MaxR	
50th %ile Green (s)	71.4	71.4	71.4	71.4	25.3	
50th %ile Term Code	Coord	Coord	Coord	Coord	MaxR	
30th %ile Green (s)	71.4	71.4	71.4	71.4	25.3	
30th %ile Term Code	Coord	Coord	Coord	Coord	MaxR	
10th %ile Green (s)	71.4	71.4	71.4	71.4	25.3	
10th %ile Term Code	Coord	Coord	Coord	Coord	MaxR	
Queue Length 50th (m)	23.9	6.6	6.6	28.7	38.6	
Queue Length 95th (m)	m31.4	m3.7	13.3	42.7	62.7	
Internal Link Dist (m)	49.7			210.6	93.8	
Turn Bay Length (m)		30.0	85.0			
Base Capacity (vph)	1157	1286	524	1157	392	
Starvation Cap Reductn	0	0	0	0	0	
Spillback Cap Reductn	0	0	0	0	0	
Storage Cap Reductn	0	0	0	0	0	
Reduced v/c Ratio	0.40	0.67	0.16	0.29	0.55	

Intersection Summary			
Area Type:	Other		
Cycle Length: 110			
Actuated Cycle Length: 110			
Offset: 2 (2%), Referenced to phase 2:EBT and 6:WBTL, Start of Green			
Natural Cycle: 65			
Control Type: Actuated-Coordinated			
Maximum v/c Ratio: 0.67			
Intersection Signal Delay: 8.8		Intersection LOS: A	
Intersection Capacity Utilization 83.9%		ICU Level of Service E	
Analysis Period (min) 15			

m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 10: 416 NB Ramps & Roger Stevens



Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	558	5	630	634	7	663
Future Volume (vph)	558	5	630	634	7	663
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Storage Length (m)		0.0	125.0		0.0	0.0
Storage Lanes		0	2		1	1
Taper Length (m)			100.0		30.0	
Lane Util. Factor	1.00	1.00	0.97	1.00	1.00	0.95
Frt	0.999				0.853	0.850
Flt Protected			0.950		0.999	
Satd. Flow (prot)	1783	0	3288	1784	1520	1441
Flt Permitted			0.950		0.999	
Satd. Flow (perm)	1783	0	3288	1784	1520	1441
Right Turn on Red		Yes				Yes
Satd. Flow (RTOR)					332	331
Link Speed (k/h)	80			80	48	
Link Distance (m)	191.8			211.8	133.2	
Travel Time (s)	8.6			9.5	10.0	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	558	5	630	634	7	663
Shared Lane Traffic (%)						50%
Lane Group Flow (vph)	563	0	630	634	339	331
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(m)	7.4			7.4	3.7	
Link Offset(m)	0.0			0.0	0.0	
Crosswalk Width(m)	1.6			1.6	1.6	
Two way Left Turn Lane						
Headway Factor	1.06	1.06	1.06	1.06	1.06	1.06
Turning Speed (k/h)		14	24		24	14
Number of Detectors	2		1	2	1	1
Detector Template	Thru		Left	Thru	Left	Right
Leading Detector (m)	30.5		6.1	30.5	6.1	6.1
Trailing Detector (m)	0.0		0.0	0.0	0.0	0.0
Detector 1 Position(m)	0.0		0.0	0.0	0.0	0.0
Detector 1 Size(m)	1.8		6.1	1.8	6.1	6.1
Detector 1 Type	Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel						
Detector 1 Extend (s)	0.0		0.0	0.0	0.0	0.0
Detector 1 Queue (s)	0.0		0.0	0.0	0.0	0.0
Detector 1 Delay (s)	0.0		0.0	0.0	0.0	0.0
Detector 2 Position(m)	28.7			28.7		
Detector 2 Size(m)	1.8			1.8		
Detector 2 Type	Cl+Ex			Cl+Ex		
Detector 2 Channel						
Detector 2 Extend (s)	0.0			0.0		
Turn Type	NA		Prot	NA	Prot	Perm
Protected Phases	2		1	6	8	
Permitted Phases						8
Detector Phase	2		1	6	8	8
Switch Phase						
Minimum Initial (s)	20.0		5.0	20.0	10.0	10.0
Minimum Split (s)	26.1		14.5	26.1	29.0	29.0
Total Split (s)	50.0		31.0	81.0	29.0	29.0
Total Split (%)	45.5%		28.2%	73.6%	26.4%	26.4%
Maximum Green (s)	43.9		26.0	74.9	23.0	23.0
Yellow Time (s)	4.6		3.0	4.6	3.3	3.3
All-Red Time (s)	1.5		2.0	1.5	2.7	2.7
Lost Time Adjust (s)	0.0		0.0	0.0	0.0	0.0
Total Lost Time (s)	6.1		5.0	6.1	6.0	6.0
Lead/Lag	Lag		Lead			

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lead-Lag Optimize?						
Vehicle Extension (s)	3.0		3.0	3.0	3.0	3.0
Recall Mode	C-Max		None	C-Max	None	None
Walk Time (s)	7.0			7.0	7.0	7.0
Flash Dont Walk (s)	11.0			11.0	16.0	16.0
Pedestrian Calls (#/hr)	0			0	0	0
Act Effct Green (s)	54.9		25.8	85.7	12.2	12.2
Actuated g/C Ratio	0.50		0.23	0.78	0.11	0.11
v/c Ratio	0.63		0.82	0.46	0.73	0.73
Control Delay	26.0		49.8	4.8	15.2	14.8
Queue Delay	0.0		0.0	0.0	0.0	0.0
Total Delay	26.0		49.8	4.8	15.2	14.8
LOS	C		D	A	B	B
Approach Delay	26.0			27.2	15.0	
Approach LOS	C			C	B	
90th %ile Green (s)	43.9		29.8	78.7	19.2	19.2
90th %ile Term Code	Coord		Max	Coord	Gap	Gap
70th %ile Green (s)	52.4		28.5	85.9	12.0	12.0
70th %ile Term Code	Coord		Gap	Coord	Gap	Gap
50th %ile Green (s)	56.6		26.3	87.9	10.0	10.0
50th %ile Term Code	Coord		Gap	Coord	Min	Min
30th %ile Green (s)	59.0		23.9	87.9	10.0	10.0
30th %ile Term Code	Coord		Gap	Coord	Min	Min
10th %ile Green (s)	62.5		20.4	87.9	10.0	10.0
10th %ile Term Code	Coord		Gap	Coord	Min	Min
Queue Length 50th (m)	82.4		69.3	28.7	1.4	0.0
Queue Length 95th (m)	148.7		86.6	55.0	27.1	26.9
Internal Link Dist (m)	167.8			187.8	109.2	
Turn Bay Length (m)			125.0			
Base Capacity (vph)	889		816	1389	580	563
Starvation Cap Reductn	0		0	0	0	0
Spillback Cap Reductn	0		0	0	0	0
Storage Cap Reductn	0		0	0	0	0
Reduced v/c Ratio	0.63		0.77	0.46	0.58	0.59

Intersection Summary			
Area Type:	Other		
Cycle Length: 110			
Actuated Cycle Length: 110			
Offset: 0 (0%), Referenced to phase 2:EBT and 6:WBT, Start of Green			
Natural Cycle: 90			
Control Type: Actuated-Coordinated			
Maximum v/c Ratio: 0.82			
Intersection Signal Delay: 23.7		Intersection LOS: C	
Intersection Capacity Utilization 79.4%		ICU Level of Service D	
Analysis Period (min) 15			

Splits and Phases: 16: East Employee Access & Roger Stevens

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	235	5	15	329	5	15
Future Volume (Veh/h)	235	5	15	329	5	15
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	235	5	15	329	5	15
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (m)				351		
pX, platoon unblocked						
vC, conflicting volume			240		596	238
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			240		596	238
tC, single (s)			5.1		7.4	7.2
tC, 2 stage (s)						
tF (s)			3.1		4.4	4.2
p0 queue free %			98		98	98
cM capacity (veh/h)			915		333	610

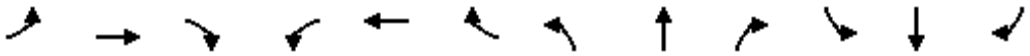
Direction, Lane #	EB 1	WB 1	WB 2	NB 1
Volume Total	240	15	329	20
Volume Left	0	15	0	5
Volume Right	5	0	0	15
cSH	1700	915	1700	505
Volume to Capacity	0.14	0.02	0.19	0.04
Queue Length 95th (m)	0.0	0.4	0.0	0.9
Control Delay (s)	0.0	9.0	0.0	12.4
Lane LOS		A		B
Approach Delay (s)	0.0	0.4		12.4
Approach LOS				B

Intersection Summary			
Average Delay	0.6		
Intersection Capacity Utilization	28.3%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	219	5	25	329	0	5
Future Volume (Veh/h)	219	5	25	329	0	5
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	219	5	25	329	0	5
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume			224		600	222
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			224		600	222
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			98		100	99
cM capacity (veh/h)			1345		455	818

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	224	354	5
Volume Left	0	25	0
Volume Right	5	0	5
cSH	1700	1345	818
Volume to Capacity	0.13	0.02	0.01
Queue Length 95th (m)	0.0	0.4	0.1
Control Delay (s)	0.0	0.7	9.4
Lane LOS		A	A
Approach Delay (s)	0.0	0.7	9.4
Approach LOS			A

Intersection Summary			
Average Delay	0.5		
Intersection Capacity Utilization	45.6%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	2	217	11	15	329	10	1	7	8	10	9	14
Future Volume (Veh/h)	2	217	11	15	329	10	1	7	8	10	9	14
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	2	217	11	15	329	10	1	7	8	10	9	14
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	339			228			609	596	222	602	596	334
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	339			228			609	596	222	602	596	334
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			99			100	98	99	97	98	98
cM capacity (veh/h)	1220			1340			389	412	817	398	412	708

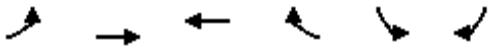
Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	230	354	16	33
Volume Left	2	15	1	10
Volume Right	11	10	8	14
cSH	1220	1340	545	494
Volume to Capacity	0.00	0.01	0.03	0.07
Queue Length 95th (m)	0.0	0.3	0.7	1.6
Control Delay (s)	0.1	0.4	11.8	12.8
Lane LOS	A	A	B	B
Approach Delay (s)	0.1	0.4	11.8	12.8
Approach LOS			B	B

Intersection Summary				
Average Delay	1.2			
Intersection Capacity Utilization	41.4%	ICU Level of Service	A	
Analysis Period (min)	15			

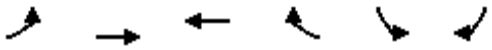
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	237	13	310	331	14	327
Future Volume (Veh/h)	237	13	310	331	14	327
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	237	13	310	331	14	327
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (m)				192		
pX, platoon unblocked						
vC, conflicting volume			250		1194	244
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			250		1194	244
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			76		91	59
cM capacity (veh/h)			1316		157	795

Direction, Lane #	EB 1	WB 1	WB 2	NB 1
Volume Total	250	310	331	341
Volume Left	0	310	0	14
Volume Right	13	0	0	327
cSH	1700	1316	1700	682
Volume to Capacity	0.15	0.24	0.19	0.50
Queue Length 95th (m)	0.0	7.0	0.0	21.4
Control Delay (s)	0.0	8.6	0.0	15.4
Lane LOS		A		C
Approach Delay (s)	0.0	4.1		15.4
Approach LOS				C

Intersection Summary			
Average Delay	6.4		
Intersection Capacity Utilization	64.3%	ICU Level of Service	C
Analysis Period (min)	15		



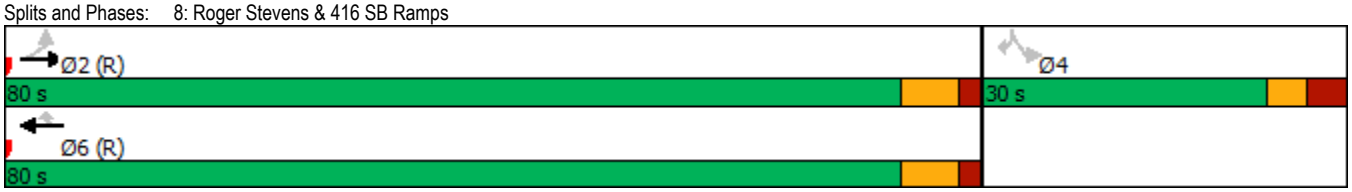
Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	178	1044	399	97	267	867
Future Volume (vph)	178	1044	399	97	267	867
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Storage Length (m)	60.0			30.0	110.0	110.0
Storage Lanes	1			1	1	1
Taper Length (m)	100.0				60.0	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	0.88
Frt				0.850		0.850
Flt Protected	0.950				0.950	
Satd. Flow (prot)	1695	1784	1784	1517	1695	2669
Flt Permitted	0.500				0.950	
Satd. Flow (perm)	892	1784	1784	1517	1695	2669
Right Turn on Red				Yes		Yes
Satd. Flow (RTOR)				97		867
Link Speed (k/h)		80	80		50	
Link Distance (m)		122.5	76.1		162.5	
Travel Time (s)		5.5	3.4		11.7	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	178	1044	399	97	267	867
Shared Lane Traffic (%)						
Lane Group Flow (vph)	178	1044	399	97	267	867
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Left	Left	Right	Left	Right
Median Width(m)		3.7	3.7		3.7	
Link Offset(m)		0.0	0.0		0.0	
Crosswalk Width(m)		1.6	1.6		1.6	
Two way Left Turn Lane						
Headway Factor	1.06	1.06	1.06	1.06	1.06	1.06
Turning Speed (k/h)	24			14	24	14
Number of Detectors	1	2	2	1	1	1
Detector Template	Left	Thru	Thru	Right	Left	Right
Leading Detector (m)	6.1	30.5	30.5	6.1	6.1	6.1
Trailing Detector (m)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Position(m)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Size(m)	6.1	1.8	1.8	6.1	6.1	6.1
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel						
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 2 Position(m)		28.7	28.7			
Detector 2 Size(m)		1.8	1.8			
Detector 2 Type		Cl+Ex	Cl+Ex			
Detector 2 Channel						
Detector 2 Extend (s)		0.0	0.0			
Turn Type	Perm	NA	NA	Perm	Perm	Perm
Protected Phases		2	6			
Permitted Phases	2			6	4	4
Detector Phase	2	2	6	6	4	4
Switch Phase						
Minimum Initial (s)	20.0	20.0	20.0	20.0	10.0	10.0
Minimum Split (s)	26.6	26.6	43.6	43.6	29.7	29.7
Total Split (s)	80.0	80.0	80.0	80.0	30.0	30.0
Total Split (%)	72.7%	72.7%	72.7%	72.7%	27.3%	27.3%
Maximum Green (s)	73.4	73.4	73.4	73.4	23.3	23.3
Yellow Time (s)	4.6	4.6	4.6	4.6	3.3	3.3
All-Red Time (s)	2.0	2.0	2.0	2.0	3.4	3.4
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.6	6.6	6.6	6.6	6.7	6.7
Lead/Lag						



Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lead-Lag Optimize?						
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Recall Mode	C-Max	C-Max	C-Max	C-Max	Max	Max
Walk Time (s)			7.0	7.0	7.0	7.0
Flash Dont Walk (s)			30.0	30.0	16.0	16.0
Pedestrian Calls (#/hr)			0	0	0	0
Act Effct Green (s)	73.4	73.4	73.4	73.4	23.3	23.3
Actuated g/C Ratio	0.67	0.67	0.67	0.67	0.21	0.21
v/c Ratio	0.30	0.88	0.34	0.09	0.74	0.69
Control Delay	6.5	16.5	5.9	0.3	54.5	5.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	6.5	16.5	5.9	0.3	54.5	5.9
LOS	A	B	A	A	D	A
Approach Delay		15.0	4.8		17.3	
Approach LOS		B	A		B	
90th %ile Green (s)	73.4	73.4	73.4	73.4	23.3	23.3
90th %ile Term Code	Coord	Coord	Coord	Coord	MaxR	MaxR
70th %ile Green (s)	73.4	73.4	73.4	73.4	23.3	23.3
70th %ile Term Code	Coord	Coord	Coord	Coord	MaxR	MaxR
50th %ile Green (s)	73.4	73.4	73.4	73.4	23.3	23.3
50th %ile Term Code	Coord	Coord	Coord	Coord	MaxR	MaxR
30th %ile Green (s)	73.4	73.4	73.4	73.4	23.3	23.3
30th %ile Term Code	Coord	Coord	Coord	Coord	MaxR	MaxR
10th %ile Green (s)	73.4	73.4	73.4	73.4	23.3	23.3
10th %ile Term Code	Coord	Coord	Coord	Coord	MaxR	MaxR
Queue Length 50th (m)	7.2	54.9	17.2	0.1	54.0	0.0
Queue Length 95th (m)	19.1	#109.8	24.2	1.0	#89.3	16.8
Internal Link Dist (m)		98.5	52.1		138.5	
Turn Bay Length (m)	60.0			30.0	110.0	110.0
Base Capacity (vph)	595	1190	1190	1044	359	1248
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.30	0.88	0.34	0.09	0.74	0.69

Intersection Summary			
Area Type:	Other		
Cycle Length: 110			
Actuated Cycle Length: 110			
Offset: 96 (87%), Referenced to phase 2:EBTL and 6:WBT, Start of Green			
Natural Cycle: 90			
Control Type: Actuated-Coordinated			
Maximum v/c Ratio: 0.88			
Intersection Signal Delay: 14.2		Intersection LOS: B	
Intersection Capacity Utilization 84.7%		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: 8: Roger Stevens & 416 SB Ramps



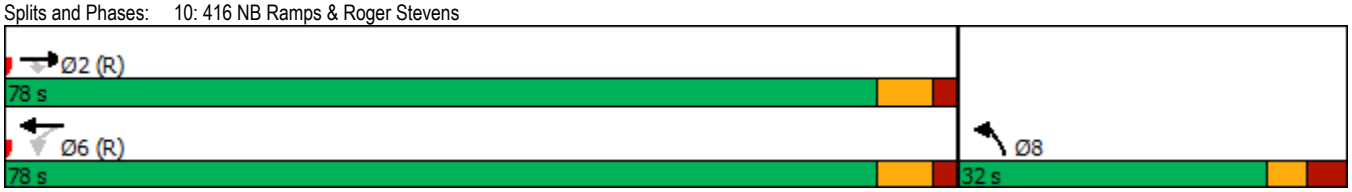
Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	458	861	86	338	168	47
Future Volume (vph)	458	861	86	338	168	47
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Storage Length (m)		30.0	85.0		0.0	0.0
Storage Lanes		1	1		1	0
Taper Length (m)			100.0		30.0	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.850			0.970	
Flt Protected			0.950		0.962	
Satd. Flow (prot)	1784	1517	1695	1784	1665	0
Flt Permitted			0.453		0.962	
Satd. Flow (perm)	1784	1517	808	1784	1665	0
Right Turn on Red		Yes				Yes
Satd. Flow (RTOR)		861			12	
Link Speed (k/h)	80			80	50	
Link Distance (m)	73.7			234.6	117.8	
Travel Time (s)	3.3			10.6	8.5	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	458	861	86	338	168	47
Shared Lane Traffic (%)						
Lane Group Flow (vph)	458	861	86	338	215	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(m)	3.7			3.7	3.7	
Link Offset(m)	0.0			0.0	0.0	
Crosswalk Width(m)	1.6			1.6	1.6	
Two way Left Turn Lane						
Headway Factor	1.06	1.06	1.06	1.06	1.06	1.06
Turning Speed (k/h)		14	24		24	14
Number of Detectors	2	1	1	2	1	
Detector Template	Thru	Right	Left	Thru	Left	
Leading Detector (m)	30.5	6.1	6.1	30.5	6.1	
Trailing Detector (m)	0.0	0.0	0.0	0.0	0.0	
Detector 1 Position(m)	0.0	0.0	0.0	0.0	0.0	
Detector 1 Size(m)	1.8	6.1	6.1	1.8	6.1	
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	
Detector 1 Channel						
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0	
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0	
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0	
Detector 2 Position(m)	28.7			28.7		
Detector 2 Size(m)	1.8			1.8		
Detector 2 Type	Cl+Ex			Cl+Ex		
Detector 2 Channel						
Detector 2 Extend (s)	0.0			0.0		
Turn Type	NA	Perm	Perm	NA	Prot	
Protected Phases	2			6	8	
Permitted Phases		2	6			
Detector Phase	2	2	6	6	8	
Switch Phase						
Minimum Initial (s)	20.0	20.0	20.0	20.0	10.0	
Minimum Split (s)	38.6	38.6	26.6	26.6	22.5	
Total Split (s)	78.0	78.0	78.0	78.0	32.0	
Total Split (%)	70.9%	70.9%	70.9%	70.9%	29.1%	
Maximum Green (s)	71.4	71.4	71.4	71.4	25.3	
Yellow Time (s)	4.6	4.6	4.6	4.6	3.3	
All-Red Time (s)	2.0	2.0	2.0	2.0	3.4	
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	
Total Lost Time (s)	6.6	6.6	6.6	6.6	6.7	
Lead/Lag						

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lead-Lag Optimize?						
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Recall Mode	C-Max	C-Max	C-Max	C-Max	Max	
Walk Time (s)	7.0	7.0				
Flash Dont Walk (s)	25.0	25.0				
Pedestrian Calls (#/hr)	0	0				
Act Effct Green (s)	71.4	71.4	71.4	71.4	25.3	
Actuated g/C Ratio	0.65	0.65	0.65	0.65	0.23	
v/c Ratio	0.40	0.67	0.16	0.29	0.55	
Control Delay	6.5	1.9	8.5	9.2	41.3	
Queue Delay	0.0	0.0	0.0	0.0	0.0	
Total Delay	6.5	1.9	8.5	9.2	41.3	
LOS	A	A	A	A	D	
Approach Delay	3.5			9.0	41.3	
Approach LOS	A			A	D	
90th %ile Green (s)	71.4	71.4	71.4	71.4	25.3	
90th %ile Term Code	Coord	Coord	Coord	Coord	MaxR	
70th %ile Green (s)	71.4	71.4	71.4	71.4	25.3	
70th %ile Term Code	Coord	Coord	Coord	Coord	MaxR	
50th %ile Green (s)	71.4	71.4	71.4	71.4	25.3	
50th %ile Term Code	Coord	Coord	Coord	Coord	MaxR	
30th %ile Green (s)	71.4	71.4	71.4	71.4	25.3	
30th %ile Term Code	Coord	Coord	Coord	Coord	MaxR	
10th %ile Green (s)	71.4	71.4	71.4	71.4	25.3	
10th %ile Term Code	Coord	Coord	Coord	Coord	MaxR	
Queue Length 50th (m)	23.9	6.6	6.6	28.7	38.6	
Queue Length 95th (m)	m31.4	m3.7	13.3	42.7	62.7	
Internal Link Dist (m)	49.7			210.6	93.8	
Turn Bay Length (m)		30.0	85.0			
Base Capacity (vph)	1157	1286	524	1157	392	
Starvation Cap Reductn	0	0	0	0	0	
Spillback Cap Reductn	0	0	0	0	0	
Storage Cap Reductn	0	0	0	0	0	
Reduced v/c Ratio	0.40	0.67	0.16	0.29	0.55	

Intersection Summary			
Area Type:	Other		
Cycle Length: 110			
Actuated Cycle Length: 110			
Offset: 2 (2%), Referenced to phase 2:EBT and 6:WBTL, Start of Green			
Natural Cycle: 65			
Control Type: Actuated-Coordinated			
Maximum v/c Ratio: 0.67			
Intersection Signal Delay: 8.8		Intersection LOS: A	
Intersection Capacity Utilization 83.9%		ICU Level of Service E	
Analysis Period (min) 15			

m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 10: 416 NB Ramps & Roger Stevens

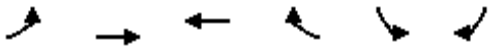


Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	558	5	630	634	7	663
Future Volume (vph)	558	5	630	634	7	663
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Storage Length (m)		0.0	125.0		0.0	0.0
Storage Lanes		0	2		1	1
Taper Length (m)			100.0		30.0	
Lane Util. Factor	1.00	1.00	0.97	1.00	1.00	0.95
Frt	0.999				0.853	0.850
Flt Protected			0.950		0.999	
Satd. Flow (prot)	1783	0	3288	1784	1520	1441
Flt Permitted			0.950		0.999	
Satd. Flow (perm)	1783	0	3288	1784	1520	1441
Right Turn on Red		Yes				Yes
Satd. Flow (RTOR)					332	331
Link Speed (k/h)	80			80	48	
Link Distance (m)	191.8			211.8	133.2	
Travel Time (s)	8.6			9.5	10.0	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	558	5	630	634	7	663
Shared Lane Traffic (%)						50%
Lane Group Flow (vph)	563	0	630	634	339	331
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(m)	7.4			7.4	3.7	
Link Offset(m)	0.0			0.0	0.0	
Crosswalk Width(m)	1.6			1.6	1.6	
Two way Left Turn Lane						
Headway Factor	1.06	1.06	1.06	1.06	1.06	1.06
Turning Speed (k/h)		14	24		24	14
Number of Detectors	2		1	2	1	1
Detector Template	Thru		Left	Thru	Left	Right
Leading Detector (m)	30.5		6.1	30.5	6.1	6.1
Trailing Detector (m)	0.0		0.0	0.0	0.0	0.0
Detector 1 Position(m)	0.0		0.0	0.0	0.0	0.0
Detector 1 Size(m)	1.8		6.1	1.8	6.1	6.1
Detector 1 Type	Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel						
Detector 1 Extend (s)	0.0		0.0	0.0	0.0	0.0
Detector 1 Queue (s)	0.0		0.0	0.0	0.0	0.0
Detector 1 Delay (s)	0.0		0.0	0.0	0.0	0.0
Detector 2 Position(m)	28.7			28.7		
Detector 2 Size(m)	1.8			1.8		
Detector 2 Type	Cl+Ex			Cl+Ex		
Detector 2 Channel						
Detector 2 Extend (s)	0.0			0.0		
Turn Type	NA		Prot	NA	Prot	Perm
Protected Phases	2		1	6	8	
Permitted Phases						8
Detector Phase	2		1	6	8	8
Switch Phase						
Minimum Initial (s)	20.0		5.0	20.0	10.0	10.0
Minimum Split (s)	26.1		14.5	26.1	29.0	29.0
Total Split (s)	50.0		31.0	81.0	29.0	29.0
Total Split (%)	45.5%		28.2%	73.6%	26.4%	26.4%
Maximum Green (s)	43.9		26.0	74.9	23.0	23.0
Yellow Time (s)	4.6		3.0	4.6	3.3	3.3
All-Red Time (s)	1.5		2.0	1.5	2.7	2.7
Lost Time Adjust (s)	0.0		0.0	0.0	0.0	0.0
Total Lost Time (s)	6.1		5.0	6.1	6.0	6.0
Lead/Lag	Lag		Lead			

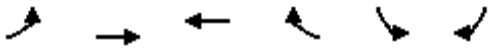
Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lead-Lag Optimize?						
Vehicle Extension (s)	3.0		3.0	3.0	3.0	3.0
Recall Mode	C-Max		None	C-Max	None	None
Walk Time (s)	7.0			7.0	7.0	7.0
Flash Dont Walk (s)	11.0			11.0	16.0	16.0
Pedestrian Calls (#/hr)	0			0	0	0
Act Effct Green (s)	54.9		25.8	85.7	12.2	12.2
Actuated g/C Ratio	0.50		0.23	0.78	0.11	0.11
v/c Ratio	0.63		0.82	0.46	0.73	0.73
Control Delay	26.0		49.8	4.8	15.2	14.8
Queue Delay	0.0		0.0	0.0	0.0	0.0
Total Delay	26.0		49.8	4.8	15.2	14.8
LOS	C		D	A	B	B
Approach Delay	26.0			27.2	15.0	
Approach LOS	C			C	B	
90th %ile Green (s)	43.9		29.8	78.7	19.2	19.2
90th %ile Term Code	Coord		Max	Coord	Gap	Gap
70th %ile Green (s)	52.4		28.5	85.9	12.0	12.0
70th %ile Term Code	Coord		Gap	Coord	Gap	Gap
50th %ile Green (s)	56.6		26.3	87.9	10.0	10.0
50th %ile Term Code	Coord		Gap	Coord	Min	Min
30th %ile Green (s)	59.0		23.9	87.9	10.0	10.0
30th %ile Term Code	Coord		Gap	Coord	Min	Min
10th %ile Green (s)	62.5		20.4	87.9	10.0	10.0
10th %ile Term Code	Coord		Gap	Coord	Min	Min
Queue Length 50th (m)	82.4		69.3	28.7	1.4	0.0
Queue Length 95th (m)	148.7		86.6	55.0	27.1	26.9
Internal Link Dist (m)	167.8			187.8	109.2	
Turn Bay Length (m)			125.0			
Base Capacity (vph)	889		816	1389	580	563
Starvation Cap Reductn	0		0	0	0	0
Spillback Cap Reductn	0		0	0	0	0
Storage Cap Reductn	0		0	0	0	0
Reduced v/c Ratio	0.63		0.77	0.46	0.58	0.59

Intersection Summary			
Area Type:	Other		
Cycle Length: 110			
Actuated Cycle Length: 110			
Offset: 0 (0%), Referenced to phase 2:EBT and 6:WBT, Start of Green			
Natural Cycle: 90			
Control Type: Actuated-Coordinated			
Maximum v/c Ratio: 0.82			
Intersection Signal Delay: 23.7		Intersection LOS: C	
Intersection Capacity Utilization 79.4%		ICU Level of Service D	
Analysis Period (min) 15			

Splits and Phases: 16: East Employee Access & Roger Stevens



Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	160	1115	346	44	50	808
Future Volume (vph)	160	1115	346	44	50	808
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Storage Length (m)	60.0			30.0	110.0	110.0
Storage Lanes	1			1	1	1
Taper Length (m)	100.0				60.0	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	0.88
Frt				0.850		0.850
Flt Protected	0.950				0.950	
Satd. Flow (prot)	1695	1784	1784	1517	1695	2669
Flt Permitted	0.539				0.950	
Satd. Flow (perm)	962	1784	1784	1517	1695	2669
Right Turn on Red				Yes		Yes
Satd. Flow (RTOR)				44		808
Link Speed (k/h)		80	80		50	
Link Distance (m)		122.5	76.1		162.5	
Travel Time (s)		5.5	3.4		11.7	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	160	1115	346	44	50	808
Shared Lane Traffic (%)						
Lane Group Flow (vph)	160	1115	346	44	50	808
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Left	Left	Right	Left	Right
Median Width(m)		3.7	3.7		3.7	
Link Offset(m)		0.0	0.0		0.0	
Crosswalk Width(m)		1.6	1.6		1.6	
Two way Left Turn Lane						
Headway Factor	1.06	1.06	1.06	1.06	1.06	1.06
Turning Speed (k/h)	24			14	24	14
Number of Detectors	1	2	2	1	1	1
Detector Template	Left	Thru	Thru	Right	Left	Right
Leading Detector (m)	6.1	30.5	30.5	6.1	6.1	6.1
Trailing Detector (m)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Position(m)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Size(m)	6.1	1.8	1.8	6.1	6.1	6.1
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel						
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 2 Position(m)		28.7	28.7			
Detector 2 Size(m)		1.8	1.8			
Detector 2 Type		Cl+Ex	Cl+Ex			
Detector 2 Channel						
Detector 2 Extend (s)		0.0	0.0			
Turn Type	Perm	NA	NA	Perm	Perm	Perm
Protected Phases		2	6			
Permitted Phases	2			6	4	4
Detector Phase	2	2	6	6	4	4
Switch Phase						
Minimum Initial (s)	20.0	20.0	20.0	20.0	10.0	10.0
Minimum Split (s)	26.6	26.6	43.6	43.6	29.7	29.7
Total Split (s)	90.0	90.0	90.0	90.0	30.0	30.0
Total Split (%)	75.0%	75.0%	75.0%	75.0%	25.0%	25.0%
Maximum Green (s)	83.4	83.4	83.4	83.4	23.3	23.3
Yellow Time (s)	4.6	4.6	4.6	4.6	3.3	3.3
All-Red Time (s)	2.0	2.0	2.0	2.0	3.4	3.4
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.6	6.6	6.6	6.6	6.7	6.7
Lead/Lag						



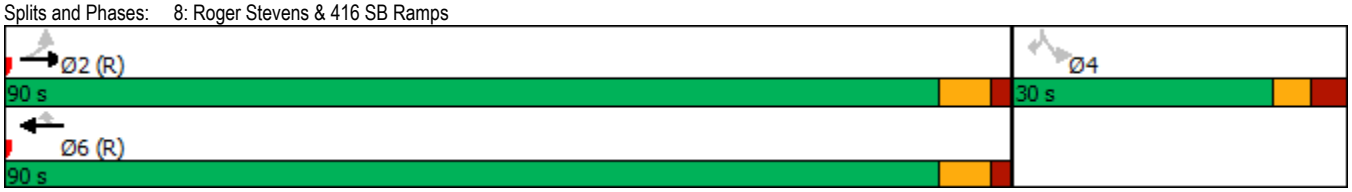
Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lead-Lag Optimize?						
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Recall Mode	C-Max	C-Max	C-Max	C-Max	Max	Max
Walk Time (s)			7.0	7.0	7.0	7.0
Flash Dont Walk (s)			30.0	30.0	16.0	16.0
Pedestrian Calls (#/hr)			0	0	0	0
Act Effct Green (s)	83.4	83.4	83.4	83.4	23.3	23.3
Actuated g/C Ratio	0.70	0.70	0.70	0.70	0.19	0.19
v/c Ratio	0.24	0.90	0.28	0.04	0.15	0.69
Control Delay	3.9	18.7	5.0	0.3	41.7	6.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	3.9	18.7	5.0	0.3	41.7	6.4
LOS	A	B	A	A	D	A
Approach Delay		16.8	4.4		8.4	
Approach LOS		B	A		A	
90th %ile Green (s)	83.4	83.4	83.4	83.4	23.3	23.3
90th %ile Term Code	Coord	Coord	Coord	Coord	MaxR	MaxR
70th %ile Green (s)	83.4	83.4	83.4	83.4	23.3	23.3
70th %ile Term Code	Coord	Coord	Coord	Coord	MaxR	MaxR
50th %ile Green (s)	83.4	83.4	83.4	83.4	23.3	23.3
50th %ile Term Code	Coord	Coord	Coord	Coord	MaxR	MaxR
30th %ile Green (s)	83.4	83.4	83.4	83.4	23.3	23.3
30th %ile Term Code	Coord	Coord	Coord	Coord	MaxR	MaxR
10th %ile Green (s)	83.4	83.4	83.4	83.4	23.3	23.3
10th %ile Term Code	Coord	Coord	Coord	Coord	MaxR	MaxR
Queue Length 50th (m)	5.6	236.2	14.7	0.0	9.9	0.0
Queue Length 95th (m)	m9.3	#291.0	21.7	m0.3	21.0	17.3
Internal Link Dist (m)		98.5	52.1		138.5	
Turn Bay Length (m)	60.0			30.0	110.0	110.0
Base Capacity (vph)	668	1239	1239	1067	329	1169
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.24	0.90	0.28	0.04	0.15	0.69

Intersection Summary			
Area Type:	Other		
Cycle Length: 120			
Actuated Cycle Length: 120			
Offset: 102 (85%), Referenced to phase 2:EBTL and 6:WBT, Start of Green			
Natural Cycle: 90			
Control Type: Actuated-Coordinated			
Maximum v/c Ratio: 0.90			
Intersection Signal Delay: 12.0		Intersection LOS: B	
Intersection Capacity Utilization 81.4%		ICU Level of Service D	
Analysis Period (min) 15			

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

m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 8: Roger Stevens & 416 SB Ramps



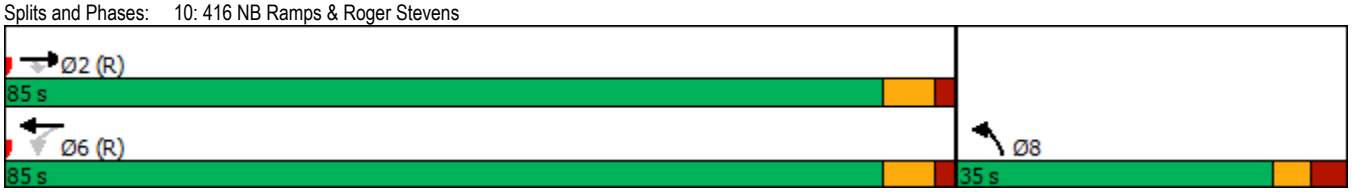
Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	273	905	238	228	173	81
Future Volume (vph)	273	905	238	228	173	81
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Storage Length (m)		30.0	85.0		0.0	0.0
Storage Lanes		1	1		1	0
Taper Length (m)			100.0		30.0	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.850			0.957	
Flt Protected			0.950		0.967	
Satd. Flow (prot)	1784	1517	1695	1784	1651	0
Flt Permitted			0.585		0.967	
Satd. Flow (perm)	1784	1517	1044	1784	1651	0
Right Turn on Red		Yes				Yes
Satd. Flow (RTOR)		905			18	
Link Speed (k/h)	80			80	50	
Link Distance (m)	73.7			234.6	117.8	
Travel Time (s)	3.3			10.6	8.5	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	273	905	238	228	173	81
Shared Lane Traffic (%)						
Lane Group Flow (vph)	273	905	238	228	254	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(m)	3.7			3.7	3.7	
Link Offset(m)	0.0			0.0	0.0	
Crosswalk Width(m)	1.6			1.6	1.6	
Two way Left Turn Lane						
Headway Factor	1.06	1.06	1.06	1.06	1.06	1.06
Turning Speed (k/h)		14	24		24	14
Number of Detectors	2	1	1	2	1	
Detector Template	Thru	Right	Left	Thru	Left	
Leading Detector (m)	30.5	6.1	6.1	30.5	6.1	
Trailing Detector (m)	0.0	0.0	0.0	0.0	0.0	
Detector 1 Position(m)	0.0	0.0	0.0	0.0	0.0	
Detector 1 Size(m)	1.8	6.1	6.1	1.8	6.1	
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	
Detector 1 Channel						
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0	
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0	
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0	
Detector 2 Position(m)	28.7			28.7		
Detector 2 Size(m)	1.8			1.8		
Detector 2 Type	Cl+Ex			Cl+Ex		
Detector 2 Channel						
Detector 2 Extend (s)	0.0			0.0		
Turn Type	NA	Perm	Perm	NA	Prot	
Protected Phases	2			6	8	
Permitted Phases		2	6			
Detector Phase	2	2	6	6	8	
Switch Phase						
Minimum Initial (s)	20.0	20.0	20.0	20.0	10.0	
Minimum Split (s)	38.6	38.6	26.6	26.6	22.5	
Total Split (s)	85.0	85.0	85.0	85.0	35.0	
Total Split (%)	70.8%	70.8%	70.8%	70.8%	29.2%	
Maximum Green (s)	78.4	78.4	78.4	78.4	28.3	
Yellow Time (s)	4.6	4.6	4.6	4.6	3.3	
All-Red Time (s)	2.0	2.0	2.0	2.0	3.4	
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	
Total Lost Time (s)	6.6	6.6	6.6	6.6	6.7	
Lead/Lag						

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lead-Lag Optimize?						
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Recall Mode	C-Max	C-Max	C-Max	C-Max	Max	
Walk Time (s)	7.0	7.0				
Flash Dont Walk (s)	25.0	25.0				
Pedestrian Calls (#/hr)	0	0				
Act Effct Green (s)	78.4	78.4	78.4	78.4	28.3	
Actuated g/C Ratio	0.65	0.65	0.65	0.65	0.24	
v/c Ratio	0.23	0.69	0.35	0.20	0.63	
Control Delay	2.9	1.7	11.1	8.8	46.1	
Queue Delay	0.0	0.0	0.0	0.0	0.0	
Total Delay	2.9	1.7	11.1	8.8	46.1	
LOS	A	A	B	A	D	
Approach Delay	2.0			10.0	46.1	
Approach LOS	A			A	D	
90th %ile Green (s)	78.4	78.4	78.4	78.4	28.3	
90th %ile Term Code	Coord	Coord	Coord	Coord	MaxR	
70th %ile Green (s)	78.4	78.4	78.4	78.4	28.3	
70th %ile Term Code	Coord	Coord	Coord	Coord	MaxR	
50th %ile Green (s)	78.4	78.4	78.4	78.4	28.3	
50th %ile Term Code	Coord	Coord	Coord	Coord	MaxR	
30th %ile Green (s)	78.4	78.4	78.4	78.4	28.3	
30th %ile Term Code	Coord	Coord	Coord	Coord	MaxR	
10th %ile Green (s)	78.4	78.4	78.4	78.4	28.3	
10th %ile Term Code	Coord	Coord	Coord	Coord	MaxR	
Queue Length 50th (m)	4.4	0.0	23.2	19.6	50.2	
Queue Length 95th (m)	m7.6	m0.0	37.8	30.2	78.3	
Internal Link Dist (m)	49.7			210.6	93.8	
Turn Bay Length (m)		30.0	85.0			
Base Capacity (vph)	1165	1304	682	1165	403	
Starvation Cap Reductn	0	0	0	0	0	
Spillback Cap Reductn	0	0	0	0	0	
Storage Cap Reductn	0	0	0	0	0	
Reduced v/c Ratio	0.23	0.69	0.35	0.20	0.63	

Intersection Summary			
Area Type:	Other		
Cycle Length: 120			
Actuated Cycle Length: 120			
Offset: 118 (98%), Referenced to phase 2:EBT and 6:WBTL, Start of Green			
Natural Cycle: 65			
Control Type: Actuated-Coordinated			
Maximum v/c Ratio: 0.69			
Intersection Signal Delay: 9.8		Intersection LOS: A	
Intersection Capacity Utilization 86.8%		ICU Level of Service E	
Analysis Period (min) 15			

m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 10: 416 NB Ramps & Roger Stevens

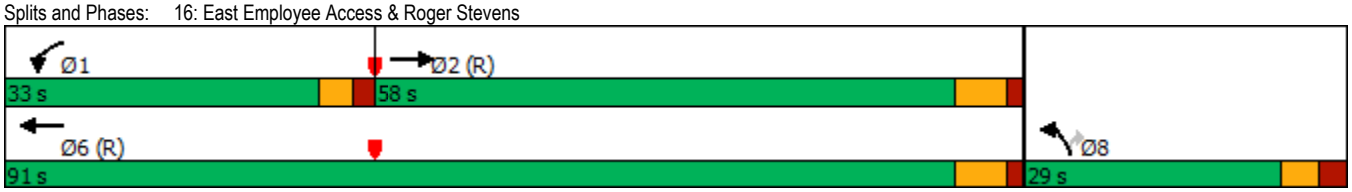


Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	643	6	643	510	6	630
Future Volume (vph)	643	6	643	510	6	630
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Storage Length (m)		0.0	125.0		0.0	0.0
Storage Lanes		0	2		1	1
Taper Length (m)			100.0		30.0	
Lane Util. Factor	1.00	1.00	0.97	1.00	1.00	0.95
Frt	0.999				0.853	0.850
Flt Protected			0.950		0.999	
Satd. Flow (prot)	1783	0	3288	1784	1520	1441
Flt Permitted			0.950		0.999	
Satd. Flow (perm)	1783	0	3288	1784	1520	1441
Right Turn on Red		Yes				Yes
Satd. Flow (RTOR)					315	315
Link Speed (k/h)	80			80	48	
Link Distance (m)	191.8			211.8	133.2	
Travel Time (s)	8.6			9.5	10.0	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	643	6	643	510	6	630
Shared Lane Traffic (%)						50%
Lane Group Flow (vph)	649	0	643	510	321	315
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(m)	7.4			7.4	3.7	
Link Offset(m)	0.0			0.0	0.0	
Crosswalk Width(m)	1.6			1.6	1.6	
Two way Left Turn Lane						
Headway Factor	1.06	1.06	1.06	1.06	1.06	1.06
Turning Speed (k/h)		14	24		24	14
Number of Detectors	2		1	2	1	1
Detector Template	Thru		Left	Thru	Left	Right
Leading Detector (m)	30.5		6.1	30.5	6.1	6.1
Trailing Detector (m)	0.0		0.0	0.0	0.0	0.0
Detector 1 Position(m)	0.0		0.0	0.0	0.0	0.0
Detector 1 Size(m)	1.8		6.1	1.8	6.1	6.1
Detector 1 Type	Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel						
Detector 1 Extend (s)	0.0		0.0	0.0	0.0	0.0
Detector 1 Queue (s)	0.0		0.0	0.0	0.0	0.0
Detector 1 Delay (s)	0.0		0.0	0.0	0.0	0.0
Detector 2 Position(m)	28.7			28.7		
Detector 2 Size(m)	1.8			1.8		
Detector 2 Type	Cl+Ex			Cl+Ex		
Detector 2 Channel						
Detector 2 Extend (s)	0.0			0.0		
Turn Type	NA		Prot	NA	Prot	Perm
Protected Phases	2		1	6	8	
Permitted Phases						8
Detector Phase	2		1	6	8	8
Switch Phase						
Minimum Initial (s)	20.0		5.0	20.0	10.0	10.0
Minimum Split (s)	26.1		14.5	26.1	29.0	29.0
Total Split (s)	58.0		33.0	91.0	29.0	29.0
Total Split (%)	48.3%		27.5%	75.8%	24.2%	24.2%
Maximum Green (s)	51.9		28.0	84.9	23.0	23.0
Yellow Time (s)	4.6		3.0	4.6	3.3	3.3
All-Red Time (s)	1.5		2.0	1.5	2.7	2.7
Lost Time Adjust (s)	0.0		0.0	0.0	0.0	0.0
Total Lost Time (s)	6.1		5.0	6.1	6.0	6.0
Lead/Lag	Lag		Lead			

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lead-Lag Optimize?						
Vehicle Extension (s)	3.0		3.0	3.0	3.0	3.0
Recall Mode	C-Max		None	C-Max	None	None
Walk Time (s)	7.0			7.0	7.0	7.0
Flash Dont Walk (s)	11.0			11.0	16.0	16.0
Pedestrian Calls (#/hr)	0			0	0	0
Act Effct Green (s)	62.5		28.1	95.6	12.3	12.3
Actuated g/C Ratio	0.52		0.23	0.80	0.10	0.10
v/c Ratio	0.70		0.84	0.36	0.73	0.73
Control Delay	28.4		52.4	3.6	16.3	16.0
Queue Delay	0.0		0.0	0.0	0.2	0.2
Total Delay	28.4		52.4	3.6	16.5	16.2
LOS	C		D	A	B	B
Approach Delay	28.4			30.8	16.4	
Approach LOS	C			C	B	
90th %ile Green (s)	51.9		31.6	88.5	19.4	19.4
90th %ile Term Code	Coord		Max	Coord	Gap	Gap
70th %ile Green (s)	59.6		31.2	95.8	12.1	12.1
70th %ile Term Code	Coord		Gap	Coord	Gap	Gap
50th %ile Green (s)	64.1		28.8	97.9	10.0	10.0
50th %ile Term Code	Coord		Gap	Coord	Min	Min
30th %ile Green (s)	66.6		26.3	97.9	10.0	10.0
30th %ile Term Code	Coord		Gap	Coord	Min	Min
10th %ile Green (s)	70.3		22.6	97.9	10.0	10.0
10th %ile Term Code	Coord		Gap	Coord	Min	Min
Queue Length 50th (m)	107.5		76.4	20.4	1.3	0.0
Queue Length 95th (m)	#198.7		82.6	37.9	27.7	27.8
Internal Link Dist (m)	167.8			187.8	109.2	
Turn Bay Length (m)			125.0			
Base Capacity (vph)	928		808	1421	545	530
Starvation Cap Reductn	0		0	0	0	0
Spillback Cap Reductn	0		0	0	22	21
Storage Cap Reductn	0		0	0	0	0
Reduced v/c Ratio	0.70		0.80	0.36	0.61	0.62

Intersection Summary			
Area Type:	Other		
Cycle Length: 120			
Actuated Cycle Length: 120			
Offset: 104 (87%), Referenced to phase 2:EBT and 6:WBT, Start of Green			
Natural Cycle: 90			
Control Type: Actuated-Coordinated			
Maximum v/c Ratio: 0.84			
Intersection Signal Delay: 26.4		Intersection LOS: C	
Intersection Capacity Utilization 83.8%		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: 16: East Employee Access & Roger Stevens



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	348	5	5	207	5	5
Future Volume (Veh/h)	348	5	5	207	5	5
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	348	5	5	207	5	5
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (m)				351		
pX, platoon unblocked						
vC, conflicting volume			353		568	350
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			353		568	350
tC, single (s)			5.1		7.4	7.2
tC, 2 stage (s)						
tF (s)			3.1		4.4	4.2
p0 queue free %			99		99	99
cM capacity (veh/h)			817		351	518

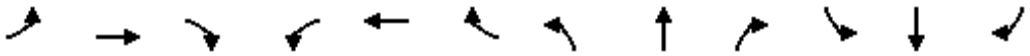
Direction, Lane #	EB 1	WB 1	WB 2	NB 1
Volume Total	353	5	207	10
Volume Left	0	5	0	5
Volume Right	5	0	0	5
cSH	1700	817	1700	419
Volume to Capacity	0.21	0.01	0.12	0.02
Queue Length 95th (m)	0.0	0.1	0.0	0.6
Control Delay (s)	0.0	9.4	0.0	13.8
Lane LOS		A		B
Approach Delay (s)	0.0	0.2		13.8
Approach LOS				B

Intersection Summary			
Average Delay	0.3		
Intersection Capacity Utilization	29.7%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	273	1	5	190	4	26
Future Volume (Veh/h)	273	1	5	190	4	26
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	273	1	5	190	4	26
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume			274		474	274
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			274		474	274
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			100		99	97
cM capacity (veh/h)			1289		547	765

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	274	195	30
Volume Left	0	5	4
Volume Right	1	0	26
cSH	1700	1289	727
Volume to Capacity	0.16	0.00	0.04
Queue Length 95th (m)	0.0	0.1	1.0
Control Delay (s)	0.0	0.2	10.2
Lane LOS		A	B
Approach Delay (s)	0.0	0.2	10.2
Approach LOS			B

Intersection Summary			
Average Delay	0.7		
Intersection Capacity Utilization	25.2%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	11	295	5	4	183	15	8	4	23	12	3	2
Future Volume (Veh/h)	11	295	5	4	183	15	8	4	23	12	3	2
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	11	295	5	4	183	15	8	4	23	12	3	2
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	198			300			522	526	298	543	520	190
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	198			300			522	526	298	543	520	190
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	99			100			98	99	97	97	99	100
cM capacity (veh/h)	1375			1261			458	452	742	430	455	851

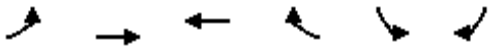
Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	311	202	35	17
Volume Left	11	4	8	12
Volume Right	5	15	23	2
cSH	1375	1261	611	461
Volume to Capacity	0.01	0.00	0.06	0.04
Queue Length 95th (m)	0.2	0.1	1.4	0.9
Control Delay (s)	0.3	0.2	11.3	13.1
Lane LOS	A	A	B	B
Approach Delay (s)	0.3	0.2	11.3	13.1
Approach LOS			B	B

Intersection Summary				
Average Delay	1.3			
Intersection Capacity Utilization	32.7%	ICU Level of Service	A	
Analysis Period (min)	15			

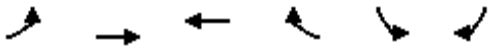
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	339	13	317	199	13	310
Future Volume (Veh/h)	339	13	317	199	13	310
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	339	13	317	199	13	310
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (m)				192		
pX, platoon unblocked						
vC, conflicting volume			352		1178	346
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			352		1178	346
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			74		92	56
cM capacity (veh/h)			1207		155	697

Direction, Lane #	EB 1	WB 1	WB 2	NB 1
Volume Total	352	317	199	323
Volume Left	0	317	0	13
Volume Right	13	0	0	310
cSH	1700	1207	1700	612
Volume to Capacity	0.21	0.26	0.12	0.53
Queue Length 95th (m)	0.0	8.0	0.0	23.5
Control Delay (s)	0.0	9.0	0.0	17.3
Lane LOS		A		C
Approach Delay (s)	0.0	5.6		17.3
Approach LOS				C

Intersection Summary			
Average Delay	7.1		
Intersection Capacity Utilization	69.2%	ICU Level of Service	C
Analysis Period (min)	15		



Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (vph)	179	1054	409	102	281	873
Future Volume (vph)	179	1054	409	102	281	873
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Storage Length (m)	60.0			30.0	110.0	110.0
Storage Lanes	1			1	1	1
Taper Length (m)	100.0				60.0	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	0.88
Frt				0.850		0.850
Flt Protected	0.950				0.950	
Satd. Flow (prot)	1695	1784	1784	1517	1695	2669
Flt Permitted	0.493				0.950	
Satd. Flow (perm)	880	1784	1784	1517	1695	2669
Right Turn on Red				Yes		Yes
Satd. Flow (RTOR)				102		873
Link Speed (k/h)		80	80		50	
Link Distance (m)		122.5	76.1		162.5	
Travel Time (s)		5.5	3.4		11.7	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	179	1054	409	102	281	873
Shared Lane Traffic (%)						
Lane Group Flow (vph)	179	1054	409	102	281	873
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Left	Left	Right	Left	Right
Median Width(m)		3.7	3.7		3.7	
Link Offset(m)		0.0	0.0		0.0	
Crosswalk Width(m)		1.6	1.6		1.6	
Two way Left Turn Lane						
Headway Factor	1.06	1.06	1.06	1.06	1.06	1.06
Turning Speed (k/h)	24			14	24	14
Number of Detectors	1	2	2	1	1	1
Detector Template	Left	Thru	Thru	Right	Left	Right
Leading Detector (m)	6.1	30.5	30.5	6.1	6.1	6.1
Trailing Detector (m)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Position(m)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Size(m)	6.1	1.8	1.8	6.1	6.1	6.1
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel						
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 2 Position(m)		28.7	28.7			
Detector 2 Size(m)		1.8	1.8			
Detector 2 Type		Cl+Ex	Cl+Ex			
Detector 2 Channel						
Detector 2 Extend (s)		0.0	0.0			
Turn Type	Perm	NA	NA	Perm	Perm	Perm
Protected Phases		2	6			
Permitted Phases	2			6	4	4
Detector Phase	2	2	6	6	4	4
Switch Phase						
Minimum Initial (s)	20.0	20.0	20.0	20.0	10.0	10.0
Minimum Split (s)	26.6	26.6	43.6	43.6	29.7	29.7
Total Split (s)	80.0	80.0	80.0	80.0	30.0	30.0
Total Split (%)	72.7%	72.7%	72.7%	72.7%	27.3%	27.3%
Maximum Green (s)	73.4	73.4	73.4	73.4	23.3	23.3
Yellow Time (s)	4.6	4.6	4.6	4.6	3.3	3.3
All-Red Time (s)	2.0	2.0	2.0	2.0	3.4	3.4
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.6	6.6	6.6	6.6	6.7	6.7
Lead/Lag						

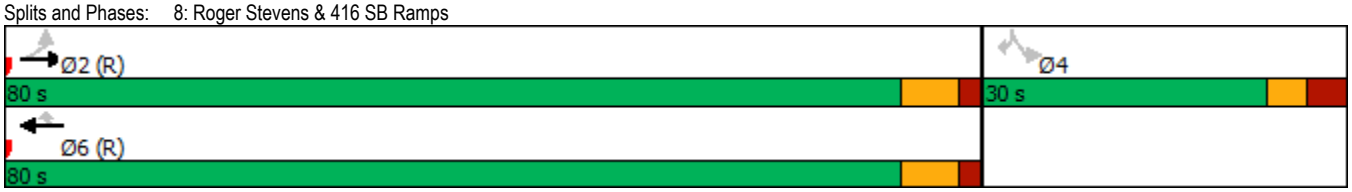


Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lead-Lag Optimize?						
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Recall Mode	C-Max	C-Max	C-Max	C-Max	Max	Max
Walk Time (s)			7.0	7.0	7.0	7.0
Flash Dont Walk (s)			30.0	30.0	16.0	16.0
Pedestrian Calls (#/hr)			0	0	0	0
Act Effct Green (s)	73.4	73.4	73.4	73.4	23.3	23.3
Actuated g/C Ratio	0.67	0.67	0.67	0.67	0.21	0.21
v/c Ratio	0.30	0.89	0.34	0.10	0.78	0.70
Control Delay	6.5	17.1	5.8	0.3	57.5	5.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	6.5	17.1	5.8	0.3	57.5	5.9
LOS	A	B	A	A	E	A
Approach Delay		15.6	4.7		18.5	
Approach LOS		B	A		B	
90th %ile Green (s)	73.4	73.4	73.4	73.4	23.3	23.3
90th %ile Term Code	Coord	Coord	Coord	Coord	MaxR	MaxR
70th %ile Green (s)	73.4	73.4	73.4	73.4	23.3	23.3
70th %ile Term Code	Coord	Coord	Coord	Coord	MaxR	MaxR
50th %ile Green (s)	73.4	73.4	73.4	73.4	23.3	23.3
50th %ile Term Code	Coord	Coord	Coord	Coord	MaxR	MaxR
30th %ile Green (s)	73.4	73.4	73.4	73.4	23.3	23.3
30th %ile Term Code	Coord	Coord	Coord	Coord	MaxR	MaxR
10th %ile Green (s)	73.4	73.4	73.4	73.4	23.3	23.3
10th %ile Term Code	Coord	Coord	Coord	Coord	MaxR	MaxR
Queue Length 50th (m)	7.1	55.1	17.2	0.1	57.4	0.0
Queue Length 95th (m)	19.1	#279.2	23.9	m0.7	#96.5	16.8
Internal Link Dist (m)		98.5	52.1		138.5	
Turn Bay Length (m)	60.0			30.0	110.0	110.0
Base Capacity (vph)	587	1190	1190	1046	359	1253
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.30	0.89	0.34	0.10	0.78	0.70

Intersection Summary

Area Type: Other
Cycle Length: 110
Actuated Cycle Length: 110
Offset: 96 (87%), Referenced to phase 2:EBTL and 6:WBT, Start of Green
Natural Cycle: 90
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.89
Intersection Signal Delay: 14.8 Intersection LOS: B
Intersection Capacity Utilization 86.1% 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.
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 8: Roger Stevens & 416 SB Ramps



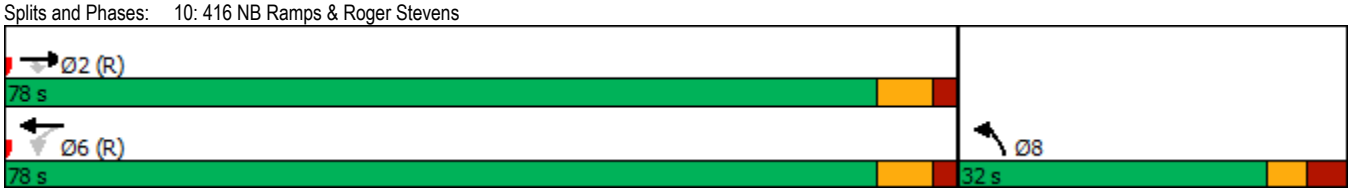
Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	479	864	90	353	189	49
Future Volume (vph)	479	864	90	353	189	49
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Storage Length (m)		30.0	85.0		0.0	0.0
Storage Lanes		1	1		1	0
Taper Length (m)			100.0		30.0	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.850			0.972	
Flt Protected			0.950		0.962	
Satd. Flow (prot)	1784	1517	1695	1784	1668	0
Flt Permitted			0.439		0.962	
Satd. Flow (perm)	1784	1517	783	1784	1668	0
Right Turn on Red		Yes				Yes
Satd. Flow (RTOR)		832			11	
Link Speed (k/h)	80			80	50	
Link Distance (m)	73.7			234.6	117.8	
Travel Time (s)	3.3			10.6	8.5	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	479	864	90	353	189	49
Shared Lane Traffic (%)						
Lane Group Flow (vph)	479	864	90	353	238	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(m)	3.7			3.7	3.7	
Link Offset(m)	0.0			0.0	0.0	
Crosswalk Width(m)	1.6			1.6	1.6	
Two way Left Turn Lane						
Headway Factor	1.06	1.06	1.06	1.06	1.06	1.06
Turning Speed (k/h)		14	24		24	14
Number of Detectors	2	1	1	2	1	
Detector Template	Thru	Right	Left	Thru	Left	
Leading Detector (m)	30.5	6.1	6.1	30.5	6.1	
Trailing Detector (m)	0.0	0.0	0.0	0.0	0.0	
Detector 1 Position(m)	0.0	0.0	0.0	0.0	0.0	
Detector 1 Size(m)	1.8	6.1	6.1	1.8	6.1	
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	
Detector 1 Channel						
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0	
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0	
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0	
Detector 2 Position(m)	28.7			28.7		
Detector 2 Size(m)	1.8			1.8		
Detector 2 Type	Cl+Ex			Cl+Ex		
Detector 2 Channel						
Detector 2 Extend (s)	0.0			0.0		
Turn Type	NA	Perm	Perm	NA	Prot	
Protected Phases	2			6	8	
Permitted Phases		2	6			
Detector Phase	2	2	6	6	8	
Switch Phase						
Minimum Initial (s)	20.0	20.0	20.0	20.0	10.0	
Minimum Split (s)	38.6	38.6	26.6	26.6	22.5	
Total Split (s)	78.0	78.0	78.0	78.0	32.0	
Total Split (%)	70.9%	70.9%	70.9%	70.9%	29.1%	
Maximum Green (s)	71.4	71.4	71.4	71.4	25.3	
Yellow Time (s)	4.6	4.6	4.6	4.6	3.3	
All-Red Time (s)	2.0	2.0	2.0	2.0	3.4	
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	
Total Lost Time (s)	6.6	6.6	6.6	6.6	6.7	
Lead/Lag						

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lead-Lag Optimize?						
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Recall Mode	C-Max	C-Max	C-Max	C-Max	Max	
Walk Time (s)	7.0	7.0				
Flash Dont Walk (s)	25.0	25.0				
Pedestrian Calls (#/hr)	0	0				
Act Effct Green (s)	71.4	71.4	71.4	71.4	25.3	
Actuated g/C Ratio	0.65	0.65	0.65	0.65	0.23	
v/c Ratio	0.41	0.68	0.18	0.31	0.61	
Control Delay	6.7	2.0	8.7	9.3	43.6	
Queue Delay	0.0	0.0	0.0	0.0	0.0	
Total Delay	6.7	2.0	8.7	9.3	43.6	
LOS	A	A	A	A	D	
Approach Delay	3.7			9.2	43.6	
Approach LOS	A			A	D	
90th %ile Green (s)	71.4	71.4	71.4	71.4	25.3	
90th %ile Term Code	Coord	Coord	Coord	Coord	MaxR	
70th %ile Green (s)	71.4	71.4	71.4	71.4	25.3	
70th %ile Term Code	Coord	Coord	Coord	Coord	MaxR	
50th %ile Green (s)	71.4	71.4	71.4	71.4	25.3	
50th %ile Term Code	Coord	Coord	Coord	Coord	MaxR	
30th %ile Green (s)	71.4	71.4	71.4	71.4	25.3	
30th %ile Term Code	Coord	Coord	Coord	Coord	MaxR	
10th %ile Green (s)	71.4	71.4	71.4	71.4	25.3	
10th %ile Term Code	Coord	Coord	Coord	Coord	MaxR	
Queue Length 50th (m)	26.8	7.7	7.0	30.3	43.8	
Queue Length 95th (m)	m34.5	m6.2	14.0	44.9	69.7	
Internal Link Dist (m)	49.7			210.6	93.8	
Turn Bay Length (m)		30.0	85.0			
Base Capacity (vph)	1157	1276	508	1157	392	
Starvation Cap Reductn	0	0	0	0	0	
Spillback Cap Reductn	0	0	0	0	0	
Storage Cap Reductn	0	0	0	0	0	
Reduced v/c Ratio	0.41	0.68	0.18	0.31	0.61	

Intersection Summary			
Area Type:	Other		
Cycle Length: 110			
Actuated Cycle Length: 110			
Offset: 2 (2%), Referenced to phase 2:EBT and 6:WBTL, Start of Green			
Natural Cycle: 65			
Control Type: Actuated-Coordinated			
Maximum v/c Ratio: 0.68			
Intersection Signal Delay: 9.6		Intersection LOS: A	
Intersection Capacity Utilization 84.1%		ICU Level of Service E	
Analysis Period (min) 15			

m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 10: 416 NB Ramps & Roger Stevens

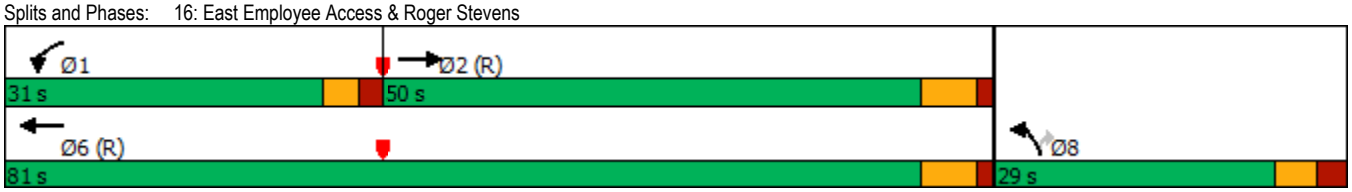


Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	569	6	630	650	7	663
Future Volume (vph)	569	6	630	650	7	663
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800
Storage Length (m)		0.0	125.0		0.0	0.0
Storage Lanes		0	2		1	1
Taper Length (m)			100.0		30.0	
Lane Util. Factor	1.00	1.00	0.97	1.00	1.00	0.95
Frt	0.999				0.853	0.850
Flt Protected			0.950		0.999	
Satd. Flow (prot)	1783	0	3288	1784	1520	1441
Flt Permitted			0.950		0.999	
Satd. Flow (perm)	1783	0	3288	1784	1520	1441
Right Turn on Red		Yes				Yes
Satd. Flow (RTOR)	1				332	331
Link Speed (k/h)	80			80	48	
Link Distance (m)	191.8			211.8	133.2	
Travel Time (s)	8.6			9.5	10.0	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Adj. Flow (vph)	569	6	630	650	7	663
Shared Lane Traffic (%)						50%
Lane Group Flow (vph)	575	0	630	650	339	331
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(m)	7.4			7.4	3.7	
Link Offset(m)	0.0			0.0	0.0	
Crosswalk Width(m)	1.6			1.6	1.6	
Two way Left Turn Lane						
Headway Factor	1.06	1.06	1.06	1.06	1.06	1.06
Turning Speed (k/h)		14	24		24	14
Number of Detectors	2		1	2	1	1
Detector Template	Thru		Left	Thru	Left	Right
Leading Detector (m)	30.5		6.1	30.5	6.1	6.1
Trailing Detector (m)	0.0		0.0	0.0	0.0	0.0
Detector 1 Position(m)	0.0		0.0	0.0	0.0	0.0
Detector 1 Size(m)	1.8		6.1	1.8	6.1	6.1
Detector 1 Type	Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel						
Detector 1 Extend (s)	0.0		0.0	0.0	0.0	0.0
Detector 1 Queue (s)	0.0		0.0	0.0	0.0	0.0
Detector 1 Delay (s)	0.0		0.0	0.0	0.0	0.0
Detector 2 Position(m)	28.7			28.7		
Detector 2 Size(m)	1.8			1.8		
Detector 2 Type	Cl+Ex			Cl+Ex		
Detector 2 Channel						
Detector 2 Extend (s)	0.0			0.0		
Turn Type	NA		Prot	NA	Prot	Perm
Protected Phases	2		1	6	8	
Permitted Phases						8
Detector Phase	2		1	6	8	8
Switch Phase						
Minimum Initial (s)	20.0		5.0	20.0	10.0	10.0
Minimum Split (s)	26.1		14.5	26.1	29.0	29.0
Total Split (s)	50.0		31.0	81.0	29.0	29.0
Total Split (%)	45.5%		28.2%	73.6%	26.4%	26.4%
Maximum Green (s)	43.9		26.0	74.9	23.0	23.0
Yellow Time (s)	4.6		3.0	4.6	3.3	3.3
All-Red Time (s)	1.5		2.0	1.5	2.7	2.7
Lost Time Adjust (s)	0.0		0.0	0.0	0.0	0.0
Total Lost Time (s)	6.1		5.0	6.1	6.0	6.0
Lead/Lag	Lag		Lead			

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lead-Lag Optimize?						
Vehicle Extension (s)	3.0		3.0	3.0	3.0	3.0
Recall Mode	C-Max		None	C-Max	None	None
Walk Time (s)	7.0			7.0	7.0	7.0
Flash Dont Walk (s)	11.0			11.0	16.0	16.0
Pedestrian Calls (#/hr)	0			0	0	0
Act Effct Green (s)	54.9		25.8	85.7	12.2	12.2
Actuated g/C Ratio	0.50		0.23	0.78	0.11	0.11
v/c Ratio	0.65		0.82	0.47	0.73	0.73
Control Delay	26.4		50.0	4.9	15.2	14.8
Queue Delay	0.0		0.0	0.0	0.0	0.0
Total Delay	26.4		50.0	4.9	15.2	14.8
LOS	C		D	A	B	B
Approach Delay	26.4			27.1	15.0	
Approach LOS	C			C	B	
90th %ile Green (s)	43.9		29.8	78.7	19.2	19.2
90th %ile Term Code	Coord		Max	Coord	Gap	Gap
70th %ile Green (s)	52.4		28.5	85.9	12.0	12.0
70th %ile Term Code	Coord		Gap	Coord	Gap	Gap
50th %ile Green (s)	56.6		26.3	87.9	10.0	10.0
50th %ile Term Code	Coord		Gap	Coord	Min	Min
30th %ile Green (s)	59.0		23.9	87.9	10.0	10.0
30th %ile Term Code	Coord		Gap	Coord	Min	Min
10th %ile Green (s)	62.5		20.4	87.9	10.0	10.0
10th %ile Term Code	Coord		Gap	Coord	Min	Min
Queue Length 50th (m)	84.8		69.4	29.4	1.4	0.0
Queue Length 95th (m)	#156.9		86.7	59.7	27.1	26.9
Internal Link Dist (m)	167.8			187.8	109.2	
Turn Bay Length (m)			125.0			
Base Capacity (vph)	889		816	1389	580	563
Starvation Cap Reductn	0		0	0	0	0
Spillback Cap Reductn	0		0	0	0	0
Storage Cap Reductn	0		0	0	0	0
Reduced v/c Ratio	0.65		0.77	0.47	0.58	0.59

Intersection Summary			
Area Type:	Other		
Cycle Length: 110			
Actuated Cycle Length: 110			
Offset: 0 (0%), Referenced to phase 2:EBT and 6:WBT, Start of Green			
Natural Cycle: 90			
Control Type: Actuated-Coordinated			
Maximum v/c Ratio: 0.82			
Intersection Signal Delay: 23.7		Intersection LOS: C	
Intersection Capacity Utilization 80.1%		ICU Level of Service D	
Analysis Period (min) 15			
# 95th percentile volume exceeds capacity, queue may be longer.			
Queue shown is maximum after two cycles.			

Splits and Phases: 16: East Employee Access & Roger Stevens



Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	246	5	15	345	5	15
Future Volume (Veh/h)	246	5	15	345	5	15
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	246	5	15	345	5	15
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (m)				351		
pX, platoon unblocked						
vC, conflicting volume			251		624	248
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			251		624	248
tC, single (s)			5.1		7.4	7.2
tC, 2 stage (s)						
tF (s)			3.1		4.4	4.2
p0 queue free %			98		98	98
cM capacity (veh/h)			905		319	601

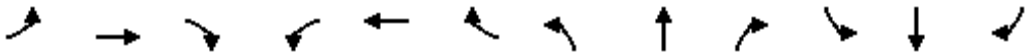
Direction, Lane #	EB 1	WB 1	WB 2	NB 1
Volume Total	251	15	345	20
Volume Left	0	15	0	5
Volume Right	5	0	0	15
cSH	1700	905	1700	492
Volume to Capacity	0.15	0.02	0.20	0.04
Queue Length 95th (m)	0.0	0.4	0.0	1.0
Control Delay (s)	0.0	9.0	0.0	12.6
Lane LOS		A		B
Approach Delay (s)	0.0	0.4		12.6
Approach LOS				B

Intersection Summary			
Average Delay	0.6		
Intersection Capacity Utilization	29.2%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	229	5	25	345	0	5
Future Volume (Veh/h)	229	5	25	345	0	5
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	229	5	25	345	0	5
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume			234		626	232
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			234		626	232
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			98		100	99
cM capacity (veh/h)			1333		439	808

Direction, Lane #	EB 1	WB 1	NB 1
Volume Total	234	370	5
Volume Left	0	25	0
Volume Right	5	0	5
cSH	1700	1333	808
Volume to Capacity	0.14	0.02	0.01
Queue Length 95th (m)	0.0	0.4	0.1
Control Delay (s)	0.0	0.7	9.5
Lane LOS		A	A
Approach Delay (s)	0.0	0.7	9.5
Approach LOS			A

Intersection Summary			
Average Delay	0.5		
Intersection Capacity Utilization	47.0%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	2	227	11	15	345	10	1	7	8	10	9	14
Future Volume (Veh/h)	2	227	11	15	345	10	1	7	8	10	9	14
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	2	227	11	15	345	10	1	7	8	10	9	14
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	355			238			635	622	232	628	622	350
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	355			238			635	622	232	628	622	350
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	100			99			100	98	99	97	98	98
cM capacity (veh/h)	1204			1329			373	398	807	382	398	693

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	240	370	16	33
Volume Left	2	15	1	10
Volume Right	11	10	8	14
cSH	1204	1329	530	478
Volume to Capacity	0.00	0.01	0.03	0.07
Queue Length 95th (m)	0.0	0.3	0.7	1.7
Control Delay (s)	0.1	0.4	12.0	13.1
Lane LOS	A	A	B	B
Approach Delay (s)	0.1	0.4	12.0	13.1
Approach LOS			B	B

Intersection Summary				
Average Delay	1.2			
Intersection Capacity Utilization	42.3%	ICU Level of Service	A	
Analysis Period (min)	15			

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (veh/h)	248	13	310	347	14	327
Future Volume (Veh/h)	248	13	310	347	14	327
Sign Control	Free			Free	Stop	
Grade	0%			0%	0%	
Peak Hour Factor	1.00	1.00	1.00	1.00	1.00	1.00
Hourly flow rate (vph)	248	13	310	347	14	327
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None			None		
Median storage veh)						
Upstream signal (m)				192		
pX, platoon unblocked						
vC, conflicting volume			261		1222	254
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol			261		1222	254
tC, single (s)			4.1		6.4	6.2
tC, 2 stage (s)						
tF (s)			2.2		3.5	3.3
p0 queue free %			76		91	58
cM capacity (veh/h)			1303		151	784

Direction, Lane #	EB 1	WB 1	WB 2	NB 1
Volume Total	261	310	347	341
Volume Left	0	310	0	14
Volume Right	13	0	0	327
cSH	1700	1303	1700	669
Volume to Capacity	0.15	0.24	0.20	0.51
Queue Length 95th (m)	0.0	7.1	0.0	22.1
Control Delay (s)	0.0	8.6	0.0	15.8
Lane LOS		A		C
Approach Delay (s)	0.0	4.1		15.8
Approach LOS				C

Intersection Summary			
Average Delay	6.4		
Intersection Capacity Utilization	64.9%	ICU Level of Service	C
Analysis Period (min)	15		