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Halifax, Nova Scotia
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Item No. 12.1.1
Transportation Standing Committee
March 24, 2022

TO: Chair and Members of Transportation Standing Committee

SUBMITTED BY: Original Signed

Jacques Dubé, Chief Administrative Officer

DATE: February 2, 2022

SUBJECT: **Bayers Road Interim Outbound Bus Lane**

INFORMATION REPORT

ORIGIN

At the August 17, 2021 meeting of Regional Council, the following motions were put and passed:

"That Halifax Regional Council:

6. *Approve an increase to the Design Services component of RFP No. 18-302 Consulting Services - to WSP Canada Inc. (P.O. No. 2070796457) in the amount of $52,042.89[1] (net HST included) with funding from Project Account No. CT200002 – Major Strategic Multi-Modal Corridor*

7. *Approve the construction budget for Bayers Road Interim Transit Priority Measures between Windsor Street and Connaught Avenue in the amount of $100,000.00 based on the Engineer's Estimate with funding from Project Account No. CT200002 – Major Strategic Multi-Modal Corridor"*

LEGISLATIVE AUTHORITY

Halifax Regional Municipality Charter, subsection 318(2): "In so far as is consistent with their use by the public, the Council has full control over the streets in the Municipality."

Halifax Regional Municipality Charter, subsection 321(2): "The Council may, by policy, appoint a traffic authority for all or part of the Municipality."

Halifax Regional Municipality Charter, subsection 321(8): "The traffic authority for the Municipality has, with respect to highways in the Municipality, excluding those for which the Provincial Traffic Authority has authority, the powers conferred upon a traffic authority by or pursuant to the Motor Vehicle Act."

Halifax Regional Municipality Charter, subsection 322(1): "The Council may design, lay out, open, expand, construct, maintain, improve, alter, repair, light, water, clean, and clear streets in the Municipality."

[1] The portion of this cost associated with the interim design for phase 2 was $25,810.79 (net HST included).

Nova Scotia Motor Vehicle Act, subsection 90 (5) which states that "The traffic authority may (c) exclude from traffic on specified streets or specified portions of streets vehicles other than public transit vehicles or vehicles specified by the traffic authority".

BACKGROUND

Bayers Road is an important corridor for HRM's current and future transit plans and has been identified in key municipal plans and strategies including the *Moving Forward Together Plan* (2016), *Integrated Mobility Plan* (2017) and *Rapid Transit Strategy* (2020) for transit priority improvements that give buses an advantage over general traffic (e.g., dedicated bus lanes, queue jump lanes, transit signal priority).

In February 2018, Regional Council directed staff to proceed to detailed design for transit priority lanes in both directions on Bayers Road between Romans Avenue and Windsor Street. In July 2018, RFP 18-302 was awarded to WSP Canada Inc. to prepare the detailed design for the Bayers Road transit priority corridor.

Due to the size and complexity of the project, the detailed design was separated into two (2) phases for implementation and tendering, as shown in Figure 1.

Phase 1 includes Bayers Road between Romans Avenue and Connaught Avenue, and Phase 2 includes Bayers Road between Connaught Avenue and Windsor Street. WSP Canada Inc. completed the detailed design for Phase 1 in March 2019, and construction was completed in September 2021.

Detailed design for Phase 2 was completed in September 2020. Construction, which was originally scheduled to take place during 2022, was delayed to 2023 due to right of way acquisition negotiation challenges. The land acquisition process remains in progress with 6 of the 27 remaining parcels acquired at the time of this report. The real estate team continues to manage the challenges and regularly communicates the risk management plan with the Project Team, and tendering is planned to occur in fall / winter 2022.

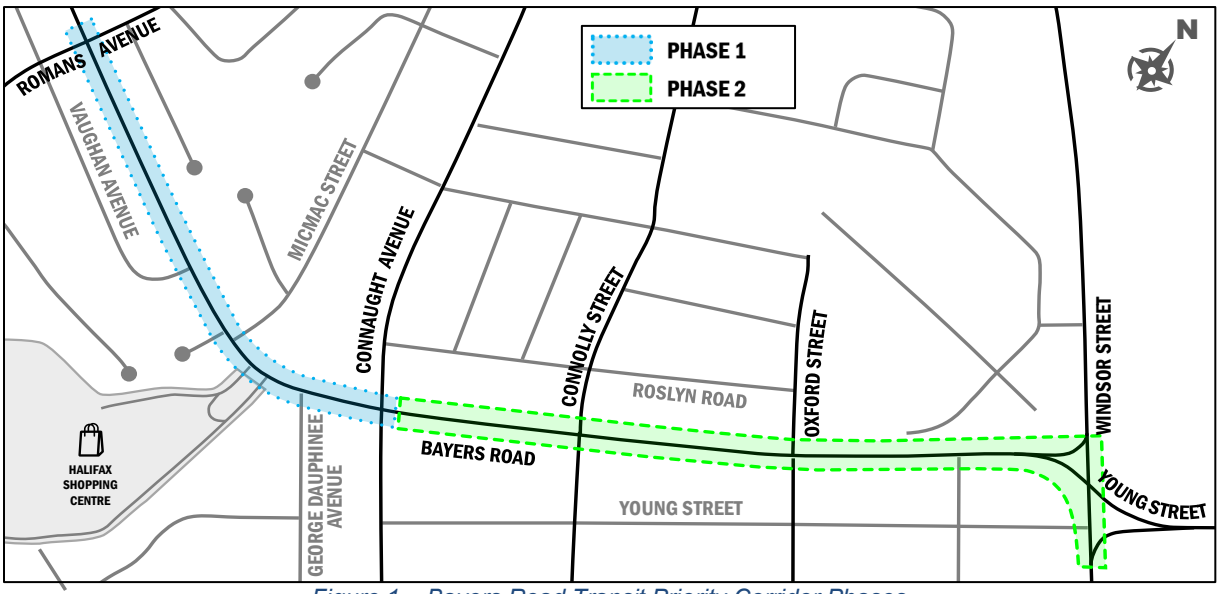


Figure 1 – Bayers Road Transit Priority Corridor Phases

Since Phase 2 construction is now delayed until 2023, staff have explored options to provide an interim solution to address transit operational challenges on Bayers Road and further leverage the recent investments in transit priority measures that have been made on Bayers Road, Young Street, and Robie Street. Specifically, this includes reconfiguring the roadway within the existing curbs to include an outbound bus lane between Windsor Street and Connaught Avenue to allow buses to reduce delay and eliminate the interim routing that currently diverts outbound buses on Route 1 to a parallel local street (Roslyn Road) during the weekday afternoon peak period.

On August 17, 2021, Regional Council approved a budget increase for the Bayers Road project of $692,875 (net HST included) for design and construction costs beyond the original project budget. This budget increase included fees for the design and tendering of the interim outbound bus lane ($25,810.79 – net HST included) and a construction budget of $100,000. A summary of the project timeline to date is provided in Figure 2.

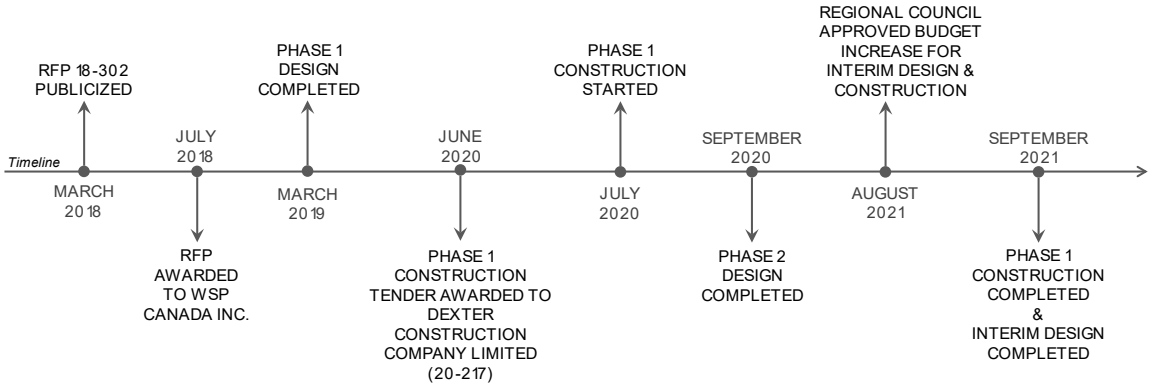
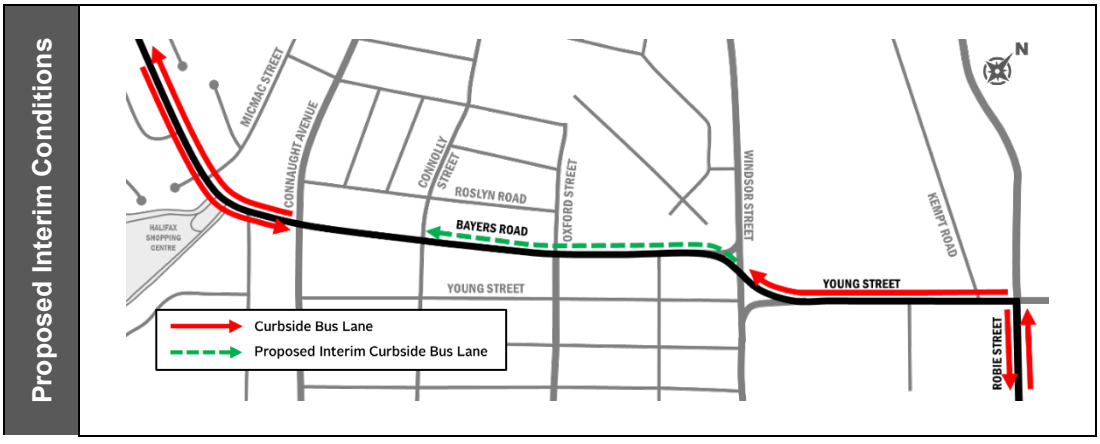


Figure 2 - Bayers Road Transit Priority Corridor Project Timeline

DISCUSSION

Due to congestion during the weekday afternoon peak period on Bayers Road, Halifax Transit currently reroutes outbound Route 1 buses to Roslyn Road between Oxford Street and Connaught Avenue to avoid significant delays. This is not an ideal situation due to the indirectness of the route and given that Roslyn Road is not generally suitable for a high-volume transit service. To address this concern, staff have considered an interim outbound bus lane on Bayers Road between Windsor Street and Connaught Avenue to bridge the gap between the completion of Phase 1 construction (completed 2021) and Phase 2 construction (anticipated 2023), as illustrated in Figure 3. It should be noted that this proposed interim outbound bus lane would likely need to be removed to facilitate Phase 2 construction.



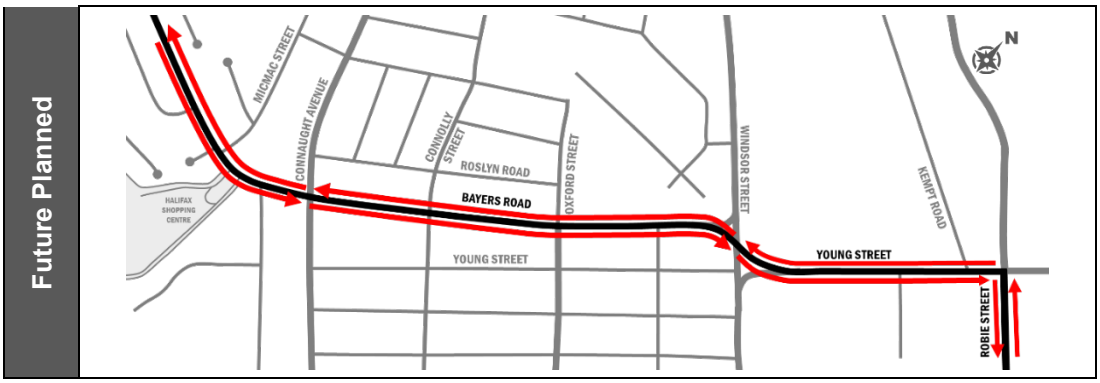


Figure 3 – Proposed / Future Planned Transit Network

Proposed Interim Bus Lane Configuration

The proposed interim bus lane configuration for Bayers Road will repurpose the existing outbound (westbound) mixed traffic curb lane as a peak period bus lane between Windsor Street and Connolly Street. Existing and proposed typical street cross sections are illustrated in Figures 4 and Figure 5, respectively. A schematic diagram showing existing conditions, the proposed interim design, and the full-build out configuration is provided in Figure 6. Further details on the proposed configuration include:

- The lane will be designated as a peak period bus lane, with the operational period designated as weekdays between 3:00-6:00PM. During these periods, the lane will not permit general purpose traffic, however, vehicles will be permitted to enter the lane to make right turns at intersections and driveways. On-street parking and loading will also not be permitted in the lane during these periods
- When the bus lane is not operational (any time other than weekdays between 3:00-6:00PM), on-street parking and loading will be permitted where indicated by regulatory signage. Since on-street parking is currently prohibited in the outbound curb lane on weekdays between 4:00-6:00PM, the net change of the proposed interim bus lane is a one-hour extension (3:00-4:00PM) of the existing parking restriction during weekday afternoon periods.
- The proposed configuration can be implemented within existing curbs, and changes to the street are limited to pavement markings and signage. The existing centerline of the roadway and the inbound (eastbound) mid-block lane configuration and on-street parking controls will remain intact.
- The bus lane will terminate at Connolly Street, where it will transition back to a general-purpose traffic lane between Connolly Street and Connaught Avenue. Extension of the bus lane to Connaught Avenue was considered as an option; however, the anticipated impacts to traffic operation were deemed unacceptable due to the current configuration of the westbound approach at Connaught Avenue, which is limited to two lanes. Further detail on additional options considered is provided in Attachment A.
- At the Bayers Road – Oxford Street intersection, left turn restrictions will be implemented in both directions on Bayers Road during the afternoon peak period (3:00-6:00PM) to reduce potential traffic delays and mitigate the potential for collisions that could occur from vehicles merging into the curb lane to bypass vehicles waiting to make a left turn.

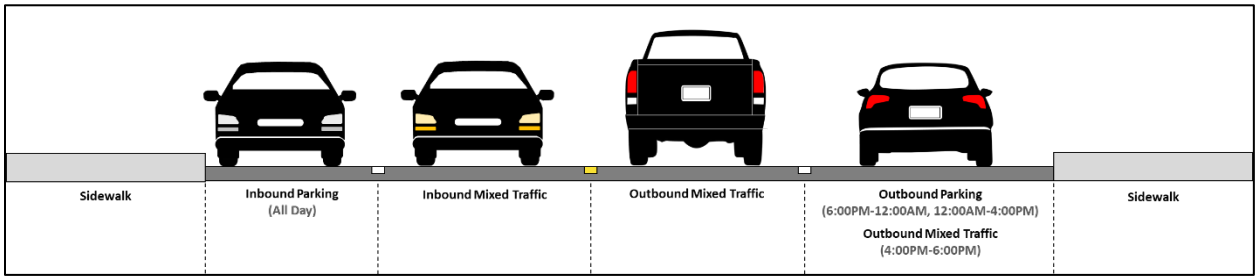


Figure 4 – Bayers Road Existing Cross Section (Oxford Street to Connolly Street)

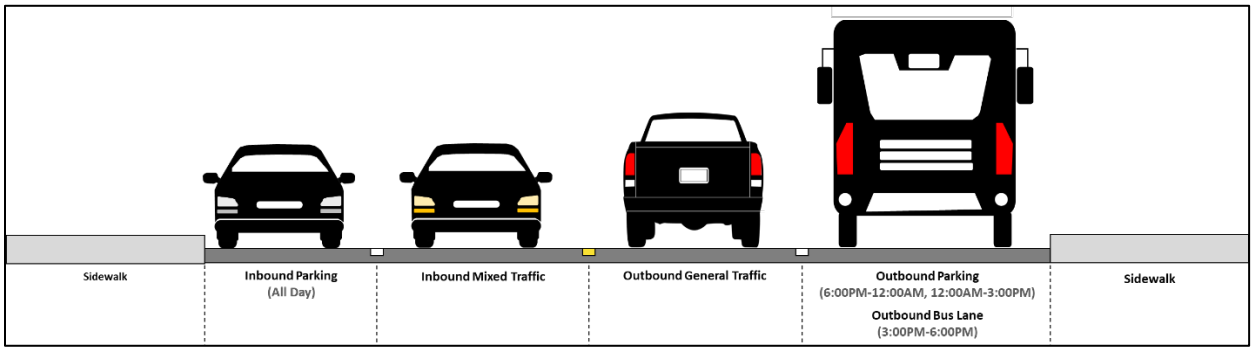


Figure 5 – Bayers Road Proposed Interim Cross Section (Oxford Street to Connolly Street)

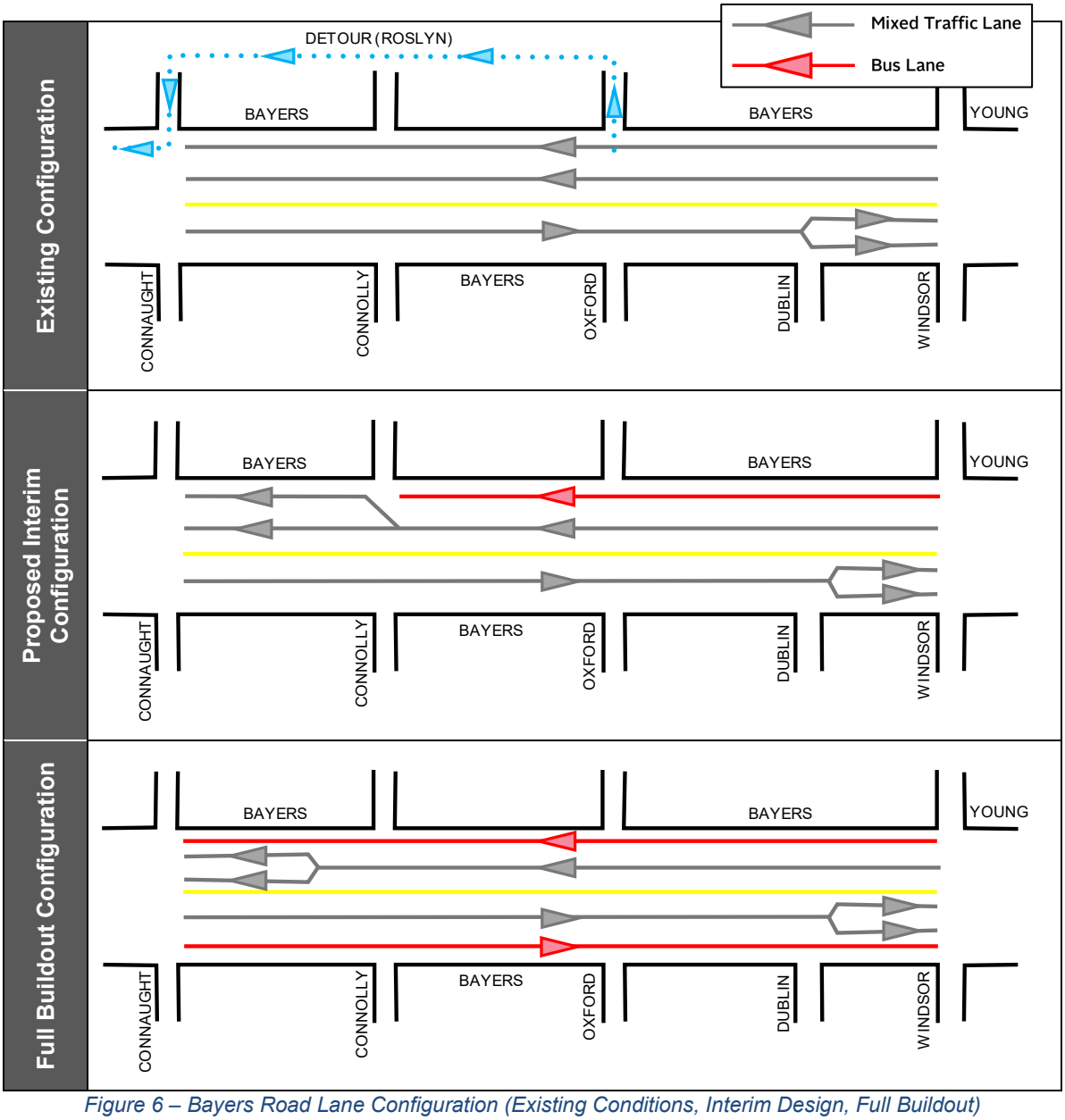


Figure 6 – Bayers Road Lane Configuration (Existing Conditions, Interim Design, Full Buildout)

Impacts of Proposed Interim Configuration

Staff have reviewed the potential implications of the interim configuration in terms of anticipated transit improvements and impacts to traffic operation and on-street parking on the corridor. The results of the operational review, detailed in the attached memorandum (Attachment A), are summarized below:

Transit Operation	Anticipated implications for transit operations are summarized as follows: • The proposed bus lane will allow buses to bypass traffic congestion between Connolly Street and Windsor Street during the weekday afternoon peak period, reducing travel time and improving schedule adherence. • Eliminates the need for Route 1 buses to detour off Bayers Road to Roslyn Road, allowing them to stay on their regular routing on Bayers Road.
Traffic Impacts	The traffic impacts of the proposed configuration are primarily focused on outbound (westbound) traffic, as vehicle throughput capacity is effectively reduced by half between Windsor Street and Connolly Street. With the westbound curb lane designated for buses during the afternoon peak period, general purpose through traffic will be reduced to a single lane. Right turning vehicles will be permitted to enter the curb lane to make right turns at intersections and driveways. Intersection impacts are summarized as follows: • Bayers Road @ Oxford Street: The proposed design would modify the Bayers Road westbound approach at Oxford Street from a through-left / through-right configuration to through-left / *'Right-Turn Only (Except Buses)*'. With the westbound approach reduced to a single lane for through traffic, it is proposed that left turn restrictions be implemented during the afternoon peak period (3:00-6:00PM) in both the eastbound and westbound directions. o Prohibiting eastbound/westbound left turns prevents through traffic from weaving into the *'Right-Turns Only Except for Buses'* lane, thus improving safety for all road users. Restricting eastbound and westbound left turns during peak periods marginally improves operations for eastbound/westbound through movements and has a negligible impact on intersection performance. These traffic movements would likely divert to alternate routes; however, the anticipated impact would be minimal as traffic volumes are relatively low (peak hour volume of 50 vehicles) o The proposed changes are expected to have a minimal impact on the overall intersection performance during the AM peak; however, operations during the PM peak will worsen, as the delays for outbound vehicles are expected to more than double (13 seconds → 28 seconds) and the 95th percentile queue lengths (the length of queued vehicles that would be exceeded only 5% of the time) are expected to exceed three times the existing length (66m → 214m). For context, this queue length could extend past Dublin Street and within 100m of Windsor Street. • Bayers Road @ Connolly Street: The proposed design would modify the Bayers Road westbound approach at Connolly Street from a through-left / through-right configuration to through-left / *'Right-Turn Only (Except Buses)*'. The outbound bus lane would extend from Windsor Street and terminate immediately east of Connolly Street; therefore, buses would be required to travel with mixed traffic between Connolly Street and Connaught Avenue. o The proposed changes are expected to have minimal impact on the overall intersection performance during the AM peak; however, operations during the PM peak will worsen, as the westbound volume-to-capacity (v/c) ratio – which represents the relationship between traffic demand and lane capacity (a higher v/c ratio indicates more congested conditions, and the theoretical capacity is reached at a v/c ratio of 1.0) – is expected to increase by double (0.45 → 0.90). With a v/c ratio of 0.9, this indicates that 90% of available lane capacity will be used. o If eastbound/westbound left turns are restricted at Bayers/Oxford, there is potential for vehicles to reroute to this intersection (up to approximately 50 vehicles during the peak hour). Results indicate that this could increase the v/c ratio from 0.90 → 0.95. With increased numbers of left turns being from the through lane, there is potential that some drivers may shift into the curb lane to bypass left turning vehicles that are waiting for a gap in traffic.

	• Bayers Road @ Connaught Avenue: No traffic impacts, as the proposed interim configuration does not change existing lane configurations at the intersection.
On-Street Parking	• Since the Interim Design maintains existing curb lines and retains the existing centerline and inbound (eastbound) lanes and curb access controls, there are no impacts to parking on the south side of Bayers Road relative to existing conditions. • The overall impact to on-street parking is minimal – 12 of the approximately 48 on-street parking spaces on this segment would be impacted, and the impact would be limited to a one-hour extension of the existing no-stopping restriction during weekday afternoon period. This may require additional support from compliance. • When not operational, the bus lane would be designated for curb access including parking and loading. It is expected that this will achieve an effective balance that provides transit priority when it is needed the most and accommodate other needs of the street when transit priority is not required.

Alternate Options Considered

An alternative interim configuration was considered that involves extending the interim bus lane to Connaught Avenue. Ultimately, reducing the westbound approach to one through lane significantly impacts operations of the westbound approach and the overall intersection performance during both peak periods. Operational analysis indicates that westbound delays would be expected to exceed five times the existing delay during the PM peak (101 seconds → 513 seconds). During the PM peak, results indicate that westbound 95th percentile queue lengths would increase by approximately 2.5 times compared to existing conditions (166m → 416m).

Overview of Advantages and Disadvantages

The following is a summary of the relevant advantages and disadvantages associated with the addition of an interim outbound bus lane on Bayers Road between Windsor Street and Connolly Street.

Advantages:

- Buses are expected to experience travel time savings during the afternoon peak period compared to existing conditions, improving service reliability.
- Enables buses that currently detour off Bayers Road onto Roslyn Road (to avoid delays during congested periods) to return to their regular routing on Bayers Road.
- Capacity for westbound traffic is maintained at the Bayers Road/Connaught Avenue intersection, avoiding substantial impacts to general purpose traffic.
- Provides high visibility transit priority that could help to encourage mode shift to transit, and with commuting soon likely to return to a post-COVID 'new normal', this is an opportune time to try to influence behaviors as people re-establish commuting patterns.

Disadvantages:

- Capacity for westbound traffic will be reduced to one lane between Windsor Street and Connolly Street, which will be expected to increase traffic congestion during the weekday afternoon peak period. Traffic modeling indicates that vehicle queueing will increase considerably during peak periods, with 95th percentile queues potentially extending more than 200m (more than three times existing conditions). There is potential that congestion could result in the diversion of traffic to alternate routes, including local streets in the immediate area.
- Eastbound / westbound left-turn restrictions implemented at the Bayers Road – Oxford Street intersection during peak periods will impact neighbourhood access for local residents and will likely result in traffic diversion to nearby intersections and streets.
- Retains a gap in outbound transit priority between Connolly Street and Connaught Avenue, which will continue to expose transit to congestion during peak periods that will result in delays and schedule variability.
- A one-hour extension of the existing parking restriction during weekday afternoon periods for 12 of the existing 48 on-street parking spaces on the north side of Bayers Road.
- Additional enforcement burden for Halifax Regional Police and HRM Parking Services.

- The interim design will only be in place until construction of Phase 2 begins, which is targeted for 2023.

It should be noted that most of the advantages and disadvantages identified for the interim configuration are consistent with those that apply to the full buildout of the Bayers Road project, which Regional Council considered and endorsed when approving the overall Bayers Road project.

Next Steps
Construction is targeted for May 2022, with the goal of completion prior to planned Halifax Transit service changes on May 30, 2022. Staff will be communicating these changes to local residents over the coming weeks. Following implementation, traffic data will be collected at key intersections to monitor the impacts of the changes.

FINANCIAL IMPLICATIONS

On August 17, 2021, Regional Council approved an increase in budget to the Bayers Road project that allowed for a construction budget of $100,000.

RISK CONSIDERATION

There are risks associated with this approach that should be noted:

- There is potential that traffic congestion during peak periods could be worse than indicated by the traffic modeling presented in the traffic impact analysis. Analysis results for the interim design remain relatively good, largely because throughput traffic capacity at the critical westbound approach to Connaught Avenue is retained; however, if queues extend east of Connolly Street (as they sometimes do on busy traffic days), traffic capacity on that section would be halved and queues could grow considerably.

- If the changes increase congestion significantly, there is potential for negative public perception of the project and transit priority infrastructure in general, particularly due to the high-profile nature of the Bayers Road corridor. Although congestion related to the introduction of transit priority infrastructure on Bayers Road is a real possibility even for the full buildout of Phase 2, staff have yet to initiate the communications efforts likely to accompany full buildout that would aim to rationalize the changes based on their origins in the IMP and their integral part of the overall transit priority network.

COMMUNITY ENGAGEMENT

Community consultation was completed during both the functional design phase (2017-18) and detailed design phase (2019-20), including the following:

- September 28, 2017: Staff held a public open house wherein functional designs were presented along with an overview of project benefits and impacts.

- December 12, 2019: Staff held a community meeting with residents of the Westmount subdivision and of Micmac Street to discuss the proposed changes and solicit feedback from residents on how they would be impacted. The Transportation Standing Committee subsequently received correspondence from residents of these communities and representatives from the Anglican Church of the Apostles expressing concerns in February 2020.

- January 29, 2020: Staff held a public open house that allowed residents to view the detailed design drawings and learn about key features of the project.

- Residents on the section of Bayers Road between Connaught Avenue and Windsor Street were invited to provide feedback related to on-street parking by completing a survey. A total of 24 completed surveys were received, in addition to a letter from the St. Catherine of Siena Church.

ATTACHMENTS

Attachment A: *Traffic Impact Assessment – Bayers Road Interim Outbound Transit Lane* (HRM Transportation Planning, January 2022)

A copy of this report can be obtained online at halifax.ca or by contacting the Office of the Municipal Clerk at 902.490.4210.

Report Prepared by: Hannah McBride, MScE, EIT, Program Engineer-in-Training, Planning & Development, 902.237.0418

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MEMORANDUM

TO: Roddy MacIntyre, P. Eng. – Acting Director, Traffic Management
Victoria Horne – Director, Parking Services
Patricia Hughes – Director, Planning & Customer Engagement (Halifax Transit)

FROM: Hannah McBride, MScE, EIT, Program Engineer-in-Training – Planning & Development
Mike Connors, MScE, P. Eng. – Program Manager – Planning & Development

DATE: January 14, 2022

SUBJECT: Traffic Assessment – Bayers Road Interim Outbound Transit Lane

An interim design solution is being considered for the Bayers Road transit priority corridor that would add an outbound (westbound) transit priority lane (TPL) on Bayers Road, helping to bridge the gap between the completion of Phase 1 construction (completed 2021) and Phase 2 construction (anticipated 2023). This memorandum outlines the potential implications of interim designs on traffic operations and parking and provides recommendations for consideration.

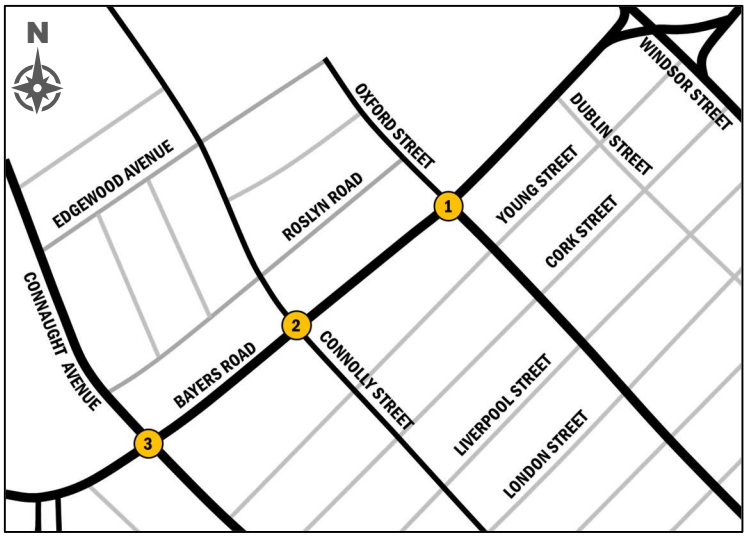

Figure 1 –Study Area

Background Information

The *Moving Forward Together Plan* (2016), *Integrated Mobility Plan* (2017) and *Rapid Transit Strategy* (2020) recommended that transit priority improvements should be pursued on Bayers Road, where transit should be prioritized using features that give buses an advantage over general traffic (i.e., queue jump lanes, dedicated bus lanes, signal priority, etc.).The *Moving Forward Together Plan* (MFTP) identifies Bayers Road as a critical transit corridor and recognizes the urgent need for Transit Priority Measures (TPMs) on the corridor to provide reliable service to transit users. The *Integrated Mobility Plan* (IMP) Action Item #91 prioritizes the delivery of a transit priority corridor (TPC) on Bayers Road between Romans Avenue and Windsor Street.

Traffic congestion occurs regularly on Bayers Road and has a significant impact on travel time for buses that impacts service reliability. A TPC allows buses to move more freely through congested traffic conditions, improving transit travel time and reliability allowing people to travel more conveniently and efficiently.

Planning & Development
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HRM has been planning for potential road widening on the Bayers Road corridor for several years. Road widening plans for Bayers Road were originally aimed at adding a general purpose traffic lane in both directions to increase vehicular traffic capacity. Over the past several years, HRM has been strategically acquiring and preserving some of the lands necessary to complete road widening. These efforts have been focused on the section of Bayers Road between Romans Avenue and Connaught Avenue, and the majority of properties required have been acquired to date. Corridor widening required for the addition of bus lanes on Bayers Road is very similar to that envisioned as part of original widening project; however, the additional roadway space is allocated to transit priority rather than general purpose traffic.

In February 2018, Regional Council approved staff's recommendation to proceed to detailed design for transit priority lanes in both directions on Bayers Road between Romans Avenue and Windsor Street. In July 2018, RFP 18-302 was awarded to WSP Canada Inc. to prepare the detailed design for the Bayers Road TPC (contract value of $114,324 with net HST included). Due to the size and complexity of the project, the detailed design was divided separated into two (2) phases for implementation and tendering, as shown in Figure 2.

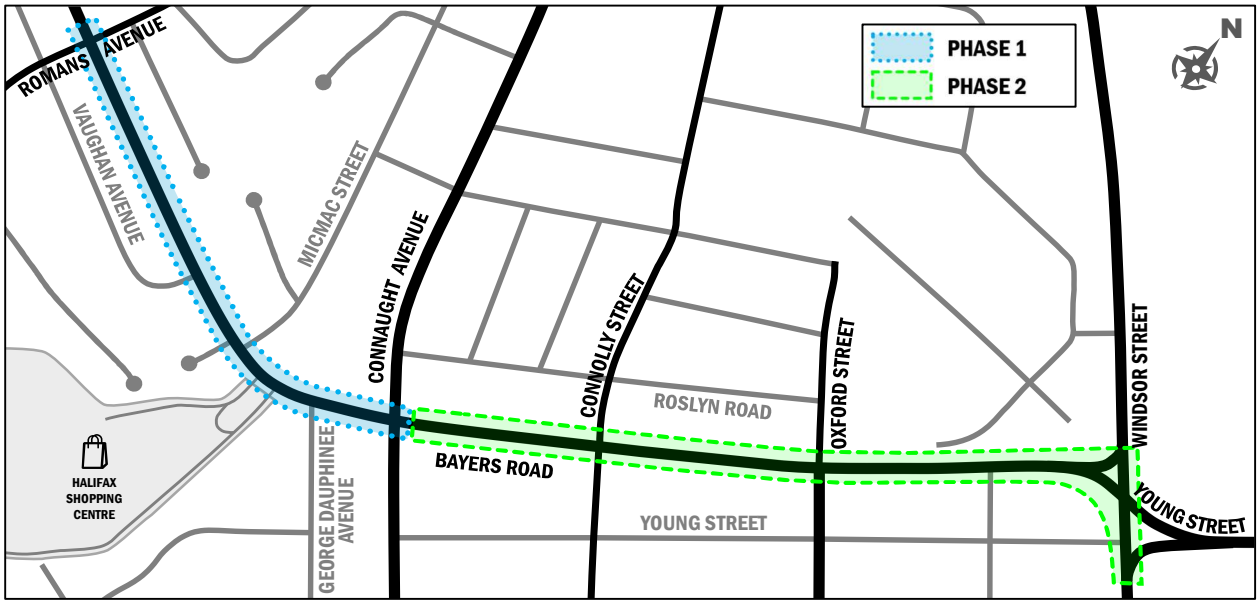

Figure 2 – Bayers Road Transit Priority Corridor Phases

Phase 1 includes Bayers Road between Romans Avenue and Connaught Avenue, and Phase 2 includes Bayers Road between Connaught Avenue and Windsor Street. WSP Canada Inc. completed the detailed design for Phase 1 (March 2019) and Phase 2 (September 2020).

Dexter Construction Company Limited completed the construction of Phase 1 in September 2021. Originally, the tender of Phase 2 construction was planned for Fall/Winter 2021 with construction in 2022. However, due to the status of the land acquisition schedule, it is expected that the Phase 2 construction will be tendered in Fall/Winter 2022 and construction would take place in 2023 at the earliest.

On August 17th, 2021, Regional Council approved an increase in budget to the Bayers Road project that allowed for design of the interim outbound bus lane (contract value of $52,042.89 with net HST included) and a construction budget of $100,000.

Transit Connectivity

Ultimately, it is envisioned that bus lanes on Bayers Road will connect to transit priority measures (TPMs) that are currently operational on Young Street and Robie Street. The resulting continuous TPC across the Halifax peninsula will provide significant potential for moving people more efficiently and conveniently by transit. Due to the delay of Phase 2 construction, there is a gap in TPMs between Phase 1 and Young / Robie Street (approximately 800 m), as shown in Figure 3. As a result, outbound congestion occurs daily during the afternoon peak within the Phase 2 boundaries and a bottle neck occurs at the Bayers Road / Windsor Street intersection. An interim outbound bus lane will reduce transit delays during the afternoon peak period and improve service reliability, making transit a more attractive alternative. In addition, an outbound bus lane will allow buses to stay on Bayers Road and avoid detouring onto local streets.

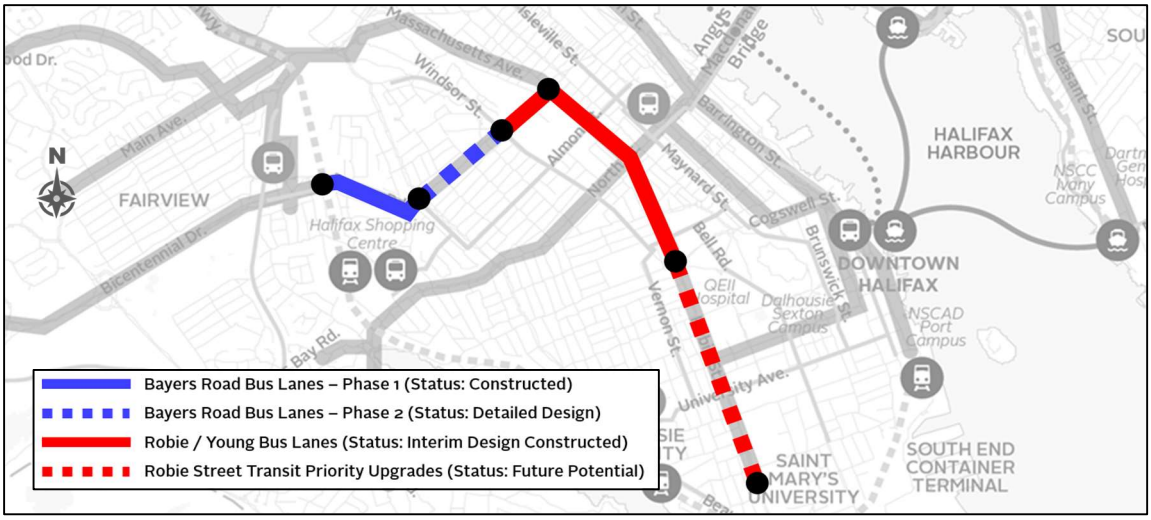

Figure 3 – Proposed IMP Transit Priority Corridors (Source: IMP, Figure 20)

Bayers Road Transit Services (Existing Conditions and Future Planned)

Bayers Road is a significant connection for Halifax Transit. Existing transit routes on Bayers Road are shown in Figure 4. Transit Routes 1 (Spring Garden), 8 (Sackville), 28 (Bayers Lake), 29 (Barrington) and 330 (Tantallon MetroX) currently operate on Bayers Road. Since traffic congestion on Bayers Road occurs daily during the afternoon peak period, Halifax Transit has rerouted Route 1 outbound buses onto Roslyn Road to reduce delays. Currently, Route 330 bypasses the most congested section of Bayers Road, however, Route 330 is planned to be rerouted to the outbound transit priority lane (TPL) on Bayers Road upon completion of Phase 2.

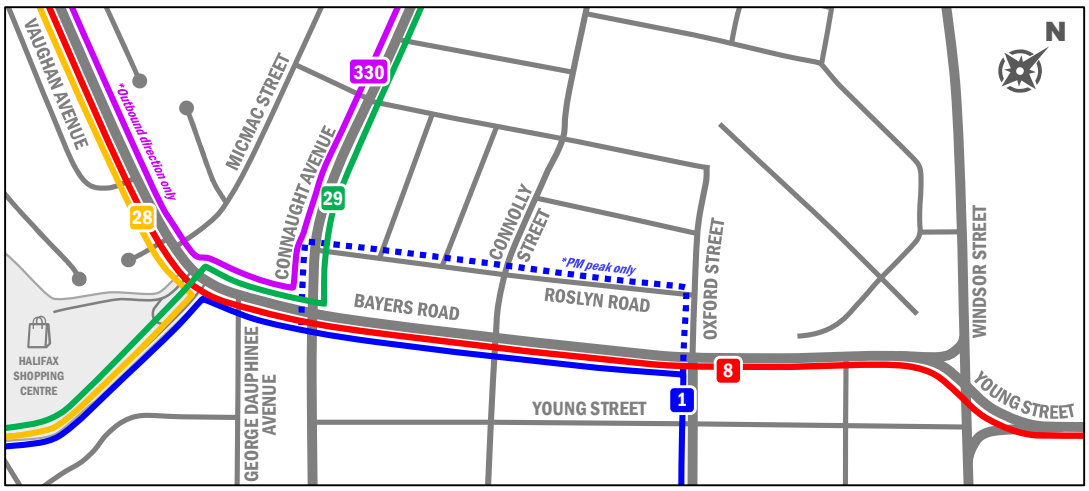

Figure 4 – Existing Transit Routes in the Study Area

Existing conditions indicate that there are approximately 15 two-way buses per hour (bph) during the afternoon peak hour on Bayers Road between Romans Avenue and Connaught Avenue (4 bph inbound, 11 bph outbound). Between Connaught Avenue and Windsor Street, there are 23 two-way bph (8 bph inbound, 15 bph outbound).

It is anticipated that Bedford Express routes will be relocated to Bayers Road. The Rapid Transit Strategy indicates that the bus rapid transit (BRT) Purple Line will use the full length of Bayers Road, where as the BRT Yellow Line will use Bayers Road only between the Halifax Shopping Centre (HSC) and Connaught Avenue.

Transit volumes on Bayers Road are expected to nearly double with implementation of the MFTP and the BRT Purple Line. Existing and future transit volumes on Bayers Road are summarized in Table 1.

Table 1 – Existing & Future Transit Volumes on Bayers Road (Afternoon Peak)[1] [2]

	Direction	Between Romans-Connaught	Between Connaught-Windsor
Existing Conditions	Inbound	4	8
	Outbound	11	15
	Total	**15**	**23**
Future Conditions: Planned for November 2022[3]	Inbound	4	8
	Outbound	18	22
	Total	**22**	**30**
Future Conditions: Including MFTP Services	Inbound	4	14
	Outbound	18	28
	Total	**22**	**42**
Future Conditions: Including MFTP & BRT Services[4]	Inbound	10	12
	Outbound	24	26
	Total	**34**	**38**

[1] Transit volumes for Route 29 are not included in the scenarios
[2] Transit volumes for Route 330 are included in all the scenarios (outbound direction only) since it will be rerouted to Bayers Road
[3] Transit volumes include Bedford Express routes
[4] Future transit volumes consider the Purple BRT Line and do not consider the Yellow BRT Line

Proposed Interim Outbound Bus Lane

Staff have considered an interim outbound bus lane on Bayers Road to provide a short-term solution to transit operation on the corridor to bridge the gap between the completion of Phase 1 construction (completed 2021) and Phase 2 construction (anticipated 2023).

Currently, congestion during the weekday afternoon peak period has resulted in Halifax Transit rerouting outbound buses onto Roslyn Road between Oxford Street and Connaught Avenue to avoid significant delays, as shown in Figure 5, Box A. This is not an ideal situation given that Roslyn Road is a local street and is not generally suitable for a high-volume transit service.

WSP Canada Inc. completed one design option for the interim configuration in September 2021, which is included in **Appendix A**. The Consultant Interim Design (Interim Design Option #1) considers an outbound TPL between Windsor Street and Connolly Street, leaving a gap in the outbound transit lane network between Connolly Street and Connaught Avenue, see Figure 5, Box B. An alternative interim configuration is available for consideration that involves extending the interim bus lane to Connaught avenue (Interim Design Option #2), see Figure 5, Box C.

Both interim configurations repurpose the existing westbound curb lane to add an outbound bus lane on Bayers Road within the Phase 2 boundaries. This change will provide high visibility transit priority that could help to encourage mode shift to transit, and with commuting soon likely to return to a post-COVID ‘new normal’, this is an opportune time to try to influence behaviors as people re-establish commuting patterns.

In summary, there are two interim designs options available for consideration:

> **Interim Design Option #1:** An outbound bus lane extends from Windsor Street and terminates east of Connolly Street, as shown in Attachment A (WSP, September 2021).
>
> **Interim Design Option #2:** An outbound bus lane extends from Windsor Street and terminates east of Connaught Avenue.

Ultimately, the proposed final (Phase 2) design consists of an inbound and outbound transit priority lane between Romans Avenue and Windsor Street, as shown in Figure 5, Box D.

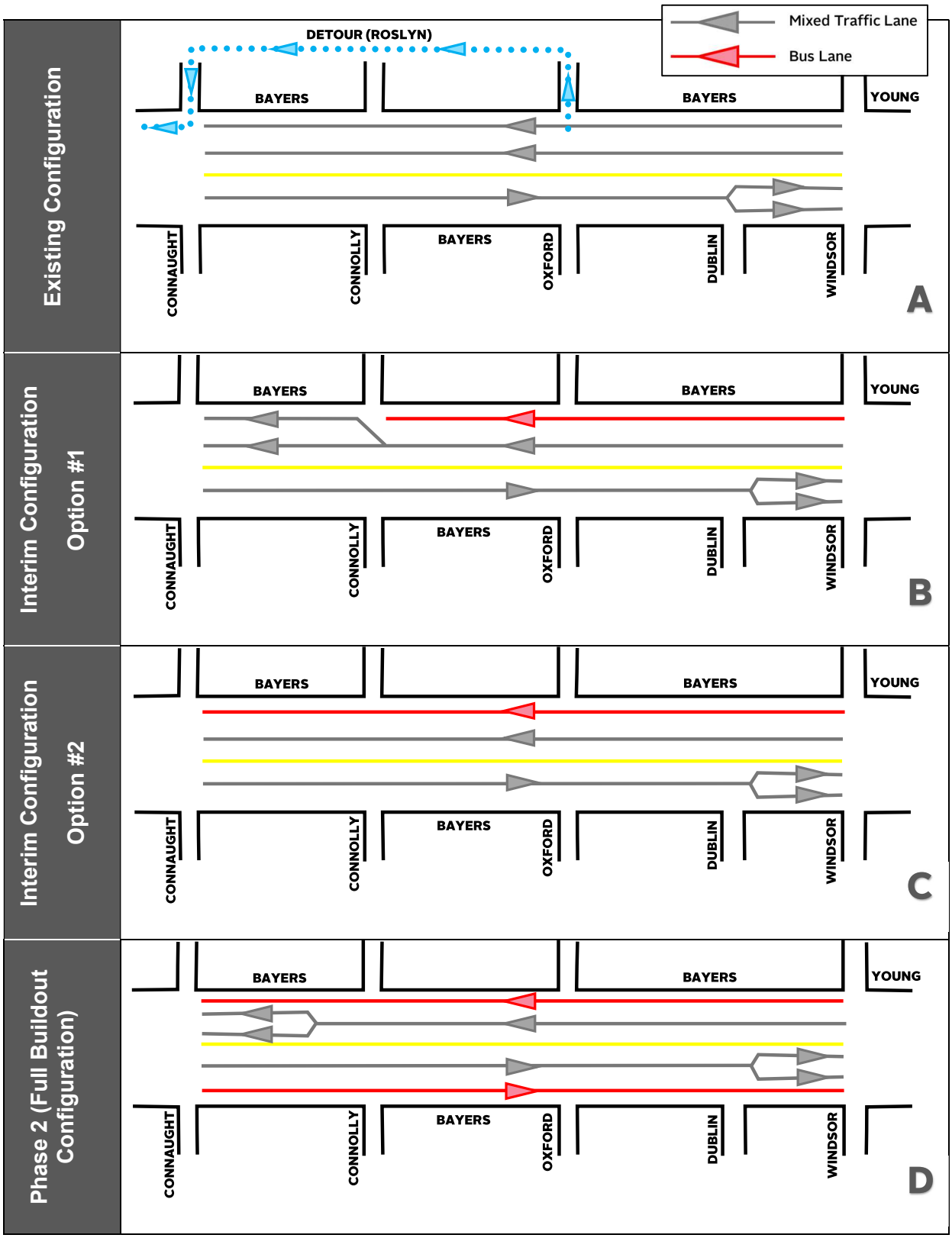

Figure 5 – Bayers Road Lane Configuration (Existing Conditions, Interim Options and Phase 2 Conditions)

Existing Conditions

Bayers Road at Oxford Street

The Bayers Road / Oxford Street intersection is a 4-leg signalized intersection with two lanes on each approach. The northbound, westbound, and southbound approaches include an exclusive left-turn lane, and the eastbound approach consists of shared left/through and through/right lanes, as shown in Photo 1.

Projected AM and PM peak hour traffic volumes at the Bayers Road / Oxford Street intersection are illustrated in Figure 6. It should be noted that 2022 traffic volumes were projected based on October 2021 data, an annual growth rate of 1% and design factor of 5% to account for potential impacts of the COVID-19 pandemic. The 2022 volume projections indicate 1,510 vph during the AM peak and 1,755 vph during the PM peak.

Photo 1 – Bayers Road at Oxford Street Existing Conditions

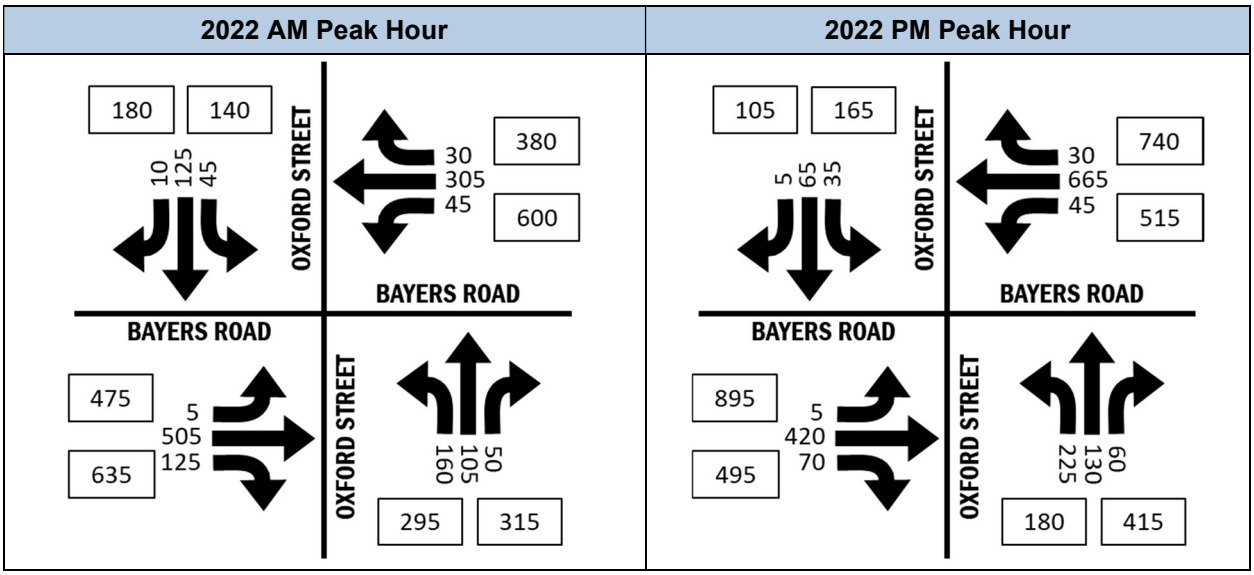

Figure 6 – Existing Traffic Volumes: Bayers Road @ Oxford Street

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Bayers Road at Connolly Street

The Bayers Road / Connolly Street intersection is a 4-leg intersection with stop control on the Connolly Street approaches and an enhanced pedestrian crossing on the north leg. The northbound, westbound, and southbound approaches consist of one share lane and the eastbound approach consists of shared left/through and through/right lanes as shown in Photo 2.

Projected AM and PM peak hour traffic volumes at the Bayers Road / Connolly Street intersection are illustrated in Figure 7. It should be noted that 2022 traffic volumes were deduced based on data from the surrounding intersections. 2022 volume projections indicate approximately 1,185 vph during the AM peak and 1,395 vph during the PM peak.

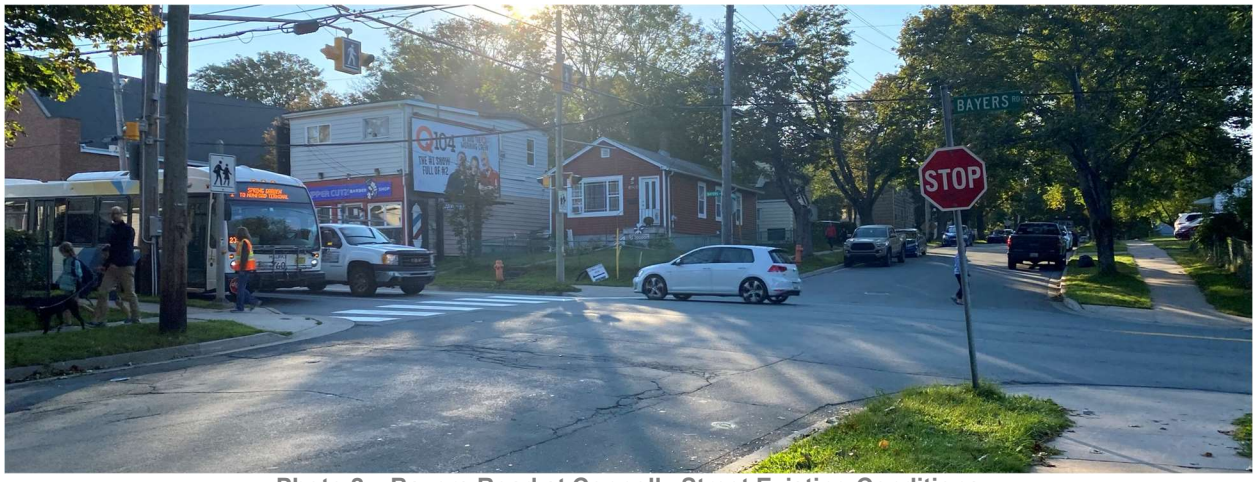

Photo 2 – Bayers Road at Connolly Street Existing Conditions

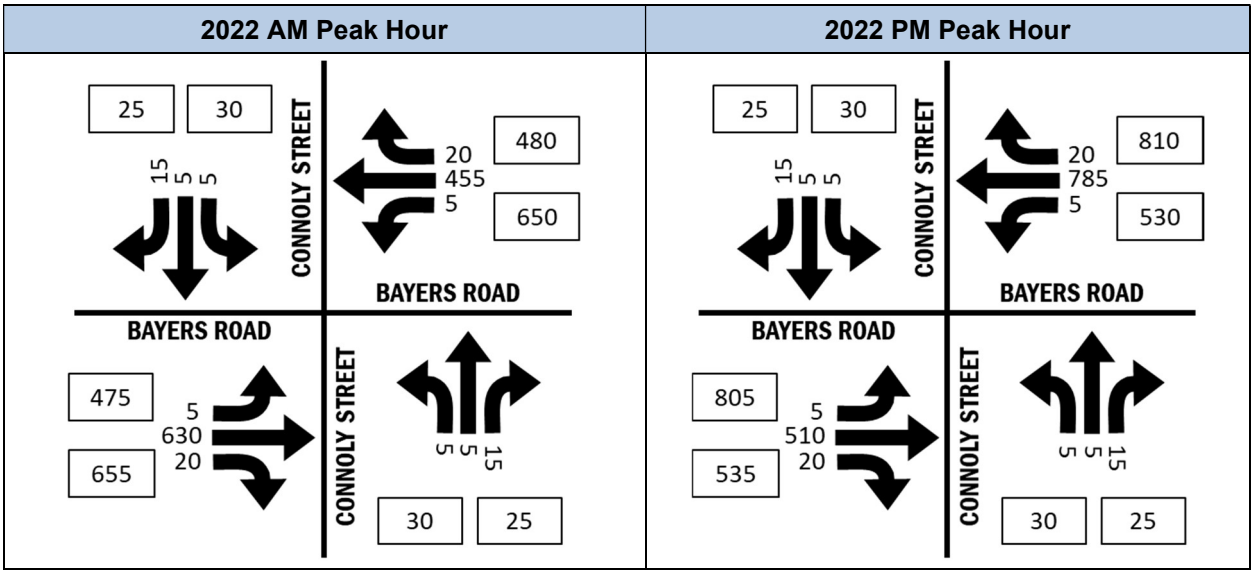

Figure 7 – Existing Traffic Volumes: Bayers Road @ Connolly Street

Bayers Road at Connaught Avenue

The Bayers Road / Connaught Avenue intersection is a major signalized intersection that has recently been modified to accommodate the first phase of the transit priority corridor design, as shown in Figure 8.

Projected AM and PM peak hour traffic volumes at the Bayers Road / Connaught Avenue intersection are illustrated in Figure 9. It should be noted that 2022 traffic volumes were projected based on October 2021 data, an annual growth rate of 1% and design factor of 5% to account for potential impacts of the COVID-19 pandemic. The 2022 volume projections indicate 3,200 vph during the AM peak and 3,960 vph during the PM peak at this intersection.

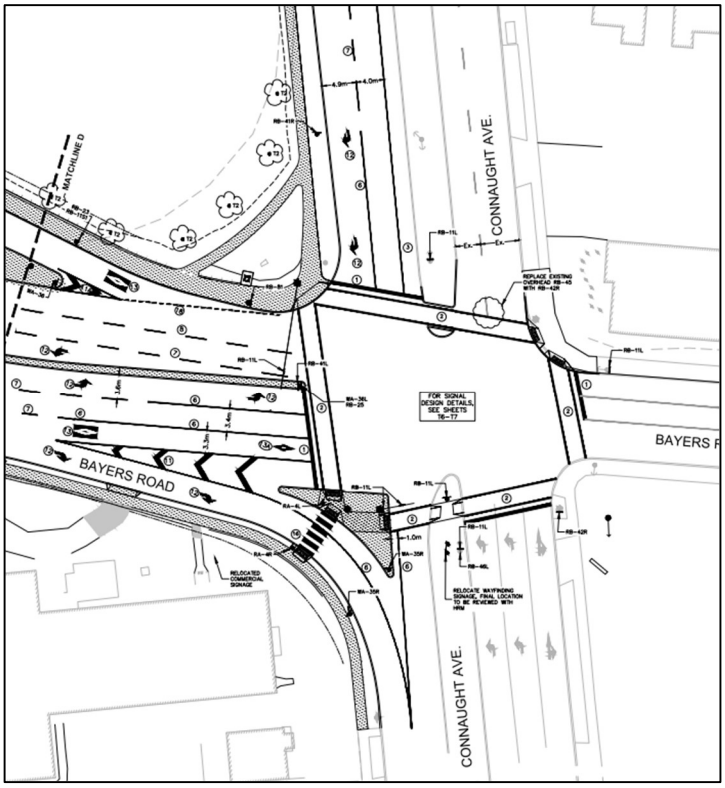

Figure 8 – Bayers Road at Connaught Avenue Existing Conditions (Phase 1 Complete)

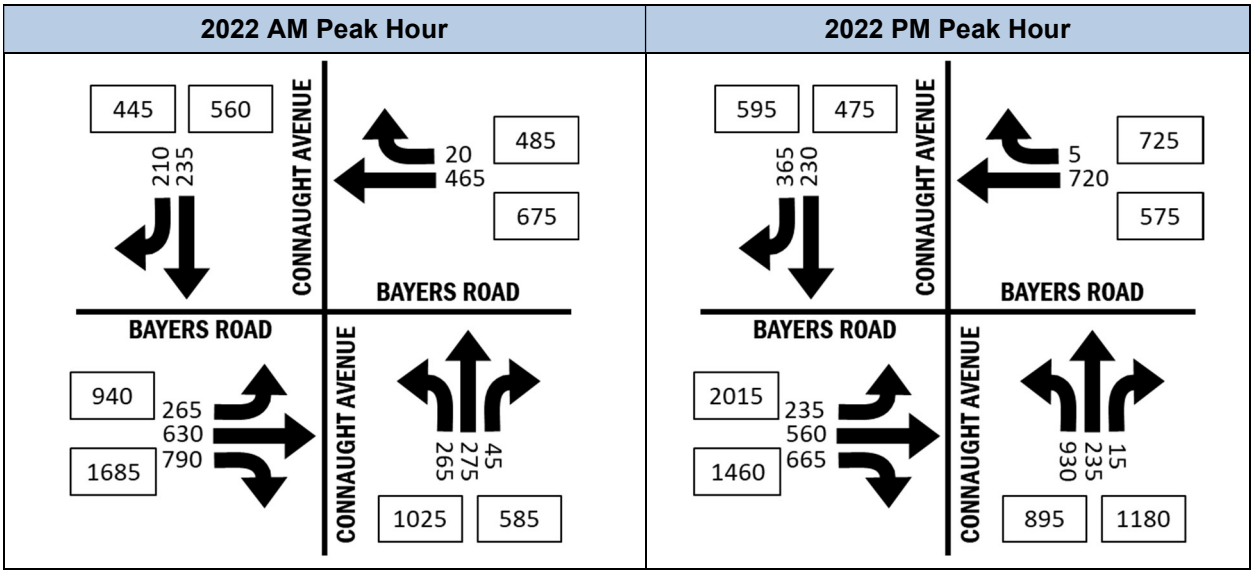

Figure 9 – Existing Traffic Volumes: Bayers Road @ Connaught Avenue

Parking Supply

In June 2021, the project team completed a review of on-street parking for the section of Bayers Road between Connaught Avenue and Windsor Street.[5] The June 2021 memo indicated that there are currently approximately 48 on-street parking spaces on Bayers Road between Connaught Avenue and Windsor Street. Parking restrictions along this section vary, including a combination of all-day unlimited (all day, no time restrictions), all-day time-limited (15-minutes to 2-hour maximum, Monday to Friday), and time of day restricted (no parking 4-6PM, Monday to Friday). In all areas where parking spaces exist, evening / overnight and weekend parking is permitted without time restrictions. Parking supply and controls are summarized below in Table 2 and Figure 10, respectively. There are no formally signed loading zones on Bayers Road; however, the *Nova Scotia Motor Vehicle Act* allows stopping temporarily within a "No Parking" zone while engaged in loading or unloading. As a result, "No Parking" zones effectively operate as de facto loading areas.

Table 2 – Existing Parking Supply (June 2021 Study)

	Approximate # of Parking Spaces		
Block	**Inbound (Eastbound)**	**Outbound (Westbound)**	**Total**
Connaught Avenue to Connolly Street	5	5	**10**
Connolly Street to Oxford Street	13	12	**25**
Oxford Street to Dublin Street	10	0	**10**
Dublin Street to Windsor Street	3	0	**3**
Total	**31**	**17**	**48**

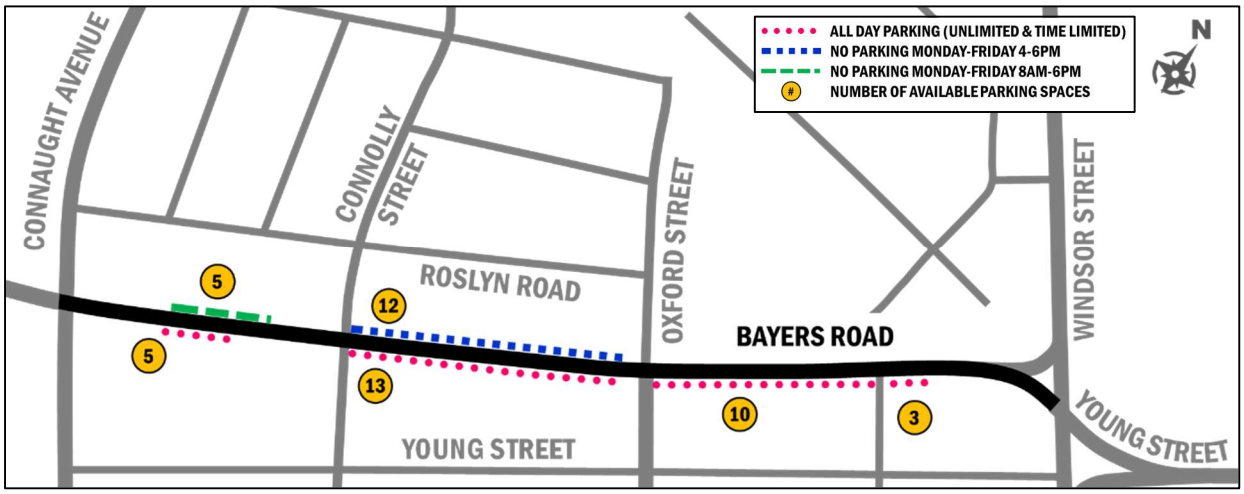

Figure 10 – Existing Parking Controls

[5] *On-Street Parking Review: Bayers Road (Connaught Avenue to Windsor Street)* [HRM Transportation Planning, June 2021]

Daytime parking utilization observations suggest that parking occupancy is relatively low on Bayers Road, ranging between 0% and 27%. The average parking duration on Bayers Road was estimated to be approximately 47 minutes.

Given the primarily residential nature of this segment of Bayers Road and the prevalence of single-family homes with driveways, low on-street parking utilization is not unexpected. Since data collection was completed during daytime hours only, utilization during evening and overnight periods – when demand is potentially higher as more people are at their residences – was not captured. Also, since observations were made on only two days, the data likely do not capture semi-regular events (e.g., funerals) that are known to significantly increase on-street parking demand in the area.

Proposed Modifications

Ultimately, the proposed final (Phase 2) design consists of an inbound and outbound (eastbound and westbound) TPL between Romans Avenue and Windsor Street. Due to the delay of Phase 2 construction until 2023, an interim design option is being considered to accommodate an outbound (westbound) bus lane that will reduce transit delay during the afternoon peak period and allow buses to stay on Bayers Road and avoid detouring onto local streets.

The potential interim designs options available are:

Interim Design Option #1: An outbound bus lane extends from Windsor Street and terminates east of Connolly Street, as shown in Appendix A (WSP, September 2021).

Interim Design Option #2: An outbound bus lane extends from Windsor Street and terminates east of Connaught Avenue.

It should be noted that the interim design solution respects the existing curb lines on Bayers Road. The implications of the interim design options on the study intersections and parking supply are evaluated in the following subsections.

Bayers Road at Oxford Street

Since Phase 1 boundaries terminate at Connaught Avenue, there are no lane configuration modifications associated with Phase 1 at the Bayers Road / Oxford Street intersection compared to existing conditions. Both interim design options consist of a westbound transit priority lane extending past the Bayers Road / Oxford Street intersection, therefore, there are no differences in the lane configurations associated with the Interim Design Option #1 or #2. Both interim options involve modifying the existing westbound through / right-turn lane to a *'Right-Turn Only (Except Buses)*', maintaining the existing two-lane approach. The Phase 2 Design involves implementing an eastbound transit priority lane through the intersection. The lane configuration changes associated with the design scenarios are represented in Figure 11.

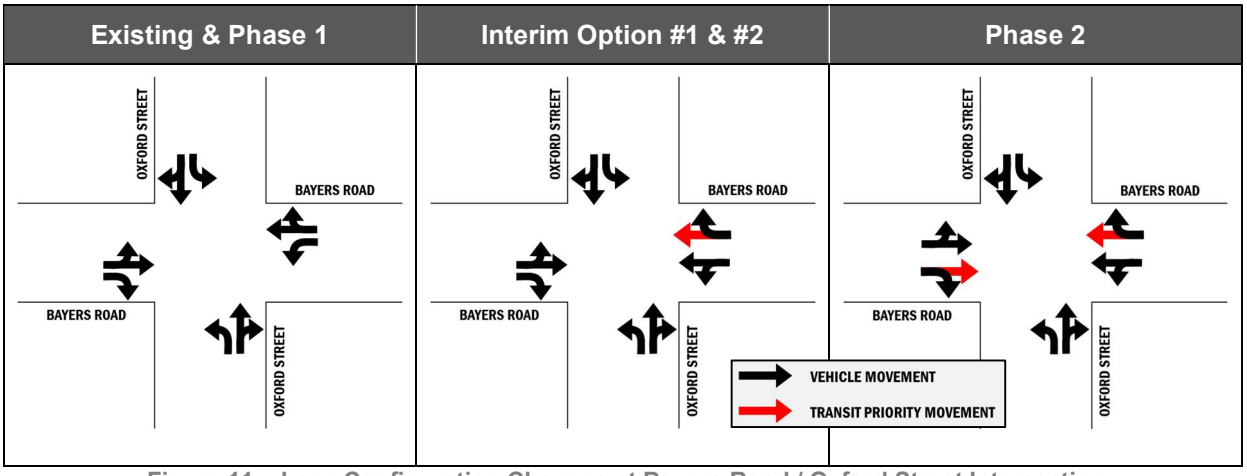

Figure 11 – Lane Configuration Changes at Bayers Road / Oxford Street Intersection

Bayers Road at Connolly Street

Since Phase 1 boundaries terminate at Connaught Avenue, there are no lane configuration modifications associated with Phase 1 at the Bayers Road / Connolly Street intersection compared to existing conditions. Both interim design options consist of a westbound transit priority lane that extends to the Bayers Road / Connolly Street intersection, but a receiving transit lane is only considered in Interim Design Option #2. The Phase 2 Design involves implementing an eastbound transit priority lane through the intersection. The lane configuration changes associated with the design scenarios are represented in Figure 12.

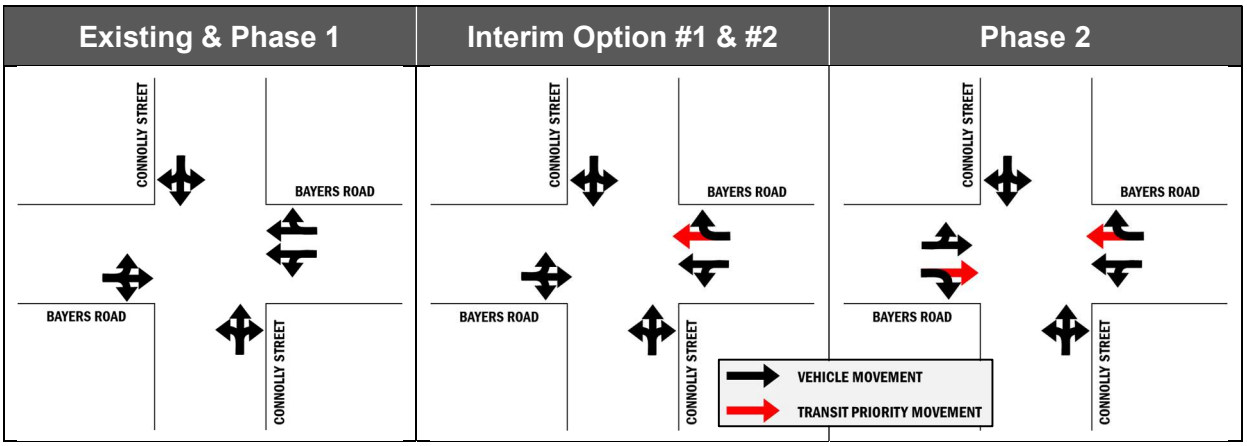

Figure 12 – Lane Configuration Changes at Bayers Road / Connaught Avenue Intersection

Bayers Road at Connaught Avenue

The existing intersection of Bayers Road / Connaught Avenue represents the completed Phase 1 design. There are no implications at this intersection based on Interim Design Option #1, therefore, no modifications to the lane configurations are proposed between the existing (completed Phase 1) or Interim Design Option #1 scenario. The Interim Design Option #2 involves modifying the existing westbound through / right-turn lane to a *'Right-Turn Only (Except Buses)*', maintaining the existing two-lane approach. The Phase 2 Design involves expanding the westbound approach to include two through lanes in addition to the right-turn/transit lane. The lane configuration changes associated with the design scenarios are represented in Figure 13.

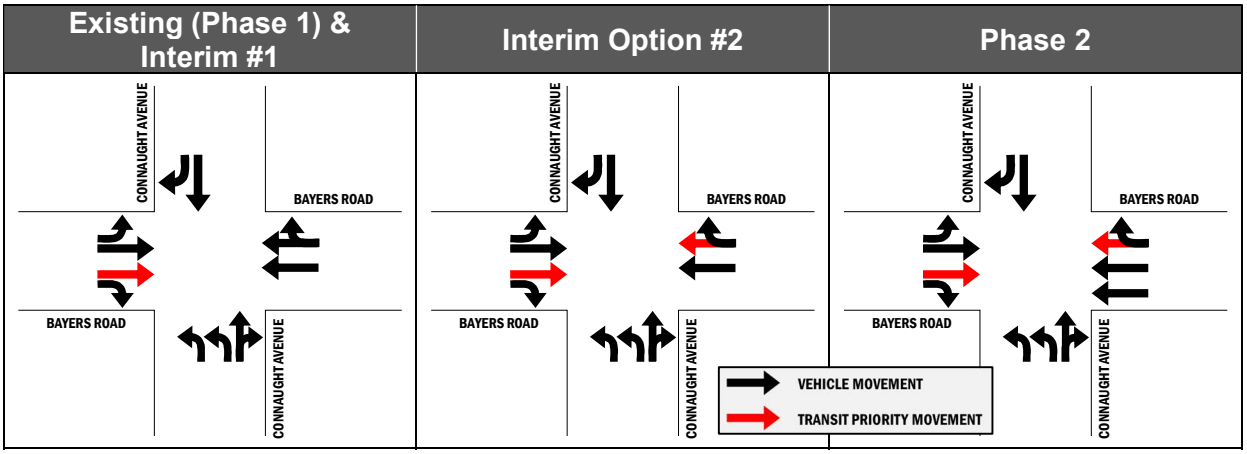

Figure 13 – Lane Configuration Changes at Bayers Road / Connaught Avenue Intersection

Intersection Performance Analysis

Intersection performance analyses were completed using *Synchro 10.0* to model existing and proposed conditions at the Oxford Street, Connolly Street and Connaught Avenue intersections on Bayers Road. Traffic analyses results are provided in **Appendix C** and are summarized in Table 3-5.

Bayers Road at Oxford Street

At Bayers Road / Oxford Street, the Synchro model will remain consistent with respect to the proposed Interim Designs #1 and 2:

- Transit priority lanes terminate prior to the intersection and transitions to *'Right-Turn Only (Except Buses'*)
- No transit priority signal phases are required since a receiving lane will be present when the *'Right-Turns Only Except for Buses*' condition is implemented

The following analysis scenarios were considered:

1. Existing Conditions
    - Existing lane configurations and signal phasing / timing
2. Interim Design 1 & 2 – WB/EB-L Permitted
    - Existing signal phasing / timing
    - Modified lane configuration for the westbound approach
    - Permit eastbound and westbound left-turns on Bayers Road
3. Interim Design 1 & 2 – WB/EB-L Prohibited
    - Existing signal phasing / timing
    - Modified lane configuration for the westbound approach
    - Prohibit eastbound and westbound left-turns on Bayers Road

Analysis results, summarized in Table 3, indicate that:

- All movements operate with HRM acceptable limits based on existing conditions.
- The most critical impacts occur during the PM peak period, when the V/C for the westbound approach increases from 0.50 to 0.85 and 95th percentile queues increase from approximately 66m to 214m.
- Modifying the westbound approach has a negligible impact on intersection performance.

- Prohibiting westbound left-turns marginally improves operations for westbound through movements and has a negligible impact on intersection performance.
- All movements operate within HRM acceptable limits with the proposed interim design options.

There are limitations associated with the traffic analysis software that should be considered when reviewing these results:

- Since Synchro does not explicitly model transit priority lanes, the traffic model for Bayers Road / Oxford Street will remain consistent between the proposed Interim Design and the Phase 2 Design. Transit priority lanes terminate prior to the intersection and transition to *'Right-Turn Only (Except Buses)'*, and transit signal priority phases are not required since a receiving lane will be present for buses.
- Synchro is primarily an intersection modelling software and does not explicitly consider the interaction of queueing between intersections. There is potential that the resulting increase to westbound queues will be worse that reported in the results due to the significant decrease on storage space, particularly during the afternoon peak when outbound volumes increase significantly.

Table 3 – Intersection Performance Analysis Results: Bayers Road @ Oxford Street

		Bayers Road						Oxford Street					
		EB-L	EB-T	EB-R	WB-L	WB-T	WB-R	NB-L	NB-T	NB-R	SB-L	SB-T	SB-R
AM Peak													
Existing Conditions: Phase 1 (Page C-1)	Hourly Volume	5	505	125	45	305	30	160	105	50	45	125	10
	Delay	12.8		1.8	7.2			85.8	39.1		40.4	44.0	
	V/C	0.57		0.18	0.25			0.90	0.52		0.30	0.52	
	95th% Queue	92.9		6.3	23.8			71.2	47.9		19.8	46.3	
	Int. Delay	24.5											
Interim Design 1 & 2: WB/EB-L Permitted (Page C-7)	Hourly Volume	5	505	125	45	305	30	160	105	50	45	125	10
	Delay	12.4		1.8	9.5		2.3	96.0	40.2		41.4	45.3	
	V/C	0.57		0.18	0.4		0.04	0.94	0.54		0.31	0.54	
	95th% Queue	92.9		6.3	54.0		3.2	71.6	47.9		19.8	46.3	
	Int. Delay	26.1											
Interim Design 1 & 2: WB/EB-L Prohibitted (Page C-11)	Hourly Volume	0	505	125	0	350	30	160	105	50	45	125	10
	Delay		12.7	1.8		9.0	2.3	83.9	38.9		40.2	43.7	
	V/C		0.57	0.18		0.35	0.04	0.89	0.52		0.30	0.52	
	95th% Queue		91.1	6.3		50.4	3.2	71.1	47.9		19.8	46.3	
	Int. Delay	24.6											
PM Peak													
Existing Conditions: Phase 1 (Page C-4)	Hourly Volume	5	420	70	45	665	30	225	130	60	35	65	5
	Delay	15.7		3.0	13.2			58.9	29.7		27.5	25.8	
	V/C	0.54		0.12	0.50			0.84	0.49		0.18	0.21	
	95th% Queue	87.6		6.2	66.1			71.7	46.7		13.0	20.5	
	Int. Delay	21.8											
Interim Design 1 & 2: WB/EB-L Permitted (Page C-9)	Hourly Volume	5	420	70	45	665	30	225	130	60	35	65	5
	Delay	15.6		3.0	28.5		3.7	59.6	29.8		27.7	25.9	
	V/C	0.54		0.11	0.85		0.04	0.85	0.5		0.18	0.21	
	95th% Queue	87.6		6.2	214.6		4.1	71.7	46.7		13.0	20.5	
	Int. Delay	28.0											
Interim Design 1 & 2: WB/EB-L Prohibitted (Page C-13)	Hourly Volume	0	420	70	0	710	30	225	130	60	35	65	5
	Delay		15.4	3.0		25.0	3.7	58.9	29.7		27.5	25.8	
	V/C		0.53	0.12		0.80	0.04	0.84	0.49		0.18	0.21	
	95th% Queue		85.6	6.2		205.1	4.1	71.7	46.7		13.0	20.5	
	Int. Delay	26.4											

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Bayers Road at Connolly Street

At Bayers Road / Connolly Street, the Synchro model will remain consistent with respect to the proposed Interim Designs #1 and 2:

- Transit priority lanes terminate prior to the intersection and transitions to *'Right-Turn Only (Except Buses*')
- No transit priority signal phases are required since a receiving lane will be present when the *'Right-Turns Only Except for Buses*' condition is implemented

The following analysis scenarios were considered:

4. Existing Conditions
    - Existing lane configurations
5. Interim Design 1 & 2 – WB/EB-L Permitted at Bayers/Oxford
    - Modified lane configuration for the westbound approach
    - Existing traffic volumes
6. Interim Design 1 & 2 – WB/EB-L Prohibited at Bayers/Oxford
    - Modified lane configuration for the westbound approach
    - WB/EB left turning vehicles from Bayers/Oxford rerouted to this intersection

Analysis results, summarized in Table 3, indicate that:

- All movements operate with HRM acceptable limits based on existing conditions during both peak periods.
- All movements operate with HRM acceptable limits based on the interim designs during the AM peak.
- The most critical impacts occur during the PM peak period, when the V/C for the westbound approach increases from 0.45 to 0.90.
- Modifying the westbound approach has a negligible impact on intersection performance.
- Rerouting EB/WB left turns from Bayers/Oxford has a negligible impact on intersection performance (~50 two-way vph).

The previously discussed limitations with traffic analysis software should be considered when reviewing the results at this intersection. When modelled with *SimTraffic* (microsimulation software), westbound 95th percentile queue lengths are expected to exceed four times the projected length with Interim Design #2 compared to Interim Design #1 (48m → 197m).

Table 4 – Intersection Performance Analysis Results: Bayers Road @ Connolly Street

		Bayers Road						Connolly Street					
		EB-L	EB-T	EB-R	WB-L	WB-T	WB-R	NB-L	NB-T	NB-R	SB-L	SB-T	SB-R
AM Peak													
Existing Conditions: Phase 1 (Page C-2)	Hourly Volume	5	630	20	5	455	20	5	5	15	5	5	15
	Delay	0.1			0.3		0.0	21.6			25.4		
	V/C	0.70			0.31		0.16	0.11			0.13		
	95th% Queue	0.1			0.1		0.0	2.7			3.3		
	Int. Delay	1.1											
Interim Design 1 & 2: WB/EB-L Permitted at Oxford (Page C-8)	Hourly Volume	5	630	20	5	455	20	5	5	15	5	5	15
	Delay	0.1			0.2		0.0	18.6			17.7		
	V/C	0.71			0.62		0.01	0.09			0.08		
	95th% Queue	0.1			0.1		0.0	18.6			17.7		
	Int. Delay	0.9											
Interim Design 1 & 2: WB/EB-L Prohibitted at Oxford (Page C-12)	Hourly Volume	10	630	20	50	455	20	5	5	15	5	5	15
	Delay	0.3			1.8		0.0	21.6			21.0		
	V/C	0.71			0.68		0.01	0.11			0.10		
	95th% Queue	0.3			1.6		0.0	21.6			21.0		
	Int. Delay	0.9											
PM Peak													
Existing Conditions: Phase 1 (Page C-5)	Hourly Volume	5	510	20	5	785	20	5	5	15	5	5	15
	Delay	0.2			0.2		0.0	17.7			23.6		
	V/C	0.74			0.45		0.26	0.08			0.12		
	95th% Queue	0.1			0.1		0.0	2.1			3.0		
	Int. Delay	0.8											
Interim Design 1 & 2: WB/EB-L Permitted at Oxford (Page C-10)	Hourly Volume	5	510	20	5	785	20	5	5	15	5	5	15
	Delay	0.2			0.1		0.0	13.4			16.0		
	V/C	0.91			0.90		0.01	0.06			0.07		
	95th% Queue	0.2			0.1		0.0	1.4			1.8		
	Int. Delay	0.7											
Interim Design 1 & 2: WB/EB-L Prohibitted at Oxford (Page C-14)	Hourly Volume	10	510	20	50	785	20	5	5	15	5	5	15
	Delay	0.5			1.5		0.0	14.6			17.2		
	V/C	0.93			0.95		0.01	0.06			0.08		
	95th% Queue	0.4			1.4		0.0	1.6			2.0		
	Int. Delay	1.6											

Bayers Road at Connaught Avenue

At Bayers Road / Connaught Avenue, the Synchro model will remain consistent with respect to the existing conditions, Phase 1 Design and proposed Interim Design #1:

- An eastbound transit priority lane extends to the intersection with a transit priority signal phase (no receiving lane present)
- Two westbound travel lanes (one through lane and one shared through/right-turn lane)

Since the intersection performance for the existing conditions, Phase 1 Design and Interim Design #1 will be the same, the following analysis scenarios were considered:

1. Existing Conditions / Phase 1 / Interim Design #1
    - Existing lane configurations and signal phasing / timing with eastbound transit priority signal activated
2. Interim Design #2 – Transit Priority Lane Extends to Connaught Avenue
    - Existing signal phasing / timing with eastbound transit priority signal activated
    - Westbound approach is modified to include to one through lane and one lane ‘Right-Turns Only Except for Buses’

Analysis results, summarized in Table 5, indicate that:

- Several movements are currently operating above capacity based on existing conditions:
  - AM peak: EB through and NB left-turn movements
  - PM peak: EB left-turn and through, WB through / right-turn and NB left-turn movements
- Reducing the WB approach to accommodate one through lane (Interim Design #2) significantly impacts operations of the WB approach and the overall intersection performance during both peak periods
  - Significant implications for EB left-turn movements during the AM peak (fewer gaps to complete permitted left-turn movement)

Table 5 – Intersection Performance Analysis Results: Bayers Road @ Connaught Avenue

		Bayers Road						Connaught Avenue				
		EB-L	EB-T		EB-R	WB-T	WB-R	NB-L	NB-T	NB-R	SB-T	SB-R
			Vehicles	Transit								
AM Peak												
Hourly Volume		265	620	10	790	465	20	265	275	45	235	210
Existing Conditions & Interim Design #1 (Page C-3)	**Delay**	40.3	46	65.5	2.6	36.6		96.7	36.7		59.2	25.0
	V/C	0.80	0.90	0.23	0.65	0.56		0.96	0.61		0.75	0.38
	95th% Queue	77.3	216.7	8.7	3.6	71.5		62.2	97.3		91.6	55.9
	Int. Delay	45.9										
Interim Design #2: WB Bus Lane Extends to Connaught Avenue (Page C-15)	**Delay**	125.2	46.0	65.5	2.6	94.3	0.1	96.7	36.7		59.2	25.0
	V/C	1.14	0.90	0.23	0.65	1.05	0.04	0.96	0.61		0.75	0.38
	95th% Queue	114	216.7	8.7	3.6	193.5	0.0	62.2	97.3		91.6	55.9
	Int. Delay	61.1										
PM Peak												
Hourly Volume		235	550	10	665	720	5	930	235	15	230	365
Existing Conditions & Interim Design #1 (Page C-6)	**Delay**	181.6	71.8	80.7	1.8	101.1		221.3	25.4		80.8	48.6
	V/C	1.26	0.97	0.28	0.55	1.06		1.38	0.36		0.85	0.76
	95th% Queue	128.8	237.0	9.8	3.0	166.1		231.7	68.5		112.9	136.9
	Int. Delay	108.5										
Interim Design #2: WB Bus Lane Extends to Connaught Avenue (Page C-16)	**Delay**	181.6	71.8	80.7	1.8	513.6	0.0	221.3	25.4		80.8	48.6
	V/C	1.26	0.97	0.28	0.55	2.06	0.01	1.38	0.36		0.85	0.76
	95th% Queue	128.8	237.0	9.8	3.0	415.7	0.0	231.7	68.5		112.9	136.9
	Int. Delay	183.4										

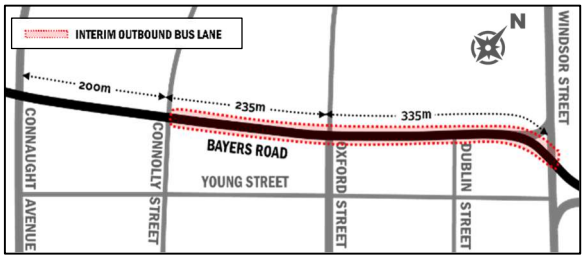
A summary of features, impacts, advantages and disadvantages of Interim Design #1 and Interim Design #2 are provided in Table 6 and Table 7 respectively.

Table 6 – Summary of Features, Impacts, Advantages and Disadvantages of Interim Design #1

Features

The configuration of Interim Design Option #1 repurposes the existing westbound curb lane to add an outbound (westbound) bus lane on Bayers Road between Windsor Street and Connolly Street. Buses would travel in mixed traffic between Connolly Street and Connaught Avenue.

This solution provides significant transit benefits in the short-term, reducing transit delays and removing the need for buses to divert to Roslyn Road. Traffic analysis results indicate that significant impacts to traffic operations **are not** expected.



Intersection	Proposed Changes	Impacts
Bayers Road & Oxford Street	Bayers Road WB approach is modified to include one general traffic lane and one bus lane. Consideration given to restricting EB/WB left turns during peak periods to reduce interference with through vehicles and optimize inbound/outbound traffic flow	Modifications have a minimal impact on the overall intersection performance. During the AM peak, all movements are expected to operate within HRM acceptable limits. During the PM peak, delays for WB vehicles are expect to more than double (13 seconds → 28 seconds)[A] and the 95th percentile queue lengths are expected to exceed three times the existing length (66m → 214m)[A]. Prohibiting EB/WB left turns prevents through traffic from weaving into the *'Right-Turns Only Except for Buses'* lane, thus improving safety for all road users. Restricting EB/WB left turns during peak periods marginally improves operations for EB/WB through movements and has a negligible impact on intersection performance. These traffic movements would likely divert to alternate routes; however, the anticipated impact would be minimal as traffic volumes are relatively low (50 vph vehicles during both peak hours).
Bayers Road & Connolly Street	Bayers Road WB approach is modified to include one general traffic lane and one bus lane.	Impacts to traffic operations on Bayers Road are expected to be minimal compared to existing peak period conditions. All movements operate within HRM acceptable limits during the AM peak. During the PM peak, WB vehicles are expected to exceed HRM acceptable limits for V/C (0.45 → 0.90)[A]. If EB/WB left turns are restricted at Bayers/Oxford, there is potential for vehicles to reroute to Bayers/Connolly (50 vph vehicles during peak hours). Negligible impacts are expected at the Connolly Street intersection as a result.
Bayers Road & Connaught Avenue	No changes to this intersection compared to existing conditions (Phase 1 build-out).	Buses travel with mixed traffic until completion of Phase 2 build-out. During the afternoon peak, WB 95th percentile queue length is not expected to exceed the 166m[A].

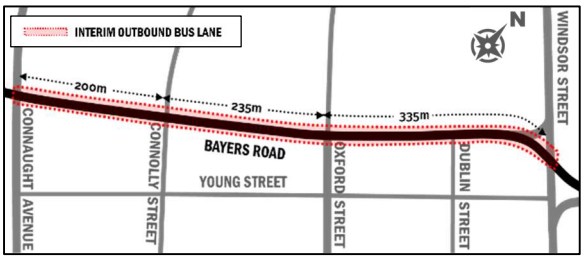
Advantages	Disadvantages
• Two WB lanes are available for general traffic at Connaught Avenue • Improved travel times for transit compared to existing conditions • WB queue at Connaught Avenue is not expected to spill back to Connolly Street • Buses are removed from Roslyn Road	• No priority measures for transit between Connolly Street and Connaught Avenue • Burden of enforcing the bus lane falls on Halifax Regional Police (HRP)

Table 7 – Summary of Features, Impacts, Advantages and Disadvantages of Interim Design #2

Features

The configuration of Interim Design Option #2 repurposes the existing westbound curb lane to add an outbound (westbound) bus lane on Bayers Road between Windsor Street and Connolly Street. Buses would have a dedicated outbound transit facility between Robie Street and Highway 102.

This solution provides significant transit benefits in the short-term, reducing transit delays and removing the need for buses to divert to Roslyn Road. Traffic analysis results indicate that significant impacts to traffic operations **are** expected.



Intersection	Proposed Changes	Impacts
Bayers Road & Oxford Street	Bayers Road WB approach is modified to include one general traffic lane and one bus lane. Consideration given to restricting EB/WB left turns during peak periods to reduce interference with through vehicles and optimize inbound/outbound traffic flow.	Modifications to this intersection have the same impact as Interim Design #1, however, there is an increased risk of impacts from Bayers/Connaught and Bayers/Connolly spilling back to Bayers/Oxford under sever traffic conditions. Prohibiting EB/WB left turns prevents through traffic from weaving into the *'Right-Turns Only Except for Buses'* lane, thus improving safety for all road users. Restricting EB/WB left turns during peak periods marginally improves operations for EB/WB through movements and has a negligible impact on intersection performance. These traffic movements would likely divert to alternate routes; however, the anticipated impact would be minimal as traffic volumes are relatively low (50 vph vehicles during both peak hours).
Bayers Road & Connolly Street	Bayers Road WB approach is modified to include one general traffic lane and a bus lane.	Modifications to this intersection have a negligible impact on the WB approach and the overall intersection performance; however, significant impacts are expected as a result of changes at Bayers/Connaught. WB 95th percentile queue lengths are expected to exceed four times the projected length of Interim Design #1 (48m → 197m)[B].
Bayers Road & Connaught Avenue	Bayers Road WB approach is modified to include one general traffic lane and a bus lane.	Reducing the WB approach to one through lane significantly impacts operations of the WB approach and the overall intersection performance during both peak periods. WB delays are expected to exceed five times the existing delay during the PM peak (101 seconds → 513 seconds)[A]. During the PM peak, WB 95th percentile queue lengths are expected to increase by approximately 2.5 times compared to existing conditions (166m → 416m)[A]. As a result of less gaps in WB traffic, delays for EB left turning vehicles are expected to exceed three times the existing delay (40 seconds → 125 seconds)[A].

Advantages	Disadvantages
• Improved travel times for transit compared to existing conditions • Connected outbound transit network between Robie Street and Highway 102 • Buses are removed from Roslyn Road	• WB queues at Connaught Avenue has significant impacts on outbound traffic flow during the PM peak (queues spill back past Connolly Street) • Burden of enforcement falls on HRP

[A] *Synchro Result*
[B] *SimTraffic Result*

Impacts to Parking Supply

As previously discussed, there are approximately 48 on-street parking spaces with varying controls on Bayers Road between Connaught Avenue and Windsor Street. Since the Interim Design respects existing curb lines and prioritizes maintaining an outbound (westbound) transit lane, there are no impacts to parking on the inbound (south) side of Bayers Road compared to existing conditions. Outbound on-street parking will be impacted by the interim bus lane – although the number of spaces will remain approximately the same as existing, parking will be prohibited during periods when the bus lane is operational.

Given that the interim configuration includes only an outbound bus lane and that outbound congestion is generally not an issue during the morning peak, it is considered appropriate make the bus lane operational only during the afternoon peak period (3-6PM). Outside of the afternoon peak period, the outbound bus lane can be designated for curb access including on-street parking and loading in a manner consistent to existing conditions. Signage will be required to indicate time periods during with the bus lane is operational and on-street parking is prohibited.

Overall, the net result of this change for on-street parking relative to existing conditions would be that the approximately 12 parking spaces on the north side of Bayers Road between Connolly Street and Oxford Street would have their time restriction change from 4-6PM (current) to 3-6PM (proposed), extending the no parking period by one hour. The remaining parking spaces on Bayers Road would not be affected.

When not operational, the bus lane would be designated for curb access including parking and loading. It is expected that this will achieve an effective balance that provides transit priority when it is needed the most and accommodate other needs of the street when transit priority is not required. The proposed interim parking supply and controls are summarized below in Figure 14.

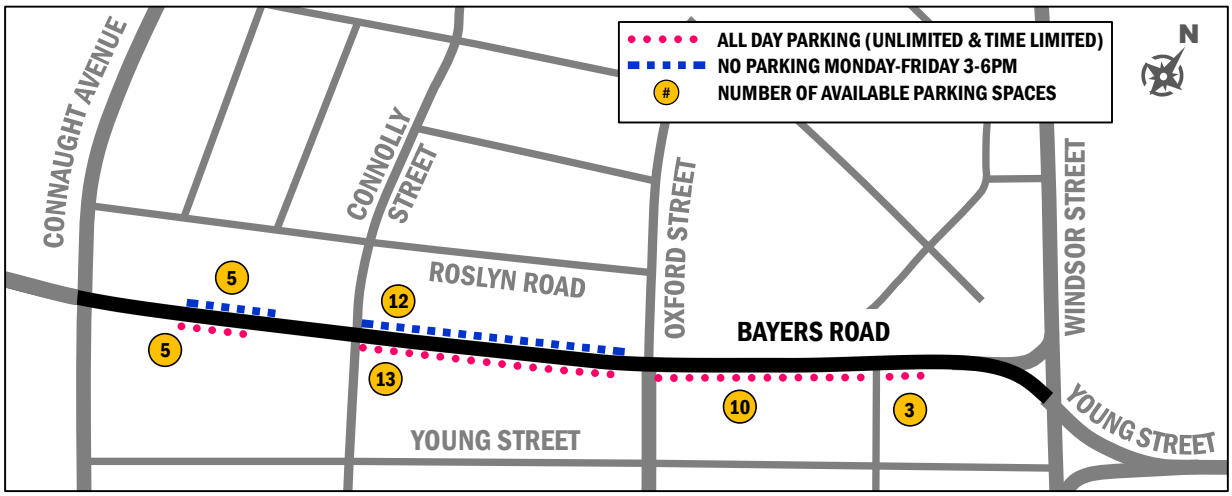


Figure 14 – Interim Design Parking Supply

Recommended Approach

The following recommendations are presented for consideration:

1. **Implement Interim Design #1, which repurposes the existing westbound curb lane to add an outbound (westbound) bus lane on Bayers Road between Windsor Street and Connolly Street.** This solution will provide significant transit benefits in the short-term, reducing transit delays and removing the need for buses to divert to Roslyn Road. Traffic analysis results indicate that significant impacts to traffic operation are not expected.

   This change will provide high visibility transit priority that could help to encourage mode shift to transit, and with commuting soon likely to return to a post-COVID 'new normal', this is an opportune time to try to influence behaviors as people re-establish commuting patterns.

   There are risks associated with this recommendation that should be considered:
   - There is potential that traffic congestion during peak periods could be worse than indicated in the Synchro modeling presented in this traffic impact analysis. Analysis results for the interim design remain relatively good largely because throughput traffic capacity at the critical westbound approach to Connaught Avenue is retained; however, if queues extend east of Connolly Street (as they sometimes do on busy traffic days), traffic capacity on that section would be halved and queues could grow considerably.
   - If the changes increase congestion significantly, there is potential for negative public perception of the project and transit priority infrastructure in general, particularly due to the high-profile nature of the Bayers Road corridor. Although congestion related to the introduction of transit priority infrastructure on Bayers Road is a real possibility even for the full buildout of Phase 2, staff have yet to initiate the communications efforts likely to accompany full buildout that would aim to rationalize the changes based on their origins in the IMP and their integral part of the overall transit priority network. Further, Regional Council has not considered this specific design and its traffic impacts.

2. **Restrict eastbound and westbound left-turns at the Bayers Road / Oxford Street intersection during the afternoon peak period (3:00-6:00 PM)** to avoid potential delays to through traffic caused by left turning vehicles and to reduce the potential for safety concerns associated with vehicles weaving into the *'Right-Turn Only (Except Buses)'* lane. These traffic movements would likely divert to alternate routes; however, the anticipated impact would be minimal as traffic volumes are relatively low (maximum peak hourly volume = 50vph). Nevertheless, communication with the local community of these changes should be considered.

3. **Designate the interim outbound bus lane as operational only on weekdays between 3:00-6:00 PM.** When not operational, it is recommended that portions of the bus lane be designated for curb access including parking and loading. It is expected that this will achieve an effective balance that provides transit priority when it is needed the most and accommodate other needs of the street when transit priority is not required. The overall impact to on-street parking is minimal – 12 of the approximately 48 on-street parking spaces on this segment would be impacted, and the impact would be limited to a one-hour extension of the existing parking restriction during weekday afternoon periods.

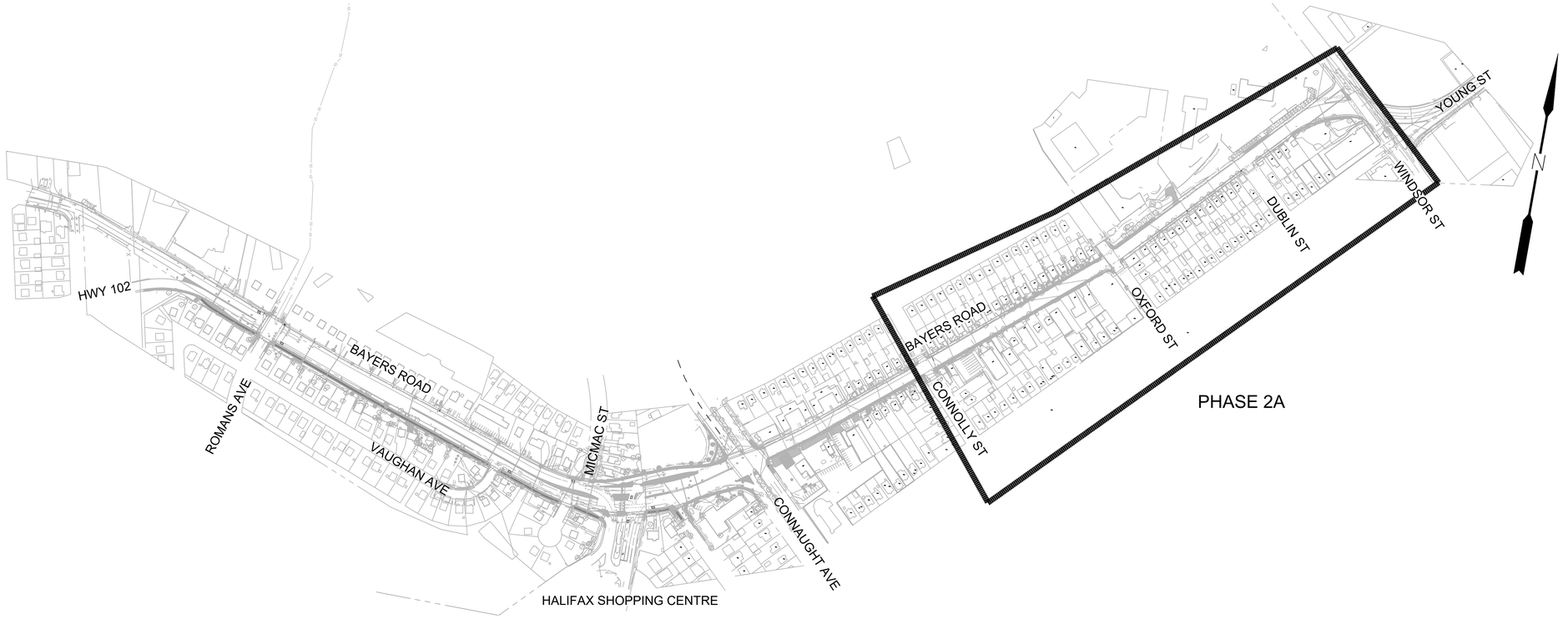
If you have any questions, please do not hesitate to contact me.

Regards,

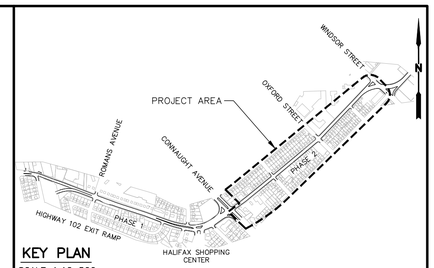
Hannah McBride, MScE, EIT
Program Engineer-in-Training – Planning & Development
Halifax Regional Municipality
Email: Hannah.McBride@halifax.ca
Phone: 902-237-0418

Appendix A:

Interim Design Drawings (WSP)



OVERALL PLAN



KEY PLAN
SCALE 1:12 500

PLAN LEGEND

EXISTING		PROPOSED
	UTILITY POLE AND GUY WIRE	
	STREET LIGHT	
	WATER VALVE	
	SIGN POST/BASE	
	CONCRETE CURB	
X X	FENCE	X X
RW RW	RETAINING WALL	RW
	PROPERTY LINE	
C	COMBINED MANHOLE & PIPE	
	SANITARY MANHOLE & PIPE	
	STORM MANHOLE & PIPE	
	CATCHBASIN	
	GAS MAIN	
	CONCRETE SURFACE	
	EDGE OF ASPHALT	
	EDGE OF GRAVEL	
	WATERMAIN	
	PEDESTRIAN RAMP	
	PUSH BUTTON POLE	
	TRAFFIC SIGNAL POLE	
	GPS OPTICOM	
	TRAFFIC CONTROLLER	C
	VEHICLE DETECTION	
	TRAFFIC SIGNAL HEAD	
	PEDESTRIAN HEAD	
	VEHICLE DETECTOR	
TL TL	TRAFFIC SIGNAL CONDUIT	TL TL
	BUS STOP AND/OR SHELTER	

NOTES

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7. CONTRACTOR IS RESPONSIBLE FOR SETTING GRADES AND LAYOUT CONTROL.
8. TRAFFIC SIGNS ARE NOT TO BE REMOVED OR REPLACED WITHOUT AUTHORIZATION FROM THE TRAFFIC AUTHORITY AND THE ENGINEER.
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11. AT COMPLETION OF WORK REINSTATE ALL DISTURBED SURFACES TO THE SATISFACTION OF THE ENGINEER.
12. WATER VALVE BOX EXTENSIONS – THE MINIMUM INSIDE DIAMETER OF A VALVE BOX EXTENSION SHALL BE 125 mm AND THE MINIMUM LENGTH OF A VALVE BOX EXTENSION SHALL BE 300 mm. CONTRACTOR TO CONFIRM APPROPRIATE PRODUCT TO BE USED WITH HALIFAX WATER OPERATIONS DEPARTMENT STAFF.

REVIEWED AND APPROVED FOR TRAFFIC SIGNALS AND PAVEMENT MARKINGS

Appr'd _____ Date _____
for TRAFFIC AUTHORITY

SIGNAGE SCHEDULE (NOT TO SCALE)

1	2	2	1	5	1
					
RA-2	RB-11S1	RB-41R	RB-80S2	RB-81	WB-8

SIGNAGE NOTES

1. SIGN POST INSTALLATION SHALL FOLLOW HRM RED BOOK FIGURE No. "HRM 38" FOR URBAN TRAFFIC SIGN POST DETAIL UNLESS OTHERWISE INDICATED.
2. ALL GROUND MOUNTED SIGN POSTS TO BE INSTALLED BY THE CONTRACTOR.
3. ALL SIGN INSTALLATIONS/REMOVALS SHALL BE COMPLETED BY HRM.
4. CONTRACTOR TO MAINTAIN SAFE PEDESTRIAN ACCESS THROUGH PROJECT AREA AT ALL TIMES AT NO ADDITIONAL COST TO HRM.
5. REMOVE ANY EXISTING PARKING SIGNAGE IN CONFLICT WITH REDESIGNATED CURB SPACE.

PAINT

PAVEMENT MARKING TABLE					
IDENTIFICATION	MATERIAL	ITEM	SIZE/WIDTH	COLOUR	QUANTITY
P1.1	PAINT	SINGLE LINE–SOLID	100 mm	WHITE	518m
P1.3	PAINT	SINGLE LINE–BROKEN	100 mm (3 m LINE, 3 m SPACING)	WHITE	96m
P1.7	PAINT	SINGLE LINE–BROKEN	100 mm (0.5 m LINE, 0.5 m SPACING)	WHITE	30m
P1.10	PAINT	SINGLE LINE–SOLID	100 mm	YELLOW	520m
P2	PAINT	STOP BAR	450 mm	WHITE	22m
P4	PAINT	CROSSWALK	2 x 200 mm	WHITE	81m
P5	PAINT	ZEBRA CROSSWALK	600 mm WIDE, 600 mm SPACING, 2.5 m WIDE	WHITE	13m
P9.1	PAINT	ARROW	3/4 TAC SIZE	WHITE	9EA.
P13	PAINT	RESERVED LANE DIAMOND SYMBOL	0.75 m X 3.0 m	WHITE	6EA.

PAVEMENT MARKING NOTES

1. ALL LANE MARKINGS SHALL BE ACCORDING TO MANUAL OF UNIFORM TRAFFIC CONTROL DEVICES FOR CANADA (MUTCDC) USING SIGNS APPROVED FOR USE IN NOVA SCOTIA.
2. ALL LANE WIDTHS SHOWN ARE EXISTING.
3. REMOVE ALL EXISTING PAVEMENT MARKINGS WITHIN CONSTRUCTION AREA AND REPLACE WITH NEW MARKINGS AS SHOWN.
4. LANE LINES ARE TO BE 0.1m WIDE EXCEPT WHERE OTHERWISE INDICATED. CROSSWALK LINES ARE TO BE 0.2m WIDE, STOP BARS ARE TO BE 0.45m WIDE.
5. CENTERLINES AND CENTER CROSS HATCHING TO BE YELLOW, ALL OTHER PAVEMENT MARKINGS TO BE WHITE.
6. ALL DIMENSIONS ARE IN METERS UNLESS INDICATED OTHERWISE.
7. ALL DIMENSIONS MEASURE FROM THE CENTRE OF THE PAVEMENT MARKINGS AND/OR THE FACE OF CURB.
8. APPLY TEMPORARY LANE MARKINGS (TAPE ON PAVEMENT) AFTER REMOVAL OF EXISTING PAVEMENT MARKING. PERMANENT MARKINGS TO BE APPLIED WITHIN 48 HOURS.
9. REPAINT ALL EXISTING CROSSWALKS AND STOP BARS UNLESS OTHERWISE NOTED.

No.	Date	Revision Description	Appr'd
1	09/17/2021	ISSUED FOR PRE–TENDER REVIEW	

WSP Canada Inc.
1 Spectacle Lake Drive
Dartmouth, Nova Scotia, Canada B3B 1X7
T 902-835-9955 F 902-835-1645 www.wsp.com

HALIFAX

BAYERS ROAD PHASE 2 INTERIM WB TRANSIT LANE

CONNAUGHT AVE. TO WINDSOR STREET HALIFAX, NS

PAVEMENT MARKING AND SIGNAGE PLAN

Date 09/14/2020	Drawn DP	Tender No. 19–000
Scale 1:250	Survey No. SU17xxxx	Sheet P01
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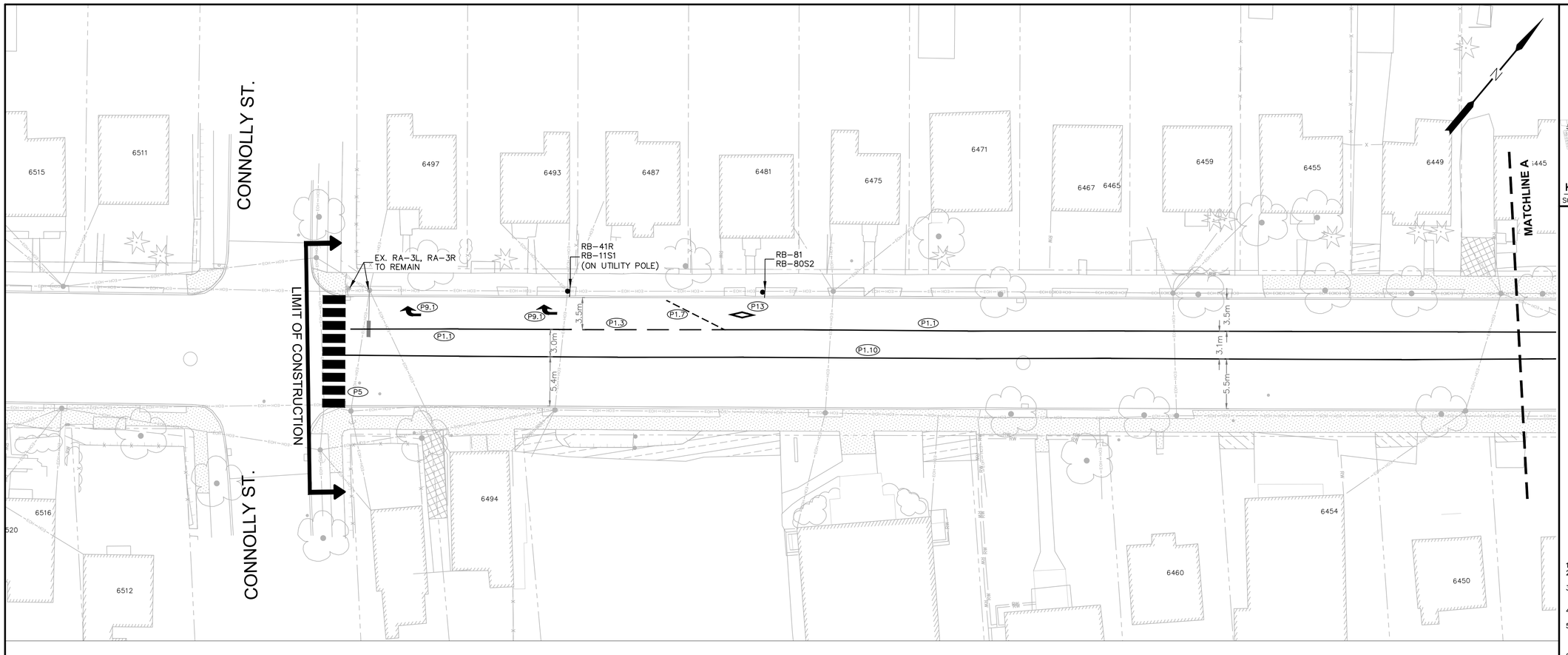

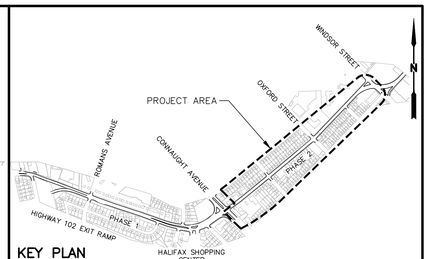

KEY PLAN
SCALE 1:12 500

PLAN LEGEND

EXISTING		PROPOSED
	UTILITY POLE AND GUY WIRE	
	STREET LIGHT	
	WATER VALVE	
	SIGN POST/BASE	
	CONCRETE CURB	
X X	FENCE	X X
RW RW	RETAINING WALL	RW
	PROPERTY LINE	
	COMBINED MANHOLE & PIPE	
	SANITARY MANHOLE & PIPE	
	STORM MANHOLE & PIPE	
	CATCHBASIN	
	GAS MAIN	
	CONCRETE SURFACE	
	EDGE OF ASPHALT	
	EDGE OF GRAVEL	
	WATERMAIN	
	PEDESTRIAN RAMP	
	PUSH BUTTON POLE	
	TRAFFIC SIGNAL POLE	
	GPS OPTICOM	
	TRAFFIC CONTROLLER	
	VEHICLE DETECTION	
	TRAFFIC SIGNAL HEAD	
	PEDESTRIAN HEAD	
	VEHICLE DETECTOR	
TL TL	TRAFFIC SIGNAL CONDUIT	TL TL
	BUS STOP AND/OR SHELTER	

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HALIFAX

BAYERS ROAD PHASE 2
INTERIM WB TRANSIT LANE
CONNAUGHT AVE. TO WINDSOR STREET HALIFAX, NS

PAVEMENT MARKING AND SIGNAGE PLAN
CIVIC 6520 TO OXFORD STREET

Date 09/14/2020	Drawn DP	Tender No. 19-000
Scale 1:250	Survey No. SU17xxxx	
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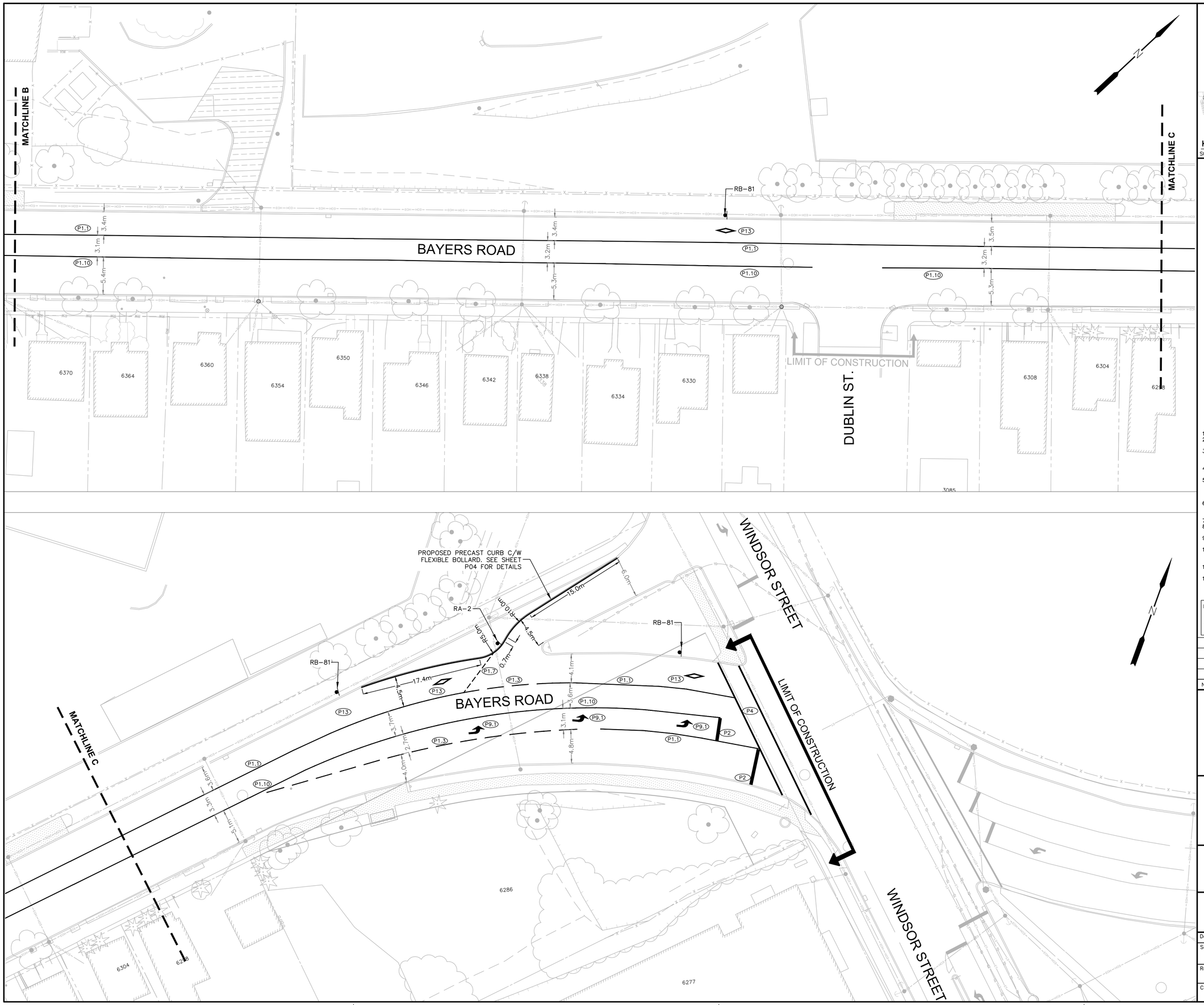

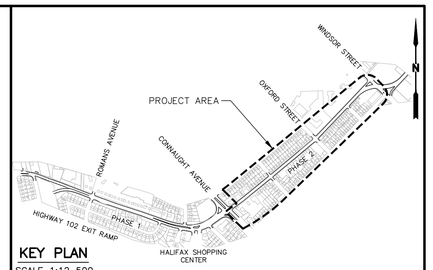

KEY PLAN
SCALE 1:12 500

PLAN LEGEND

EXISTING		PROPOSED
	UTILITY POLE AND GUY WIRE	
	STREET LIGHT	
	WATER VALVE	
	SIGN POST/BASE	
	CONCRETE CURB	
X — X	FENCE	X — X
RW — RW	RETAINING WALL	RW
	PROPERTY LINE	
C	COMBINED MANHOLE & PIPE	
	SANITARY MANHOLE & PIPE	
	STORM MANHOLE & PIPE	
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HALIFAX

BAYERS ROAD PHASE 2 INTERIM WB TRANSIT LANE

CONNAUGHT AVE. TO WINDSOR STREET HALIFAX, NS

PAVEMENT MARKING AND SIGNAGE PLAN OXFORD STREET TO WINDSOR STREET

Date 09/14/2020	Drawn DP	Tender No. 19-000
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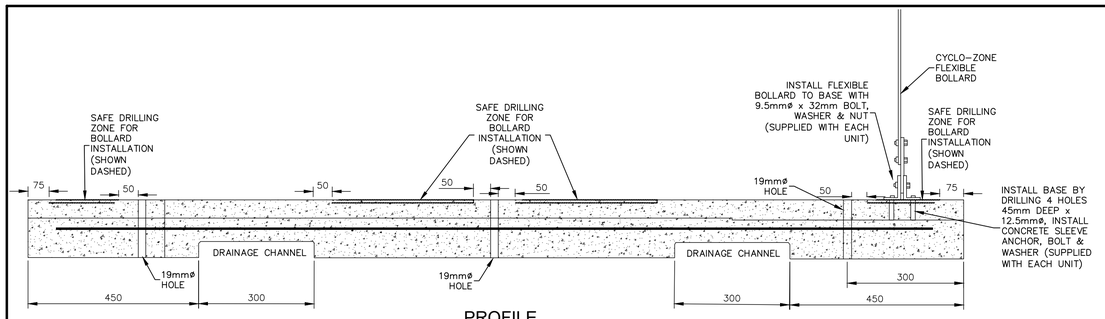
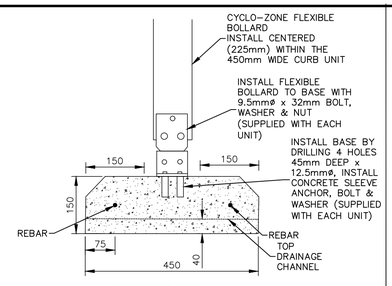
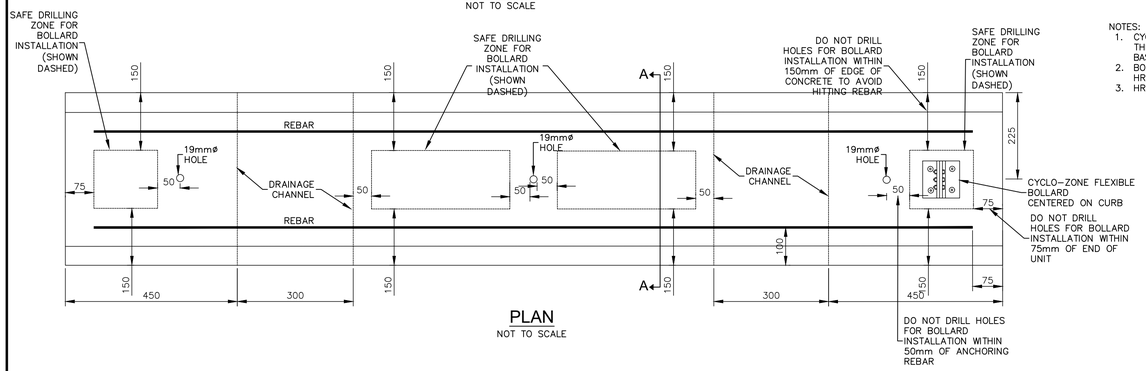


PROFILE
NOT TO SCALE



SECTION A-A
NOT TO SCALE



PLAN
NOT TO SCALE

NOTES:
1. CYCLO-ZONE FLEXIBLE BOLLARD COMES COMPLETE FROM THE MANUFACTURER WITH FLEXIBLE BOLLARD, STEEL BASE, INSTALLATION HARDWARE AND INSTRUCTIONS.
2. BOLLARD TO BE GREEN WITH WHITE REFLECTIVE TAPE AND HRM LOGO.
3. HRM TO SUPPLY MANUFACTURER WITH LOGO.

I FLEXIBLE BOLLARD INSTALLATION DETAILS - MID UNIT
N.T.S.

PRE-CAST CURB NOTES:

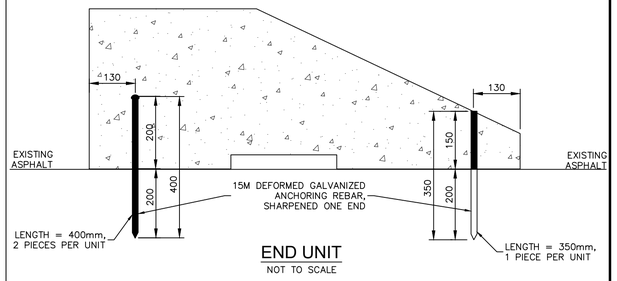
1. ALL DIMENSIONS ARE IN MILLIMETERS.
2. SCC CONCRETE WITH INTEGRAL WATERPROOFING (50MPa)
3. COMPONENTS MANUFACTURED IN ACCORDANCE WITH/AS PER CSA A23.1.
4. CONCRETE TO CONFORM TO CONCRETE EXPOSURE CLASS C-1.
5. PRE-CAST WITH 3 HOLES CONSTRUCTED WITH 19MMø PVC CONDUIT PIPE (CUT FLUSH) TO ACCOMMODATE 15M DEFORMED GALVANIZED ANCHORING REBAR DOWELS.

END UNIT:

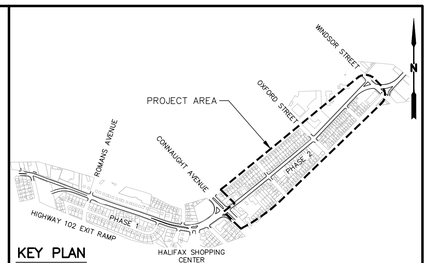
6. DIMENSIONS: L=1220mm, W=450mm, H=450mm
7. REINFORCEMENT: 2x10M DEFORMED REBAR, LENGTH=1070
8. EQUIPPED WITH 2 x 55mm GALVANIZED "SWIFT LIFT" (OR APPROVED EQUIVALENT) LIFTING RINGS WITH A 2.5T LIFTING CAPACITY.
9. 3 PIECES OF ANCHORING REBAR FOR END UNIT TO BE 15M DEFORMED GALVANIZED REBAR DOWELS, SHARPENED ONE END, 2 x 400mm LONG (REAR), 1 x 350mm LONG (FRONT).
10. PRE-CAST END UNIT TO HAVE 1 DRAINAGE SLOT IN BOTTOM.
11. END UNIT COMES WITH GALVANIZED STEEL PILE SLEEVE PRE-SET IN CONCRETE FOR SIGN POST. STEEL PIPE SLEEVE TO BE GALVANIZED, 64mmø I.D., 4mm W.T.

MID UNIT:

12. DIMENSIONS: L=2440mm, W=450mm, H=150mm.
13. REINFORCEMENT: 2x10M DEFORMED REBAR, LENGTH = 2290.
14. ANCHORING REBAR FOR MID UNIT TO BE 15M DEFORMED GALVANIZED REBAR DOWELS, SHARPENED ONE END, 2 x 350mm LONG.
15. PRE-CAST MID UNIT TO HAVE 2 DRAINAGE SLOTS IN BOTTOM.
16. CONTRACTOR IS REQUIRED TO MATCH THE START AND STOP END LOCATIONS FOR THE PRE-CAST UNITS SHOWN ON THE DRAWINGS. IT MAY BE NECESSARY TO SAW CUT THE MID UNIT PIECES AT SOME LOCATIONS.
17. CONTRACTOR IS NOT TO SAW CUT THE END PIECE IN EACH ROW.
18. PRE-CAST MID UNITS HAVE THREE HOLES FOR ANCHORING REBAR. ONLY 2 REBAR ANCHORS PER UNIT ARE REQUIRED. ONE AT EACH END.



END UNIT
NOT TO SCALE



KEY PLAN
SCALE 1:12 500

PLAN LEGEND

EXISTING		PROPOSED
	UTILITY POLE AND GUY WIRE	
	STREET LIGHT	
	WATER VALVE	
	SIGN POST/BASE	
	CONCRETE CURB	
X X	FENCE	X X
RW RW	RETAINING WALL	RW
	PROPERTY LINE	
C	COMBINED MANHOLE & PIPE	
S	SANITARY MANHOLE & PIPE	
ST	STORM MANHOLE & PIPE	
	CATCHBASIN	
	GAS MAIN	
	CONCRETE SURFACE	
	EDGE OF ASPHALT	
	EDGE OF GRAVEL	
	WATERMAIN	
	PEDESTRIAN RAMP	
	PUSH BUTTON POLE	
	TRAFFIC SIGNAL POLE	
	GPS OPTICOM	
	TRAFFIC CONTROLLER	
	VEHICLE DETECTION	
	TRAFFIC SIGNAL HEAD	
	PEDESTRIAN HEAD	
	VEHICLE DETECTOR	
TL TL	TRAFFIC SIGNAL CONDUIT	TL TL
	BUS STOP AND/OR SHELTER	

NOTES

1. ALL WORK IS TO BE DONE IN ACCORDANCE WITH HRM CONTRACT DOCUMENTS.
2. GRADES SHOWN ARE APPROXIMATE. FINISHED GRADE IS TO BE APPROVED IN THE FIELD BY THE ENGINEER.
3. UTILITY INFORMATION IS APPROXIMATE ONLY. CONTRACTOR IS RESPONSIBLE TO ARRANGE FOR ON SITE LOCATES WITH ALL UTILITIES PRIOR TO START OF WORK.
4. CONTRACTOR TO OBTAIN ALL NECESSARY PERMITS REQUIRED TO PERFORM WORK AND TO COMPLY WITH ALL APPLICABLE ENVIRONMENTAL REGULATIONS.
5. WHERE EXISTING CONDITIONS ARE SHOWN THEY ARE NOT NECESSARILY ACCURATE OR COMPLETE. THE CONTRACTOR SHALL CONFIRM ALL EXISTING DIMENSIONS AND LOCATIONS AND REPORT ANY DISCREPANCIES TO THE ENGINEER.
6. THE CONTRACTOR SHALL CHECK AND VERIFY ALL PROPOSED DIMENSIONS BEFORE PROCEEDING WITH CONSTRUCTION. ANY ADJUSTMENTS WILL BE MADE BY THE ENGINEER AS NECESSARY.
7. CONTRACTOR IS RESPONSIBLE FOR SETTING GRADES AND LAYOUT CONTROL.
8. TRAFFIC SIGNS ARE NOT TO BE REMOVED OR REPLACED WITHOUT AUTHORIZATION FROM THE TRAFFIC AUTHORITY AND THE ENGINEER.
9. THE CONTRACTOR IS RESPONSIBLE FOR PROTECTION OF TREES. TREES ARE NOT TO BE REMOVED WITHOUT PERMISSION FROM THE ENGINEER.
10. WORK IN THE IMMEDIATE AREA OF A NOVA SCOTIA COORDINATE MONUMENT MUST BE CARRIED OUT BY HAND. THE CONTRACTOR IS RESPONSIBLE FOR ANY COSTS IF MONUMENTS ARE DISTURBED.
11. AT COMPLETION OF WORK REINSTATE ALL DISTURBED SURFACES TO THE SATISFACTION OF THE ENGINEER.
12. WATER VALVE BOX EXTENSIONS – THE MINIMUM INSIDE DIAMETER OF A VALVE BOX EXTENSION SHALL BE 125 mm AND THE MINIMUM LENGTH OF A VALVE BOX EXTENSION SHALL BE 300 mm. CONTRACTOR TO CONFIRM APPROPRIATE PRODUCT TO BE USED WITH HALIFAX WATER OPERATIONS DEPARTMENT STAFF.

REVIEWED AND APPROVED FOR TRAFFIC SIGNALS AND PAVEMENT MARKINGS

Appr'd _____ Date _____
for TRAFFIC AUTHORITY

No.	Date	Revision Description	Appr'd
1	09/17/2021	ISSUED FOR PRE-TENDER REVIEW	

WSP Canada Inc.
1 Spectacle Lake Drive
Dartmouth, Nova Scotia, Canada B3B 1X7
T 902-835-9955 F 902-835-1645 www.wsp.com

HALIFAX

BAYERS ROAD PHASE 2 INTERIM WB TRANSIT LANE
CONNAUGHT AVE. TO WINDSOR STREET HALIFAX, NS

PAVEMENT MARKING AND SIGNAGE PLAN
OXFORD STREET TO WINDSOR STREET

Date 09/14/2020	Drawn DP	Tender No.	19-000
Scale	Survey No. SU17xxxx	Sheet	P04
Reference	DATUM HORZ: NAD83(CSRS) EPOCH 2010.0 3° MTM PROJECTION ZONE 5 VERT: CGVD2013	Drawing No.	181-10877
Checked GO			

PROFILE
NOT TO SCALE

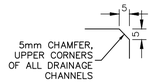
CROSS SECTION
NOT TO SCALE

PRE-CAST END UNIT - SIGN POST DETAIL
NOT TO SCALE

PROFILE
NOT TO SCALE

MID UNIT
NOT TO SCALE

ANCHORING DETAILS - PRE-CAST UNIT
NOT TO SCALE



CHAMFER DETAIL
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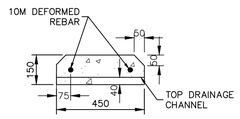
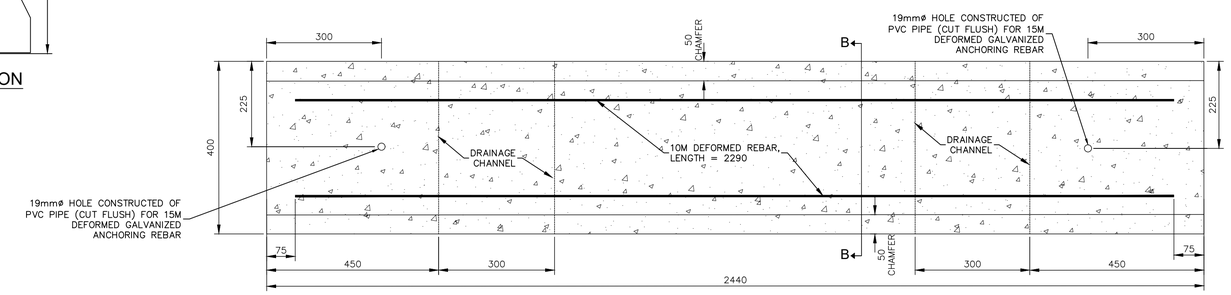
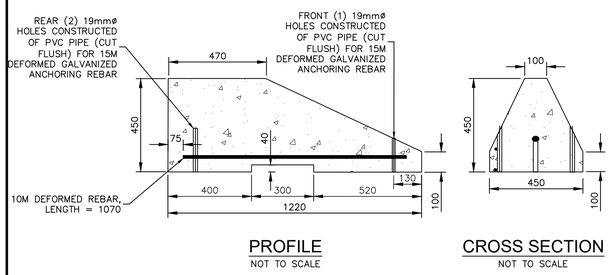


SECTION B-B
NOT TO SCALE



PLAN
NOT TO SCALE

PRE-CAST CONCRETE BIKE LANE CURB - MID UNIT DETAILS
NOT TO SCALE



PROFILE
NOT TO SCALE

CROSS SECTION
NOT TO SCALE

PRE-CAST CONCRETE BIKE LANE CURB - END UNIT DETAILS
NOT TO SCALE

J PRE-CAST BIKE LANE CURB DETAIL
N.T.S.

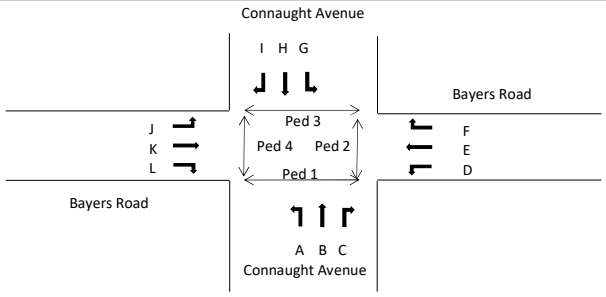
Appendix B:

Traffic Volume Data

Table B-1

Bayers Road
@
Connaught Avenue

Halifax, Nova Scotia
Thursday, October 28, 2021



AM Peak Period Volume Data

Time Interval		Connaught Avenue Northbound Approach			Bayers Road Westbound Approach			Connaught Avenue Southbound Approach			Bayers Road Eastbound Approach			Total Vehicles
Start	*End*	A	B	C	D	E	F	G	H	I	J	K	L	
07:30	07:45	46	73	10	0	88	4	0	43	28	96	147	211	746
07:45	08:00	59	57	8	0	93	5	0	54	43	68	162	231	780
08:00	08:15	44	57	4	0	113	3	0	66	33	60	145	202	727
08:15	08:30	62	80	8	0	111	5	0	62	38	71	151	190	778
08:30	08:45	70	61	14	0	103	8	0	52	47	77	147	166	745
08:45	09:00	56	72	12	0	118	5	0	59	51	51	153	207	784
09:00	09:15	64	50	7	0	111	3	0	50	65	55	151	188	744
09:15	09:30	63	44	7	0	101	3	0	61	53	56	123	152	663
AM Peak Hour		**252**	**263**	**41**	**0**	**443**	**21**	**0**	**223**	**201**	**254**	**602**	**751**	**3051**
07:30	**08:30**	**211**	**267**	**30**	**0**	**405**	**17**	**0**	**225**	**142**	**295**	**605**	**834**	**3031**
08:30	**09:30**	**253**	**227**	**40**	**0**	**433**	**19**	**0**	**222**	**216**	**239**	**574**	**713**	**2936**
		Ped 1			**Ped 2**			**Ped 3**			**Ped 4**			**Total Peds**
07:30	**08:30**	**11**			**10**			**17**			**7**			**45**
08:30	**09:30**	**16**			**9**			**4**			**4**			**33**

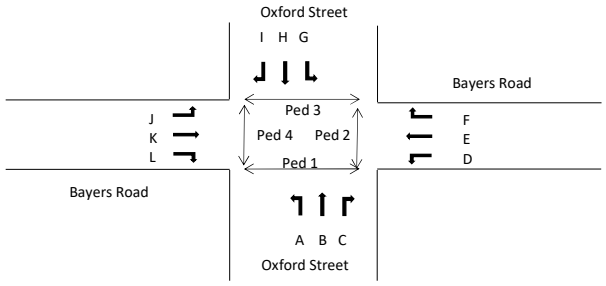
PM Peak Period Volume Data

Time Interval		Connaught Avenue Northbound Approach			Bayers Road Westbound Approach			Connaught Avenue Southbound Approach			Bayers Road Eastbound Approach			Total Vehicles
Start	*End*	A	B	C	D	E	F	G	H	I	J	K	L	
15:45	16:00	217	56	5	0	155	1	0	45	88	59	121	146	893
16:00	16:15	227	62	4	0	175	1	0	45	96	50	132	156	948
16:15	16:30	228	55	2	0	176	2	0	60	83	55	144	156	961
16:30	16:45	205	59	5	0	181	0	0	52	72	60	123	165	922
16:45	17:00	225	50	4	0	156	2	0	63	98	60	136	158	952
17:00	17:15	201	45	1	0	186	0	0	59	82	52	129	178	933
17:15	17:30	200	39	3	0	180	1	0	58	82	47	138	173	921
17:30	17:45	199	41	3	0	178	2	0	44	57	54	137	180	895
PM Peak Hour		**885**	**226**	**15**	**0**	**688**	**5**	**0**	**220**	**349**	**225**	**535**	**635**	**3783**
15:45	**16:45**	**877**	**232**	**16**	**0**	**687**	**4**	**0**	**202**	**339**	**224**	**520**	**623**	**3724**
16:45	**17:45**	**825**	**175**	**11**	**0**	**700**	**5**	**0**	**224**	**319**	**213**	**540**	**689**	**3701**
		Ped 1			**Ped 2**			**Ped 3**			**Ped 4**			**Total Peds**
15:45	**16:45**	**14**			**9**			**21**			**14**			**58**
16:45	**17:45**	**21**			**14**			**13**			**7**			**55**

Table B-2

Bayers Road
@
Oxford Street

Halifax, Nova Scotia
Thursday, October 28, 2021



AM Peak Period Volume Data

Time Interval		Oxford Street Northbound Approach			Bayers Road Westbound Approach			Oxford Street Southbound Approach			Bayers Road Eastbound Approach			Total Vehicles
Start	*End*	A	B	C	D	E	F	G	H	I	J	K	L	
07:00	07:15	13	5	3	1	51	2	5	8	0	0	121	24	233
07:15	07:30	11	7	11	3	53	3	5	5	0	0	128	13	239
07:30	07:45	20	14	13	7	64	3	11	9	1	0	129	32	303
07:45	08:00	24	6	11	2	69	3	14	15	1	0	111	48	304
08:00	08:15	37	13	11	9	59	5	12	26	3	0	118	30	323
08:15	08:30	35	18	8	15	82	6	11	21	0	1	121	25	343
08:30	08:45	43	38	11	10	66	7	8	31	1	0	121	29	365
08:45	09:00	35	30	17	9	82	9	12	39	4	0	120	36	393
AM Peak Hour		**150**	**99**	**47**	**43**	**289**	**27**	**43**	**117**	**8**	**1**	**480**	**120**	**1424**
07:00	**08:00**	**68**	**32**	**38**	**13**	**237**	**11**	**35**	**37**	**2**	**0**	**489**	**117**	**1079**
08:00	**09:00**	**150**	**99**	**47**	**43**	**289**	**27**	**43**	**117**	**8**	**1**	**480**	**120**	**1424**
		Ped 1			**Ped 2**			**Ped 3**			**Ped 4**			**Total Peds**
07:00	**08:00**	**5**			**3**			**3**			**4**			**15**
08:00	**09:00**	**14**			**35**			**7**			**51**			**107**

PM Peak Period Volume Data

Time Interval		Oxford Street Northbound Approach			Bayers Road Westbound Approach			Oxford Street Southbound Approach			Bayers Road Eastbound Approach			Total Vehicles
Start	*End*	A	B	C	D	E	F	G	H	I	J	K	L	
15:00	15:15	49	25	17	12	150	12	15	13	1	2	92	13	401
15:15	15:30	54	30	13	10	169	3	8	23	1	2	94	19	426
15:30	15:45	52	33	14	12	158	5	7	13	0	0	107	17	418
15:45	16:00	59	36	14	10	158	9	4	12	3	0	109	16	430
16:00	16:15	38	33	16	7	136	16	5	12	1	3	106	21	394
16:15	16:30	45	41	17	7	131	23	4	17	1	1	116	12	415
16:30	16:45	42	50	17	6	126	27	3	14	0	3	90	22	400
16:45	17:00	46	44	16	7	137	19	5	19	0	2	104	26	425
PM Peak Hour		**214**	**124**	**58**	**44**	**635**	**29**	**34**	**61**	**5**	**4**	**402**	**65**	**1675**
15:00	**16:00**	**214**	**124**	**58**	**44**	**635**	**29**	**34**	**61**	**5**	**4**	**402**	**65**	**1675**
16:00	**17:00**	**171**	**168**	**66**	**27**	**530**	**85**	**17**	**62**	**2**	**9**	**416**	**81**	**1634**
		Ped 1			**Ped 2**			**Ped 3**			**Ped 4**			**Total Peds**
15:00	**16:00**	**5**			**52**			**33**			**17**			**107**
16:00	**17:00**	**10**			**23**			**25**			**18**			**76**

Appendix C:

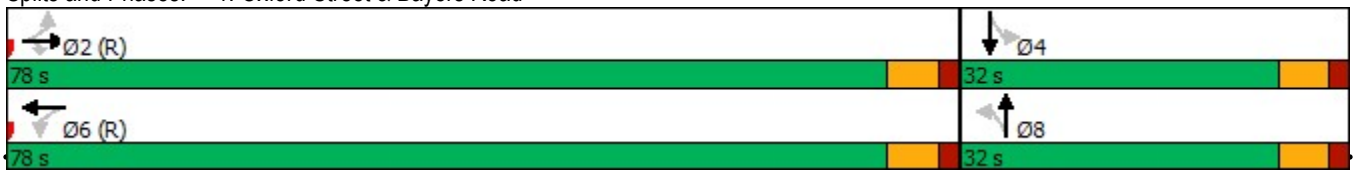
Synchro / SimTraffic Reports

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	5	505	125	45	305	30	160	105	50	45	125	10
Future Volume (vph)	5	505	125	45	305	30	160	105	50	45	125	10
Satd. Flow (prot)	0	1419	1085	0	2936	0	1449	1459	0	1420	1328	0
Flt Permitted		0.997			0.836		0.611			0.565		
Satd. Flow (perm)	0	1414	1033	0	2467	0	919	1459	0	777	1328	0
Satd. Flow (RTOR)			136		17			20			3	
Lane Group Flow (vph)	0	554	136	0	414	0	174	168	0	49	147	0
Turn Type	Perm	NA	Perm	Perm	NA		Perm	NA		Perm	NA	
Protected Phases		2			6			8			4	
Permitted Phases	2		2	6			8			4		
Total Split (s)	78.0	78.0	78.0	78.0	78.0		32.0	32.0		32.0	32.0	
Total Lost Time (s)		5.9	5.9		5.9		5.9	5.9		5.9	5.9	
Act Effct Green (s)		75.1	75.1		75.1		23.1	23.1		23.1	23.1	
Actuated g/C Ratio		0.68	0.68		0.68		0.21	0.21		0.21	0.21	
v/c Ratio		0.57	0.18		0.25		0.90	0.52		0.30	0.52	
Control Delay		12.8	1.8		7.2		85.8	39.1		40.4	44.0	
Queue Delay		0.0	0.0		0.0		0.0	0.0		0.0	0.0	
Total Delay		12.8	1.8		7.2		85.8	39.1		40.4	44.0	
LOS		B	A		A		F	D		D	D	
Approach Delay		10.6			7.2			62.9			43.1	
Approach LOS		B			A			E			D	
Queue Length 50th (m)		61.4	0.0		16.7		35.3	27.2		8.6	26.6	
Queue Length 95th (m)		92.9	6.3		23.8		#71.2	47.9		19.8	46.3	
Internal Link Dist (m)		217.3			309.1			518.4			229.7	
Turn Bay Length (m)			60.0				65.0			60.0		
Base Capacity (vph)		964	747		1688		218	361		184	317	
Starvation Cap Reductn		0	0		0		0	0		0	0	
Spillback Cap Reductn		0	0		0		0	0		0	0	
Storage Cap Reductn		0	0		0		0	0		0	0	
Reduced v/c Ratio		0.57	0.18		0.25		0.80	0.47		0.27	0.46	

Intersection Summary

Cycle Length: 110
Actuated Cycle Length: 110
Offset: 0 (0%), Referenced to phase 2:EBTL and 6:WBTL, Start of Green
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.90
Intersection Signal Delay: 24.5 Intersection LOS: C
Intersection Capacity Utilization 87.1% 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.

Splits and Phases: 1: Oxford Street & Bayers Road



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	5	630	20	5	455	20	5	5	15	5	5	15
Future Volume (Veh/h)	5	630	20	5	455	20	5	5	15	5	5	15
Sign Control		Free			Free			Stop			Stop	
Grade		3%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	5	685	22	5	495	22	5	5	16	5	5	16
Pedestrians					50			15			15	
Lane Width (m)					3.5			3.5			3.5	
Walking Speed (m/s)					1.2			1.2			1.2	
Percent Blockage					4			1			1	
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)		223			241							
pX, platoon unblocked				0.62			0.62	0.62	0.62	0.62	0.62	
vC, conflicting volume	532			722			997	1263	761	1306	1263	274
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	532			243			687	1117	306	1186	1117	274
tC, single (s)	4.2			4.2			7.5	6.5	6.9	7.5	6.5	6.9
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			97	96	96	93	96	98
cM capacity (veh/h)	1012			803			188	123	405	77	123	715

Direction, Lane #	EB 1	WB 1	WB 2	NB 1	SB 1
Volume Total	712	252	270	26	26
Volume Left	5	5	0	5	5
Volume Right	22	0	22	16	16
cSH	1012	803	1700	243	203
Volume to Capacity	0.00	0.01	0.16	0.11	0.13
Queue Length 95th (m)	0.1	0.1	0.0	2.7	3.3
Control Delay (s)	0.1	0.3	0.0	21.6	25.4
Lane LOS	A	A		C	D
Approach Delay (s)	0.1	0.1		21.6	25.4
Approach LOS				C	D

Intersection Summary			
Average Delay	1.1		
Intersection Capacity Utilization	61.3%	ICU Level of Service	B
Analysis Period (min)	15		

Lane Group	EBL	EBT	EBR	EBR2	WBT	WBR	NBL	NBT	NBR	SBT	SBR
Lane Configurations											
Traffic Volume (vph)	265	620	10	790	465	20	265	275	45	235	210
Future Volume (vph)	265	620	10	790	465	20	265	275	45	235	210
Satd. Flow (prot)	1551	1632	714	1387	2937	0	3008	1580	0	1600	1360
Flt Permitted	0.315						0.950				
Satd. Flow (perm)	509	1632	714	1322	2937	0	3008	1580	0	1600	1360
Satd. Flow (RTOR)				859	4						
Lane Group Flow (vph)	288	674	11	859	527	0	288	348	0	255	228
Turn Type	pm+pt	NA	custom	custom	NA		Prot	NA		NA	custom
Protected Phases	5	2	9	2 8!	6		3	8		4!	4 5 9
Permitted Phases	2			2 8							
Total Split (s)	17.0	61.0	10.0		44.0		18.0	49.0		31.0	
Total Lost Time (s)	4.0	5.9	2.0		5.9		6.0	5.2		5.2	
Act Effct Green (s)	57.3	55.4	8.0	104.1	38.1		12.0	43.5		25.5	52.8
Actuated g/C Ratio	0.48	0.46	0.07	0.87	0.32		0.10	0.36		0.21	0.44
v/c Ratio	0.80	0.90	0.23	0.65	0.56		0.96	0.61		0.75	0.38
Control Delay	40.3	46.0	65.5	2.6	36.6		96.7	36.7		59.2	25.0
Queue Delay	0.0	48.0	0.0	1.3	0.0		0.0	0.0		0.0	0.0
Total Delay	40.3	94.0	65.5	3.9	36.6		96.7	36.7		59.2	25.0
LOS	D	F	E	A	D		F	D		E	C
Approach Delay		43.1			36.6			63.9		43.1	
Approach LOS		D			D			E		D	
Queue Length 50th (m)	42.6	142.8	2.5	0.0	53.7		35.3	66.2		56.5	35.4
Queue Length 95th (m)	#77.3	#216.7	8.7	3.6	71.5		#62.2	97.3		#91.6	55.9
Internal Link Dist (m)		119.7			198.5			461.8		84.0	
Turn Bay Length (m)	90.0		15.0	15.0			110.0				
Base Capacity (vph)	358	753	47	1317	935		300	576		344	578
Starvation Cap Reductn	0	165	0	249	0		0	0		0	0
Spillback Cap Reductn	0	0	0	0	0		0	0		0	0
Storage Cap Reductn	0	0	0	0	0		0	0		0	0
Reduced v/c Ratio	0.80	1.15	0.23	0.80	0.56		0.96	0.60		0.74	0.39

Intersection Summary

Cycle Length: 120
Actuated Cycle Length: 120
Offset: 0 (0%), Referenced to phase 2:EBTL and 6:WBT, Start of Green
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.96
Intersection Signal Delay: 45.9 Intersection LOS: D
Intersection Capacity Utilization 92.4% ICU Level of Service F
Analysis Period (min) 15
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
! Phase conflict between lane groups.

Splits and Phases: 3: Connaught Avenue & Bayers Road

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	5	420	70	45	665	30	225	130	60	35	65	5
Future Volume (vph)	5	420	70	45	665	30	225	130	60	35	65	5
Satd. Flow (prot)	0	1417	1085	0	2969	0	1449	1466	0	1420	1330	0
Flt Permitted		0.993			0.895		0.708			0.548		
Satd. Flow (perm)	0	1409	1036	0	2664	0	1064	1466	0	762	1330	0
Satd. Flow (RTOR)			76		7			25			4	
Lane Group Flow (vph)	0	462	76	0	805	0	245	206	0	38	76	0
Turn Type	Perm	NA	Perm	Perm	NA		Perm	NA		Perm	NA	
Protected Phases		2			6			8			4	
Permitted Phases	2		2	6			8			4		
Total Split (s)	61.0	61.0	61.0	61.0	61.0		39.0	39.0		39.0	39.0	
Total Lost Time (s)		5.9	5.9		5.9		5.9	5.9		5.9	5.9	
Act Effct Green (s)		60.9	60.9		60.9		27.3	27.3		27.3	27.3	
Actuated g/C Ratio		0.61	0.61		0.61		0.27	0.27		0.27	0.27	
v/c Ratio		0.54	0.12		0.50		0.84	0.49		0.18	0.21	
Control Delay		15.7	3.0		13.2		58.9	29.7		27.5	25.8	
Queue Delay		0.0	0.0		0.0		0.0	0.0		0.0	0.0	
Total Delay		15.7	3.0		13.2		58.9	29.7		27.5	25.8	
LOS		B	A		B		E	C		C	C	
Approach Delay		13.9			13.2			45.5			26.4	
Approach LOS		B			B			D			C	
Queue Length 50th (m)		50.0	0.0		43.6		44.0	28.7		5.5	10.5	
Queue Length 95th (m)		87.6	6.2		66.1		#71.7	46.7		13.0	20.5	
Internal Link Dist (m)		217.3			309.1			518.4			229.7	
Turn Bay Length (m)			60.0				65.0			60.0		
Base Capacity (vph)		858	660		1626		352	501		252	442	
Starvation Cap Reductn		0	0		0		0	0		0	0	
Spillback Cap Reductn		0	0		0		0	0		0	0	
Storage Cap Reductn		0	0		0		0	0		0	0	
Reduced v/c Ratio		0.54	0.12		0.50		0.70	0.41		0.15	0.17	

Intersection Summary

Cycle Length: 100
Actuated Cycle Length: 100
Offset: 0 (0%), Referenced to phase 2:EBTL and 6:WBTL, Start of Green
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.84
Intersection Signal Delay: 21.8 Intersection LOS: C
Intersection Capacity Utilization 92.0% ICU Level of Service F
Analysis Period (min) 15
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 1: Oxford Street & Bayers Road

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	5	510	20	5	785	20	5	5	15	5	5	15
Future Volume (Veh/h)	5	510	20	5	785	20	5	5	15	5	5	15
Sign Control		Free			Free			Stop			Stop	
Grade		3%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	5	554	22	5	853	22	5	5	16	5	5	16
Pedestrians					50			15			15	
Lane Width (m)					3.5			3.5			3.5	
Walking Speed (m/s)					1.2			1.2			1.2	
Percent Blockage					4			1			1	
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)		223			241							
pX, platoon unblocked	0.93			0.65			0.69	0.69	0.65	0.69	0.69	0.93
vC, conflicting volume	890			591			1045	1490	630	1532	1490	452
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	739			106			472	1121	166	1183	1121	271
tC, single (s)	4.2			4.2			7.5	6.5	6.9	7.5	6.5	6.9
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			99			98	96	97	94	96	98
cM capacity (veh/h)	789			951			297	135	525	86	135	670

Direction, Lane #	EB 1	WB 1	WB 2	NB 1	SB 1
Volume Total	581	432	448	26	26
Volume Left	5	5	0	5	5
Volume Right	22	0	22	16	16
cSH	789	951	1700	309	219
Volume to Capacity	0.01	0.01	0.26	0.08	0.12
Queue Length 95th (m)	0.1	0.1	0.0	2.1	3.0
Control Delay (s)	0.2	0.2	0.0	17.7	23.6
Lane LOS	A	A		C	C
Approach Delay (s)	0.2	0.1		17.7	23.6
Approach LOS				C	C

Intersection Summary				
Average Delay	0.8			
Intersection Capacity Utilization	54.2%	ICU Level of Service		A
Analysis Period (min)	15			

Lane Group	EBL	EBT	EBR	EBR2	WBT	WBR	NBL	NBT	NBR	SBT	SBR
Lane Configurations											
Traffic Volume (vph)	235	550	10	665	720	5	930	235	15	230	365
Future Volume (vph)	235	550	10	665	720	5	930	235	15	230	365
Satd. Flow (prot)	1551	1632	714	1387	2955	0	3008	1609	0	1600	1360
Flt Permitted	0.102						0.950				
Satd. Flow (perm)	166	1632	714	1314	2955	0	3008	1609	0	1600	1360
Satd. Flow (RTOR)				723							
Lane Group Flow (vph)	255	598	11	723	788	0	1011	271	0	250	397
Turn Type	pm+pt	NA	custom	custom	NA		Prot	NA		NA	custom
Protected Phases	5	2	9	2 8!	6		3	8		4!	4 5 9
Permitted Phases	2			2 8							
Total Split (s)	18.0	59.0	10.0		41.0		40.0	71.0		31.0	
Total Lost Time (s)	4.0	5.9	2.0		5.9		6.0	5.2		5.2	
Act Effct Green (s)	55.0	53.1	8.0	124.1	35.1		34.0	65.8		25.8	53.8
Actuated g/C Ratio	0.39	0.38	0.06	0.89	0.25		0.24	0.47		0.18	0.38
v/c Ratio	1.26	0.97	0.28	0.55	1.06		1.38	0.36		0.85	0.76
Control Delay	181.6	71.8	80.7	1.8	101.1		221.3	25.4		80.8	48.6
Queue Delay	0.0	41.6	0.0	1.3	0.0		0.0	0.0		0.0	0.0
Total Delay	181.6	113.4	80.7	3.1	101.1		221.3	25.4		80.8	48.6
LOS	F	F	F	A	F		F	C		F	D
Approach Delay		73.9			101.1			179.9		61.0	
Approach LOS		E			F			F		E	
Queue Length 50th (m)	~74.0	161.3	3.0	0.0	~126.2		~191.1	47.0		67.7	94.9
Queue Length 95th (m)	#128.8	#237.0	9.8	3.0	#166.1		#231.7	68.5		#112.9	136.9
Internal Link Dist (m)		119.7			198.5			461.8		84.0	
Turn Bay Length (m)	90.0		15.0	15.0			110.0				
Base Capacity (vph)	203	618	40	1311	740		730	756		294	522
Starvation Cap Reductn	0	140	0	368	0		0	0		0	0
Spillback Cap Reductn	0	0	0	0	0		0	0		0	0
Storage Cap Reductn	0	0	0	0	0		0	0		0	0
Reduced v/c Ratio	1.26	1.25	0.28	0.77	1.06		1.38	0.36		0.85	0.76

Intersection Summary

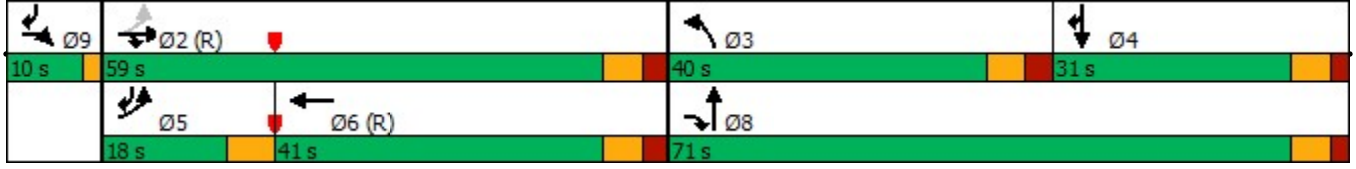
Cycle Length: 140
Actuated Cycle Length: 140
Offset: 0 (0%), Referenced to phase 2:EBTL and 6:WBT, Start of Green
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 1.38
Intersection Signal Delay: 108.5 Intersection LOS: F
Intersection Capacity Utilization 111.1% ICU Level of Service H
Analysis Period (min) 15

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

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

! Phase conflict between lane groups.

Splits and Phases: 3: Connaught Avenue & Bayers Road



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	5	505	125	45	305	30	160	105	50	45	125	10
Future Volume (vph)	5	505	125	45	305	30	160	105	50	45	125	10
Satd. Flow (prot)	0	1419	1085	0	1571	1374	1449	1459	0	1420	1328	0
Flt Permitted		0.997			0.884		0.607			0.560		
Satd. Flow (perm)	0	1414	1033	0	1395	1304	912	1459	0	770	1328	0
Satd. Flow (RTOR)			136			33		20			3	
Lane Group Flow (vph)	0	554	136	0	381	33	174	168	0	49	147	0
Turn Type	Perm	NA	Perm	Perm	NA	Perm	Perm	NA		Perm	NA	
Protected Phases		2			6			8			4	
Permitted Phases	2		2	6		6	8			4		
Total Split (s)	78.0	78.0	78.0	78.0	78.0	78.0	32.0	32.0		32.0	32.0	
Total Lost Time (s)		5.9	5.9		5.9	5.9	5.9	5.9		5.9	5.9	
Act Effct Green (s)		75.9	75.9		75.9	75.9	22.3	22.3		22.3	22.3	
Actuated g/C Ratio		0.69	0.69		0.69	0.69	0.20	0.20		0.20	0.20	
v/c Ratio		0.57	0.18		0.40	0.04	0.94	0.54		0.31	0.54	
Control Delay		12.4	1.8		9.5	2.3	96.0	40.2		41.4	45.3	
Queue Delay		0.0	0.0		0.0	0.0	0.0	0.0		0.0	0.0	
Total Delay		12.4	1.8		9.5	2.3	96.0	40.2		41.4	45.3	
LOS		B	A		A	A	F	D		D	D	
Approach Delay		10.3			8.9			68.6			44.3	
Approach LOS		B			A			E			D	
Queue Length 50th (m)		58.5	0.0		33.7	0.0	36.1	27.7		8.8	27.1	
Queue Length 95th (m)		92.9	6.3		54.0	3.2	#71.6	47.9		19.8	46.3	
Internal Link Dist (m)		217.3			309.1			518.4			229.7	
Turn Bay Length (m)			60.0				65.0			60.0		
Base Capacity (vph)		975	754		962	909	216	361		182	317	
Starvation Cap Reductn		0	0		0	0	0	0		0	0	
Spillback Cap Reductn		0	0		0	0	0	0		0	0	
Storage Cap Reductn		0	0		0	0	0	0		0	0	
Reduced v/c Ratio		0.57	0.18		0.40	0.04	0.81	0.47		0.27	0.46	

Intersection Summary

Cycle Length: 110
Actuated Cycle Length: 110
Offset: 0 (0%), Referenced to phase 2:EBTL and 6:WBTL, Start of Green
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.94
Intersection Signal Delay: 26.1 Intersection LOS: C
Intersection Capacity Utilization 92.4% ICU Level of Service F
Analysis Period (min) 15
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 1: Oxford Street & Bayers Road

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	5	630	20	5	455	20	5	5	15	5	5	15
Future Volume (Veh/h)	5	630	20	5	455	20	5	5	15	5	5	15
Sign Control		Free			Free			Stop			Stop	
Grade		3%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	5	685	22	5	495	22	5	5	16	5	5	16
Pedestrians					50			15			15	
Lane Width (m)					3.5			3.5			3.5	
Walking Speed (m/s)					1.2			1.2			1.2	
Percent Blockage					4			1			1	
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)		223			241							
pX, platoon unblocked	0.91			0.62			0.67	0.67	0.62	0.67	0.67	0.91
vC, conflicting volume	532			722			1244	1263	761	1294	1252	510
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	431			243			797	825	306	872	808	407
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			97	97	96	97	98	97
cM capacity (veh/h)	1005			806			186	198	431	157	202	576

Direction, Lane #	EB 1	WB 1	WB 2	NB 1	SB 1
Volume Total	712	500	22	26	26
Volume Left	5	5	0	5	5
Volume Right	22	0	22	16	16
cSH	1005	806	1700	291	309
Volume to Capacity	0.00	0.01	0.01	0.09	0.08
Queue Length 95th (m)	0.1	0.1	0.0	2.2	2.1
Control Delay (s)	0.1	0.2	0.0	18.6	17.7
Lane LOS	A	A		C	C
Approach Delay (s)	0.1	0.2		18.6	17.7
Approach LOS				C	C

Intersection Summary				
Average Delay	0.9			
Intersection Capacity Utilization	67.6%	ICU Level of Service		C
Analysis Period (min)	15			

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	5	420	70	45	665	30	225	130	60	35	65	5
Future Volume (vph)	5	420	70	45	665	30	225	130	60	35	65	5
Satd. Flow (prot)	0	1417	1085	0	1575	1374	1449	1466	0	1420	1330	0
Flt Permitted		0.993			0.947		0.708			0.547		
Satd. Flow (perm)	0	1409	1036	0	1495	1308	1064	1466	0	761	1330	0
Satd. Flow (RTOR)			76			33		25			4	
Lane Group Flow (vph)	0	462	76	0	772	33	245	206	0	38	76	0
Turn Type	Perm	NA	Perm	Perm	NA	Perm	Perm	NA		Perm	NA	
Protected Phases		2			6			8			4	
Permitted Phases	2		2	6		6	8			4		
Total Split (s)	61.0	61.0	61.0	61.0	61.0	61.0	39.0	39.0		39.0	39.0	
Total Lost Time (s)		5.9	5.9		5.9	5.9	5.9	5.9		5.9	5.9	
Act Effct Green (s)		61.1	61.1		61.1	61.1	27.1	27.1		27.1	27.1	
Actuated g/C Ratio		0.61	0.61		0.61	0.61	0.27	0.27		0.27	0.27	
v/c Ratio		0.54	0.11		0.85	0.04	0.85	0.50		0.18	0.21	
Control Delay		15.6	3.0		28.5	3.7	59.6	29.8		27.7	25.9	
Queue Delay		0.0	0.0		0.0	0.0	0.0	0.0		0.0	0.0	
Total Delay		15.6	3.0		28.5	3.7	59.6	29.8		27.7	25.9	
LOS		B	A		C	A	E	C		C	C	
Approach Delay		13.8			27.5			46.0			26.5	
Approach LOS		B			C			D			C	
Queue Length 50th (m)		49.5	0.0		115.0	0.0	44.2	28.8		5.6	10.6	
Queue Length 95th (m)		87.6	6.2		#214.6	4.1	#71.7	46.7		13.0	20.5	
Internal Link Dist (m)		217.3			309.1			518.4			229.7	
Turn Bay Length (m)			60.0				65.0			60.0		
Base Capacity (vph)		860	662		913	811	352	501		251	442	
Starvation Cap Reductn		0	0		0	0	0	0		0	0	
Spillback Cap Reductn		0	0		0	0	0	0		0	0	
Storage Cap Reductn		0	0		0	0	0	0		0	0	
Reduced v/c Ratio		0.54	0.11		0.85	0.04	0.70	0.41		0.15	0.17	

Intersection Summary

Cycle Length: 100
Actuated Cycle Length: 100
Offset: 0 (0%), Referenced to phase 2:EBTL and 6:WBTL, Start of Green
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.85
Intersection Signal Delay: 28.0 Intersection LOS: C
Intersection Capacity Utilization 110.7% ICU Level of Service H
Analysis Period (min) 15
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 1: Oxford Street & Bayers Road

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	5	510	20	5	785	20	5	5	15	5	5	15
Future Volume (Veh/h)	5	510	20	5	785	20	5	5	15	5	5	15
Sign Control		Free			Free			Stop			Stop	
Grade		3%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	5	554	22	5	853	22	5	5	16	5	5	16
Pedestrians					50			15			15	
Lane Width (m)					3.5			3.5			3.5	
Walking Speed (m/s)					1.2			1.2			1.2	
Percent Blockage					4			1			1	
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)		223			241							
pX, platoon unblocked	0.60			0.65			0.78	0.78	0.65	0.78	0.78	0.60
vC, conflicting volume	890			591			1472	1490	630	1522	1479	868
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	492			110			463	487	170	527	473	455
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			99			99	99	97	98	99	96
cM capacity (veh/h)	637			952			360	360	542	318	367	362

Direction, Lane #	EB 1	WB 1	WB 2	NB 1	SB 1
Volume Total	581	858	22	26	26
Volume Left	5	5	0	5	5
Volume Right	22	0	22	16	16
cSH	637	952	1700	454	353
Volume to Capacity	0.01	0.01	0.01	0.06	0.07
Queue Length 95th (m)	0.2	0.1	0.0	1.4	1.8
Control Delay (s)	0.2	0.1	0.0	13.4	16.0
Lane LOS	A	A		B	C
Approach Delay (s)	0.2	0.1		13.4	16.0
Approach LOS				B	C

Intersection Summary				
Average Delay	0.7			
Intersection Capacity Utilization	68.0%	ICU Level of Service		C
Analysis Period (min)	15			

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	505	125	0	350	30	160	105	50	45	125	10
Future Volume (vph)	0	505	125	0	350	30	160	105	50	45	125	10
Satd. Flow (prot)	0	1419	1085	0	1580	1374	1449	1459	0	1420	1328	0
Flt Permitted							0.612			0.566		
Satd. Flow (perm)	0	1419	1033	0	1580	1304	920	1459	0	778	1328	0
Satd. Flow (RTOR)			136			33		20			3	
Lane Group Flow (vph)	0	549	136	0	380	33	174	168	0	49	147	0
Turn Type		NA	Perm		NA	Perm	Perm	NA		Perm	NA	
Protected Phases		2			6			8			4	
Permitted Phases	2		2	6		6	8			4		
Total Split (s)	78.0	78.0	78.0	78.0	78.0	78.0	32.0	32.0		32.0	32.0	
Total Lost Time (s)		5.9	5.9		5.9	5.9	5.9	5.9		5.9	5.9	
Act Effct Green (s)		74.9	74.9		74.9	74.9	23.3	23.3		23.3	23.3	
Actuated g/C Ratio		0.68	0.68		0.68	0.68	0.21	0.21		0.21	0.21	
v/c Ratio		0.57	0.18		0.35	0.04	0.89	0.52		0.30	0.52	
Control Delay		12.7	1.8		9.0	2.3	83.9	38.9		40.2	43.7	
Queue Delay		0.0	0.0		0.0	0.0	0.0	0.0		0.0	0.0	
Total Delay		12.7	1.8		9.0	2.3	83.9	38.9		40.2	43.7	
LOS		B	A		A	A	F	D		D	D	
Approach Delay		10.5			8.5			61.8			42.9	
Approach LOS		B			A			E			D	
Queue Length 50th (m)		60.5	0.0		33.7	0.0	35.3	27.2		8.6	26.6	
Queue Length 95th (m)		91.1	6.3		50.4	3.2	#71.1	47.9		19.8	46.3	
Internal Link Dist (m)		217.3			309.1			518.4			229.7	
Turn Bay Length (m)			60.0				65.0			60.0		
Base Capacity (vph)		965	746		1075	898	218	361		184	317	
Starvation Cap Reductn		0	0		0	0	0	0		0	0	
Spillback Cap Reductn		0	0		0	0	0	0		0	0	
Storage Cap Reductn		0	0		0	0	0	0		0	0	
Reduced v/c Ratio		0.57	0.18		0.35	0.04	0.80	0.47		0.27	0.46	

Intersection Summary

Cycle Length: 110
Actuated Cycle Length: 110
Offset: 0 (0%), Referenced to phase 2:EBTL and 6:WBTL, Start of Green
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.89
Intersection Signal Delay: 24.6 Intersection LOS: C
Intersection Capacity Utilization 74.0% 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: 1: Oxford Street & Bayers Road

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	10	630	20	50	455	20	5	5	15	5	5	15
Future Volume (Veh/h)	10	630	20	50	455	20	5	5	15	5	5	15
Sign Control		Free			Free			Stop			Stop	
Grade		3%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	11	685	22	54	495	22	5	5	16	5	5	16
Pedestrians					50			15			15	
Lane Width (m)					3.5			3.5			3.5	
Walking Speed (m/s)					1.2			1.2			1.2	
Percent Blockage					4			1			1	
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)		223			241							
pX, platoon unblocked	0.90			0.62			0.67	0.67	0.62	0.67	0.67	0.90
vC, conflicting volume	532			722			1354	1373	761	1404	1362	510
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	429			239			956	984	303	1031	967	405
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			93			96	97	96	96	97	97
cM capacity (veh/h)	1005			806			137	149	431	116	152	577

Direction, Lane #	EB 1	WB 1	WB 2	NB 1	SB 1
Volume Total	718	549	22	26	26
Volume Left	11	54	0	5	5
Volume Right	22	0	22	16	16
cSH	1005	806	1700	242	250
Volume to Capacity	0.01	0.07	0.01	0.11	0.10
Queue Length 95th (m)	0.3	1.6	0.0	2.7	2.6
Control Delay (s)	0.3	1.8	0.0	21.6	21.0
Lane LOS	A	A		C	C
Approach Delay (s)	0.3	1.7		21.6	21.0
Approach LOS				C	C

Intersection Summary				
Average Delay	1.7			
Intersection Capacity Utilization	78.1%	ICU Level of Service	D	
Analysis Period (min)	15			

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	420	70	0	710	30	225	130	60	35	65	5
Future Volume (vph)	0	420	70	0	710	30	225	130	60	35	65	5
Satd. Flow (prot)	0	1419	1085	0	1580	1374	1449	1466	0	1420	1330	0
Flt Permitted							0.708			0.548		
Satd. Flow (perm)	0	1419	1036	0	1580	1308	1064	1466	0	762	1330	0
Satd. Flow (RTOR)			76			33		25			4	
Lane Group Flow (vph)	0	457	76	0	772	33	245	206	0	38	76	0
Turn Type		NA	Perm		NA	Perm	Perm	NA		Perm	NA	
Protected Phases		2			6			8			4	
Permitted Phases	2		2	6		6	8			4		
Total Split (s)	61.0	61.0	61.0	61.0	61.0	61.0	39.0	39.0		39.0	39.0	
Total Lost Time (s)		5.9	5.9		5.9	5.9	5.9	5.9		5.9	5.9	
Act Effct Green (s)		60.9	60.9		60.9	60.9	27.3	27.3		27.3	27.3	
Actuated g/C Ratio		0.61	0.61		0.61	0.61	0.27	0.27		0.27	0.27	
v/c Ratio		0.53	0.12		0.80	0.04	0.84	0.49		0.18	0.21	
Control Delay		15.4	3.0		25.0	3.7	58.9	29.7		27.5	25.8	
Queue Delay		0.0	0.0		0.0	0.0	0.0	0.0		0.0	0.0	
Total Delay		15.4	3.0		25.0	3.7	58.9	29.7		27.5	25.8	
LOS		B	A		C	A	E	C		C	C	
Approach Delay		13.7			24.1			45.5			26.4	
Approach LOS		B			C			D			C	
Queue Length 50th (m)		49.0	0.0		109.6	0.0	44.0	28.7		5.5	10.5	
Queue Length 95th (m)		85.6	6.2		#205.1	4.1	#71.7	46.7		13.0	20.5	
Internal Link Dist (m)		217.3			309.1			518.4			229.7	
Turn Bay Length (m)			60.0				65.0			60.0		
Base Capacity (vph)		864	660		962	809	352	501		252	442	
Starvation Cap Reductn		0	0		0	0	0	0		0	0	
Spillback Cap Reductn		0	0		0	0	0	0		0	0	
Storage Cap Reductn		0	0		0	0	0	0		0	0	
Reduced v/c Ratio		0.53	0.12		0.80	0.04	0.70	0.41		0.15	0.17	

Intersection Summary

Cycle Length: 100
Actuated Cycle Length: 100
Offset: 0 (0%), Referenced to phase 2:EBTL and 6:WBTL, Start of Green
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.84
Intersection Signal Delay: 26.4 Intersection LOS: C
Intersection Capacity Utilization 82.6% 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: 1: Oxford Street & Bayers Road

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	10	510	20	50	785	20	5	5	15	5	5	15
Future Volume (Veh/h)	10	510	20	50	785	20	5	5	15	5	5	15
Sign Control		Free			Free			Stop			Stop	
Grade		3%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	11	554	22	54	853	22	5	5	16	5	5	16
Pedestrians					50			15			15	
Lane Width (m)					3.5			3.5			3.5	
Walking Speed (m/s)					1.2			1.2			1.2	
Percent Blockage					4			1			1	
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)		223			241							
pX, platoon unblocked	0.57			0.65			0.74	0.74	0.65	0.74	0.74	0.57
vC, conflicting volume	890			591			1582	1600	630	1632	1589	868
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	433			108			562	586	168	629	572	394
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 %	98			94			98	98	97	98	98	96
cM capacity (veh/h)	633			952			282	284	542	248	290	370

Direction, Lane #	EB 1	WB 1	WB 2	NB 1	SB 1
Volume Total	587	907	22	26	26
Volume Left	11	54	0	5	5
Volume Right	22	0	22	16	16
cSH	633	952	1700	401	322
Volume to Capacity	0.02	0.06	0.01	0.06	0.08
Queue Length 95th (m)	0.4	1.4	0.0	1.6	2.0
Control Delay (s)	0.5	1.5	0.0	14.6	17.2
Lane LOS	A	A		B	C
Approach Delay (s)	0.5	1.5		14.6	17.2
Approach LOS				B	C

Intersection Summary				
Average Delay	1.6			
Intersection Capacity Utilization	94.6%	ICU Level of Service		F
Analysis Period (min)	15			

Lane Group	EBL	EBT	EBR	EBR2	WBT	WBR	NBL	NBT	NBR	SBT	SBR
Lane Configurations											
Traffic Volume (vph)	265	620	10	790	465	20	265	275	45	235	210
Future Volume (vph)	265	620	10	790	465	20	265	275	45	235	210
Satd. Flow (prot)	1551	1632	714	1387	1519	1387	3008	1580	0	1600	1360
Flt Permitted	0.137						0.950				
Satd. Flow (perm)	222	1632	714	1322	1519	1339	3008	1580	0	1600	1360
Satd. Flow (RTOR)				859		156					
Lane Group Flow (vph)	288	674	11	859	505	22	288	348	0	255	228
Turn Type	pm+pt	NA	custom	custom	NA	Perm	Prot	NA		NA	custom
Protected Phases	5	2	9	2 8!	6		3	8		4!	4 5 9
Permitted Phases	2			2 8		6					
Total Split (s)	17.0	61.0	10.0		44.0	44.0	18.0	49.0		31.0	
Total Lost Time (s)	4.0	5.9	2.0		5.9	6.9	6.0	5.2		5.2	
Act Effct Green (s)	57.3	55.4	8.0	104.1	38.1	37.1	12.0	43.5		25.5	52.8
Actuated g/C Ratio	0.48	0.46	0.07	0.87	0.32	0.31	0.10	0.36		0.21	0.44
v/c Ratio	1.14	0.90	0.23	0.65	1.05	0.04	0.96	0.61		0.75	0.38
Control Delay	125.2	46.0	65.5	2.6	94.3	0.1	96.7	36.7		59.2	25.0
Queue Delay	0.0	48.0	0.0	1.3	0.0	0.0	0.0	0.0		0.0	0.0
Total Delay	125.2	94.0	65.5	3.9	94.3	0.1	96.7	36.7		59.2	25.0
LOS	F	F	E	A	F	A	F	D		E	C
Approach Delay		56.5			90.4			63.9		43.1	
Approach LOS		E			F			E		D	
Queue Length 50th (m)	~59.7	142.8	2.5	0.0	~129.3	0.0	35.3	66.2		56.5	35.4
Queue Length 95th (m)	#114.0	#216.7	8.7	3.6	#193.5	0.0	#62.2	97.3		#91.6	55.9
Internal Link Dist (m)		119.7			198.5			461.8		84.0	
Turn Bay Length (m)	90.0		15.0	15.0			110.0				
Base Capacity (vph)	253	753	47	1317	482	521	300	576		344	578
Starvation Cap Reductn	0	165	0	249	0	0	0	0		0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0		0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0		0	0
Reduced v/c Ratio	1.14	1.15	0.23	0.80	1.05	0.04	0.96	0.60		0.74	0.39

Intersection Summary

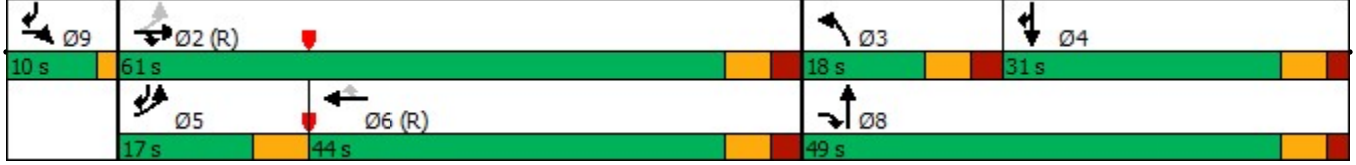
Cycle Length: 120
Actuated Cycle Length: 120
Offset: 0 (0%), Referenced to phase 2:EBTL and 6:WBT, Start of Green
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 1.14
Intersection Signal Delay: 61.1 Intersection LOS: E
Intersection Capacity Utilization 92.4% ICU Level of Service F
Analysis Period (min) 15

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

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

! Phase conflict between lane groups.

Splits and Phases: 3: Connaught Avenue & Bayers Road



Lane Group	EBL	EBT	EBR	EBR2	WBT	WBR	NBL	NBT	NBR	SBT	SBR
Lane Configurations											
Traffic Volume (vph)	235	550	10	665	720	5	930	235	15	230	365
Future Volume (vph)	235	550	10	665	720	5	930	235	15	230	365
Satd. Flow (prot)	1551	1632	714	1387	1519	1387	3008	1609	0	1600	1360
Flt Permitted	0.102						0.950				
Satd. Flow (perm)	166	1632	714	1314	1519	1334	3008	1609	0	1600	1360
Satd. Flow (RTOR)				723		134					
Lane Group Flow (vph)	255	598	11	723	783	5	1011	271	0	250	397
Turn Type	pm+pt	NA	custom	custom	NA	Perm	Prot	NA		NA	custom
Protected Phases	5	2	9	2 8!	6		3	8		4!	4 5 9
Permitted Phases	2			2 8		6					
Total Split (s)	18.0	59.0	10.0		41.0	41.0	40.0	71.0		31.0	
Total Lost Time (s)	4.0	5.9	2.0		5.9	6.9	6.0	5.2		5.2	
Act Effct Green (s)	55.0	53.1	8.0	124.1	35.1	34.1	34.0	65.8		25.8	53.8
Actuated g/C Ratio	0.39	0.38	0.06	0.89	0.25	0.24	0.24	0.47		0.18	0.38
v/c Ratio	1.26	0.97	0.28	0.55	2.06	0.01	1.38	0.36		0.85	0.76
Control Delay	181.6	71.8	80.7	1.8	513.6	0.0	221.3	25.4		80.8	48.6
Queue Delay	0.0	41.6	0.0	1.3	0.0	0.0	0.0	0.0		0.0	0.0
Total Delay	181.6	113.4	80.7	3.1	513.6	0.0	221.3	25.4		80.8	48.6
LOS	F	F	F	A	F	A	F	C		F	D
Approach Delay		73.9			510.3			179.9		61.0	
Approach LOS		E			F			F		E	
Queue Length 50th (m)	~74.0	161.3	3.0	0.0	~340.4	0.0	~191.1	47.0		67.7	94.9
Queue Length 95th (m)	#128.8	#237.0	9.8	3.0	#415.7	0.0	#231.7	68.5		#112.9	136.9
Internal Link Dist (m)		119.7			198.5			461.8		84.0	
Turn Bay Length (m)	90.0		15.0	15.0			110.0				
Base Capacity (vph)	203	618	40	1311	380	426	730	756		294	522
Starvation Cap Reductn	0	140	0	368	0	0	0	0		0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0		0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0		0	0
Reduced v/c Ratio	1.26	1.25	0.28	0.77	2.06	0.01	1.38	0.36		0.85	0.76

Intersection Summary

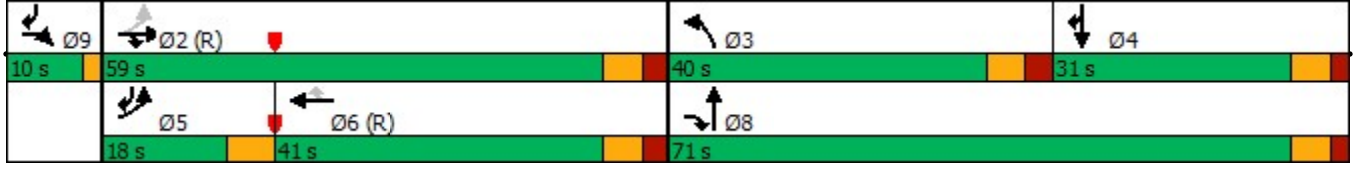
Cycle Length: 140
Actuated Cycle Length: 140
Offset: 0 (0%), Referenced to phase 2:EBTL and 6:WBT, Start of Green
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 2.06
Intersection Signal Delay: 183.4 Intersection LOS: F
Intersection Capacity Utilization 123.5% ICU Level of Service H
Analysis Period (min) 15

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

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

! Phase conflict between lane groups.

Splits and Phases: 3: Connaught Avenue & Bayers Road



Intersection: 1: Oxford Street & Bayers Road

Movement	EB	EB	WB	WB	NB	NB	SB	SB
Directions Served	LT	R	LT	R	L	TR	L	TR
Maximum Queue (m)	118.8	68.3	169.8	133.0	71.1	66.5	23.3	35.2
Average Queue (m)	44.0	11.0	110.5	21.7	41.8	30.3	7.1	12.2
95th Queue (m)	96.3	43.8	189.8	106.6	64.8	55.5	17.5	27.9
Link Distance (m)	228.7					534.8		242.6
Upstream Blk Time (%)								
Queuing Penalty (veh)								
Storage Bay Dist (m)		60.0			65.0		60.0	
Storage Blk Time (%)	5				1	0		
Queuing Penalty (veh)	4				2	0		

Intersection: 2: Connolly Street & Bayers Road

Movement	EB	WB	WB	NB	SB
Directions Served	LTR	LT	R	LTR	LTR
Maximum Queue (m)	65.8	75.0	5.0	16.9	16.8
Average Queue (m)	10.2	9.1	0.4	5.6	6.1
95th Queue (m)	41.3	47.6	3.1	14.0	15.0
Link Distance (m)	204.8	228.7	228.7	300.8	321.8
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (m)					
Storage Blk Time (%)					
Queuing Penalty (veh)					

Intersection: 3: Connaught Avenue & Bayers Road

Movement	EB	EB	EB	EB	WB	WB	NB	NB	NB	SB	SB	B84
Directions Served	L	T	R	>	T	TR	L	L	TR	T	R	T
Maximum Queue (m)	109.8	122.3	76.0	34.3	131.5	136.2	130.0	485.8	486.3	114.0	112.4	322.5
Average Queue (m)	41.6	49.3	14.0	2.7	47.6	50.4	121.1	477.0	467.1	103.4	102.6	276.1
95th Queue (m)	94.0	130.8	61.9	17.7	120.0	123.7	138.9	483.4	528.6	110.9	112.9	393.0
Link Distance (m)		118.3	118.3		204.8	204.8		473.5	473.5	89.4	89.4	309.0
Upstream Blk Time (%)		3	3					96	69	92	81	61
Queuing Penalty (veh)		21	24					0	0	0	0	0
Storage Bay Dist (m)	90.0			15.0			110.0					
Storage Blk Time (%)	0	9	11				78	87				
Queuing Penalty (veh)	0	20	76				361	403				

Intersection: 3: Connaught Avenue & Bayers Road

Movement	B84
Directions Served	T
Maximum Queue (m)	323.0
Average Queue (m)	278.2
95th Queue (m)	395.3
Link Distance (m)	309.0
Upstream Blk Time (%)	64
Queuing Penalty (veh)	0
Storage Bay Dist (m)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 1: Oxford Street & Bayers Road

Movement	EB	EB	WB	WB	NB	NB	SB	SB
Directions Served	LT	R	LT	R	L	TR	L	TR
Maximum Queue (m)	133.0	67.8	169.1	162.1	83.5	109.4	24.0	33.9
Average Queue (m)	40.0	8.9	113.0	49.1	43.6	34.2	8.7	12.2
95th Queue (m)	98.9	35.5	198.4	166.6	71.9	75.8	19.1	26.5
Link Distance (m)	228.7					534.8		242.6
Upstream Blk Time (%)								
Queuing Penalty (veh)								
Storage Bay Dist (m)		60.0			65.0		60.0	
Storage Blk Time (%)	4				4	0		
Queuing Penalty (veh)	3				8	1		

Intersection: 2: Connolly Street & Bayers Road

Movement	EB	WB	WB	NB	SB
Directions Served	LTR	LT	R	LTR	LTR
Maximum Queue (m)	82.0	215.5	21.4	23.3	16.0
Average Queue (m)	9.6	57.9	1.5	6.3	6.3
95th Queue (m)	49.5	196.9	18.7	17.6	15.1
Link Distance (m)	204.8	228.7	228.7	300.8	321.8
Upstream Blk Time (%)		4			
Queuing Penalty (veh)		17			
Storage Bay Dist (m)					
Storage Blk Time (%)					
Queuing Penalty (veh)					

Intersection: 3: Connaught Avenue & Bayers Road

Movement	EB	EB	EB	EB	WB	WB	NB	NB	NB	SB	SB	B84
Directions Served	L	T	R	>	T	R	L	L	TR	T	R	T
Maximum Queue (m)	109.9	134.8	111.4	34.3	209.3	7.2	130.0	488.2	487.1	114.5	112.4	321.1
Average Queue (m)	62.7	64.0	26.8	4.0	105.4	0.4	120.7	478.2	475.9	103.9	100.7	282.3
95th Queue (m)	124.5	155.9	98.2	21.8	256.8	3.4	137.3	485.7	494.0	109.9	120.3	400.6
Link Distance (m)		118.3	118.3		204.8	204.8		474.4	474.4	89.4	89.4	309.0
Upstream Blk Time (%)		11	11		12			96	74	93	78	71
Queuing Penalty (veh)		79	80		47			0	0	0	0	0
Storage Bay Dist (m)	90.0			15.0			110.0					
Storage Blk Time (%)	18	7	26	0			74	86				
Queuing Penalty (veh)	96	18	169	0			347	398				

Intersection: 3: Connaught Avenue & Bayers Road

Movement	B84
Directions Served	T
Maximum Queue (m)	325.4
Average Queue (m)	286.1
95th Queue (m)	388.1
Link Distance (m)	309.0
Upstream Blk Time (%)	74
Queuing Penalty (veh)	0
Storage Bay Dist (m)	
Storage Blk Time (%)	
Queuing Penalty (veh)	