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Item No. 15.3
Transportation Standing Committee
June 20, 2019

TO: Chair and Members of Transportation Standing Committee

SUBMITTED BY: Original Signed
Kelly Denty, Director Planning & Development

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DATE: May 15, 2019

SUBJECT: Transit Priority Corridors: Robie Street / Young Street

ORIGIN

- The *Integrated Mobility Plan* (IMP), approved at the December 5th, 2017 meeting of Regional Council, identified Robie Street and Young Street as proposed transit priority corridors, and actioned the prioritization of their delivery. In conjunction with approval of the IMP, Staff were directed to prepare a supplementary report *"amending the IMP to set the target date for implementation of the Young/Robie Transit Priority Corridors to fiscal 2020/21"*.

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

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".

RECOMMENDATION

It is recommended that the Transportation Standing Committee recommend that Halifax Regional Council authorize the CAO to:

1. Proceed with detailed design of time-restricted (Weekdays 6AM – 6PM) curbside bus lanes on Robie Street between Young Street and Quinpool Road (Phase 1 configuration as described in the Discussion section of this report).

2. Proceed with detailed design of a westbound curbside bus lane on Young Street between Kempt Road and Windsor Street (Phase 1 configuration as described in the Discussion section of this report).

3. Initiate efforts to further investigate the right-of-way requirements necessary to accommodate continuous curbside bus lanes in both directions (Phase 2 configuration as described in the Discussion of this report) for the following roadway segments:
    i. Robie Street (between Almon Street and Cunard Street), and
    ii. Young Street (between Robie Street and Windsor Street).

4. Initiate efforts to further investigate the right-of-way requirements necessary for future potential construction of centre median transit lanes on Robie Street.

EXECUTIVE SUMMARY

The *Integrated Mobility Plan* (IMP), adopted by Regional Council in December 2017, identifies Robie Street and Young Street as proposed transit priority corridors based on their importance for existing and planned transit operations, as well as their potential for providing priority to transit over general traffic. The physical characteristics of the corridors, as well as how people use them, have a major influence on the type of transit priority measures that can be implemented. The IMP did not go so far as to identify the type of transit priority that would be appropriate, recognizing that there are many factors that need to be considered in determining a preferred approach.

A functional design study completed by a consultant (WSP Canada Inc.) in 2018 investigated multiple design options for transit priority upgrades on Robie Street and Young Street. The design options were evaluated based on various factors that considered the potential to improve transit operation, multimodal impacts (walking, bicycling, traffic), curbside impacts (parking, loading), implementation cost, and the feedback received from stakeholders and the public. The consultant's study recommended curbside bus lanes in both directions on both Robie Street and Young Street as the preferred configuration for implementation. Functional designs completed for preferred corridor concepts identify key impacts including the need for property acquisition and right-of-way (ROW) widening.

Based on the findings of the consultant's study and additional review by staff, this report recommends a phased approach to implementing the consultant's recommended transit priority upgrades to Robie Street and Young Street. Phase 1 includes implementation of curbside bus lanes on Robie Street (Quinpool Road to Young Street) and Young Street (Robie Street to Windsor Street) only in locations where there is existing street space that can be reallocated to serve transit. Phase 2 extends the curbside bus lanes to the remaining segments after additional investigation and necessary property acquisition is completed. The phased implementation approach is recommended in order to provide near-term transit priority benefits that can be achieved without significant cost or delay, while progress is maintained on the tasks necessary (i.e. detailed design, ROW requirements, property acquisition) to implement the full extent of the recommended transit priority upgrades. It is noted that proposed Phase 1 upgrades are recommended in their own right – though transit priority benefits of full buildout of Phase 2 represent the preferred vision for the corridor, Phase 1 upgrades provide transit priority benefits that are worthwhile even if Phase 2 is not eventually pursued.

Overall, the proposed lane configuration changes, which reduce roadway traffic capacity both mid-block and at intersections, are expected to negatively impact traffic operations on the Robie Street corridor. Traffic analysis based on weekday morning and afternoon peak periods indicates that key metrics including vehicle delay and queue length will increase for some affected movements, in some cases significantly, relative to existing conditions. Analysis also indicates that based on current traffic demand during peak periods, traffic volumes will approach or exceed the amount of available capacity for some key movements. As a result, congestion on the corridor will be expected to worsen relative to existing conditions. The analysis is based on current conditions and does not take into consideration reduction in peak demand that is expected to occur from transportation demand management, increased mode share, and future demographics and settlement patterns. Allowing congestion to worsen over the short term is consistent with the approach adopted by Council in the Integrated Mobility Plan.

With approval of the recommendations in this report, the proposed Phase 1 transit priority upgrades will move to the detailed design stage, which will provide further opportunity to refine the details of the corridor configuration. Upon completion of the detailed design process, a construction tender will be issued and awarded, subject to budget availability. Staff will also continue with ongoing work related to proposed Phase 2 upgrades, including further investigation of property acquisition requirements.

A projected implementation timeline has been developed for both the Robie Street and Young Street corridors. The recommended Phase 1 upgrades are not expected to require property acquisition or significant construction works; therefore, it is anticipated that implementation can be completed during 2020. Recommended Phase 2 upgrades will require additional investigation, property acquisition, and more extensive construction works – due to the inherent uncertainty associated with these items, implementation timelines are not currently well understood.

BACKGROUND

The *Integrated Mobility Plan* (IMP), approved by Regional Council in December 2017, identifies Robie Street and Young Street as proposed transit priority corridors, where transit should be prioritized using features that give buses an advantage over general traffic (i.e. queue jump lanes, dedicated bus lanes).

In February 2017, Regional Council directed staff to enter into a contribution agreement with the federal government, under the Public Transit Infrastructure Fund (PTIF), for a project to study and design 'Transit Priority Corridors' on Bayers Road and Gottingen Street. The total project budget is $250,000, the cost of which is being shared evenly between the municipality and federal government. Upon project award, it was determined that there was adequate funding in the budget to expand the scope of work to include the Young Street and Robie Street TPM Corridors.

In May 2017, RFP 17-303 was awarded to WSP Canada Inc. (contract value $133,664) to prepare functional designs for 'transit priority corridors' on Gottingen Street, Bayers Road, Robie Street, and Young Street. The Gottingen Street and Bayers Road components of the projects were completed in 2018; this report represents the conclusion of the work under RFP 17-303.

Robie Street

Robie Street runs north-south centrally across the Halifax peninsula, connecting the north and south ends over approximately 4km. A key link in the regional roadway network, it accommodates between 15,000 and 25,000 vehicles per day (depending on location along the corridor). There is considerable variation in Robie Street's cross section, ranging from a constrained two-lane section (Cunard Street to Almon Street) to wider sections with up to six lanes and centre median. Abutting land uses and neighbourhood character also vary along its length – the south end is characterized primarily by a mix of residential and institutional uses, while the north end is mostly commercial. The Halifax Common bounds the east side of Robie Street through its central portion. South of Cunard Street, Robie Street has a distinctive character, with grassed medians and mature treed boulevards. The Draft Centre Plan designates Robie Street as a 'Centre', highlighting significant development opportunities. The Centre Plan also indicates priorities for

the area as a 'Centre' including creating a more pedestrian friendly environment *"by connecting the existing street grid and improving walkability through new and expanded mobility connections"*.

Transit service varies along the Robie Street corridor. The highest level of service is on the section between Cunard Street and Spring Garden Road, which is served by eight routes and more than 40 buses (two-way) during both the AM and PM peak hours. Buses on Robie Street are often subject to significant delays during peak periods, particularly during the afternoon in the outbound (northbound) direction. This corridor was also identified as a bus rapid transit (BRT) corridor in the recently completed Halifax Transit *Bus Rapid Transit (BRT) Study* (2018).

Young Street

Young Street runs east-west between Windsor Street and Gottingen Street, effectively functioning as an extension to the Bayers Road / Highway 102 corridor. It has a 4-5 lane cross section and accommodates approximately 15,000 vehicles per day. Abutting land uses are primarily a mix of commercial and high density residential. Similar to Robie Street, Young Street is designated in the Draft Centre Plan as a 'Centre', with similar opportunities and priorities.

Young Street is served by ten transit routes and up to 30 buses (two-way) during the peak hour. This corridor was also identified as a candidate BRT Corridor in the BRT Study.

Transit Priority Corridors

Robie Street and Young Street were identified as proposed transit priority corridors in the IMP based on their importance for existing and planned transit operations, as well as their potential for providing priority to transit over general traffic. The IMP did not go so far as to identify the type of transit priority that would be appropriate, recognizing that there are many factors that need to be considered in determining a preferred approach. The physical characteristics of the corridors, as well as how people use them, have a major influence on the type of transit priority measures that can be implemented. Also, as is typical with any project that involves reconfiguration of an existing street, there are trade-offs that need to be considered. Where right-of-way expansion is necessary, impacts to private property and other infrastructure (e.g. water & sewer, power / communications lines, trees) may be required. Loss of traffic lanes and curb access used for on-street parking, loading, and stopping may also be necessary.

The IMP transit priority corridor sections that are the focus of this report, highlighted in the IMP Transit Priority Corridors Map in Figure 1 below, include Young Street (Windsor Street to Robie Street) and Robie Street (Young Street to Quinpool Road). The section of Robie Street extending south from Quinpool Road to Inglis Street has been reviewed as part of the functional design process; however, staff do not presently have a recommendation for transit priority improvements for this section. While it is staff's opinion that the introduction of transit priority on this section of the roadway still has merit, it would likely have significant impacts to the existing streetscape, on-street parking, and/or traffic operations. Further analysis would be required to better understand the trade-offs in this location where transit volumes are still relatively high but congestion is lower than other parts of the corridor, and the likely benefits to transit would be lower at this time. Staff will continue to study opportunities to extend this corridor, and any detailed design completed on the section of Robie Street between Young Street and Quinpool Road would aim to ensure seamless integration with future extension of the corridor south of Quinpool Road. As illustrated in Figure 1, the proposed transit priority corridors on Robie Street and Young Street link directly to the Bayers Road bus lanes that have previously been approved by Regional Council and are currently in detailed design.

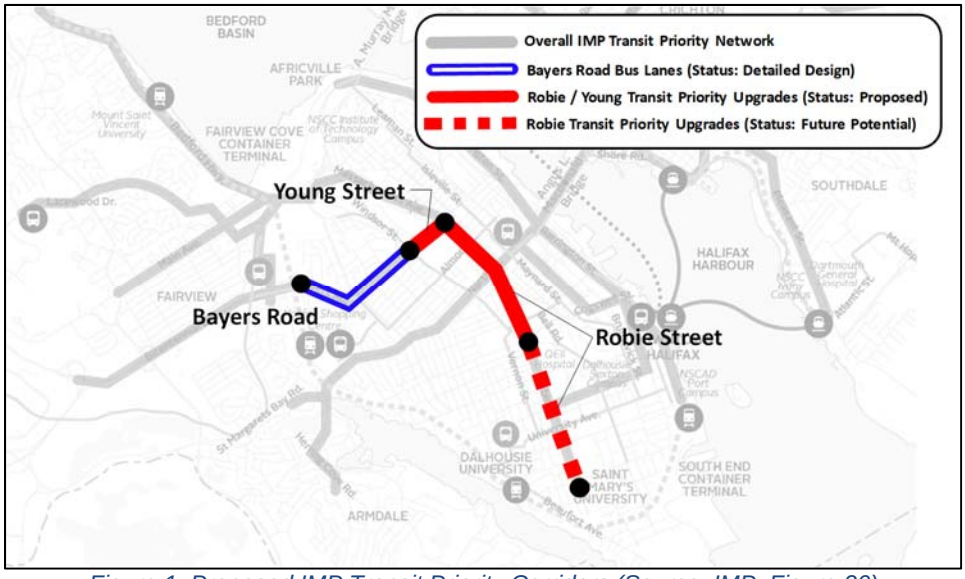


Figure 1: Proposed IMP Transit Priority Corridors (Source: IMP, Figure 20)

DISCUSSION

The primary objective of this project was to investigate transit priority options and develop functional designs for transit priority corridors on Robie Street and Young Street. The scope of the consultant's work included the following:

- Detailed investigation of existing conditions along each corridor and review of existing and projected multimodal transportation demands;
- Develop 2-3 conceptual design options representing a range of investment levels with input from the project steering committee and feedback from stakeholders;
- Public and stakeholder engagement related to the proposed design concepts;
- Identify any necessary property acquisition and utility relocation requirements for each option;
- Evaluate multimodal level of service for the options that considers factors such as transit operational benefits, intersection performance impacts, parking / curb access, and road safety.

The consultant's findings and recommendations have been summarized and are included in **Attachment A**.

Transit Priority Infrastructure

Two options for transit priority were considered for the Robie Street and Young Street corridors: (i) Curbside bus lanes and (ii) median bus lanes. Table 1 and Table 2 provide a description and summary of key advantages and disadvantages for each.

Table 1: Curbside Bus Lanes - Overview

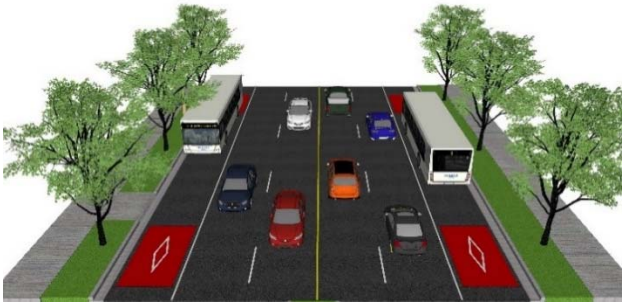
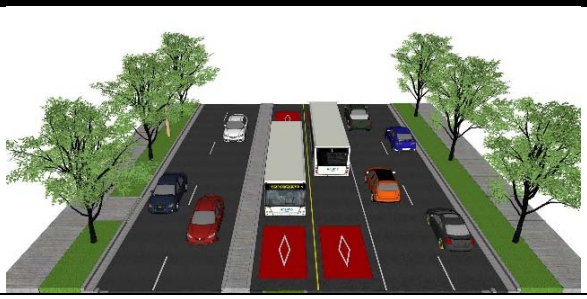
Curbside Bus Lanes	
Description: • Curb lane(s) are designated for use by buses only; • Bus lanes are designated with regulatory signage and diamond pavement markings; • Typically, right turning vehicles are permitted to use the bus lane on approaches to intersections (regulatory signage indicates "right turn except buses"); • Passenger boarding/alighting is done from the side of the street, as per existing conditions; • Bicycles may be permitted to operate in the bus lane; • Typically, bus lanes necessitate removal of parking and/or traffic lanes; however, in some cases these uses *may* be considered in a bus lane during off-peak periods.	
Where are they Most Suitable? • Streets with high volumes of transit service that experience traffic congestion; • Streets with excess lane capacity and/or good potential for street widening. • Streets without signficant right turning demand at intersections.	
Advantages / Benefits: • Dedicated space allows buses to bypass traffic congestion, reducing delay and improving service reliability; • Traffic not impacted by stopped buses; • Relatively easy to integrate operations with existing traffic signal phasing and bus stops; and • Provide flexibility to modify curb access outside of peak periods to allow other uses (i.e. parking, loading).	**Disadvantages / Challenges:** • Typically requires removal of traffic lane capacity and/or on-street parking; • Where right turns are permitted by general traffic, buses may experience delay at intersections; and • Where ROW is constrained, may require street widening and property acquisition.

Table 2: Median Bus Lanes - Overview

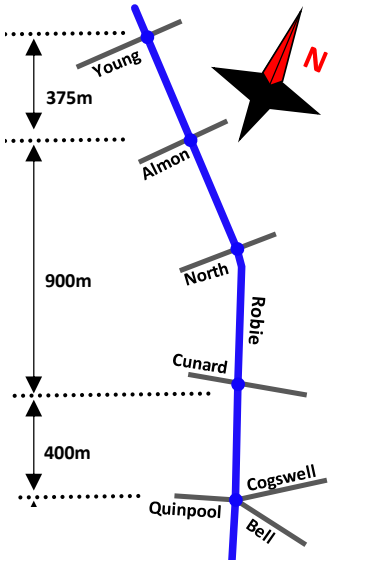
Median Bus Lanes	
Description: • Centre lane(s) are designated for use by buses only; • Bus lanes are designated with regulatory signage and diamond pavement markings; • Bus stops are located on curbed islands within the street ROW. Passengers cross travel lanes to board/alight;	
Where are they Most Suitable? • Streets with high volumes of transit service that experience traffic congestion; • Streets with excess lane capacity and/or good potential for street widening; and • Streets with low left turning demand or where prohibition of left turns may be acceptable	
Advantages / Benefits: • Dedicated space allows buses to bypass traffic congestion, reducing delay and improving service reliability; • Buses are not delayed by right turning vehicles at intersections; • Provide flexibility to modify curb access outside of peak periods to allow other uses (i.e. parking, loading).	**Disadvantages / Challenges:** • Typically requires removal of traffic lane capacity and/or on-street parking or expansion of the ROW; • Bus stop islands increase ROW needs. Where ROW is constrained, may require street widening and property acquisition. • User experience impacted, as passengers must cross traffic lanes to access bus stops and wait on a median; • May require prohibition of left turns at intersections; • Require prohibition of left turns into driveways; • Requires modification of traffic signal phasing to incorporate

Robie Street

The physical characteristics of Robie Street vary significantly along its length. South of Cunard Street, the cross section is generally wide, with four to six traffic lanes and a centre median. Between Almon Street and Cunard Street, the cross-section is reduced to three lanes and the total street ROW narrows considerably. North of Almon Street, Robie Street widens to a five-lane cross section. An overview of the physical and operational characteristics of the corridor is provided in Table 3.

Table 3: Robie Street Overview

Segment	Description
Young Street to Almon Street	Cross Section: 5 lanes, undivided Vehicular Traffic: 28,000 vehicles per day Transit: 25 2-way buses per hour (existing peak) On-Street Parking Spaces: 0
Almon Street to Cunard Street	Cross Section: 2-3 lanes, undivided Vehicular Traffic: 28,000 vehicles per day Transit: 25 2-way buses per hour (existing peak) On-Street Parking Spaces: 21
Cunard Street to Quinpool Road	Cross Section: 5 lanes, median divided Vehicular Traffic: 24,000 vehicles per day Transit: 40 2-way buses per hour (existing peak) On-Street Parking Spaces: 36



Functional design was completed for two core options for Robie Street: (i) curbside bus lanes and (ii) centre median bus lanes (functional design drawings are provided in **Attachment B**). The objective of the functional design process was to investigate the feasibility of each option and understand the potential implications for key operational aspects of the street including transit benefits, traffic / parking impacts, and impacts to the pedestrian realm. Identification of any need to expand the existing ROW is also a critical part of the design process. The following sections provide a summary of the two core options considered for Robie Street.

- *Option 1 – Curbside Bus Lanes*: Addition of curbside bus lanes on Robie Street can be completed with varying levels of impact. On the widest segments (i.e. north of Almon Street, Cunard Street to Quinpool Road), bus lanes can be added on both sides of Robie Street by reconfiguring the existing curb-to-curb space. The narrowest segment (Almon Street to Cunard Street) is considerably more challenging and would require widening / property acquisition to accommodate curbside bus lanes on both sides of the street.

  Impacts associated with curbside bus lanes for each section of Robie Street are summarized in Table 4 and described below:

  - Transit: Transit benefits associated with curbside bus lanes are expected to be significant, particularly in the most congested areas. Schedule adherence data indicate that average bus travel time on Robie Street during peak periods currently increases by up to 40% (inbound, AM Peak) and by up to 60% (outbound, PM peak) relative to off-peak periods.
  - Traffic: Traffic analysis was completed to assess the impacts of the potential removal of traffic lanes on Robie Street. On segments where it was determined that traffic lanes can be removed without significant impacts (i.e. north of Almon Street, Cunard Street to Quinpool Road), lane space was reallocated. For segments where a loss of traffic lanes would result in

significant impacts, street widening or reallocation of centre median space is an alternative option that can be considered to add curbside bus lanes.

- o Right-of-way: To add curbside bus lanes in both directions on Robie Street, the functional design indicates that property acquisition and ROW widening will be required. The majority of impacts would be on the constrained section between Almon Street and Cunard Street.
- o Parking/Loading: It would be necessary to remove all on-street street parking on Robie Street during periods when the bus lanes are operational. This amounts to a total potential loss of up to 57 parking spaces (see Table 4). Consideration could be given to allowing on-street parking during off-peak periods when the bus lanes are less critical, similar to the recently installed bus lane on Gottingen Street.
- o Pedestrian Realm: Increased pedestrian crossing distance in locations where street widening is required.

Table 4: Summary of Key Impacts – Curbside Bus Lanes

	Segment	Impacts			
		Traffic		Right-of-way	Parking
Curbside Bus Lanes	**Young Street to Almon Street**	Loss of two lanes (one each direction)		N/A	No change
	Almon Street to Cunard Street	Loss of one lane (northbound)		Significant road widening, property acquisition	Loss of up to 21 spaces*
	Cunard Street to Quinpool Road	Loss of two lanes (one each direction)	**OR**	Loss of centre median (**OR** road widening, property acquisition)	Loss of up to 36 spaces*

* On-street parking could be permitted if/when the bus lane is not in effect (i.e. outside of peak periods).

- *Option 2 – Centre Median Bus Lanes:* Centre median bus lanes represent a more transformative change to the overall functionality of Robie Street, and the associated impacts are significant. Width requirements of the centre median bus lanes option are greater than those for curbside bus lanes due to the need to add passenger waiting areas within the street ROW. As a result, widening and property acquisition would be required along much of the corridor. Impacts associated with centre median bus lanes for each section of Robie Street are summarized in Table 5 and described below:

  - o Transit: Transit operation would change significantly with centre median bus lanes, both in terms of how buses move through the corridor and how passengers access the service:
    - Running down the centre of Robie Street would provide buses a truly dedicated space that is free of direct interaction with right turning vehicles, potentially resulting in significant improvements over curb operations.
    - Passengers would board and alight via stops located on platforms within the street ROW; therefore, crossing Robie Street traffic lanes would be required.
    - Although centre median bus lanes offer significant potential for transit improvement on Robie Street, intersection operation is a key limiting factor. In order for buses running in the centre median lanes to operate effectively, it would likely be necessary to prohibit (or significantly impact the operation of) traffic making left turns from Robie Street at intersections and driveways. Given the central location of Robie Street and heavy volume of traffic turning left in either direction, this would have a significant impact on traffic patterns on the peninsula. Traffic analysis completed for the centre median lanes option indicated that without prohibition of left turns, overall benefits to transit would be expected to be negligible.
    - Added benefits that are perhaps less tangible include the added 'visibility' of transit priority and improved perception by users as a 'higher order' transit service. The centre median lane would provide strong opportunity for integration with Halifax Transit's BRT service plans. As a long-term consideration, centre median lanes could provide the footprint and base infrastructure necessary to facilitate higher order

transit in the future. As a long-term consideration, centre median lanes could provide the footprint and base infrastructure necessary to facilitate higher order transit in the future.

- Traffic: In order for centre median transit lanes to provide the intended priority to transit flow, significant impacts to traffic would be required. Left turn prohibition or restriction, which would likely be required at several intersections and driveways to reduce intersection delay for all users (including buses), would result in significant impacts to traffic flow and circulation on the peninsula road network. The proposed lane configuration changes, which reduce roadway traffic capacity both mid-block and at intersections, are expected to negatively impact traffic operations. Traffic analysis based on weekday morning and afternoon peak periods indicates that key metrics including vehicle delay and queue length will increase for some affected movements, in some cases significantly, relative to existing conditions. Analysis also indicates that based on current traffic demand during peak periods, traffic volumes will approach or exceed the amount of available capacity for some key movements. As a result, congestion on the corridor will be expected to worsen relative to existing conditions. A substantial shift in mode share from auto-based trips to transit, which could be possible with this type of facility (as part of a connected transit priority network), would help to mitigate the potential for significant traffic congestion.
- Right-of-way: To add median bus lanes on Robie Street, the functional design indicates that significant ROW widening (and associated property acquisition) will be required. The segments between Young Street and Cunard Street are most affected; the functional design for this option indicates that several properties would be likely to be extensively impacted. It is anticipated that efforts to acquire the necessary lands would require a real estate acquisition strategy to be implemented over multiple years.
- Parking: On-street parking would be removed on a full-time basis for all segments that are reduced to a single traffic lane. This amounts to a total potential loss of up to 57 parking spaces (see Table 5). Consideration could be given to allowing on-street parking during off-peak periods in the curb lane where there is more than one traffic lane.
- Pedestrian Realm: Increased pedestrian crossing distance in locations where street widening is required. Also, this configuration would require that transit passengers wait for the bus on a concrete island within the roadway, which may be less comfortable than waiting on the sidewalk.

Table 5: Summary of Key Impacts – Centre Median Bus Lanes

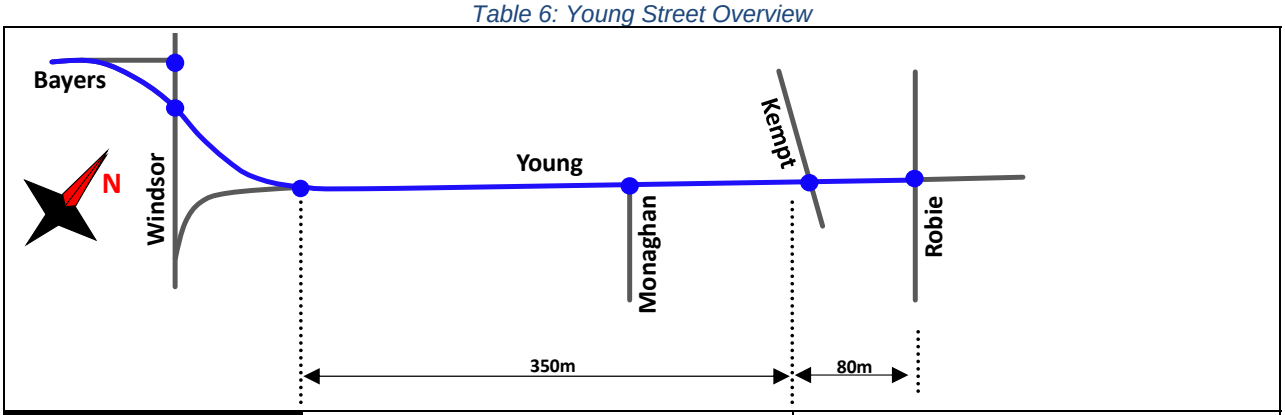
	Segment	Impacts		
		Traffic	Right-of-way	Parking
Centre Median Bus Lanes	**Young Street to Almon Street**	Loss of three lanes (1 northbound, 2 southbound) Restriction of left turn movements	Minor road widening, potential property acquisition	No change
	Almon Street to Cunard Street	Loss of one lane (northbound) Restriction of left turn movements	Significant road widening, property acquisition	Loss of up to 21 spaces*
	Cunard Street to Quinpool Road	Loss of two lanes (one each direction) Restriction of left turn movements	Modified centre median Minor road widening, potential property acquisition	Loss of up to 36 spaces*

* Where multiple traffic lanes are present in one direction, on-street parking could be permitted in the curb lane outside of peak periods.

Young Street

An overview of the physical and operational characteristics of Young Street corridor is provided in Table 6.

Table 6: Young Street Overview



Segment	Windsor Street to Kempt Road	Kempt Road to Robie Street
Description	Cross Section: 4 lanes, undivided AADT: 15,000 vehicles per day Transit: 17 2-way buses per hour (existing peak)	Cross Section: 5 lanes, undivided AADT: 15,000vehicles per day Transit: 25 2-way buses per hour (existing peak)

Functional design was completed for two options for Young Street: (i) curbside bus lanes (eastbound and westbound) and (ii) curbside bus lane (westbound only). The following sections provide a summary of the two core options considered for Young Street.

- *Option 1 – Curbside Bus Lanes (eastbound and westbound):* Addition of two curbside bus lanes on Young Street would require widening / property acquisition along the entire segment between Windsor Street and Robie Street. It would also require changes to existing traffic lane configurations. Impacts associated with option 1 for Young Street are described below:
  - Transit: Curbside bus lanes in both directions will improve transit operation for inbound and outbound buses, particularly during both the morning and afternoon peak traffic periods. The Young Street bus lanes will effectively extend the proposed Bayers Road bus lanes, which (when constructed) will extend to Windsor Street.
  - Traffic: The existing 4-lane cross section (two lanes inbound, two lanes outbound) would be reduced to three traffic lanes (one lane inbound, one lane outbound, alternating left turn lane). The proposed lane configuration changes, which reduce roadway traffic capacity both mid-block and at intersections, are expected to negatively impact traffic operations. Traffic analysis based on weekday morning and afternoon peak periods indicates that key metrics including vehicle delay and queue length will increase for some affected movements, in some cases significantly, relative to existing conditions. Analysis also indicates that based on current traffic demand during peak periods, traffic volumes will approach or exceed the amount of available capacity for some key movements. As a result, congestion on the corridor will be expected to worsen relative to existing conditions.
  - Right-of-way: To add curbside bus lanes in both directions on Young Street, the functional design indicates that ROW widening (and associated property acquisition) will be required.
  - Parking: No impact (parking is not currently permitted on Young Street).
  - Pedestrian Realm: Increased pedestrian crossing distance in locations where street widening is required.

- *Option 2 – Curbside Bus Lanes (westbound only):* Addition of an outbound curbside bus lane on Young Street can be achieved with minimal (if any) widening / property acquisition. However, it would require similar changes to existing traffic lane configurations to those described in Option 1. Impacts associated with option 2 for Young Street are described below:

- Transit: A curbside bus lane in the westbound direction will improve transit operation for outbound buses, particularly during the afternoon peak traffic period. A westbound Young Street bus lane would tie directly to the proposed Bayers Road westbound bus lane, which (when constructed) will extend to Windsor Street. Eastbound buses will not benefit from transit priority based on this configuration.
- Traffic: Similar to Option 1, the existing 4-lane cross section (two lanes inbound, two lanes outbound) would be reduced to three traffic lanes (one lane inbound, one lane outbound, alternating left turn lane). The proposed lane configuration changes, which reduce roadway traffic capacity both mid-block and at intersections, are expected to negatively impact traffic operations during weekday morning and afternoon peak periods. As a result, congestion on the corridor will be expected to worsen relative to existing conditions.
- Right-of-way: To add a westbound bus lane on Young Street, the functional design indicates that ROW widening (and associated property acquisition) may be required near the Kempt Road intersection.
- Parking: No impact (parking is not currently permitted on Young Street).
- Pedestrian Realm: No notable change to the pedestrian realm.

Centre median bus lanes are not currently being considered as an option on Young Street, as curbside bus lanes are expected to provide sufficient transit priority on the relatively short segment and are consistent with the transit priority configuration that is being implemented on the adjoining Bayers Road corridor.

Proposed Approach: Robie Street and Young Street

The results of the functional design process indicate that there is strong potential to add continuous transit priority to Robie Street and Young Street. However, it is also evident that there are major constraints – primarily ROW acquisition requirements – that limit the ability to add a complete transit priority solution in the near term. Given the importance of transit priority on these corridors to the goals of the IMP and Moving Forward Together Plan (MFTP), it is important that options be considered that achieve immediate benefits while continuing to work toward the ultimate solution. Accordingly, staff recommend a phased approach that would provide incremental benefits while working toward an ultimate solution.

A summary of the proposed phased approach to implementation for transit priority upgrades on Robie Street and Young Street is described below and illustrated in Figure 2.

- *Phase 1 (Implementation – 2020):*
  - Young Street:
    - Add a curbside bus lane (westbound only) on Young Street between Kempt Road and Windsor Street;
  - Robie Street:
    - Add curbside bus lanes to both sides of Robie Street (i) between Young Street and Almon Street and (ii) between Cunard Street and Quinpool Road;
    - Add a curbside bus lane (northbound only) on Robie Street between Almon Street and Cunard Street.

- *Phase 2 (Implementation timeline to be determined):*
  - Subject to approval of budget and resource plan, initiate efforts to further investigate and acquire, where possible, the property required to expand the ROW to facilitate addition of curbside bus lanes on the following segments:
    - Young Street (Windsor Street to Kempt Road): Eastbound bus lane, to complement the westbound bus lane recommended for implementation in Phase 1.
    - Robie Street (Almon Street to Cunard Street): Southbound bus lane, to complement the northbound bus lane recommended for implementation in Phase 1.
  - Construct the above noted curbside bus lanes as the necessary lands are acquired and become available.

- *Optional*: Add curbside bus lanes to both sides of Robie Street between Quinpool Road and University Avenue. Though it appears that there is sufficient space within the street ROW to add the bus lanes without property acquisition, repurposing of the centre median and the loss of on-street parking (and/or traffic lanes) would be required. At this time, the incremental benefit of extending transit priority south of Quinpool Road is still under consideration as it is likely there would be considerable impact to other uses in the street ROW.

➢ *Long Term:*

- Subject to approval of budget and resource plan, initiate efforts to further investigate the property required to widen the street to facilitate addition of centre median bus lanes between Young Street and University Avenue. Acquisition and preservation of this corridor is considered a strategic long-term objective that will provide the Municipality the opportunity to potentially add higher order transit services such as centre running Bus Rapid Transit or light rail in the future.

  Staff are currently in the process of reviewing the land requirements and developing a potential real estate acquisition strategy; it is anticipated that this process will require several years and have significant cost implications. However, given the Robie Street corridor's strategic location along the centre of the peninsula, these efforts are expected to be warranted.

It is noted that proposed Phase 1 upgrades are recommended in their own right – though transit priority benefits of full buildout of Phase 2 represent the preferred vision for the corridor, Phase 1 upgrades provide transit priority benefits that are worthwhile even if Phase 2 is not eventually pursued.

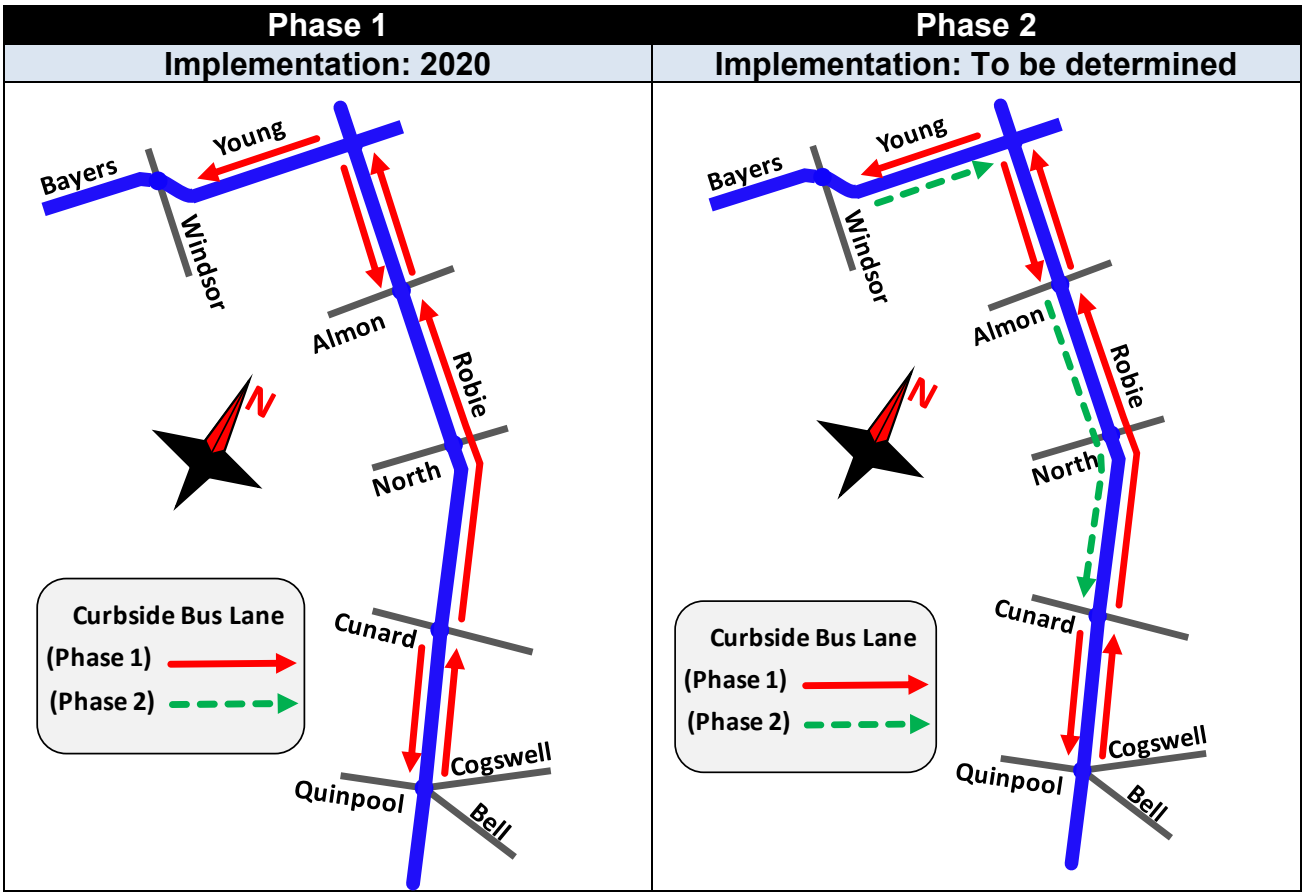


Figure 2: Proposed Configuration / Phasing - Robie Street Transit Priority Corridor

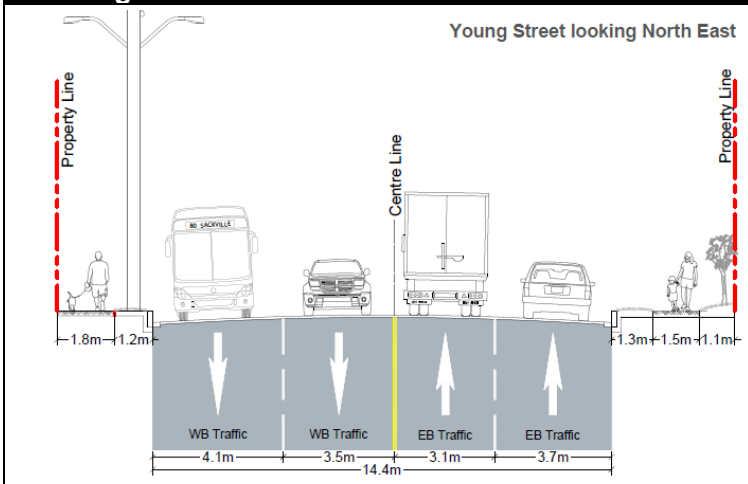
Proposed Phase 1 Details

This section provides further details related to the proposed Phase 1 transit priority upgrades for Robie Street and Young Street, including cross sections for each segment, key operational changes, intersection upgrades, and a summary of the associated impacts.

- *Cross Sections:* Existing and proposed cross sections for each affected segment are presented in the following tables

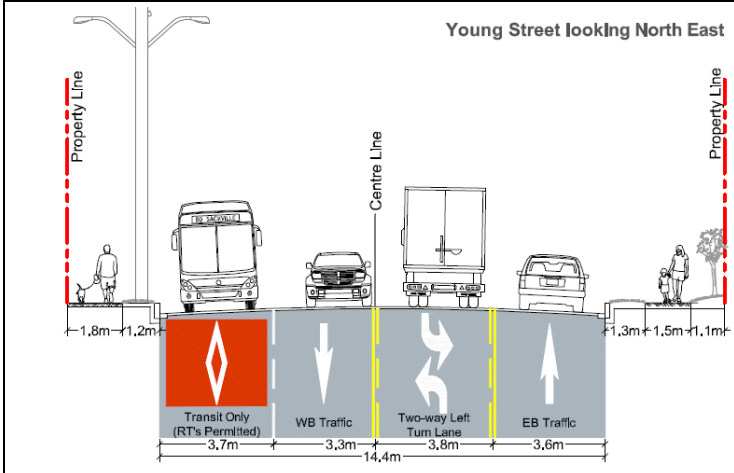
Table 7: Proposed Street Configuration Options – Young Street (Windsor Street to Kempt Road)

Existing Conditions

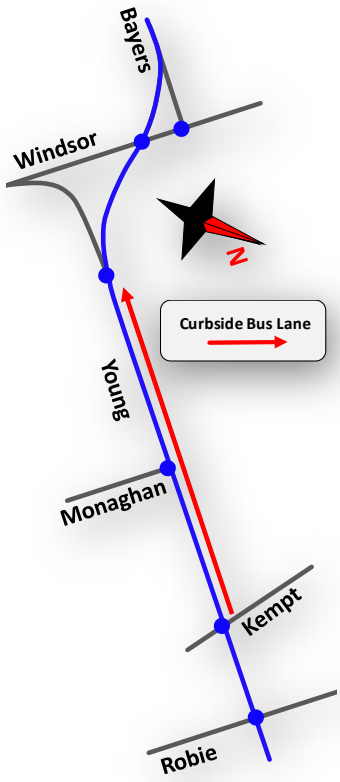


Young Street (looking to the east)

Phase 1: Westbound Curbside Transit Lane



Young Street (looking to the east)

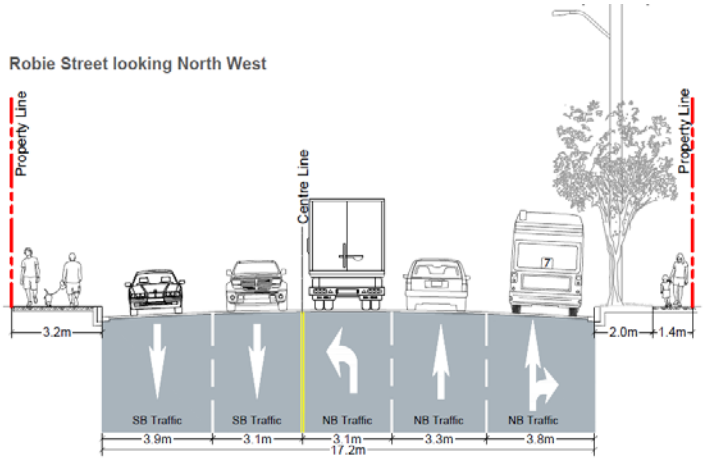


Summary of Changes

- Transit: Designate existing westbound curb lane as a dedicated bus lane (also permitted for use by right turning vehicles);
- Traffic: Loss of one westbound and one eastbound traffic lane, and conversion of one lane to a two-way left turn lane. Young Street accommodates average annual weekday traffic (AADT) of approximately 15,000 vehicles per day (vpd), which is within typically acceptable ranges for 'road diet' configurations of this type (15,000 to 24,000 vpd).
- Parking: There is currently no on-street parking on this segment of Young Street.
- Right-of-way: Transit road ROW widening may be required near of the Kempt Road intersection; however, it is anticipated that the majority of changes are possible within existing curb-to-curb width.

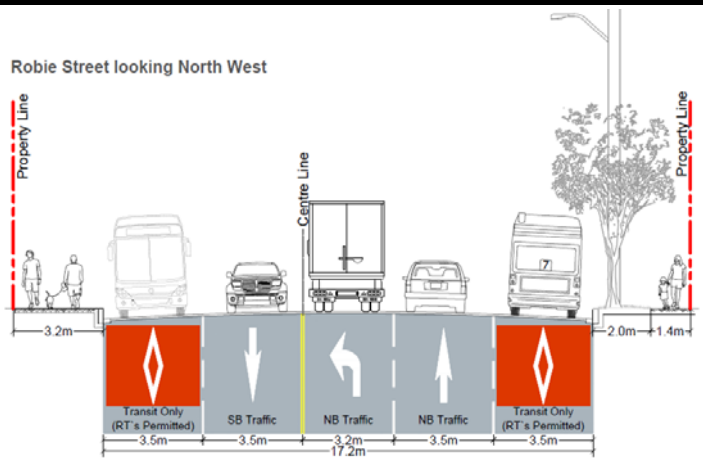
Table 8: Proposed Street Configuration Options – Robie Street (Young Street to Almon Street)

Existing Conditions

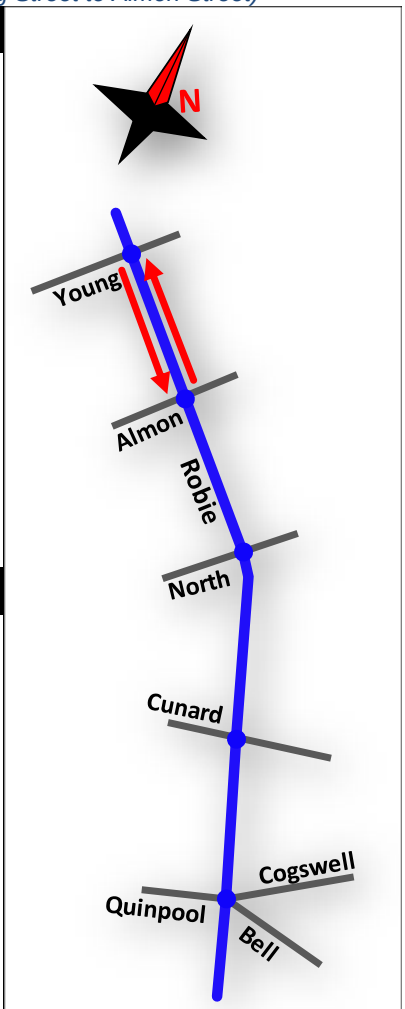


Robie Street (looking to the north)

Phase 1/2: Northbound / Southbound Curbside Transit Lanes



Robie Street (looking to the north)

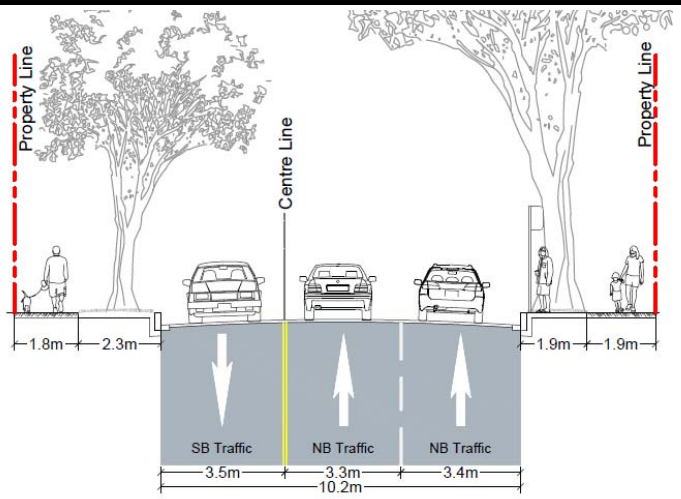


Summary of Changes

- Transit: Designate existing northbound and southbound curb lanes as dedicated bus lanes (also permitted for use by right turning vehicles);
- Traffic: Loss of one northbound and one southbound traffic lane. The proposed lane configuration changes, which reduce roadway traffic capacity both mid-block and at intersections, are expected to negatively impact traffic operations. Analysis indicates that based on current traffic demand during peak periods, traffic volumes will approach or exceed the amount of available capacity for some key movements. As a result, congestion on the corridor will be expected to worsen relative to existing conditions.
- Parking: There is currently no on-street parking on this segment. Consideration could be given to permitting time-restricted on-street parking within the bus lane during evenings, overnight, and on weekends;
- Right-of-way: Transit road ROW widening is not required; all changes are within existing curb-to-curb width.

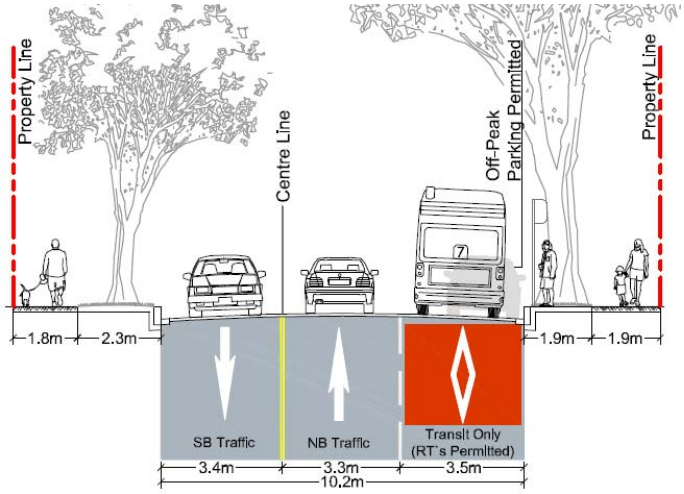
Table 9: Proposed Street Configuration Options – Robie Street (Almon Street to Cunard Street)

Existing Conditions

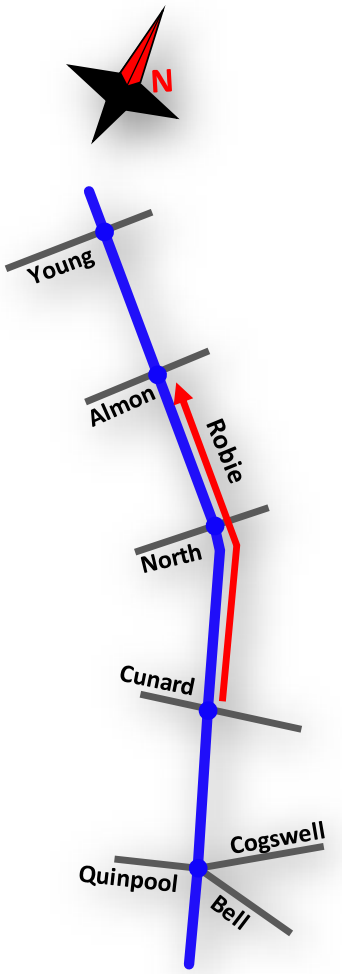


Robie Street (looking to the north)

Phase 1: Northbound Curbside Transit Lane



Robie Street (looking to the north)

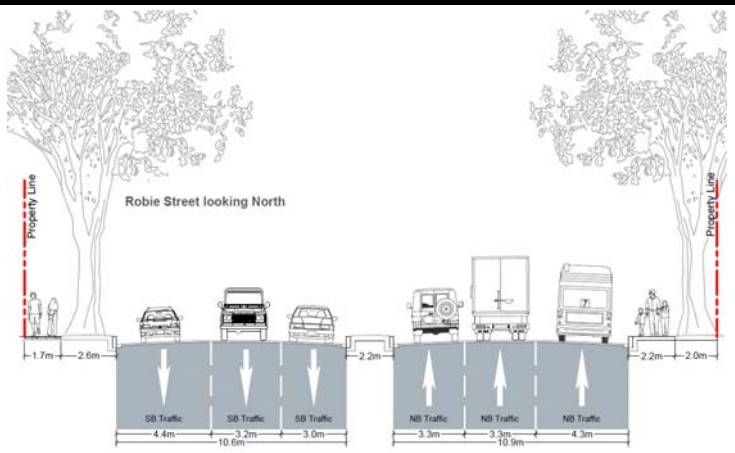


Summary of Changes

- Transit: Designate existing northbound curb lane as a dedicated bus lane (also permitted for use by right turning vehicles);
- Traffic: Loss of one northbound traffic lane. The proposed lane configuration changes, which reduce roadway traffic capacity both mid-block and at intersections, are expected to negatively impact traffic operations. Analysis indicates that based on current traffic demand during peak periods, traffic volumes will approach or exceed the amount of available capacity for some key movements. As a result, congestion on the corridor will be expected to worsen relative to existing conditions.
- Parking: Removal of all on-street parking (up to 21 spaces) and loading while bus lane is operational. Parking can be accommodated within the bus lane outside of operational periods;
- Right-of-way: Transit road ROW widening is not required; all changes are within existing curb-to-curb width.

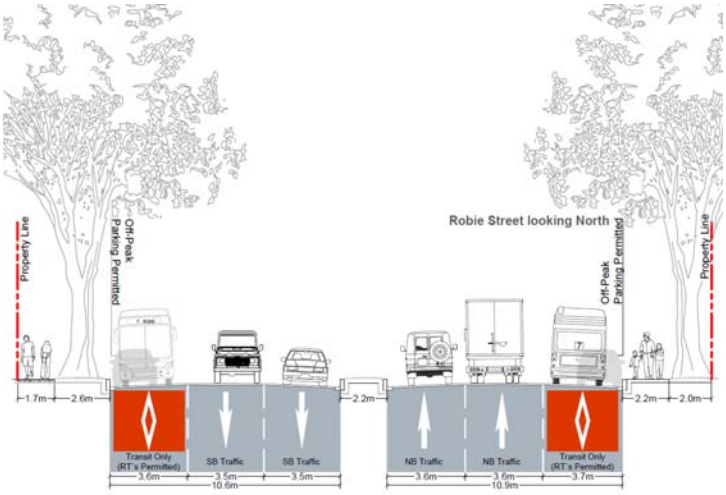
Table 10: Proposed Street Configuration Options – Robie Street (Cunard Street to Quinpool Road)

Existing Conditions

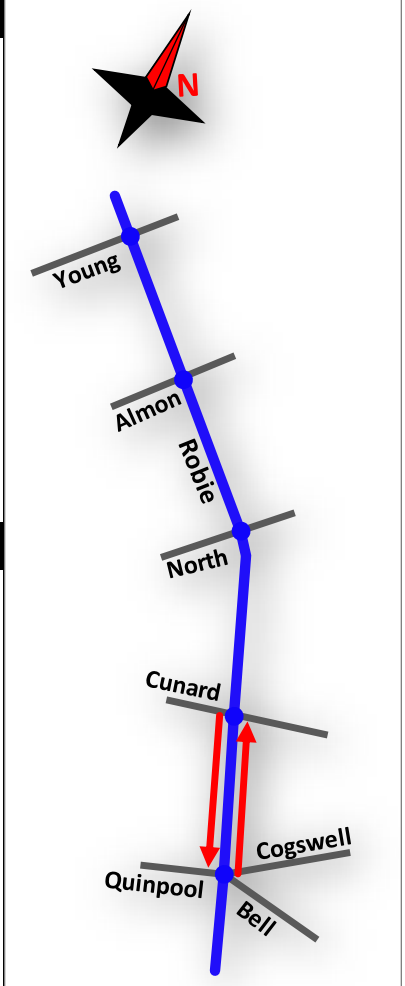


Robie Street (looking to the north)

Phase 1/2: Northbound / Southbound Curbside Transit Lanes



Robie Street (looking to the north)



Summary of Changes

- Transit: Designate existing northbound and southbound curb lanes (also permitted for use by right turning vehicles);
- Traffic: Loss of one northbound and one southbound traffic lane. The proposed lane configuration changes, which reduce roadway traffic capacity both mid-block and at intersections, are expected to negatively impact traffic operations. Analysis indicates that based on current traffic demand during peak periods, traffic volumes will approach or exceed the amount of available capacity for some key movements. As a result, congestion on the corridor will be expected to worsen relative to existing conditions.
- Parking: Removal of all on-street parking (up to 36 spaces) and loading while bus lane is operational. Parking can be accommodated within the bus lane outside of operational periods;
- Right-of-way: Transit road ROW widening is not required; all changes are within existing curb-to-curb width.

- Intersections: Proposed changes at intersections and the anticipated impacts are summarized in Table 11. Traffic impact analysis was completed to evaluate these intersection changes – results are summarized in **Attachment C**.

  Overall, the proposed lane configuration changes, which reduce roadway traffic capacity both mid-block and at intersections, are expected to negatively impact traffic operations on the Robie Street corridor. Traffic analysis based on weekday morning and afternoon peak periods indicates that key metrics including vehicle delay and queue length will increase for some affected movements, in some cases significantly, relative to existing conditions. Analysis also indicates that based on current traffic demand during peak periods, traffic volumes will approach or exceed the amount of available capacity for some key movements. As a result, congestion on the corridor will be expected to worsen relative to existing conditions.

  Resulting traffic congestion may encourage motorists to consider alternatives such as (i) shifting to other modes (i.e. transit, active transportation), (ii) changing commute times earlier or later in the day, and (iii) diversion to other routes. It is difficult to predict how motorists will react to the proposed changes, but it is anticipated that provision of higher order transit – the type facilitated by the changes proposed in this report – will be essential in efforts to make transit a more attractive option for more people. These are the types of behavior shifts that are fundamental to the success of the IMP's transportation planning objectives.

Table 11: Summary of Intersection Modifications / Impacts – Robie Street Transit Priority Corridor (Phase 1)

Intersection	Proposed Changes	Impacts
Young Street @ Kempt Road	Young Street WB Approach: reduced from two through lanes to one.	Impacts are not expected to be significant; however, there is potential that queue spillback between Kempt Road and Robie Street could impede operations during peak periods due to the limited distance between the intersections.
Robie Street @ Young Street	Robie Street SB Approach: reduced from two through lanes to one. Young Street WB Approach: reduced from two through lanes to one.	Impacts to affected movements (primarily Robie Street SB through and Young Street WB movements) that may significantly increase vehicle delay (up to approximately 60 seconds per vehicle) and maximum vehicle queues by up to approximately four times relative to existing peak period conditions.
Robie Street @ Almon Street	Robie Street NB Approach: Prohibit left turn movement to Almon Street and convert curb lane from a through-right to right-turn only (except buses).	During the PM peak hour, impacts to affected movements (primarily Robie Street NB through movement) may significantly increase vehicle delay (up to approximately 60 seconds per vehicle) and maximum vehicle queues by up to approximately three times relative to existing peak period conditions. Also, prohibition of the NB left turn movement may be inconvenient for some drivers and result in traffic diversion to other intersections.
Robie Street @ North Street	Robie Street NB Approach: Retain existing lane configuration but allow NB buses to proceed through from the right turn lane.	Impacts are not expected to be significant; however, there is potential that a reduction in storage space for the NB right turn movement at North Street could result in queues impeding the NB through movement.
Robie Street @ Cunard Street	Robie Street NB Approach: Convert curb lane to right turn only (except buses). Cunard Street: • Modify the east intersection leg to realign the EB movement, as illustrated in the concept presented in Figure 3. • Remove WB right turn lane	During the PM peak hour, impacts to the Robie Street NB and Cunard Street WB approaches may significantly increase vehicle delay (up to approximately 40 seconds per vehicle) and maximum vehicle queues by up to approximately two times relative to existing peak period conditions.

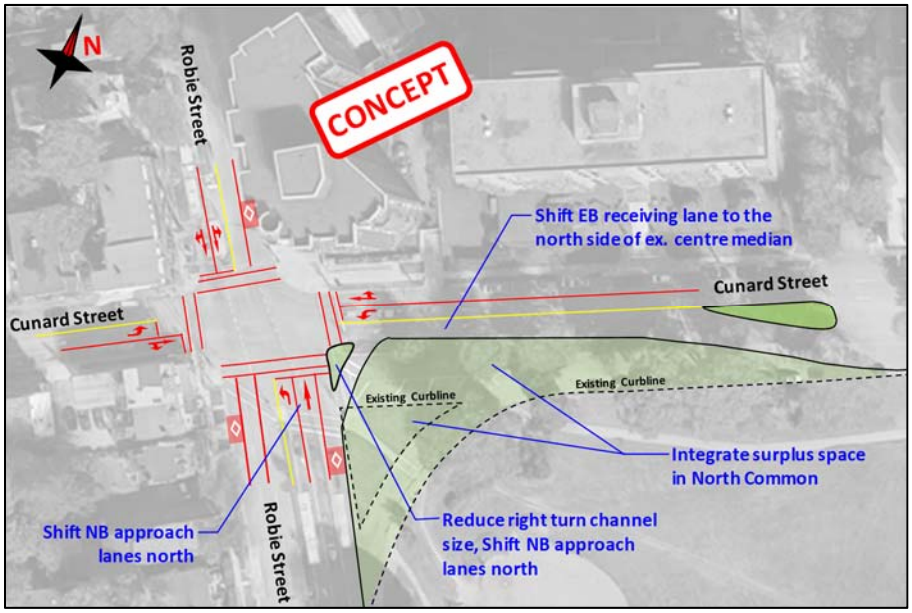


Figure 3: Proposed Intersection Configuration – Robie Street @ Cunard Street

- Transit Service: Significant transit improvement in both directions is expected, as buses avoid the traffic congestion that frequently occurs during peak periods. It is estimated that these transit priority measures will substantially reduce delay, particularly for peak direction buses during morning and afternoon peak periods. For example, travel time data for Robie Street indicate that total trip time between South Street and Young Street regularly increases by up to 18 minutes during the weekday PM peak. The proposed transit priority improvements will enable buses to avoid these significant delays, which will improve schedule adherence during congested periods and play an influential role in making the service more attractive to users.

  With implementation of these transit priority improvements on Robie Street, it is anticipated that consideration will be given to relocating some limited stop services included in the MFTP (i.e. Routes 135, 136, 137, 138, 186, 192, 194, 196) from Gottingen Street, which runs parallel. Because of the low overall impact on ridership, these routes could be relocated to Robie Street without changing the general purpose of the routes, provided that the relocation would have a net positive impact on reliability and running time.

- Active Transportation:
  - *Walking*: Since roadway widening is not necessary as part of proposed Phase 1 improvements, pedestrian crossing distance will not increase. The proposed reconfiguration of the Robie Street – Cunard Street intersection has the potential to improve the pedestrian experience considerably through decreased crossing distances and reduced exposure to conflicts with vehicular traffic.
  - *Bicycling*: Bicycles will be permitted to ride in the bus lanes. However, Robie Street is not an identified cycling corridor, and parallel north-south cycling routes more suited to comfortable cycling are currently available (bicycle lanes on Windsor Street and South Park Street) or are being planned (local street bikeways on Vernon Street, Seymour Street, and other routes currently under consideration in the north end).

Parking / Loading: Impacts to approximately 57 existing on-street parking spaces on Robie Street between Quinpool Road and Almon Street. A Parking Study that includes a review of existing on-street parking and loading on Robie Street (and the immediately surrounding streets) is included in **Attachment D**. Parking utilization observations on Robie Street suggest that parking occupancy and parking duration are relatively high, with an overall average of 66% utilized and localized areas

where utilization exceeded 80%. In general, parking turnover was limited, with overall average parking duration exceeding 4 hours. It appears that there is limited potential for abutting side streets to absorb parking loss on Robie Street; it is also noted that other ongoing active transportation projects on abutting side streets could result in additional parking impacts that could further limit this potential.

There are no formally signed loading zones on Robie Street; 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. Current demand for loading is focused primarily around commercial properties located north of Cunard Street. A summary of existing loading activities is included in **Attachment D**.

Designating the bus lane as operational only during certain times (i.e. weekday 6AM – 6PM) would eliminate all on-street parking and loading during those peak periods but would provide the opportunity to accommodate these uses outside of peak periods, and in some areas add parking where it currently isn't available. This may be desirable given the relatively high demand for parking along some sections of the corridor. Retaining on-street parking during off-peak periods also reduces the effective width of the traveled way, which typically has the benefit of reducing vehicle speeds. It is noted that there are challenges associated with this type of time-variable curb use – specifically, these include the need for additional and potentially confusing signage, non-compliance by users (both on purpose and because of confusion), and the need for additional enforcement resources. It is anticipated that HRM's Curbside Management policy will encourage increased use of time-variable curb use to better accommodate curbside needs throughout the day – increased familiarity with this type of curbside management approach, in combination with public education and awareness initiatives, can help to improve public understanding and compliance. Options for time-restricted bus lanes and their associated implications for compliance and enforcement are summarized in Table 12.

Table 12: Time-Restricted Bus Lane Options

	Bus Lane Operational	Parking / Loading Permitted	Comments
1	Full-Time	N/A	Provides the clearest direction about how curb space can be used (allows for the use of more permanent pavement markings and simple signage). Does not allow for flexible use of curb space and may induce higher traffic speeds when bus service is limited.
2	Weekdays All Day	Weekends All Day	Minimal restrictions around curb access reduces potential confusion, but weekend parking requires that pavement markings and signage be flexible. Flexible use of curb space improves street function when transit priority is least critical.
3	Weekdays 6AM - 6PM	Weekdays 6PM – 6AM Weekends All Day	Curb access restrictions change multiple times daily, increasing signage requirements and potential for confusion and non-compliance. Flexible use of curb space improves street function when transit priority is least critical, but limits usefulness of transit lane for buses weekday evenings, when they may still have value.
4	Weekdays 6-9AM, 3-6PM	Weekdays 6PM – 6AM Weekdays 9AM – 3PM Weekends All Day	Curb access restrictions change several times daily, increasing signage requirements and potential for confusion and non-compliance. Flexible use of curb space improves street function when transit priority is least critical, but limits usefulness of transit lane for buses midday and evenings on weekdays, when they may still have value.

COMMUNITY ENGAGEMENT

Stakeholder and public consultation were completed to develop an understanding of the key issues on each corridor and solicit feedback on the presented concept designs.

- Stakeholder consultation sessions were held with the following groups:
  - North End Business Association
  - Halifax Shopping Centre (20Vic Management)
  - Halifax Cycling Coalition
  - It's More Than Buses
  - Walk & Roll
  - Canadian National Institute for the Blind (CNIB)
  - Dalhousie Transportation Collaboratory (DalTrac)

  The information obtained from these groups was considered during the development of the design options and incorporated into the options evaluation process.

- Functional design options for both corridors were presented at a public consultation session on Thursday, February 1st, 2018 at the Maritime Hall. In addition, a Shape Your City online engagement portal was established for each corridor. Feedback was collected via in-person comments, a paper feedback survey, and an online survey (there were a total of 601 respondents for the Robie Street survey, and 442 respondents for the Young Street survey). The information obtained from public consultation was used to develop an understanding of priorities on each corridor and evaluate public response to the design options. Survey results are summarized in **Attachment E**.

Summary of Stakeholder and Public Consultation Feedback:
The Robie Street and Young Street corridor concept options were presented to the public at an Open House on Thursday, February 1st, 2018, and a Shape Your City online consultation page was established. Results are provided in **Attachment E** and summarized below.

- Robie Street:
  - Total survey respondents: 601
  - The addition of curbside bus lanes in both directions on Robie Street received a favorable response from more than 70% of respondents. Support for a curbside bus lane in one direction only was much less popular, with only 35% of responses favorable (respondents were presented this as an ultimate solution as opposed to an interim solution).
  - Support for centre median bus lanes was mixed, with approximately half of respondents indicating a favorable response.
  - Among the potential trade-offs associated with implementation of the presented options (property impacts, parking / loading, traffic congestion, increased bus traffic, and implementation costs), the potential for increased traffic congestion was the lone category that most respondents (53%) indicated was unacceptable.

- Young Street:
  - Total survey respondents: 442
  - The addition of dedicated bus lanes on Young Street received a favorable response from more than 75% of respondents. Among the potential trade-offs associated with implementation of the presented options, the potential for increased traffic congestion was the lone category that most respondents (53%) indicated was unacceptable.
  - Support for a curbside bus lane in one direction only was less popular, with only 40% of responses favorable (respondents were presented this as an ultimate solution as opposed to an interim solution).

Next Steps / Implementation Plan
The following describes the next steps that are anticipated to be required for implementation of both

corridors.

Phase 1 Transit Priority Upgrades:

- Detailed Design of recommended Phase 1 upgrades on Robie Street and Young Street will be completed by staff, potentially with assistance from an engineering consultant. During detailed design, public and stakeholder engagement will be completed to provide opportunity for additional feedback on the design and related impacts.
- Implementation of the recommended Phase 1 upgrades is not anticipated to require property acquisition, which significantly reduces schedule uncertainty. Along most of the corridor, construction will be limited to modification to pavement markings and signage. Proposed upgrades at the Robie Street – Cunard Street intersection represent the most significant construction works included in Phase 1.
- If the recommendations contained in this report are adopted, an approximate implementation timeline is summarized in Table 13. It is anticipated that implementation of Phase 1 can be completed during 2020.

Table 13: Estimated Implementation Timeline - Robie Street / Young Phase 1 Transit Priority Upgrades

Task	2019		2020		
	Summer	Fall	Winter	Spring	Summer
1. **Detailed Design**[a b]					
2. **Construction Tendering**[c]					
3. **Construction**[d]					

Notes:

a. Assumes Regional Council approval of staff recommendations in June/July 2019.
b. Detailed design completed by HRM internal resources or consultant (to be determined).
c. Award of construction tender subject to budget availability.
d. Construction timelines for this project are uncertain. Mitigation of construction-related impacts on traffic will likely be desired due to the siginificance of the Robie Street corridor. It has been assumed that construction will commence during spring, coinciding with the start of the road

Phase 2 Transit Priority Upgrades:

- Due to the need for property acquisition and ROW widening to add continuous curbside bus lanes on both sides of Robie Street and Young Street, the timelines associated with Phase 2 upgrades on Robie Street and Young Street are uncertain. Staff are currently undertaking a review of the ROW required to implement Phase 2 upgrades and will be developing a real estate acquisition strategy.

Long-Term Strategy:

- Though centre median bus lanes were not identified as the preferred transit priority configuration for Robie Street at this time, the future potential for higher order transit (i.e. light rail) with similar space requirements warrants consideration given the corridor's strategic central location on the peninsula. In conjunction with the review of ROW requirements and real estate acquisition strategy described above for Phase 2, staff are completing further investigation of ROW property needs for the centre median bus lanes option. These efforts will provide staff with a better understanding of the feasibility of acquiring the lands necessary to preserve the corridor.

FINANCIAL IMPLICATIONS

It is expected that the detailed design will be undertaken by internal staff resources. Should staff resources not be available, there is $250K of budget set aside in Capital Account CM000009 – Transit

Priority Measures, for detailed design. A preliminary Class D cost estimate for construction is $1.9 million, which includes the transit priority measures, traffic signal rehabilitation at two intersections and other potential intersection upgrades that may be identified as part of an in-service safety audit. Construction of the recommended Robie Street and Young Street Phase 1 transit priority upgrades is not budgeted at this time. Upon completion of the detailed design process, the budget will be identified for Regional Council's consideration as part of the 2020/21 Capital Budget process.

Budget Summary: CM000009-Transit Priority Measures

Beginning Balance	$1,041,072
Less: Estimate of detailed design (Reservation 2558)	$ 250,000
Remaining balance	$ 791,072

RISK CONSIDERATION

Risks associated with the recommendations of this report are outlined in Table 14:

Table 14: Summary of Project Risks

Description	Risk Level	Mitigation Opportunities
Ability to appropriately internally resource the land acquisition effort required to be successful.	Medium	Retain external consultant to augment internal resources.
Encroachment of new developments in corridor, in the interim.	Medium	Ongoing review of development applications to ensure that corridor ROW needs are retained.
Underestimation of resulting traffic congestion.	High	Ongoing implementation of sustainable transportation initiatives that promote mode shift and transportation demand management.

ENVIRONMENTAL IMPLICATIONS

This project is supportive of the Council Priority Outcome of building Healthy, Livable communities, as it aims to make it more convenient for residents to choose sustainable transportation options for everyday transportation purposes. Transit enhancements are aimed at encouraging more people to take transit, promoting a shift to non-auto modes (targeted in the Regional Plan and IMP) and a reduction in greenhouse gas (GHG) emissions.

ALTERNATIVES

The Transportation Standing Committee may recommend to Regional Council that some or all of the recommendations not be approved or be modified. Alternatives are presented below:

1. The Committee may recommend that Regional Council direct the CAO to modify the scope of the proposed Phase 1 transit priority upgrades on Robie Street and/or Young Street. Potential options include:
    - Extend the proposed Phase 1 transit priority upgrades to include some or all of the Robie Street segments between Inglis Street and Quinpool Road. This alternative is not recommended at this time, as it is not anticipated that the resulting transit benefits would justify impacts (loss of the centre median, on-street parking and/or traffic lanes) and the potentially significant cost implications.
    - Reduce the proposed Phase 1 transit priority upgrades to include only certain segments of Robie Street or Young Street. This alternative is not recommended, as it does not provide the full extent of immediate, low impact transit priority benefits that can be achieved.
    - Modify the proposed approach time restrictions for the bus lane (operational weekdays 6AM – 6PM) to include different time restriction periods (or no time restrictions at all).

This alternative is not recommended, as staff feel that the proposed approach effectively balances the need for transit priority with other demands on the street.

2. The Committee may recommend that Regional Council direct the CAO to abandon the proposed phased approach to transit priority upgrades in favor of an approach that holds off on implementation until all necessary lands are acquired to enable construction of continuous bus lanes in both directions. This alternative is not recommended, as it does not provide the full extent of immediate, low-impact transit priority benefits that can be achieved and is not consistent with the policy direction adopted by Council in the MFTP and IMP.

3. The Committee may recommend that Regional Council direct the CAO to abandon efforts to further investigate the right-of-way acquisition requirements for the Phase 2 transit priority upgrades and/or the Robie Street centre median bus lane option. This alternative is not recommended, as it does not allow staff to fully consider the potential of these options.

4. The Committee may recommend that Regional Council direct the CAO that no changes be made to the Robie Street and/or Young Street corridor. This alternative is not recommended, as it is not consistent with the policy direction included in the MFTP and IMP.

ATTACHMENTS

Attachment A: *Halifax Transit Priority Corridors: Robie Street and Young Street* (WSP, July 2018)
Attachment B: Functional Design Drawings – Robie Street and Young Street
Attachment C: Traffic Impact Analysis – Robie Street / Young Street
Attachment D: On-Street Parking Review – Robie Street
Attachment E: Community Consultation Results Summary

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.

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Report Approved by:	Peter Duncan, Manager Infrastructure Planning, Planning & Development, 902.490.5449

Attachment A

HALIFAX

HALIFAX REGIONAL MUNICIPALITY

HALIFAX TRANSIT PRIORITY CORRIDORS – YOUNG STREET AND ROBIE STREET

FINAL REPORT

JULY 2018

Project No. 171-09619

wsp

Attachment A

TABLE OF CONTENTS

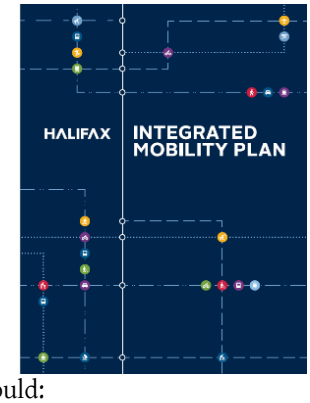
APPENDICES

1 INTRODUCTION AND BACKGROUND

1.1 BACKGROUND

Recent and ongoing policy development efforts have made improvements to Halifax's transit service a key priority for the Municipality. Specifically, Halifax Transit's *Moving Forward Together Plan* (adopted by Regional Council in April 2016) includes bold moves that aim to improve transit service levels through increased priority, enhanced reliability, and reduced travel time. The bold moves are being made in support of the following four Council-endorsed '*Moving Forward Principles*':

1. Increase the proportion of resources allocated towards high ridership services.
2. Build a simplified transfer based system.
3. Invest in service quality and reliability.
4. Give transit increased priority in the transportation network.



Among the key initiatives that the Municipality is considering for transit upgrades are Transit Priority Measures (TPMs) – strategically located street and intersection upgrades that provide priority for the movement of buses. TPMs provide opportunities to make notable improvements to transit operation, and can be particularly effective in locations where right-of-way (ROW) constraints limit the ability to implement more dedicated facility options. When used effectively, TPMs can provide significant network benefits to transit operation that can stem from time savings of as little as a few seconds at a time, with greater improvements when provided along a full corridor.

The *Integrated Mobility Plan* (IMP) was unanimously approved by Halifax Regional Council on December 5, 2017. The Plan identifies 137 specific actions to promote mobility through the municipality and encourage the use of non-auto modes. The plan identifies specific routes as Transit Priority Corridors and its Action #91 specifically recommends that the Municipality should:

IMP #91: *Prioritize the delivery of Transit Priority Corridors, starting with but not limited to:*

1. *Bayers Road (Romans Avenue to Windsor Street).*
2. *Gottingen Street (North Street to Cogswell Street).*
3. ***Robie Street (Young Street to Inglis Street).***
4. ***Young Street (Windsor Street to Robie Street).***

WSP Canada Inc. has been retained to prepare functional designs for transit priority on the four corridors identified in the IMP Action #91.

Analysis was completed and a recommendation report was submitted to Transportation Standing Committee (TSC) on February 1, 2018 to provide corridor level transit priority on Bayers Road and Gottingen Street. Regional Council has approved the corridor level transit priority on Bayers Road that includes some widening along the corridor and realignment of the Halifax Shopping Centre intersection to provide what is expected to be a significant improvement for transit operations along that corridor. Additionally, Halifax Regional Council has approved transit priority for Gottingen Street that is expected to provide benefit to thousands of daily transit users. That project is proceeding to detailed design with construction expected in 2018.

This current report represents Phase 2 of the project and reviews options for continuing the transit priority to **Young Street** and **Robie Street**.

1.2 STUDY AREA

The Study Area for this phase of this project includes the following corridors (shown in Figure 1-1):

1. Young Street: Windsor Street to Robie Street; and,
2. Robie Street: Young Street to Inglis Street.

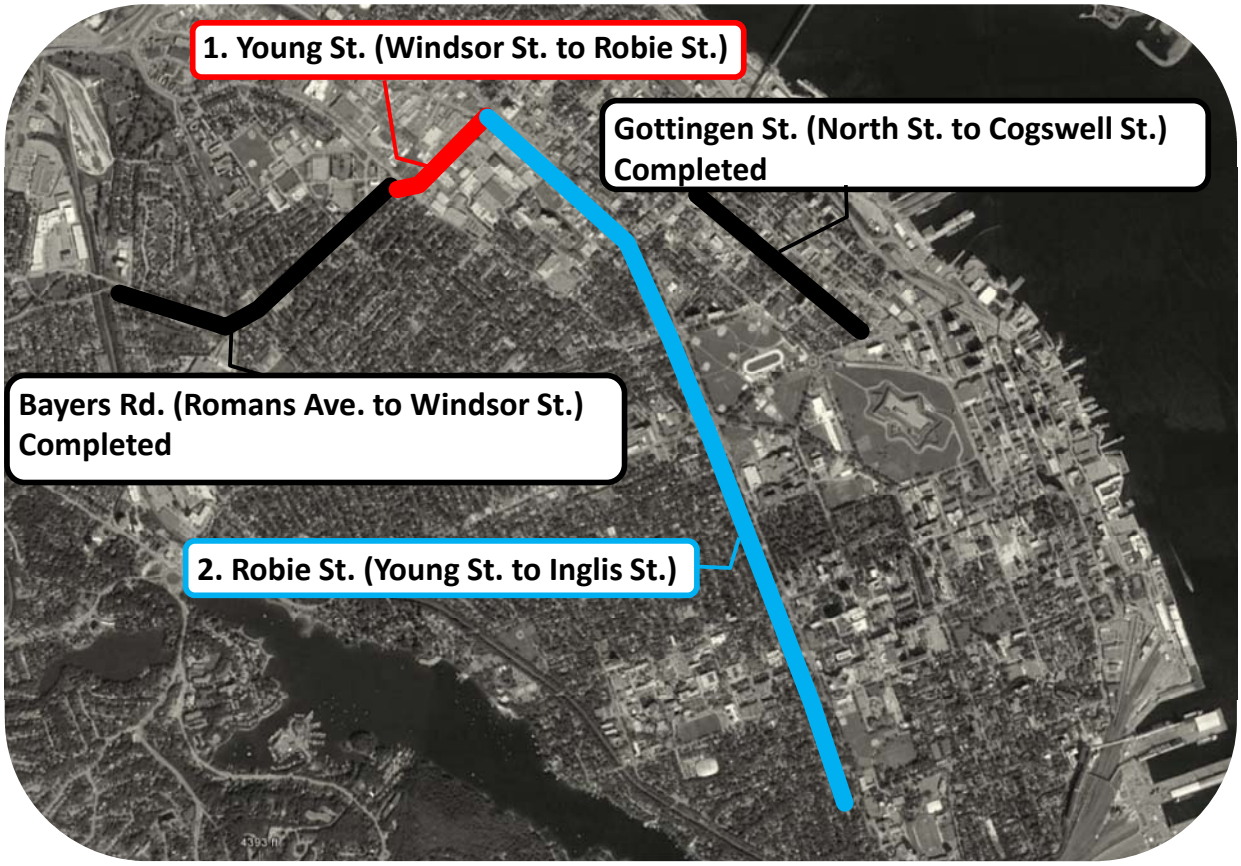


Figure 1-1 – Study Area Corridors

1.3 STUDY OBJECTIVES

The primary goal of this assignment is to develop and evaluate functional design options for transit priority along the study area corridors. Specific project objectives include:

1. Complete a detailed investigation of existing conditions within the Study Areas, including topographic survey and establishment of the functional operations of each street (i.e. traffic operation, transit delay, parking, loading, etc.);
2. Develop an understanding of existing and projected multimodal transportation demands;
3. Prepare functional design options and 'Class D' Cost Estimates for each proposed option along each transit priority corridor;
4. Engage with key HRM internal stakeholders, external stakeholders, and the general public to identify the relevant constraints and obtain feedback on design options;
5. Complete assessments for each of the functional design options that focus on transit operational benefits, intersection performance, parking / curb access, and road safety considerations;
6. Prepare a design report that documents background information, summarizes key design assumptions and rationale, and provides comparative evaluation for each option.

2 OVERVIEW OF EXISTING OPERATIONS

2.1 TRAFFIC CONGESTION

Traffic congestion along the considered corridors has become an increasing concern in recent years (See Figure 2-1 where red indicates heavy congestion with green indicating light congestion). Long delays and queues have been observed throughout the study area, particularly northbound on Robie Street during the PM peak period, where travel times for traffic between Inglis Street and Young Street have been observed to range from 15-30 minutes on a typical weekday (compared to 10-15 minutes during periods of reduced congestion).

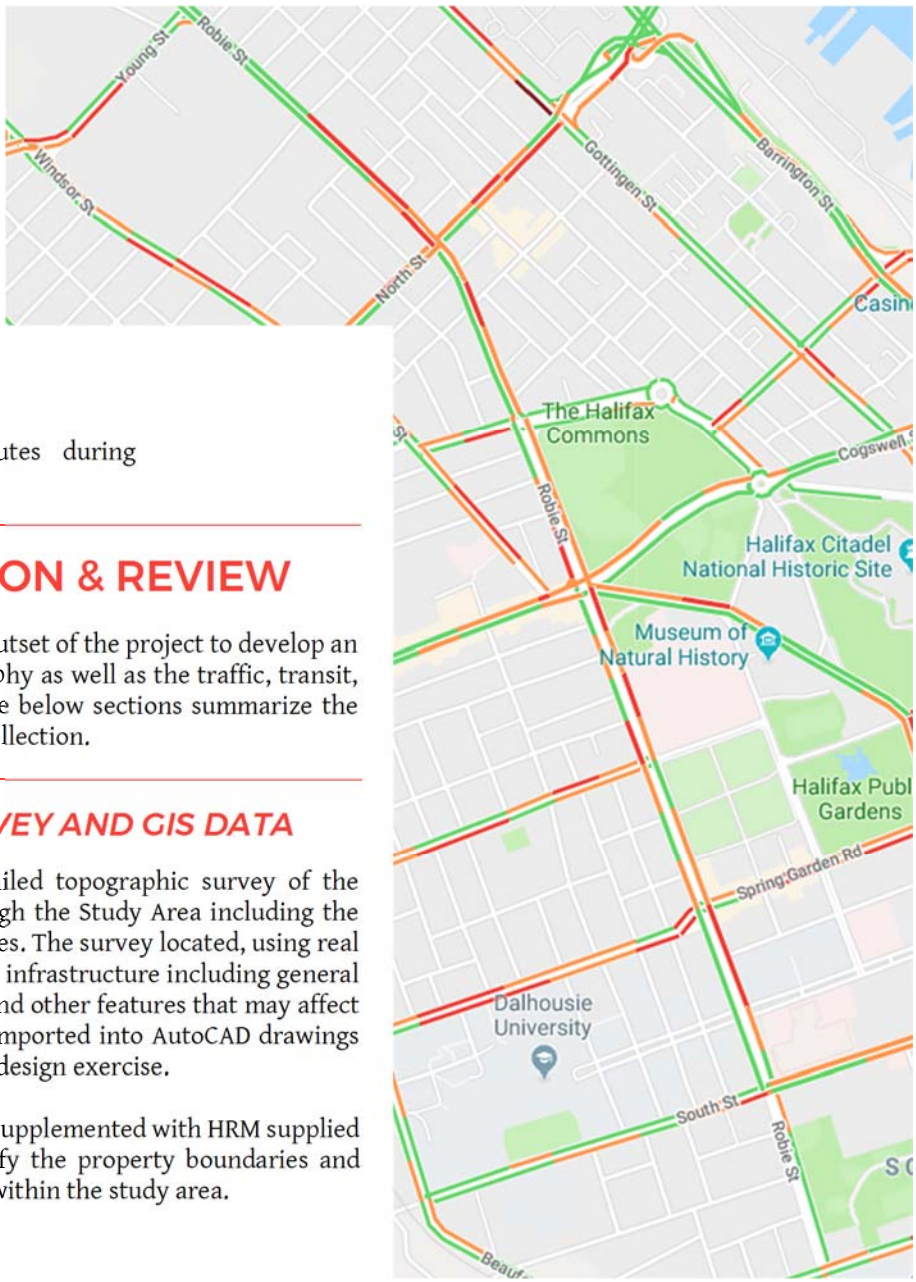


Figure 2-1 - Google Traffic Maps
4:10 PM, February 1, 2018

2.2 DATA COLLECTION & REVIEW

Significant data were collected at the outset of the project to develop an understanding of the existing topography as well as the traffic, transit, and active transportation demand. The below sections summarize the methodology and results of this data collection.

2.2.1 TOPOGRAPHIC SURVEY AND GIS DATA

WSP's survey team conducted a detailed topographic survey of the existing terrain of the corridors through the Study Area including the approach streets and abutting properties. The survey located, using real world coordinates, all relevant existing infrastructure including general site grades, curbs, utility poles, trees, and other features that may affect the proposed designs. The data were imported into AutoCAD drawings for use as the topographic base for the design exercise.

The topographic field survey has been supplemented with HRM supplied GIS data and aerial imagery to identify the property boundaries and approximate HRM right-of-way limits within the study area.

2.2.2 TRAFFIC VOLUMES

Intersection turning movement counts (collected between 2012 and 2016) and existing traffic signal timings for key study area intersections were provided by HRM Traffic Management for use in the review of existing traffic characteristics and analysis of intersection performance. Historical 24-hour machine counts were also provided along each corridor for consideration of historical and anticipated growth trends.

GROWTH TRENDS

Traffic volumes collected by HRM along each corridor were analyzed in order to develop an understanding of traffic growth trends. While results (See Figure 2-2) do not indicate a clear growth trend for traffic volumes on study area routes, they do indicate substantial variability in corridor traffic volumes.

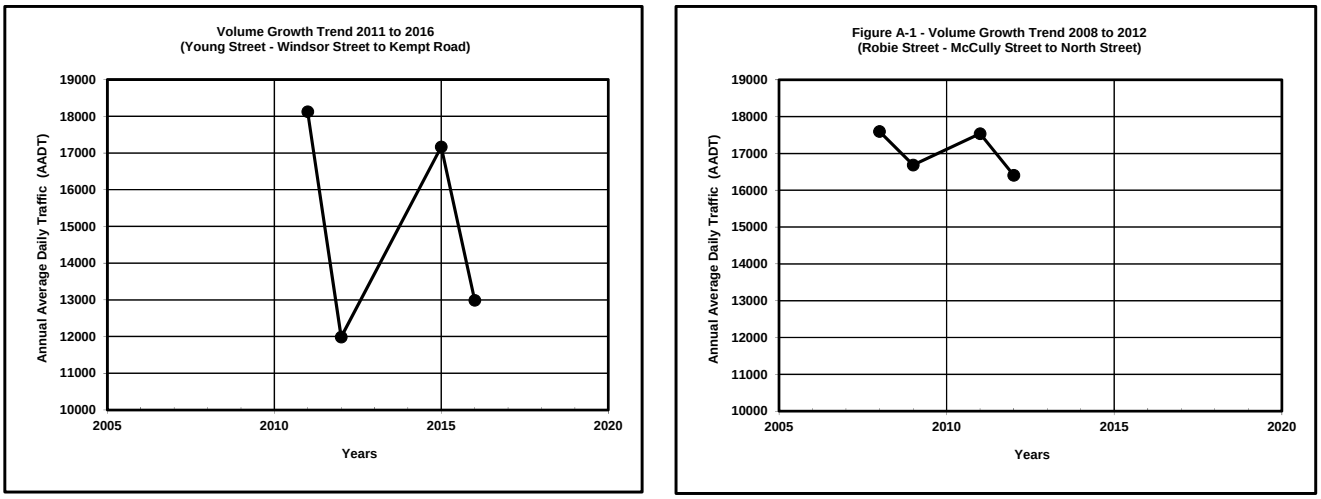


Figure 2-2 – Traffic Volume Growth Rates – Young Street and Robie Street

DESIGN HOURLY VOLUMES

Design hourly volumes were developed using the intersection turning movement count data collected by HRM Traffic Management with an added 5% design hourly factor. This factor is not intended to consider any traffic volume growth resulting from proposed or anticipated development in this area but considers the day-to-day variability in traffic volumes.

Given the volume variability and lack of a clear historical trend of annual volume growth, the design hourly volumes have been estimated using the observed AM and PM peak hour volumes with a 5% design hourly factor but no additional annual growth. If traffic volume growth is observed in the future, it is expected to increase congestion and increase the need for transit priority.

2.2.3 TRANSIT DATA

Since there is some uncertainty of planned frequency for some of the future routes identified in *Moving Forward Together Plan* (Halifax Transit, 2016) and because ridership forecasts for these routes were not available for this project, transit vehicle and ridership volumes for existing routing (provided by Halifax Transit) were used in the analysis.

It is recognized that each of the study area roads have been identified as Transit Priority Corridors by the Council approved *Integrated Mobility Plan*. While analysis uses existing vehicle and ridership volumes, it is expected that transit ridership and vehicle volumes will likely increase, particularly with the implementation of corridor level transit priority measures.

2.2.4 PEDESTRIANS AND BICYCLISTS

Available pedestrian and bicycle volume data for the study area were provided by HRM Traffic Management. These included counts of bicyclists at the Robie Street at Bell Road intersection as well as screenline counts for several streets in the area. Counts were collected twice per year (Spring and Fall) from 2013 to 2016.

2.2.5 PARKING

Field investigation was completed by WSP to inventory the location of existing on-street parking along each of the studied corridors. Data on parking utilization were not available.

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3 PROJECT APPROACH / FRAMEWORK

3.1 DESIGN OBJECTIVES / CONSIDERATIONS

The design objective for this project is to provide priority for transit along each corridor while also considering active transportation, traffic operations (including heavy vehicles) as well as the impact to parking and adjacent properties. The considerations are summarized in Table 3-1.

Table 3-1 – Project Considerations

Factor	Evaluation Considerations
Halifax Transit	Efficient movement of buses through the study corridors is a key consideration of this project. Design options have reviewed the ability of buses to navigate through the intersections and along the corridors with consideration given to the estimated and observed delays under existing conditions and the potential to improve transit operation through transit priority.
Active Transportation (Pedestrians / Cyclists)	Accommodation of active transportation is very important to HRM and the provision of sidewalks and safe street crossings is an important consideration. Evaluation of each design options based on pedestrian and cyclist accommodation will focus on the extent to which key inputs such as pedestrian / cyclist exposure to vehicular traffic (i.e. crossing distances) are expected to change with implementation of each option.
Vehicular Traffic	Both Young Street and Robie Street in the project study area are classified as arterial streets and designated as Truck Routes by HRM By-Law T-400. The approach of the assessment of impacts to vehicular traffic includes performance analysis of the intersections and the corridors under consideration. Intersection performance analysis, completed using Synchro / SimTraffic is the basis upon which intersection capacity requirements (i.e. lane configurations, # of lanes) are determined. Comparison of results among the design alternatives enables understanding of the impact that each has on vehicular traffic performance.
Parking / Loading	The available parking and loading has been identified along the study area corridors. Impacts to parking and loading have been considered in the analysis.
Right-of-Way Impacts	Consideration has been given to the impacts of roadway expansion. Where available, properties already owned by HRM were considered first and where necessary, property acquisition has been identified. Other impacts on adjacent properties (i.e. grading) were also considered in the options analysis.

3.2 DESIGN WORKSHOP

A Functional Design Workshop was held early in the design phase (August 16, 2017) with HRM staff to discuss innovative, yet feasible options for transit priority measures along each corridor. A discussion on prioritization within a transit priority corridor began the workshop. Although it was recognized that precise priorities for each corridor and section of each corridor is highly context sensitive, the group came to a consensus that right-of-way prioritization for the transit corridors were:

Higher Priority
↓
Lower Priority

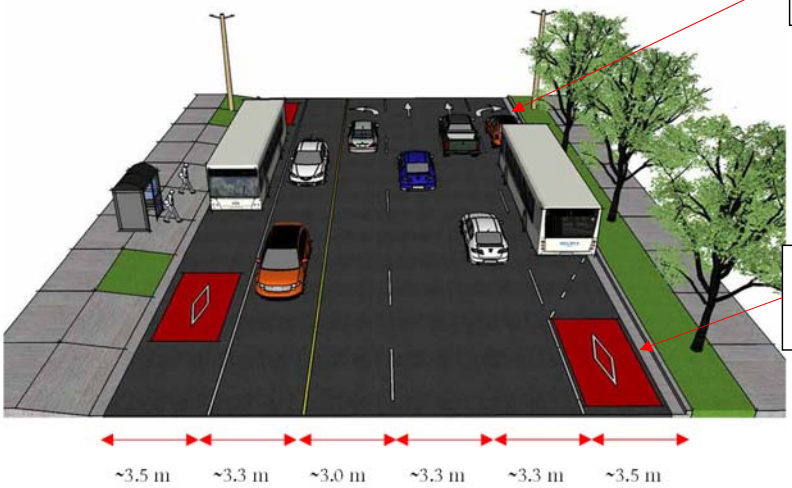
1. Sidewalk
2. Transit and transit stops
3. Non-Transit Traffic
4. Deliveries and Loading
5. Parking (Vehicular / Bicycles)

During the design workshop, different types of transit lanes were discussed as options for consideration on this project. These lane types are described in the following sections.

3.2.1 CURBSIDE BUS LANES

Curbside bus lanes provide a dedicated lane for buses, allowing them to avoid traffic congestion. This reduces the delay experienced by buses and increases the overall reliability of the transit network. The curbside lane is intended for use only by transit vehicles, however general traffic may also use the lane strictly for making right turn movements. Where no receiving lane is available, Transit Signal Priority (TSP) can also be provided to buses as they are able to bypass long queues of traffic in their dedicated travel lane. Curbside bus lanes should be designated with diamond pavement markings, and in some cases red markings to improve visibility.

Dedicated curbside bus lane, right-turns permitted for general traffic



Diamond pavement markings are commonly used to identify curbside bus lanes

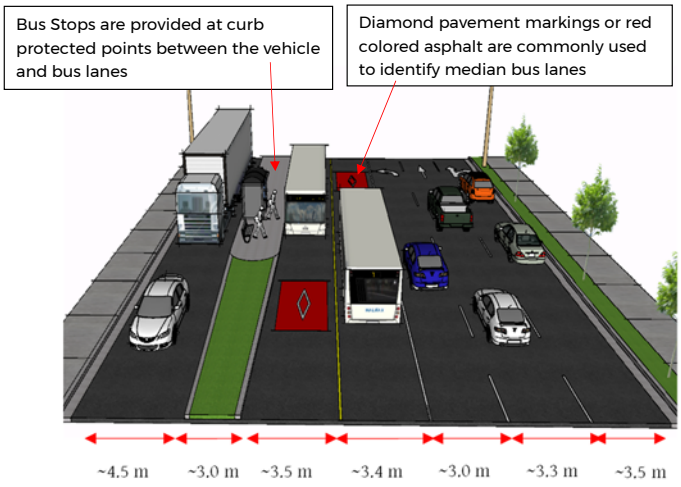
WHERE ARE THEY SUITABLE?

Curbside bus lanes are best suited on high volume corridors with heavy congestion, frequent transit service, and a low volume of right turn movements and parking.

Transit Operational Improvements	Curbside bus lanes give transit their own dedicated lane allowing them to bypass traffic congestion, increasing their overall reliablility.
Road Safety	Curbside bus lanes reduce the number of potential conflicts between buses and general traffic including parked cars and roadway projects have indicated a reduction in total collisions with the installation of curbside transit lanes (Source:*http://www.wrirosscities.org/sites/default/files/Traffic-Safety-Bus-Priority-Corridors-BRT-EMBARQ-World-Resources-Institute.pdf*) .
Trade-Offs	Curbside bus lanes can be installed by either (i) repurposing curbside space (traffic lanes / parking) or (ii) street widening. This leads to reduced traffic capacity, loss of on-street parking / loading loss, and / or property impacts.
Public Realm	Curbside bus lanes may result in lower volume but higher speed vehicles in the curb lane abutting the sidewalk if insufficient boulevard space is provided between the bus lane and the sidewalk.

3.2.2 MEDIAN BUS LANES

Median bus lanes also provide a dedicated lane for buses, allowing them to avoid traffic congestion. This reduces the delay experienced by buses and increases the overall reliability of the transit network. The median lane is typically intended for use only by transit vehicles. Median bus lanes can be designated with diamond pavement markings, and in some cases red paint to improve visibility.



Median Transit Lanes
(Highway 7, Richmond Hill, Ontario)

WHERE ARE THEY SUITABLE?

Median bus lanes are best suited on high volume corridors with heavy congestion, frequent transit service, and low left turning volume. Due to conflicting movements, left turn vehicles require signal separation from the through bus movements. Where these left turn volumes are high, this signal phase can be lengthy, potentially leading to increased delay. They also require a wider right-of-way due to the required pedestrian refuges / median bus stops.

Transit Operational Improvements	Median bus lanes give transit their own dedicated lane allowing them to bypass traffic congestion, increasing their overall reliablility. The transit lane is not shared with mixed traffic or parking, providing potential improvements compared to curbside lanes.
Road Safety	Collision data for several projects in Canada (Vancouver Blue Line and Spadina Avenue) indicate that median lanes offer some safety benefits due to reduced conflict points with separation of transit and non-transit vehicles, however, safety concerns were also identified including: • Potential conflicts with simultaneous left turning vehicles. • Pedestrians are required to cross traffic lanes to reach the bus stop. • Wider intersections require longer pedestrian crossings and clearance intervals. • Potential increase in collisions shortly after implementation due to drivers being unfamiliar with the lane type.
Trade-Offs	Median bus lanes can be installed by either (i) repurposing existing space (traffic lanes / parking) or (ii) street widening. This leads to reduced traffic capacity, loss of on-street parking / loading loss, and / or property impacts. Median transit lanes generally require more space than curbside lanes due to the need for transit platforms and additional curb offsets. Median lanes have a greater potential impact to traffic flow by eliminating left turns except at signalized intersections.
Public Realm	Median bus lanes generally require more space then curbside bus lanes, which can lead to longer pedestrian crossing distances. Median bus lanes require that the bus stops are also located on a refuge island, increasing the required number of crossings per transit user. Transit users are also required to wait for the bus on the refuge island, which can make some transit users uncomfortable if insufficient space is provided.

3.3 STAKEHOLDER & COMMUNITY CONSULTATION

One of the key aspects of this project was the consultation with stakeholders and the public at large. Separate meetings were held with HRM staff, stakeholder groups external to the municipality, and with the public through Open House style meetings and via an online survey.

3.3.1 HRM INTERNAL STAKEHOLDERS

A meeting was held with HRM Internal staff (July 27, 2017) who provided insight to various areas of expertise related to TPM on the identified corridors. Attendees represented the following areas of interest and expertise:

- Strategic Transportation Planning
- Traffic Management
- Parking Management
- Halifax Transit
- Streetscaping and Active Transportation
- Planning and Development
- Urban Forestry
- Cogswell Redevelopment Project

The following is a summary of what we heard from HRM staff:

YOUNG STREET

- Young Street provides access to large commercial properties.
- Centre Plan: This area is designated as a growth centre. It is envisioned as being high density.
  - Sidewalks and streetscaping need to be better and more conducive to the pedestrian.
  - For all new development in the area, HRM is particularly interested in setbacks.
  - This whole area (north of Almon St.) is envisioned as being re-created into a new "Super Block" area. There is a need to reconnect the area with smaller block systems for increased access and movement for all modes of travel.
- Bus operators request having a left turn signal from Robie St. to Young St. more than any other spot in the city.
- A very important consideration on Young Street will be access management into the large commercial and higher density residential properties.
- Large development on the northeast corner of Young St./ Windsor St./ and Bayers Rd. has been approved.
- Access management will be really important to consider along this corridor. Centre Plan's land use by-law will have the ability to regulate property access. The regulations for Young Street will be released in February 2018, and hopefully approved by September 2018.
- There are no plans for cycling projects along Young Street. Cycling work will be focused more on off-street than this corridor.

ROBIE STREET

- Centre Plan has Robie Street designated as a corridor from Young Street to Spring Garden Road.
- There is a separate study currently being done for Bus Rapid Transit within the municipality. Robie could very well be considered as a BRT corridor.
- Currently there is a queue jumping lane (southbound) at Almon St. and Robie St. – however there is not a receiving lane on the other side.
- The challenging parts of this roadway will be between Cunard St. and Almon St. Road widening will be challenging in this section.
- Significant tree interest located between North Street and Cunard Street.
- Possible road widening opportunity in front of the O'Regan's dealership. It appears the property line is set back further into the parking lot.
- Throughout the corridor, there are a number of development opportunities with active applications in to HRM now. If additional setback is needed to accommodate bus lanes, discussions with developers need to be made now.
- Halifax Common lands are undergoing a master planning exercise. If road widening occurs, impacts to Common land should be considered.
- Impacts to parking need to also be considered, specifically around the universities/hospitals?
- Try to minimize asphalt as much as possible along the corridor.

3.3.2 EXTERNAL STAKEHOLDER ENGAGEMENT

Separate meetings with stakeholders external to municipal staff were also held to introduce and review the project. Project information and consultation meetings were held with the Halifax Utility Coordinating Committee (HUCC, July 13, 2017), and various community advocacy groups. The following is a summary of feedback provided from each of the external stakeholder meetings.

HALIFAX UTILITY COORDINATING COMMITTEE (HUCC)

- Prior to any construction, HUCC members will need to know whether or not utility relocation is required.
- A change in curbs will be their biggest concern. These will have impacts of where their services are located.
- Relocation of utilities will be costly.
- Will federal infrastructure money help pay for the costs to relocate utilities?

COMMUNITY ADVOCACY GROUPS

Members from community advocacy groups came together for a project introduction and consultation meeting. The following groups were represented at this meeting:

- Walk n Roll
- Halifax Cycling Coalition
- DalTrac
- It's More than Buses
- Canadian National Institute for the Blind (CNIB)

The following is a summary of what was heard:

GENERAL COMMENTS

- General concerns were voiced from community group representatives on noise and pollution impacts, turning corridors in to "bus highways" as well as concerns on the impacts of removing on-street parking.
- Consider using TPM treatments to "brand" transit priority. (i.e. consider colouring the pavement for the bus only lanes.)
- TPM projects cannot put pedestrians at a disadvantage. Designs will require careful consideration to streetscaping, pedestrian crossing distances, and creating safe and comfortable areas for pedestrians to travel on.
- HRM must consider accessibility planning. For the visually impaired, it is much easier to delineate the sidewalk and roadway when there is landscaping/grass between the curb and the walking area. Audible bus stops are also recommended to accommodate the visually impaired.
- How will TPM impact cyclists? Need to make sure these measures are not to their detriment.
- Community Group representatives suggested HRM should consider congestion pricing – tax personal motor vehicles going into the peninsula. This will be easier (and less money) than doing road widening and will likely see an increase in ridership numbers.
- Need to consider the impact that TPM will have on surrounding residential streets.

3.3.3 PUBLIC OPEN HOUSE

Photo 1 - Young Street / Robie Street Open House – February 1, 2018

An open house (February 1, 2018) was held for members of the public to review the proposed functional design options along Young Street and Robie Street. Using panel displays, attendees were shown design options for segments of the corridor ranging from high investment (and highest impact), medium investment, and low investment (and lowest impact). A summary of user impacts were provided as well as an overview of pros and cons for various considerations of the options was provided to help compare impacts. Residents were asked to provide their feedback and indicate which of the design options they prefer (if any at all). Copies of the public open house boards for both Young Street and Robie Street are included in Appendix A while comment feedback results for each are presented in Appendix B.

3.3.4 ONLINE CONSULTATION

An online survey was commissioned by the HRM project team to gather further public input on the display boards (Appendix A) and made available on the project's Shape Your City website. The following are key highlights from the online survey for Young Street and Robie Street and are based on a summary report provided by HRM staff (Appendix C).

YOUNG STREET n=447

- 20% of survey participants indicated they 'Often' travel the corridor as a pedestrian.
- Nearly half of participants indicated they 'Never' travel on Young Street as a cyclist, and nearly half indicated they travel on Young Street 'Often' as a driver or passenger of a personal motor vehicle.
- Three quarters of participants indicated they do travel on Young Street as a transit user, however frequency of these responses varied from "Infrequently' (26%), to 'Occasionally' (26%), to 'Often' (17%). Additionally, 28% of respondents indicated they 'Never' travel the corridor as a transit user.
- 'Pedestrian safety and comfort' was the most commonly selected priority by respondents for level of importance on Young Street. Bus schedule reliability was the second most commonly selected priority and motor vehicle congestion and delay was the third most commonly selected.
- Road widening and impacts to properties was the most acceptable trade-off with the addition of a transit-only lane, while an increase in delay (time) for motor vehicle traffic was the least acceptable.
- The most preferred design option was the curbside transit only lanes in both directions while the least preferred option was the Curbside transit only lane, outbound only.

ROBIE STREET n=609

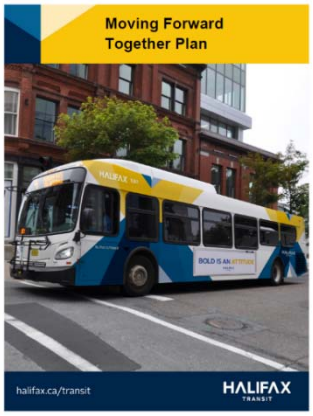
- One third of survey participants indicated they 'Often' travel the corridor as a pedestrian.
- Nearly half of participants indicated they 'Never' travel on Robie Street as a cyclist, and over half indicated they travel on Robie Street 'Often' as a driver or passenger of a personal motor vehicle.
- Three quarters of participants indicated they do travel on Robie Street as a transit user, however frequency of these responses varied from "Infrequently' (21%), to 'Occasionally' (28%), to 'Often' (27%). 15% of respondents indicated they 'Never' travel the corridor as a transit user.
- 'Pedestrian safety and comfort' was the most commonly selected priority by respondents for level of importance on Robie Street. Bus schedule reliability was the second most commonly selected priority and motor vehicle congestion and delay was the third most commonly selected.

- Loss of on-street parking and loading spaces was the most acceptable trade-off with the addition of a transit-only lane, while an increase in delay (time) for motor vehicle traffic was the least acceptable.
- For all corridor segments, the most preferred design option was the curbside transit only lanes in both directions. The least preferred option was the Curbside transit lane, outbound only.

3.4 ANALYSIS FRAMEWORK

The analysis of each option includes consideration of impacts on Transit Operations, Multimodal Level of Service, Traffic, Parking/Loading, and Property Impacts. The analysis framework for each of these considerations is described in the subsequent sections.

3.4.1 VEHICULAR IMPACTS (TRANSIT AND NON-TRANSIT)

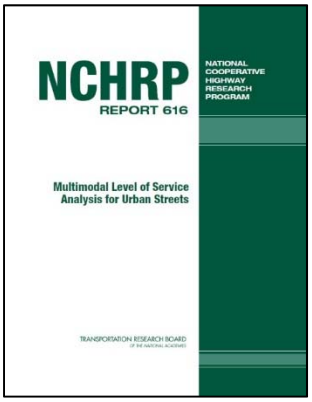


In *Halifax Transit Priority Measures Study* (WSP, 2016) an analysis framework was developed to consider the costs and benefits to transit and the overall public of a given transit priority measure. That methodology has since been included as Appendix E in *Moving Forward Together Plan* (Halifax Transit, 2016) as the methodology used for the evaluation of transit priority measures. This methodology follows the following five steps:

1. **Develop estimates for the Capital Cost** using preliminary cost estimates based on functional designs.
2. **Develop estimates for annual operating cost** using approximate costs for similar measures.
3. **Develop operational cost savings to Halifax Transit** using estimates in delay reductions to transit vehicles. This can be obtained from field observation or traffic modeling and a combination of both have been used for this project.
4. **Understand the TPM's Impact to All Road Users** using estimates in changes in delay to the movement of people using the particular intersection or corridor. This includes changes in delay to transit users as well as any estimated change in delay to motorists, cyclists, or pedestrians.
5. **Determine the payback period for the Measure** using the results of the previous four steps.

To estimate the impact on transit flow that could be expected with each option along each corridor, the delay reductions to the average transit vehicle have been estimated using traffic analysis (Synchro 9 and SimTraffic) and supplemented with field observation. This analysis has been carried into the cost analysis, overall evaluation, and the methodology to calculate the delay and payback period are included in.

3.4.2 MULTIMODAL LEVEL OF SERVICE (MMLOS)



Multimodal level of service (MMLOS) is an evaluation framework that takes a more holistic approach to intersection performance analysis than the typical vehicle-focused models that are commonplace. The framework for MMLOS is based on *NCHRP Report 616* (National Cooperative Highway Research Program NCHRP, Washington, 2008), a publication that summarizes the results of a 2-year investigation of how users perceive the multimodal quality of service on urban streets. LOS models were calibrated that rate the level of comfort and delay felt by pedestrian, bicycle, and transit users at an intersection and along a corridor and enable the analysis of "tradeoffs" of various allocations of the urban street cross section among auto, pedestrian, bicycle, and transit users. The intent is to provide a more complete representation of how key variables impact the accommodation of different road users.

The NCHRP framework for MMLOS has been applied to evaluate design alternatives for the study area. The following summarizes the NCHRP framework and how it was applied to this project:

- *NCHRP 616* included MMLOS models for corridors and signalized intersections only.
- Although there are transit multimodal level of service models for corridors, the factors for transit LOS consider transit scheduling and transit amenities (benches, shelters) that are outside the scope of this project. Evaluation of transit performance along each corridor has been performed separately.
- *Highway Capacity Manual 2010* (HCM 2010, National Academy of Sciences, Washington, 2010) used the research and models included in NCHRP 616 to provide MMLOS models for intersections and segments in HCM 2010. New to HCM 2010 was the MMLOS criteria for pedestrians at Two-way STOP controlled intersections (TWSC); however, HCM 2010 does not provide bicycle MMLOS at TWSC. Table 3-2 summarizes the factors that were found to influence the level of service of pedestrians and bicyclists.

Table 3-2 - Factors that influence Intersection Multimodal LOS by Active Mode (*HCM 2010*)

		Pedestrian LOS	Bicyclist LOS
Signalized Intersection MMLOS	**Negative Influence**	• Volume of right turns on red • Volume of permitted left turns • Traffic in outside lane • Traffic speed • Number of lanes • Pedestrian delay • Right-turn channelized lanes (low traffic volume locations)	• Width of cross street • Volume of traffic
	Positive Influence	• Right-turn channelized lanes (high traffic volume locations)	• Width of outside through lane (and bicycle lane) • Number of lanes on approach direction
Two-Way STOP-Controlled Intersection MMLOS	**Negative Influence**	• Vehicle volume • Crosswalk length • Number of lanes	No model provided
	Positive Influence	• Crosswalk width • Driver yield rates	
Overall Segment	**Negative Influence**	• Traffic volume per lane • Vehicle travel speed • Poor intersection MMLOS	• Signalized Intersections • Traffic volume per lane • Vehicle travel speed • Heavy vehicle volume • Poor intersection MMLOS
	Positive Influence	• Width of outside through lane (and bicycle lane) • Parking occupancy • Presence of sidewalk buffer • Sidewalk width	• Width of outside through lane (and bicycle lane)

The factors that influence MMLOS (signal timings, traffic volume, number of lanes, conflict points) have been considered when evaluating the design options for this project.

3.4.3 PARKING / LOADING

WSP has conducted a field review to quantify the available parking / loading along each corridor and consider the impact to parking and loading with each option.

3.4.4 ROAD SAFETY

WSP has considered how the options that could be expected to impact road safety through changes to the number and type of conflict points and expected travel speeds. Specific consideration was given to the alignment at major intersections and opportunities where intersection realignment or addition of left turn lanes may be expected to offer safety benefits.

3.4.5 COST ESTIMATES

Order of magnitude construction costs for each of the modification options for Robie Street and Young Street are presented in Appendix D based on the functional designs included in Appendix A. These cost estimates are limited by the current level of design detail and the available information on geotechnical conditions and underground servicing. As a result, the estimates are provided for preliminary planning purposes only with a 30% contingency included to reflect the uncertain nature of the estimates.

The construction cost estimates **do not include:**
Property Acquisition; Utility Pole Relocation; Engineering, Administration and Inspection Fees. Asphalt cold planing and resurfacing costs are also not included (as it is not known if or how much resurfacing will be done in conjunction with the transit priority measure upgrades).

The Young Street estimates include an allowance for modifications to private property parking areas impacted by road widening, however Robie Street estimates do not include any demolition, reinstatement or construction on private property since many properties will need to be redeveloped in conjunction with the right-of-way widenings. Construction phasing for the project may increase costs for items like mobilization & demobilization, traffic control, and construction of temporary infrastructure between phases.

3.4.6 OVERALL ANALYSIS

Using consideration of the above factors and results from the public and stakeholder consultation, overall evaluation matrices were developed for each corridor to display the overall assessment of each option and enable comparison between categories (identified in Table 3-3). For simplicity, the matrices have been formatted to a colour scale from green (most favorable) to red (least favorable), with yellow the intermediate shade. Grey was used to indicate criteria that were not applicable or where information was not available. It should be recognized that since this evaluation does not apply weighting factors to the various evaluation criteria, it essentially assigns equal value to each criterion. This is obviously not the case in reality, as transit schedule adherence may be a more influential factor on these identified transit corridors than traffic impacts. As presented, the evaluation matrix is a visual tool that enables high level options comparison.

Each option for the full corridor has also been evaluated using the payback period analysis methodology included in *Moving Forward Together Plan* (Halifax Transit, 2016) with the methodology shown in Appendix E.

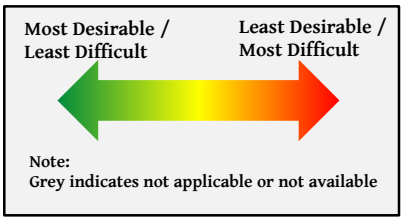


Table 3-3 – Considered Categories for Analysis

Transit Travel Time
Walking
Bicycling
Traffic and Heavy Vehicle Flow
Road Safety
Green space / Urban Forest
Onstreet Parking / Loading Impacts
Property Requirements
Implementation Cost
Public Feedback Response

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4 YOUNG STREET

4.1 EXISTING CONDITIONS

Young Street between Windsor Street and Robie Street (approximately 500 m) is an arterial roadway and designated truck route. Traffic volumes obtained by HRM Traffic Management indicate Annual Average Weekday Traffic (AAWT) volumes of approximately 15,000 vehicles per day (vpd).

Along the Young Street corridor, the intersections of Windsor Street, Kempt Road, and Robie Street are signalized. The intersection at Monaghan Drive is currently unsignalized and there are several full access commercial driveways along the corridor. The roadway has a four lane cross section for most of the corridor (See Figure 4-1) and widens to five lanes between Kempt Road and Robie Street (See Figure 4-2).

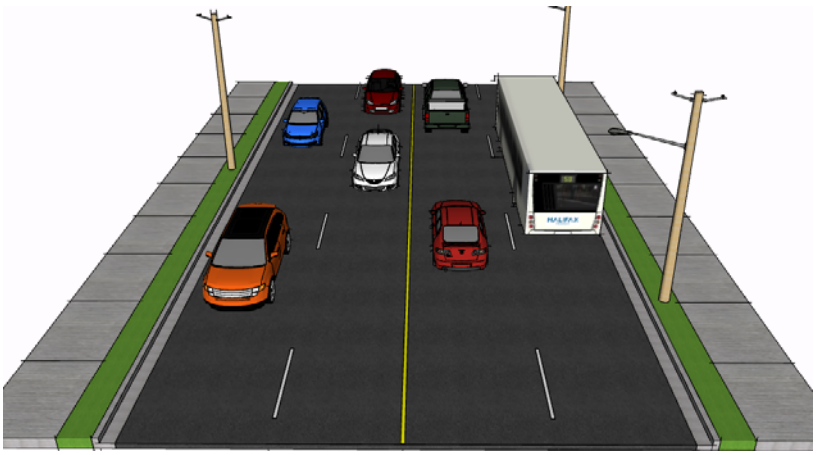


Figure 4-1 – Young Street Cross Section
(Windsor to Kempt, looking West)

Congestion along this corridor has been observed primarily where vehicles turn left at driveways along the corridor and due to the closely spaced intersections at Robie Street and Kempt Road (approximately 60 m).

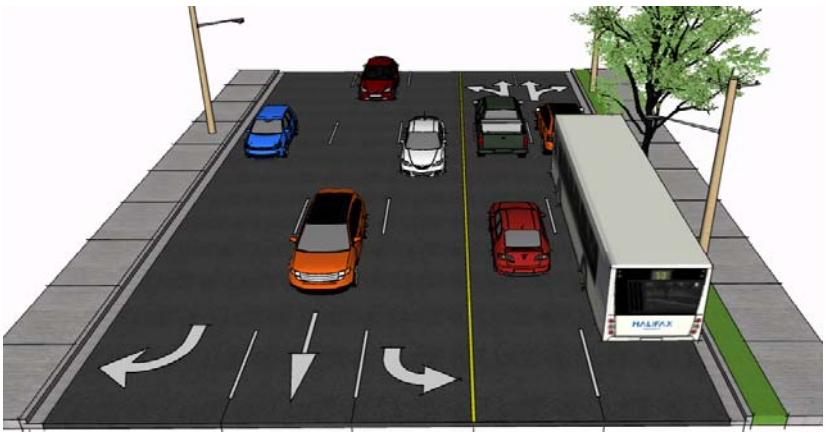


Figure 4-2 – Young Street Cross Section
(Kempt to Robie, looking West)

4.1.1 EXISTING TRANSIT

Young Street is a busy transit corridor for Halifax Transit, particularly during the AM peak period. Between Kempt Road and Robie Street it is currently used by 10 Halifax Transit Routes (#21, 31, 33, 34, 35, 42, 80, 81, 86, and 330). Transit vehicle volumes and ridership data were collected by Halifax Transit and are summarized in Table 4-1.

Table 4-1 - Existing Transit Volumes and Ridership on Young Street

		Windsor to Kempt		Kempt to Robie	
		Transit Vehicles	Transit Riders	Transit Vehicles	Transit Riders
AM Peak Hour	Eastbound	6	200	25	815
	Westbound	6	100	5	80
PM Peak Hour	Eastbound	4	60	9	110
	Westbound	13	340	16	455

4.1.2 EXISTING TRAFFIC

Turning movement counts at the Young Street intersections with Windsor Street, Kempt Road, and Robie were collected by HRM Traffic Management for the morning (7-9 AM) and afternoon (4-6 PM) peak periods. Observed AM and PM peak hour volumes are summarized in Figure 4-3. Traffic analysis of design hourly volumes (with a 5% design hourly factor), prepared using *Synchro 9* and *SimTraffic,* are summarized in Appendix F.

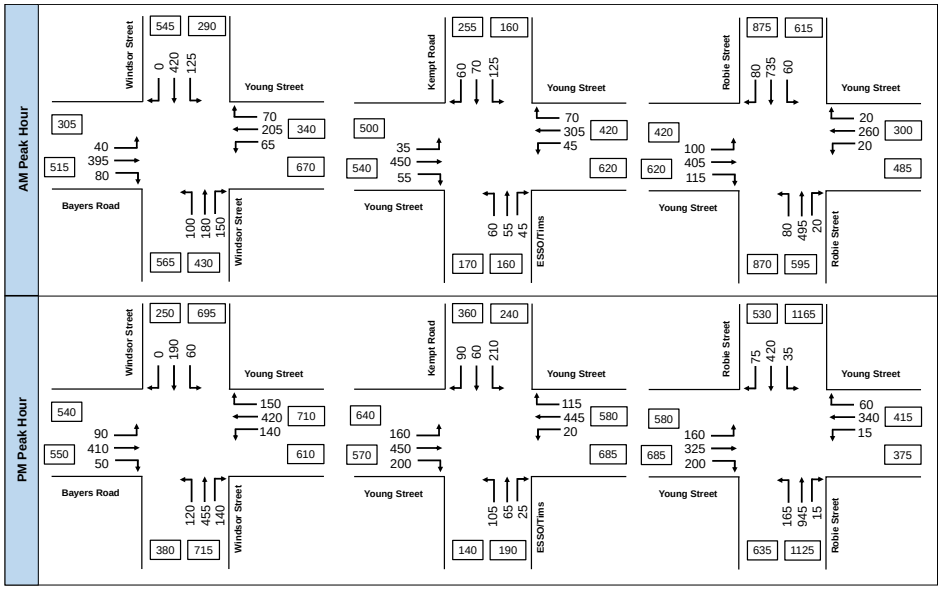


Figure 4-3 – Young St Corridor AM and PM observed peak hour traffic volumes

4.1.3 EXISTING MULTIMODAL ACCOMMODATION

A summary of the considerations that impact the multimodal aspects along this corridor are presented in Table 4-2.

Table 4-2 – Young Street – Existing MMLOS Accommodation Summary

Mode	Evaluation Considerations
Pedestrians	There is sidewalk along both sides of this corridor and pedestrian crossings of Young Street (4 lanes wide) along this corridor are at signalized intersections or the RA-5 with flashing beacons at Monastery Lane.
Cyclists	No bicycle facilities are present along this corridor. North-south bicycle lanes are in place on Windsor Street.
Halifax Transit	No special Transit lanes exist along this corridor. Transit vehicles stop at in-lane transit stops (ie no bus bays).
Heavy Trucks	HRM By-law T-400 (Truck Route By-law) designates Young Street as a full-time truck route. There is a right turn channelized lane for turns from Young Street to Robie Street that accommodates all vehicles.
Vehicular Traffic	The majority of this corridor is marked as a four-lane cross section with no auxiliary lanes (exceptions for turns at the signalized intersections). No left turn lanes are present for turns into the driveways. Traffic queueing has been observed between the closely spaced intersections.

4.1.4 ROAD SAFETY

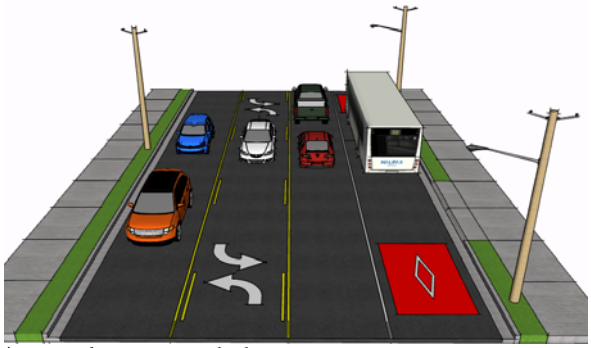
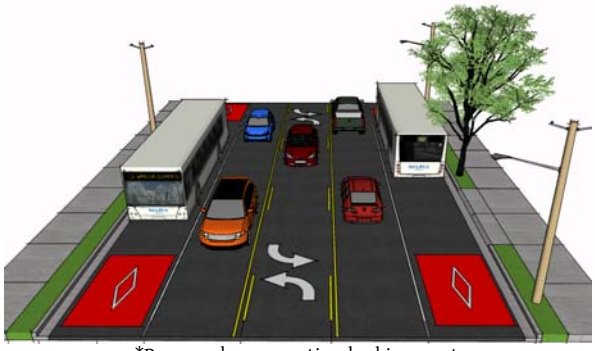
Collision reports were not available for this corridor for collision analysis. A comparative analysis between the options for this corridor considered how each option changed the number or type of conflict points.

4.1.5 EXISTING PARKING

On-street Parking is currently prohibited along the entire Young Street corridor between Windsor Street and Robie Street.

4.2 YOUNG STREET MODIFICATION OPTIONS

Three modification options were prepared for the Young Street corridor and are summarized below. Functional design plans for each option are included in Appendix A and cost estimates are included in Appendix D.

Option		Description
Low Investment	**Option Y1 – Continuous outbound Transit Lane**  *Proposed cross section looking west	• Provide a continuous outbound transit lane; and, • Install lane for left turning vehicles for driveways and intersections. <u>Impacts:</u> • Provides outbound transit priority between Robie Street and Windsor Street. • Improved flow of traffic along the corridor is expected during peak periods. • Positive for safety with left turn lane. • Analysis (Appendix F) indicates some negative impact to non-transit vehicles while providing transit benefit (outbound only).
Medium Investment	**Option Y2 – Continuous Transit Lane both directions – Windsor to Kempt**  *Proposed cross section looking west	• Provide a continuous outbound transit lane; • Provide a continuous inbound transit lane between Windsor Street and Kempt Road; and, • Install lane for left turning vehicles for driveways and intersections. <u>Impacts:</u> • Provides outbound transit priority between Robie Street and Windsor Street. • Provides inbound transit priority between Windsor Street and Kempt Road. • Improved flow of traffic along the corridor is expected during peak periods. • Requires some property acquisition. • Positive for safety with left turn lane. • Increases pedestrian crossing distances. • Analysis (Appendix F) indicates minimal impact to non-transit vehicles while providing transit benefit.
High Investment	**Option Y3 – Continuous Transit Lane both directions – full corridor**  *Proposed cross section looking west	• Provide a continuous transit lane in both directions; • Install lane for left turning vehicles for driveways and intersections; • Install eastbound right turn lane at Robie Street and restrict the right turn channel to transit only; and, • Install traffic signals at the Monaghan Drive intersection. <u>Impacts:</u> • Provides a continuous transit lane in both directions for the full corridor. • Positive for safety with left turn lane. • Increases pedestrian crossing distances. • Requires some property acquisition. • Requires realignment of right turn channel at Robie Street and restriction to non-Transit vehicles. • Analysis (Appendix F) indicates minimal impact to non-transit vehicles while providing significant transit benefit.

4.3 YOUNG STREET OPTIONS EVALUATION

Using the available data, traffic flow models were created using SimTraffic to develop estimates for changes in user delay with each option. Table 4-3 summarizes the benefits to transit and non-transit users and the estimated implementation costs (See Appendix D). Reducing the eastbound through lanes to a single lane for all eastbound transit and non-transit traffic in option Y1 contributed to low overall user benefit. The continuous transit lane provided in Option Y3 means that transit and non-transit vehicles will experience reduced merge delay as well as more continuous flow by transit vehicles.

Table 4-3 - Young Street – Overall Corridor Options Summary

	Y1 – Continuous outbound Transit Lane	Y2 – Continuous Transit Lane both directions – Windsor to Kempt	Y3- Continuous Transit Lane both directions – full corridor
Total Estimated Annual Cost Savings to Halifax Transit	$6,500.00	$11,800.00	$13,700.00
Total Estimated Daily Reduction in Transit User Delay	8 user hours	10 user hours	15 user hours
Total Estimated Daily Reduction in Overall User Delay	1 user hour	15 user hours	20 user hours
Total Estimated Implementation Cost	$230,000	$630,000	$1,400,000

A summary of the considerations that impact the multimodal aspects along this corridor is presented in Table 4-4 with red shading indicating negative impacts and green shading indicating positive impacts with grey indicating that the factor is not applicable to the Option.

Table 4-4 - Young Street Options – MMLOS Accommodation Summary

Mode	Description	Option / Evaluation Considerations		
		Option Y1	Option Y2	Option Y3
Pedestrians	Longer pedestrian crossings at Monaghan Drive crosswalk.			
	Longer pedestrian crossings at Kempt Road.			
	Reduced vehicle conflicts at Robie Street right turn channel.			
Cyclists	Opportunity to permit bikes in curbside transit lane (outbound only in Y1).			
Halifax Transit	Provides a transit lane in the outbound direction			
	Provides transit lanes in the inbound direction between Windsor Street and Kempt Road.			
	Provides inbound transit lanes for the full corridor.			
Heavy Trucks	Travel lanes are narrowed and Outbound through trucks are restricted from using the curb lane.			
	Inbound through trucks are restricted from using the curb lane.			
	Trucks are no longer permitted to use the right turn channel at Robie Street.			
Vehicular Traffic	Provides left turn lanes for driveways.			
	Removes one through lane in each direction for non-transit			
	Restricts non-transit vehicles from the right turn channel at Robie Street.			
	Improved lane alignment for eastbound traffic.			

An options evaluation matrix was created in order to display the overall assessment of each option and enable comparison between categories (See Table 4-5). As presented, the evaluation matrix is a visual tool that enables high level options comparison.

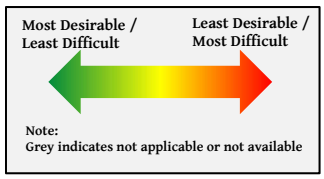


Table 4-5 Young Street Options Evaluation Summary Matrix

	Transit Corridor Options				Description
	Existing Conditions	Y1. Continuous Transit Lane - outbound only	Y2. Continuous Transit Lanes - EB ends at Kempt	Y3. Continuous Transit Lanes - both directions	
Transit Travel Time					Improved transit travel time with dedicated lanes. Option Y1 outbound only.
Walking					Longer Pedestrian crossings for Y2, Y3, however separation from higher through volume.
Bicycling					No major impacts to cycling, some benefits if bicycling permitted in transit lane.
Traffic and Heavy Vehicle Flow					Reduced to one lane in each direction.
Road Safety					Added left turn lanes for all options. Improved lane balance for Option Y3.
Green space / Urban Forest					Option Y1, Y2: No major impacts. Option Y3: Impact to some trees.
Property Requirements					Some widening for Options Y2 and Y3.
Implementation Cost					Option Y1, Y2: Lower capital cost Option Y3: Requires modifications to curb and right turn channel.
Public Feedback Response					Overall, public indicated preference for transit improvements.

Note: Parking is already prohibited and there is no proposed change to on-street parking.

Each option for the full corridor was evaluated using the payback period analysis methodology included in *Moving Forward Together Plan* (Halifax Transit, 2016) and summarized in Section 3.4.1. The methodology is included in Appendix E with results summarized in Table 4-6. With a single inbound through lane for mixed traffic there is found to be an increase in user delay inbound (and decrease outbound) for Y1, yielding minimal benefit in overall user delay. Option Y3 offers improved delay savings compared to Y2 due to the continuous lane.

Table 4-6 - Overall Analysis – Young Street

		Young Street		
		Y1- Continuous Transit Lane (Outbound Only)	**Y2- Continuous Transit Lanes -Inbound to Kempt**	**Y3- Continuous Transit Lanes - Full Corridor[2]**
Estimated Daily Delay Savings to Transit Users		~8 user hours	~10 user hours	~15 user hours
Estimated Daily Delay Savings to All Road Users		~1 user hour	~15 user hours	~20 user hours
Payback Period		~40 years	~8 years	~14 years
Combined Score for Delay and Payback		**3**	**9**	**9**
Other Key Factors	**Safety Considerations**	(+)Improvement with left turn lanes		(+)Improvement with left turn lanes (++)Improved lane balance between Robie/Kempt intersections
	Impact to Other Users	Minimal	Longer Pedestrian Crossings/sidewalk setback from higher volume (-) Impact to properties	
	Project Integration	None Identified		
	TPM Enforcement Requirements	Enforcement of typical signage required		
	Issues to Implementation	Slight Property Acquisition Required	(-)Property Acquisition Required	
	Promotion of Transit	Some Promotion of Transit	(+)Good Promotion of Transit	
	Schedule Adherence	(+)Improvement in outbound direction	(+)Improved schedule adherence, both directions	(++)Improved schedule adherence, both directions full corridor
	Public Consultation	Generally seen as the least desirable option	(+)Generally viewed as a good option	(++)Generally viewed as the best option
	Score for Other Factors[1]	**2**	**2**	**6**
Overall Evaluation		**5**	**11**	**15**

NOTES: 1. Score for other factors is the sum of the positive impacts less the negative impacts. Impacts with "++" or "--" receive double score.

2. Costs and benefits of signalization of Monaghan Drive have been excluded as this signalization can be done for any option, independently of the transit priority.

Comparative evaluation of the user impacts (Table 4-5) and payback analysis (Table 4-6) indicates that the highest overall benefit is provided with Option Y3 (Continuous transit lanes – full corridor). This option provides a continuous transit lane in both directions that connects to planned measures on Bayers Road and Robie Street.

If HRM chooses to implement Option Y2 then it should be considered an interim option due to the lane balance and weaving through the Kempt to Robie section. With its added advantages that it ties into the Robie Street corridor, **Option Y3 should ultimately be considered for implementation by HRM.**

5 ROBIE STREET

5.1 EXISTING CONDITIONS

Robie Street between Young Street and Spring Garden Road (approximately 2.5 km) is an arterial roadway, becoming a major collector between Spring Garden Road and Inglis Street. In this area the roadway transitions from north to south as follows:

- Five lane cross section (Young to Almon, See Figure 5-1)
- Two lanes with parking (Almon to Cunard, See Figure 5-2)
- Four to six lanes with a centre median and added turn lanes at intersections (Cunard to Inglis, See Figure 5-3)

These variances in cross section create operational challenges at several intersections. Most notably at Cunard Street, where the poor alignment requires a separate northbound left protected only traffic signal phase, to reduce the potential for vehicle path overlap between northbound left turning and through traffic (See Figure 5-4).

Traffic data obtained by HRM Traffic Management indicate a weekday two-way traffic volume of between 15,000 and 25,000 vehicles per day (vpd).

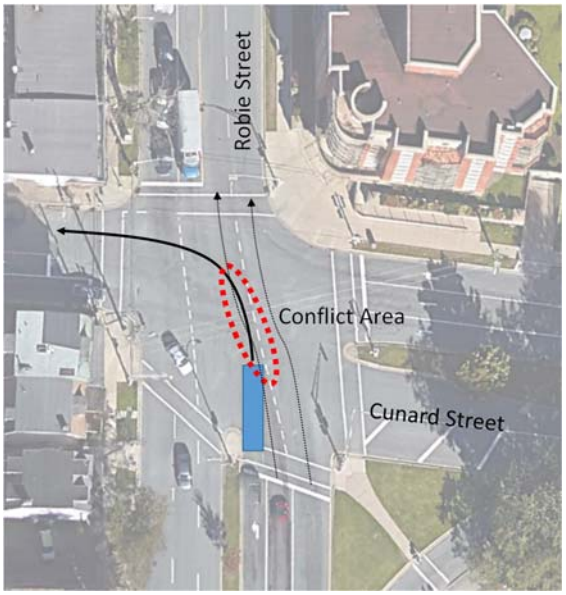


Figure 5-4 Conflict Area caused by poor alignment at Cunard Street intersection

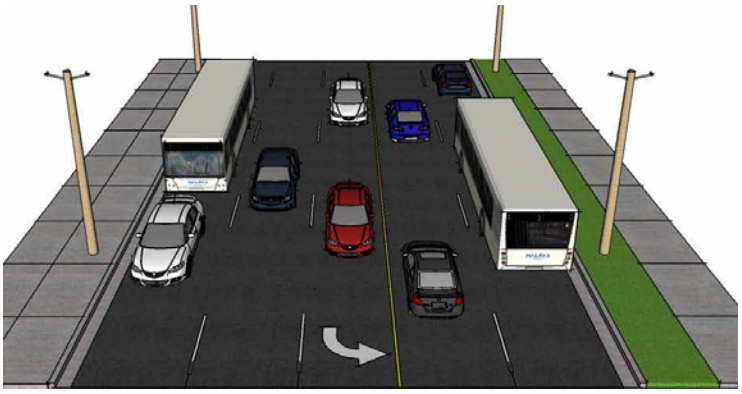


Figure 5-1 – Typical Cross Section Looking North – Almon Street to Young Street

Figure 5-2 – Typical Cross Section Looking North –

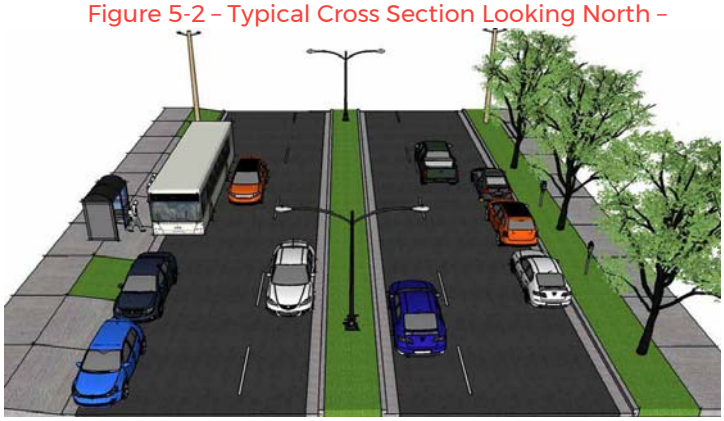


Figure 5-3 - Typical Cross Section Looking North – Inglis Street to Cunard Street

5.1.1 EXISTING TRANSIT

Robie Street serves a variety of transit routes along the approximately 3.5 km study corridor (See Figure 5-5). The 1.2 km segment between Cunard Street and Spring Garden Road in particular serves Routes 7, 17, 18, 23, 42, 80, 81, and 90 with approximately 40 two-way buses during each of the AM and PM peak hours carrying approximately 780 (AM) transit riders and 720 (PM) transit riders.

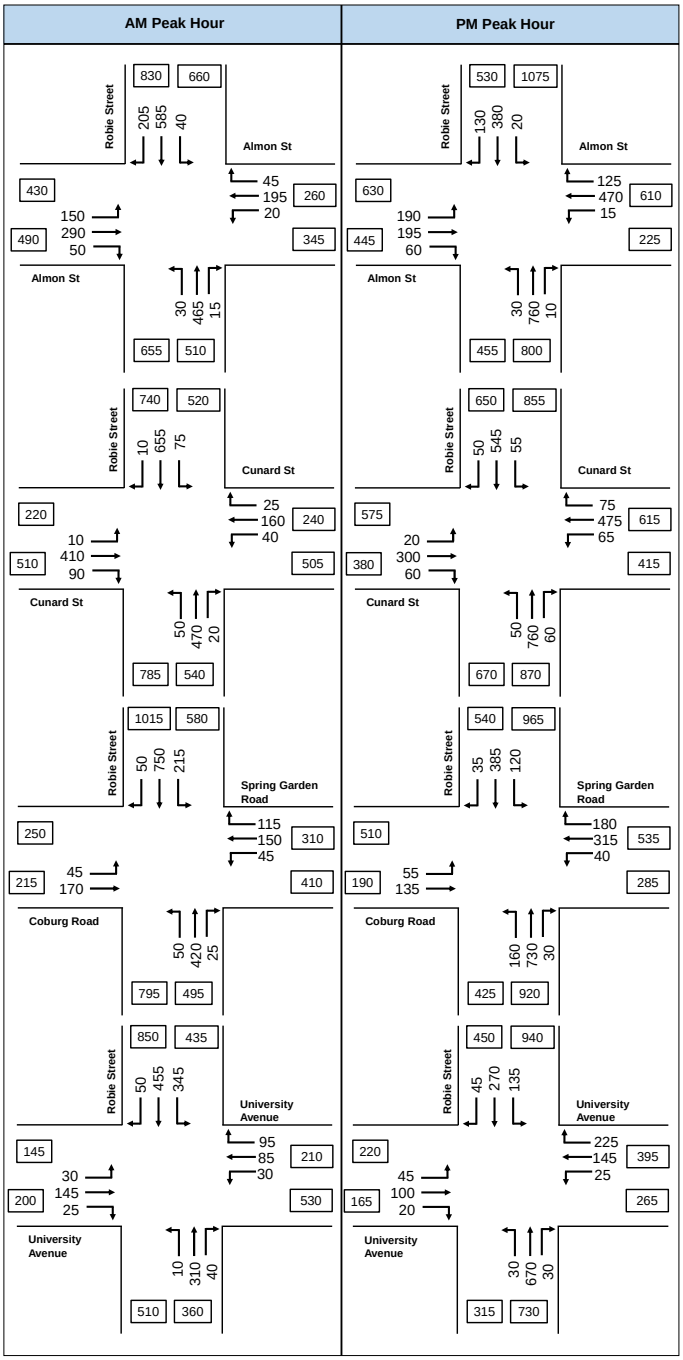


Figure 5-6 – Robie St observed AM and PM peak hour traffic volumes

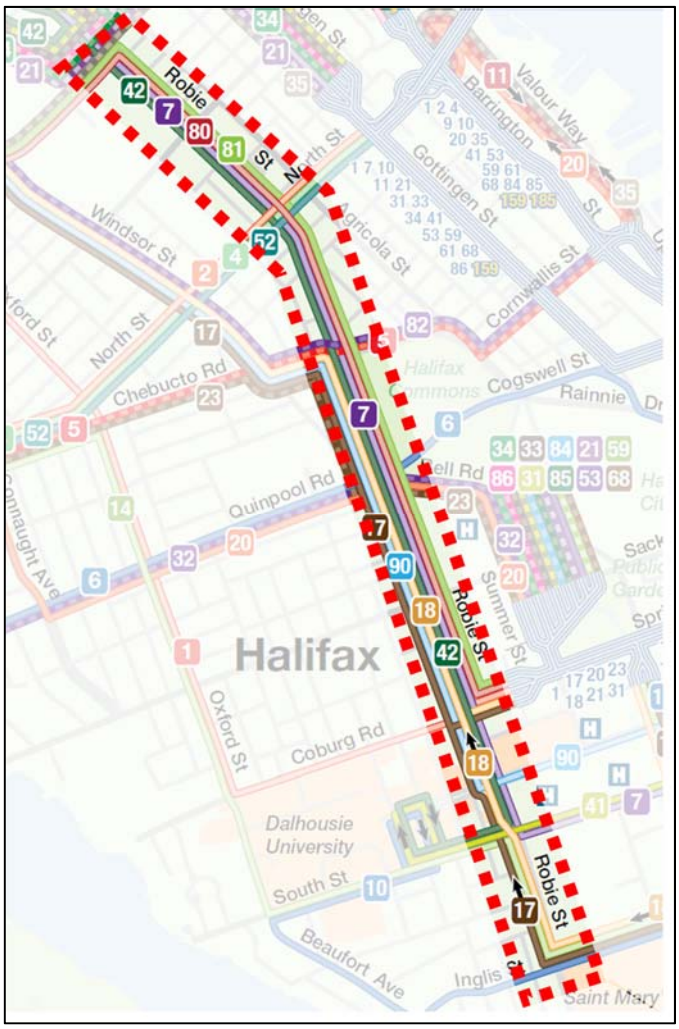


Figure 5-5 – Halifax Transit Routes on Robie Street

5.1.2 EXISTING TRAFFIC

Turning movement counts at the signalized intersections along Robie Street were collected by HRM Traffic Management for the morning (7-9 AM) and afternoon (4-6 PM) peak periods. Observed AM and PM peak hour volumes at several of the key intersections are summarized in Figure 5-6. Traffic analysis of design hourly volumes, prepared using Synchro 9 and SimTraffic, is summarized in Appendix G.

5.1.3 EXISTING MULTIMODAL ACCOMMODATION

A summary of the considerations that impact the multimodal aspects along this corridor are presented in Table 5-1.

Table 5-1 – Robie Street – Existing MMLOS Accommodation Summary

Mode	Evaluation Considerations
Pedestrians	There is sidewalk along both sides of this corridor. Pedestrian crossing distances vary by segment, ranging from 3 lanes to 6 lanes with a median. Marked pedestrian crossings are at signalized or RA-5 crosswalks with pushbuttons and flashing beacons.
Cyclists	No bicycle facilities are present along this corridor. North-south bicycle lanes are in place on Windsor Street.
Halifax Transit	No special Transit lanes exist along this corridor. Many transit stops are setback from the lane within the parking lane areas.
Heavy Trucks	HRM By-law T-400 (Truck Route By-law) designates Robie Street as a full-time truck route. Curbside lanes along Robie Street are moderate in width, however parked vehicles encroach onto these lanes. Misaligned intersections at Almon, Cunard, and Quinpool create potential for offtracking issues.
Vehicular Traffic	Robie Street is primarily 2 through lanes in each direction for the majority of its length (1 through lane each direction from Cunard to Almon). Significant queuing has been observed during peak periods, particularly at the Quinpool intersection. While the majority of the intersections have existing left turn lanes on Robie Street in each direction, notable exceptions include southbound at Cunard, and northbound at Almon and Coburg.

5.1.4 ROAD SAFETY

Collision reports were not available for this corridor for collision analysis. A comparative analysis between the options for this corridor considered how each option may be expected to change the number or type of conflict points as well as how changes to delay/queues on sidestreets may impact intersections along adjacent corridors.

5.1.5 EXISTING ON-STREET PARKING

On-street parking is permitted on Robie Street through much of this corridor. An inventory of available parking spaces was completed to estimate the number of on-street spaces that may be impacted by implementing transit priority on this corridor.

There are approximately 210 parking spaces (including 48 parking meters and one accessible parking space) along Robie Street in this corridor with an approximate breakdown as summarized in Table 5-2 and displayed in Figure 5-7.

Table 5-2 – Existing Available Parking Spaces – Robie Street Corridor

Segment		Estimated # of Spaces	Approximate Segment Length
Robie Street	Young to Jubilee	~60 spaces	2.0 km
	Jubilee to South	~80 spaces	0.75 km
	South to Inglis	~70 spaces	0.5 km

In addition to the noted parking spaces there are approximately 3 loading zone spaces and one 3-vehicle taxi stand.

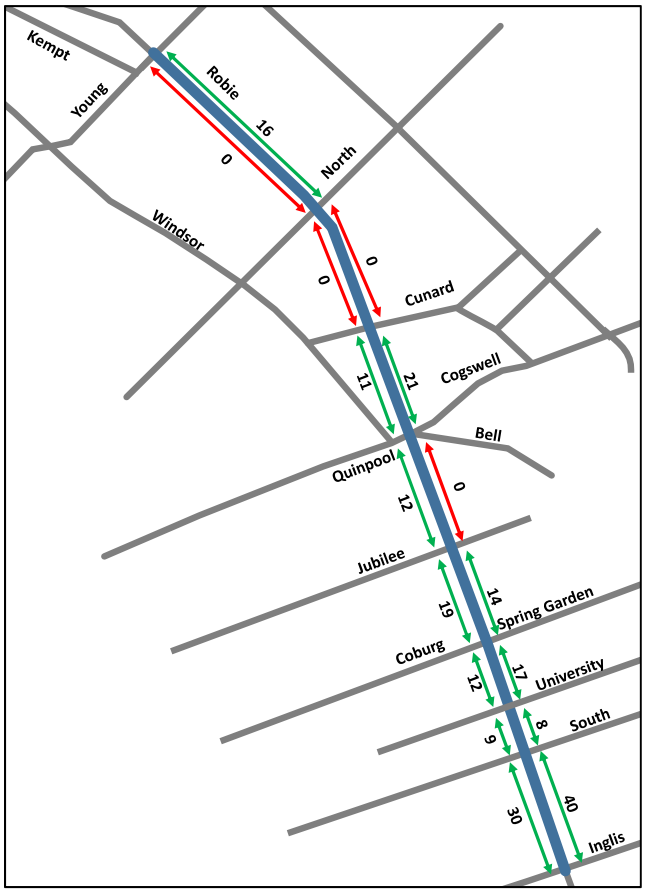


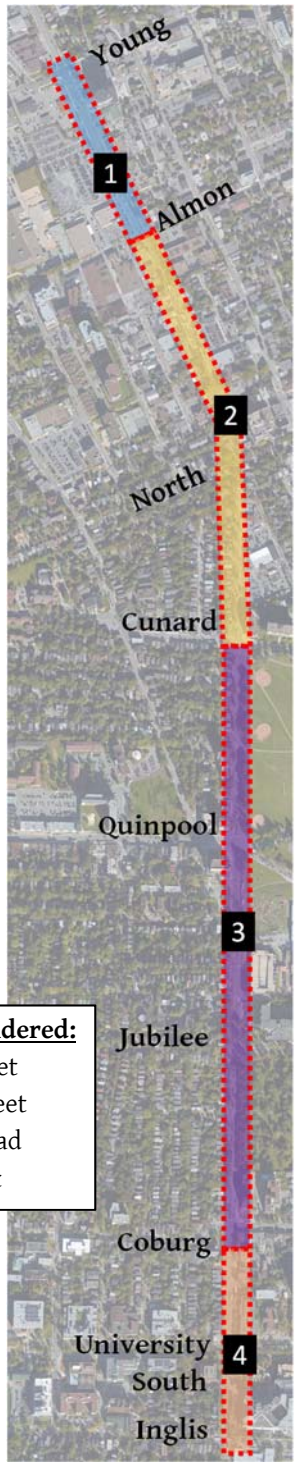
Figure 5-7 – Existing On-street Parking on Robie Street Corridor

5.2 ROBIE STREET MODIFICATION OPTIONS

With the changing road width and varying traffic and transit volumes along Robie Street, this corridor has been separated into the following four segments (See Figure 5-8) for the development and evaluation of transit priority options:

1. Young Street to Almon Street;
2. Almon Street to Cunard Street;
3. Cunard Street to Coburg Road; and,
4. Coburg Road to Inglis Street.

Recognizing the congestion, the high traffic volumes, the importance of this corridor as a truck and traffic route to / from Peninsular Halifax, and the priorities for allocation of street space, options have been prepared for each of the segments of this corridor. These options for each segment are shown conceptually in Appendix A and described in subsequent sections of this report.



Robie Street Segments Considered:

1) Young Street to Almon Street
2) Almon Street to Cunard Street
3) Cunard Street to Coburg Road
4) Coburg Road to Inglis Street

Figure 5-8 - Robie Street Segments Considered in this Study

Lane Requirements:
At the outset of the project, traffic analysis was prepared to assess the lane requirements for each segment of the corridor. Analysis considered whether reductions to one through lane in each direction for non-transit could accommodate the traffic volumes without causing significant queue spillback and negative impact to non-transit vehicle operations or to transit and traffic queuing on side streets.

Intersection analysis results with reduction to a single lane in each direction on Robie Street (See Table 5-3) indicate that:

- A second southbound through lane should be retained from Quinpool Road and ending at Coburg Road / Spring Garden Road; and,
- A second northbound through lane should be retained south of University Avenue (due to the close proximity with the South Street intersection and ending north of Quinpool Road. This is expected to create more gaps in traffic flow to better accommodate southbound left turning buses).

Recommended non-Transit through lanes on Robie Street are indicated in Figure 5-9. Additional turn lanes may be required at intersections.

For each segment of Robie Street options were prepared that included analysis and review of Curbside bus lanes and Median bus lanes. An overview of each lane type is included in 3.2.

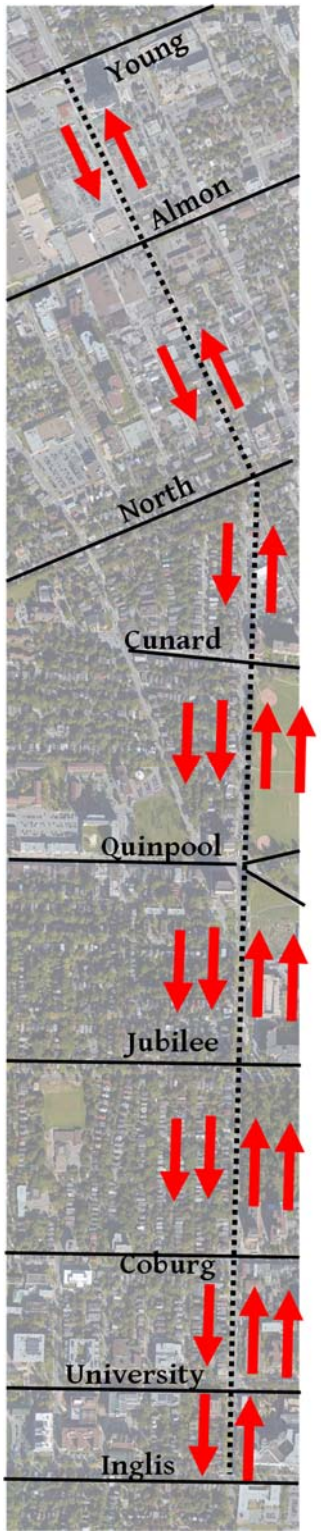


Figure 5-9 – Recommended Robie St Non-Transit Through Lanes

Table 5-3 – AM and PM Robie Street Intersection Analysis Results – (One Lane, Each Direction)

		Analysis Criteria	Control Delay (sec/veh), v/c Ratio, and 95th% Queue (m) by Intersection Movement					
			NB-L	NB-T	NB-R	SB-L	SB-T	SB-R
Robie Street AM Design Hourly Volumes	@ Young	Delay	32.4	19.0	3.5	15.7	31.4	4.4
		v/c	0.54	0.55	0.03	0.20	0.84	0.10
		Queue	40.0	123.4	3.0	17.5	262.7	9.4
	@ Almon	Delay	50.0	29.3	0.1	53.1	31.9	3.5
		v/c	0.26	0.71	0.03	0.35	0.78	0.31
		Queue	16.2	118.6	0.0	20.2	150.9	12.4
	@ Cunard	Delay	25.7	26.5	5.7	38.4	50.2	4.7
		v/c	0.27	0.62	0.10	0.32	0.82	0.02
		Queue	13.6	97.5	7.4	22.2	164.7	0.0
	@ Quinpool	Delay	52.1	204.5	56.2	62.2	417.2	0.5
		v/c	0.69	1.31	0.26	0.86	1.84	0.11
		Queue	60.7	243.8	22.1	138.8	452.1	0.0
	@ Jubilee	Delay	156.6	31.3	3.5	21.7	60.1	2.9
		v/c	0.98	0.67	0.09	0.65	1.02	0.04
		Queue	39.2	140.7	5.4	36.1	339.0	2.8
	@ Coburg	Delay	19.2	22.7	0.2	11.4	20.0	2.6
		v/c	0.23	0.60	0.05	0.49	0.77	0.07
		Queue	15.2	103.8	0.0	31.6	190.2	4.8
	@ University	Delay	18.2	24.0	18.9	12.2	12.5	4.0
		v/c	0.04	0.48	0.10	0.62	0.51	0.07
		Queue	6.0	89.4	14.0	49.8	85.0	6.3

		Analysis Criteria	Control Delay (sec/veh), v/c Ratio, and 95th% Queue (m) by Intersection Movement					
			NB-L	NB-T	NB-R	SB-L	SB-T	SB-R
Robie Street PM Design Hourly Volumes	@ Young	Delay	19.5	57.8	0.1	89.4	34.9	3.3
		v/c	0.52	1.00	0.02	0.70	0.70	0.13
		Queue	34.8	305.1	0.0	28.6	28.6	7.0
	@ Almon	Delay	15.6	51.4	0.0	41.7	27.6	10.0
		v/c	0.09	0.96	0.02	0.38	0.46	0.21
		Queue	9.6	276.0	0.0	6.8	89.1	13.2
	@ Cunard	Delay	17.1	35.1	5.2	38.6	22.9	4.0
		v/c	0.17	0.86	0.09	0.52	0.62	0.08
		Queue	12.9	264.8	8.6	31.0	142.1	6.2
	@ Quinpool	Delay	96.4	410.1	47.2	70.6	273.6	0.7
		v/c	1.00	1.82	0.31	0.87	1.50	0.15
		Queue	129.2	475.0	32.8	101.8	336.7	0.0
	@ Jubilee	Delay	31.9	38.2	3.2	45.7	40.3	1.1
		v/c	0.74	0.98	0.10	0.74	0.86	0.08
		Queue	26.8	129.9	0.7	40.2	216.8	1.3
	@ Coburg	Delay	11.7	73.6	0.2	36.1	29.1	6.8
		v/c	0.39	1.04	0.06	0.65	0.50	0.07
		Queue	26.2	286.5	0.0	28.3	83.6	1.0
	@ University	Delay	14.3	55.3	14.4	13.0	10.7	4.0
		v/c	0.07	0.96	0.07	0.50	0.32	0.07
		Queue	8.6	232.3	8.9	19.0	44.5	5.6

5.2.1 YOUNG STREET TO ALMON STREET

Robie Street from Young to Almon, has two through lanes in each direction and a centre left turn lane. This segment experiences heavy traffic volumes during the AM and PM peak periods. Two modification option s (plans included in Appendix A) were prepared for this segment and are summarized below. Intersection analysis is included in Appendix G.

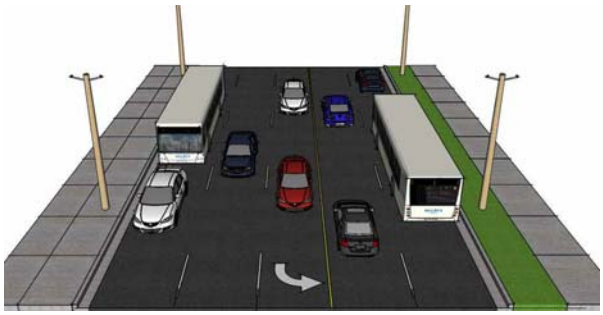


Figure 5-10 – Existing Cross Section (Young to Almon, looking north)

Option – Robie Street (Young to Almon)		Description
Curbside Transit Lanes	**1 – Provide Continuous Curbside Transit Lanes**  *Proposed cross section looking north	• Modify curb lanes as transit-only lanes. <u>Impacts:</u> • Provides a full-time continuous transit lane in both directions. • Removes transit vehicles and right turns from flow of non-transit vehicles. • Shortens the southbound right turn lane for Almon Street by designating as transit only. • Shortens the northbound through-right lane for non-transit at Young Street. • Loss of one traffic lane in each direction.
Median Transit Lanes	**2 – Provide Continuous Median Transit Lanes**  *Proposed cross section looking north	• Widen on west side and provide median transit lanes. <u>Impacts:</u> • Requires some property acquisition on west side of Robie Street. • Provides full-time separated transit lanes. • Relocates transit stops to centre of roadway. • Restricts left turns except at signalized intersections. • Removes bus conflicts with right turning vehicles. • Setback of crosswalks required to accommodate turning traffic and the need for a pedestrian refuge at Almon Street. • Accessibility implications where centre platforms must accommodate all users. • Reduces left turn conflicts. • Loss of one traffic lane in each direction.

An options evaluation matrix was created in order to display the overall assessment of each option and enable comparison between categories (See Table 5-4).

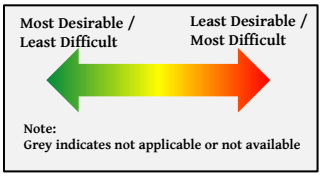


Table 5-4 – Robie Street – Young Street to Almon Street
Options Evaluation Summary Matrix

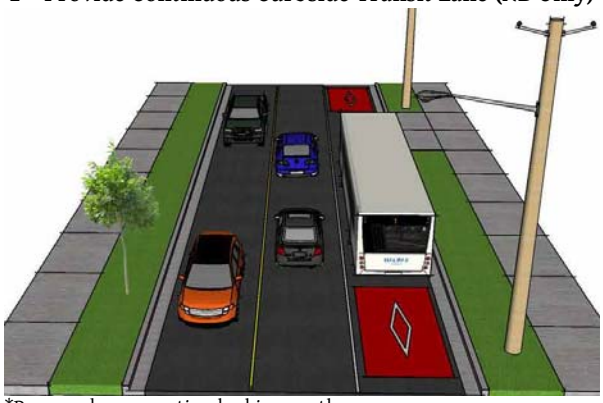
	Transit Corridor Options			Description
	Existing Conditions	1 Curbside Bus Lanes	2 Median Bus Lanes	
Transit Travel Time				Improved transit travel time with dedicated lanes.
Walking				Longer pedestrian crossings with median bus lanes, offsets slight benefit from medians at signalized crossings.
Bicycling				Median lanes: Bicyclists must cycle in mixed traffic. Curbside lanes: Opportunity to widen curb lane for buses / bikes.
Traffic and Heavy Vehicle Flow				Reduced to one lane in each direction. Left turn protected phases required with median lanes.
Road Safety				Median bus lanes offer some safety benefits compared to curbside bus lanes.
Green space / Urban Forest				Area between transit stops offers opportunity for added green space.
Property Requirements				No widening for curbside lanes, some property required with median lanes
Implementation Cost				Pavement marking and signage only for curbside lanes. Widening required for median lanes.
Public Feedback Response				Overall, public indicated preference for curbside lanes.

Note: Parking is already prohibited and there is no proposed change to parking.

5.2.2 ALMON STREET TO CUNARD STREET

Robie Street from Almon to Cunard has a single through lane in each direction and intermittent on-street parking on the east side. This segment experiences moderate traffic volumes and congestion during the AM and PM peak periods. Three modification options (plans included in Appendix A) were prepared for this segment and are summarized below. Intersection analysis is included in Appendix G.

Figure 5-11 – Existing Cross Section (Almon to Cunard, looking north)

	Option – Robie (Almon to Cunard)	Description
Curbside Transit Lanes	**1 – Provide Continuous Curbside Transit Lane (NB Only)**  *Proposed cross section looking north	• Remove parking and add northbound transit-only lane. • Widen at North Street intersection to install northbound right turn lane. <u>Impacts:</u> • Provides a full-time continuous northbound transit lane. • Removes transit vehicles and right turns from flow of non-transit vehicles. • Requires some property and impact to one tree. • Removes parking.
	2 – Provide Continuous Curbside Transit Lanes  *Proposed cross section looking north	• Remove parking and widen along full corridor and install transit-only lanes in both directions. • Install northbound right turn lane at North Street intersection. <u>Impacts:</u> • Provides a full-time continuous transit lane in both directions. • Removes transit vehicles and right turns from flow of non-transit vehicles. • Requires property acquisition and impacts to several trees. • Removes parking.

Median Transit Lanes	**3 – Provide Continuous Median Transit Lanes**  *Proposed cross section looking north	• Remove parking and widen along full corridor and install median transit-only lanes in both directions. • Install northbound right turn lane at North Street intersection. • Restrict left turns from/to unsignalized driveways and side streets. <u>Impacts:</u> • Provides full-time separated transit lanes. • Relocates transit stops to centre of roadway. • Requires extensive property acquisition and impacts to several trees. • Restricts left turns except at signalized intersections. • Removes parking. • Removes bus conflicts with right turning vehicles. • Setback of crosswalks required to accommodate turning traffic and the need for a pedestrian refuge at Almon Street and North Street. • Accessibility implications where centre platforms must accommodate all users.

An options evaluation matrix was created in order to display the overall assessment of each option and enable comparison between categories (See Table 5-5).

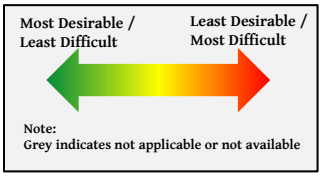


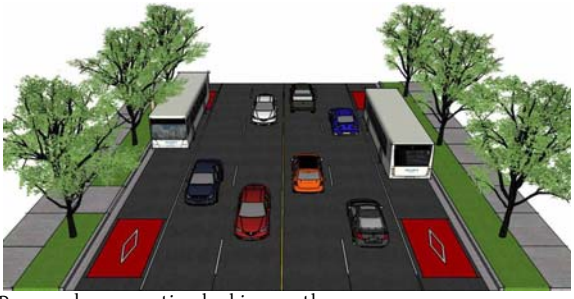
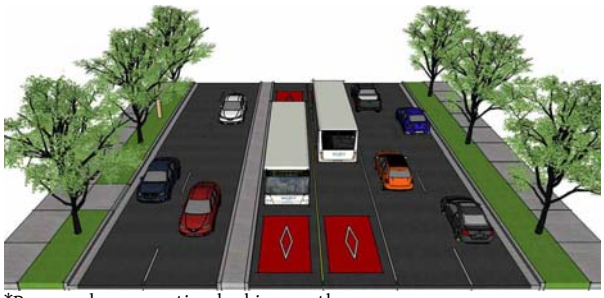
Table 5-5 – Robie Street – Almon Street to Cunard Street
Options Evaluation Summary Matrix

	Transit Corridor Options				Description
	Existing Conditions	1-Curbside (NB Only)	2-Curbside (Both Directions)	3-Median (Both Directions)	
Transit Travel Time					Improved transit travel time with dedicated lanes. Option Y1 outbound only.
Walking					Longer and offset pedestrian crossings with median bus lanes. Longer pedestrian crossings with curbside lanes in both directions
Bicycling					Median lanes: Bicyclists must cycle in mixed traffic. Curbside lanes: Opportunity to widen curb lane for buses / bikes.
Traffic and Heavy Vehicle Flow					Median lanes: Protected only left turn phases increase delay.
Road Safety					Realignment of intersections at Almon Street, Cunard Street for Options 2 and 3.
Green space / Urban Forest					Some impact to trees for Option 1. Significant impact to trees for Options 2 and 3.
Onstreet Parking / Loading Impacts					Prohibits onstreet parking in all options.
Property Requirements					Road widening required for Curbside bus lanes, significant widening for Median bus lanes
Implementation Cost					Curb and sidewalk modifications required for Option 2. Significant road reconstruction for Option 3.
Public Feedback Response					Overall, public indicated preference for curbside lanes.

5.2.3 CUNARD STREET TO COBURG ROAD / SPRING GARDEN ROAD

Robie Street from Cunard to Coburg has a median separating multiple lanes in each direction with on-street parking provided along much of the corridor. There are heavy traffic volumes and congestion at several of the intersections (particularly at the Quinpool Road intersection) during the AM and PM peak periods. Two modification options (plans included in Appendix A) were prepared for this segment and are summarized below. Intersection analysis is included in Appendix G.

Figure 5-12 - Existing Cross Section (Cunard to Coburg, looking north)

Option – Robie Street (Cunard to Coburg)		Description
Curbside Transit Lanes	**1 – Provide Continuous Curbside Transit Lanes**  *Proposed cross section looking north	• Modify curb lanes as transit-only lanes. • Remove median at several intersections. • Realign intersections at Cunard and at Quinpool. <u>Impacts:</u> • Provides a full-time continuous transit lane in both directions. • Removes transit vehicles and right turns from flow of non-transit vehicles. • Median modifications remove pedestrian refuges at several intersections. • Removes parking.
Median Transit Lanes	**2 – Provide Continuous Median Transit Lanes**  *Proposed cross section looking north	• Provide median transit lanes. • Realign intersections at Cunard and at Quinpool <u>Impacts:</u> • Requires significant property acquisition. • Provides full-time separated transit lanes. • Relocates transit stops to centre of roadway. • Removes parking. • Road widening impacts properties and trees. • Restricts left turns except at signalized intersections. • Removes bus conflicts with right turning vehicles. • Setback of crosswalks required to accommodate turning traffic and the need for a pedestrian refuge at Cunard Street, Jubilee Road, and Spring Garden Road. • Accessibility implications where centre platforms must accommodate all users.

An options evaluation matrix was created in order to display the overall assessment of each option and enable comparison between categories (See Table 5-6).

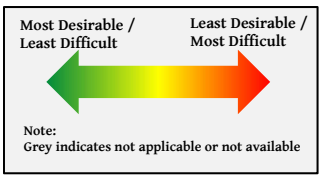


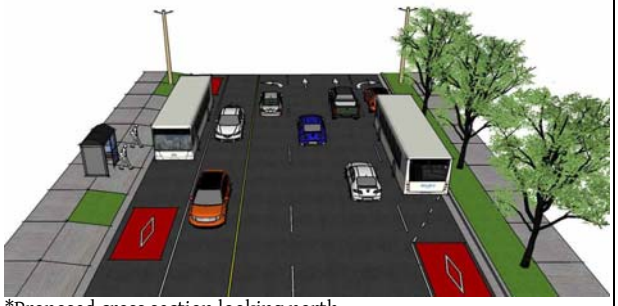
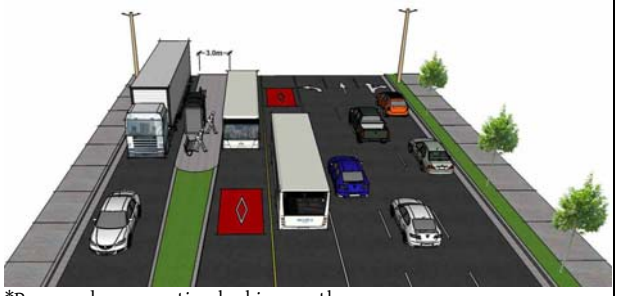
Table 5-6 – Robie Street – Cunard Street to Coburg Road
Options Evaluation Summary Matrix

	Transit Corridor Options			Description
	Existing Conditions	1 Curbside Bus Lanes	2 Median Bus Lanes	
Transit Travel Time				Improved transit travel time with dedicated lanes.
Walking				Longer and offset pedestrian crossings with median bus lanes. Adjustment to centre median for curbside option.
Bicycling				Curbside lanes: Potential to accommodate bikes along transit lane. Median lanes: Bicyclists must cycle in mixed traffic.
Traffic and Heavy Vehicle Flow				Curbside option: Some improvement to traffic Median option: Protected only left turn phases increase delay, particularly at Quinpool Rd. Left turn restrictions increase travel distance.
Road Safety				Realignment of intersections at Cunard Street and Quinpool Road.
Green space / Urban Forest				New green space available at Common along Section. Curbside Option: Some impact to trees. Median Option: Significant impact to trees.
Onstreet Parking / Loading Impacts				Remove all on-street parking from Robie Street in all options.
Property Requirements				Curbside option: Property being given back to Common and minimal widening. Median option: Some property being given back to Common, significant widening required
Implementation Cost				Pavement marking and signage only for curbside lanes. Widening required for median lanes.
Public Feedback Response				Overall, public indicated preference for curbside lanes.

5.2.4 COBURG ROAD TO INGLIS STREET

Robie Street (Coburg to Inglis) has a median separating multiple lanes in each direction. On-street parking is provided along both sides through the corridor. This segment experiences moderate traffic volumes and congestion at several of the intersections, and heavy left turn volumes from Robie Street at each of the major intersections during the AM and PM peak periods. Two modification options (plans included in Appendix A) were prepared for this segment and are summarized below. Intersection analysis is included in Appendix G.

Figure 5-13 - Existing Cross Section (Coburg to Inglis, looking north)

Option – Robie (Coburg to Inglis)		Description
Curbside Transit Lanes	**1 – Provide Continuous Curbside Transit Lanes**  *Proposed cross section looking north	• Modify curb lanes as transit-only lanes. • Remove median at several intersections. • Realign intersections at Cunard and at Quinpool. <u>Impacts:</u> • Provides a full-time continuous transit lane in both directions. • Removes transit vehicles and right turns from flow of non-transit vehicles. • Removal of the median for a portion of the corridor.
Median Transit Lanes	**2 – Provide Continuous Median Transit Lanes**  *Proposed cross section looking north	• Widen on west side and provide median transit lanes. • Realign intersections at Cunard and at Quinpool <u>Impacts:</u> • Requires property acquisition. • Provides full-time separated transit lanes. • Relocates transit stops to centre of roadway. • Restricts left turns except at signalized intersections. • Removes bus conflicts with right turning vehicles. • Setback of crosswalks required to accommodate turning traffic and the need for a pedestrian refuge at Spring Garden Road and South Street. • Accessibility implications where centre platforms must accommodate all users.

An options evaluation matrix was created in order to display the overall assessment of each option and enable comparison between categories (See Table 5-7).

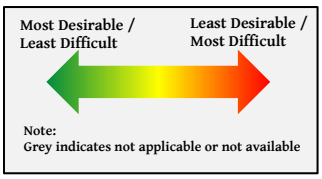


Table 5-7 – Robie Street – Coburg Road to Inglis Street
Options Evaluation Summary Matrix

	Transit Corridor Options			Description
	Existing Conditions	1 Curbside Bus Lanes	2 Median Bus Lanes	
Transit Travel Time				Improved transit travel time with dedicated lanes.
Walking				Longer and setback pedestrian crossings with median bus lanes.
Bicycling				Median lanes: Bicyclists must cycle in mixed traffic. Curbside lanes: Opportunity to widen curb lane for buses / bikes.
Traffic and Heavy Vehicle Flow				Median option: Protected only left turn phases increase delay.
Road Safety				Separation of transit vehicles from mixed traffic. Signal separation of left turns for median option.
Green space / Urban Forest				Curbside Option: Some impact to trees. Median Option: Significant impact to trees.
Onstreet Parking / Loading Impacts				Remove all on-street parking from Robie Street in all options.
Property Requirements				Curbside option: Minimal property impact. Median option: Property impacts with widening.
Implementation Cost				Curbside option: Lower cost compared to Median option.
Public Feedback Response				Overall, public indicated preference for curbside lanes.

5.3 ROBIE STREET OPTIONS EVALUATION

Recognizing that transit priority for each segment of this corridor should not be considered for implementation in isolation, corridor level options (summarized in Table 5-8) have been developed and evaluated.

Table 5-8 – Robie Street – Overall Corridor Options Summary

		Transit Corridor Option - Robie Street		
		R1 - Curbside Bus Lanes (NB Only Cunard to Almon)	**R2 - Curbside Bus Lanes (Both Directions Full Corridor)**	**R3 - Median Bus Lanes (Both Directions Full Corridor)**
Corridor Segment	**Young to Almon**	1 Continuous Curbside Transit Lanes		2 – Provide Continuous Median Transit Lanes
	Almon to Cunard	1 Continuous Curbside Transit Lane (NB Only)	2 Continuous Curbside Transit Lanes	3 – Provide Continuous Median Transit Lanes
	Cunard to Coburg	1 Continuous Curbside Transit Lanes		2 – Provide Continuous Median Transit Lanes
	Coburg to Inglis	1 Continuous Curbside Transit Lanes		2 – Provide Continuous Median Transit Lanes
Estimated Results	**Total Estimated Annual Operating Cost Savings to Halifax Transit**	$83,000	$94,000	$62,000
	Total Estimated Daily Reduction in Transit User Delay	100 user hours	115 user hours	100 user hours
	Total Estimated Daily Reduction in Overall User Delay	195 user hours	220 user hours	-550 user hours
	Total Estimated Implementation Cost (full 3.5 km corridor)	$4,350,000	$5,825,000	$11,000,000

The estimated travel time calculations have not considered modifying signal progression to favour the flow of transit vehicles. These additional modifications (available for all options) may yield improved operations to transit above those projected.

Since the median transit option requires that substantial signal timing duration is provided to accommodate the heavy left turn volumes at several intersections, the median option is found to increase the overall user delay compared to existing operations and provide reduced transit user benefits relative to the Curbside options.

A summary of the considerations that impact the multimodal aspects along this corridor is presented in Table 5-9 with red shading indicating negative impacts and green shading indicating positive impacts with grey indicating that the factor is not applicable to the Option.

Further information on the cost estimates is provided in Section 3.4.5 and cost estimates are included in Appendix D.

Table 5-9 – Robie Street Options – MMLOS Accommodation Summary

Mode	Description	Option / Evaluation Considerations		
		Option R1	Option R2	Option R3
Pedestrians	Shorter Crossings between Cunard and Quinpool			
	Longer pedestrian crossings between Almon and Cunard.			
	Removed medians at several crossings.			
	Longer pedestrian crossings at most intersections.			
	All transit users must cross to / from stations.			
	Setback crosswalks may create sightline concerns for turning traffic.			
Cyclists	Opportunity to permit bikes in curbside transit lane. Reduced travel lane width and mixed traffic for median facility.			
Halifax Transit	Provides outbound transit lane for the full corridor, provides inbound transit lane for majority of the corridor.			
	Provides inbound transit lane for the full corridor.			
Heavy Trucks	Restricts through trucks from using the curb lanes.			
	Left turning trucks from / to Robie at signalized intersections only.			
	Travel lanes are narrowed.			
Vehicular Traffic	Improved intersections at Cunard, Quinpool, and Coburg.			
	Improved intersection at Almon. NB Left turn restriction for Option R1.			
	Significant increase in delay is anticipated.			
	Reduced access with left turn restrictions along entire corridor at unsignalized intersections.			
	Parking is prohibited.			

An options evaluation matrix (See Table 5-10) was created in order to display the overall assessment of each option along Robie Street and enable comparison between categories.

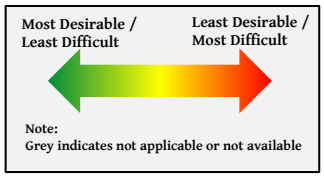


Table 5-10 – Robie Street – Overall Corridor Options Evaluation Summary Matrix

	Transit Corridor Options				Description
	Existing Conditions	1-Curbside (NB Only)	2-Curbside (Both Directions)	3-Median (Both Directions)	
Transit Travel Time					Improved transit travel time with dedicated lanes. Option Y1 outbound only.
Walking					Options R1 and R2: Adjustment to centre median for curbside option Option R3: Longer and set back pedestrian crossings with median bus lanes.
Bicycling					Options R1 and R2: Potential to accommodate bikes along transit lane. Option R3: Bicyclists must cycle in mixed traffic in narrowed lane widths.
Traffic and Heavy Vehicle Flow					Options R1 and R2: Slight improvement to traffic flow. Median option: Protected only left turn phases increase delay and turn restrictions increase travel distance.
Road Safety					Realignment of intersections at Almon Street, Cunard Street, and Quinpool Road improves vehicle tracking and safety.
Green space / Urban Forest					Option R1: Minimal impact to trees, new greenspace available at Common. Option R2: Impact to several trees, new greenspace available at Common. Option R3: Significant impact to treees, new greenspace available at Common.
Onstreet Parking / Loading Impacts					Prohibits onstreet parking in all options.
Property Requirements					Option R1: Minimal widening, opportunity to add available surplus ROW to Common. Option R2: Some widening (mainly Almon to Cunard) and opportunity to add available surplus ROW to Common. Option R3: Significant widening along full corridor, opportunity to add some surplus ROW to Common.
Implementation Cost					Curb and sidewalk modifications required for Option 2. Significant road reconstruction for Option 3.
Public Feedback Response					Overall, public indicated preference for curbside lanes.

Each option for the study corridor was evaluated using the payback period analysis methodology (See Appendix E) included in Moving Forward Together Plan (Halifax Transit, 2016) and as described in Section 3.4.1 with results summarized in Table 5-11.

Table 5-11 – Robie Street Corridor Options - Payback Period

		Robie Street		
		R1 Curbside Transit Lanes (NB only Cunard to Almon)	R2 Curbside Transit Lanes (Both Directions Full Corridor)	R3 Median Transit Lanes (Both Directions Full Corridor)
Estimated Daily Delay Savings to Transit Users		~100 user hours	~115 user hours	~100 user hours
Estimated Daily Delay Savings to All Road Users		~195 user hours	~220 user hours	~(550 user hours (negative))
Payback Period to Public		4.0 years	4.6 years	~3.5 years (no payback)
Combined Score for Delay and Payback		**9**	**10**	**0**
Other Key Factors	Safety Considerations	(+)Realignment of several intersections	(+)Realignment of several intersections	(+)Collision data for median lanes indicates a benefit relative to curbside lanes (+)Realignment of several intersections (-)Setback pedestrian crosswalks
	Impact to Other Users	No major impacts	(-)Longer pedestrian crossings at some intersections (+)Improves operations for emergency vehicles	(-)Longer pedestrian crossings at several intersections (-)Impacts property access Improves operations for emergency vehicles, impacts access to hospital
	Project Integration	None Expected		
	TPM Enforcement Requirements	Enforcement of typical transit lane and parking signage		(-) Requires additional enforcement of turn restrictions
	Issues to Implementation	(-)Acquisition of some properties is required Some tree impacts (fewer than R2)	(--)Acquisition of several properties is required (-) Impacts several trees (reduced impact than R3)	(--)Acquisition of several properties required (--) Impacts several trees
	Promotion of Transit	(+)Some Promotion of Transit	(++)Excellent Promotion of Transit	(++)Excellent Promotion of Transit
	Schedule Adherence	(++)Greatly Improved Schedule adherence while limited to NB only (Cunard to Almon)	(++)Greatly Improved Schedule adherence in both directions	(++)Greatly Improved Schedule adherence in both directions
	Public Consultation	(+)Seen by the public as not going far enough	(++)Overall seen as the best option by the public	(+)Seen as a good option by the public
	Score for Other Factors[1]	**4**	**5**	**0**
Overall Evaluation		**13**	**15**	**0**

NOTES: 1. Score for other factors is the sum of the positive impacts less the negative impacts. Impacts with "++" or "--" receive double score.

While median transit lanes can offer significant benefits and are being considered by several jurisdictions nationwide and globally, the expected benefit on Robie Street is limited. The traffic volumes at many of the intersections along Robie Street can be categorized with low right turning volumes and high left turning volumes from Robie Street. Where the left turning volumes are substantial, the time required in the traffic signal phasing to provide protected-only left turn movements is found to limit the benefits of the median transit lanes, and the generally low right turning volume has only a small impediment to the progression of transit vehicles from the curbside lanes.

Comparative evaluation of the user impacts (Table 5-10), evaluation summary matrix (Table 5-10) and payback analysis (Table 5-11) indicate significant benefits to transit are anticipated with all corridor options. While Median Transit Lanes are expected to significantly improve the visibility of transit, their implementation on Robie Street is estimated to provide reduced benefits for transit compared to the curbside options and are expected to create negative impacts to non-transit vehicles (due to the high left turn volumes and the need for protected signal phasing). These non-transit impacts may worsen transit progression along the side streets (i.e. Spring Garden Road), and for these reasons, Option R2 (Curbside Transit Lanes on Robie Street) is recommended.

If HRM chooses to implement Option R1 then it should be considered an interim option while the additional property (Almon to Cunard) is acquired. With its added advantages for transit and consistency along the corridor in the southbound direction, Option R2 should ultimately be considered for implementation by HRM.

Given the similar benefits to transit and the higher property and tree impacts, higher implementation costs, longer pedestrian crossings, and negative traffic impacts with median transit lanes, **it is recommended that HRM select corridor option R2 Curbside Transit Lanes (Both Directions Full Corridor) for implementation.** HRM could consider the implementation of R1 as an interim option.

All transit options considered are expected to offer higher than projected benefits if:

- Consideration is given to restricting left turns at several intersections (however this would have severe implications on adjacent corridors);
- If Halifax Transit anticipates future implementation of LRT along the corridor; or,
- If consideration is given to expansion to 3 non-transit through lanes and / or dual left turn lanes at several intersections.

There may be benefit to preserving the corridor (as redevelopment progresses) to accommodate future implementation of median transit lanes if higher order transit is

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6 SUMMARY & RECOMMENDATIONS

6.1 SUMMARY

Recent and ongoing policy development efforts have made improvements to Halifax's transit service a key priority for the Municipality. Specifically, Halifax Transit's *Moving Forward Together Plan* (adopted by Regional Council in April 2016) includes bold moves that will aim to improve transit service levels through increased priority, enhanced reliability, and reduced travel time. The bold moves are being made in support of the following four Council-endorsed '*Moving Forward Principles*':

1. Increase the proportion of resources allocated towards high ridership services.
2. Build a simplified transfer based system.
3. Invest in service quality and reliability.
4. Give transit increased priority in the transportation network.

Among the key initiatives that the Municipality is considering for transit upgrades are Transit Priority Measures (TPMs) – strategically located street and intersection upgrades that provide priority for the movement of buses. These measures have further been identified as action items in the Council approved *Integrated Mobility Plan* (IMP) with corridor level transit priority recommended for **Robie Street** and **Young Street**, which taken with the Regional Council approved transit priority on Bayers Road will provide a continuous transit corridor between Highway 102 and south end Halifax.

To address the identified need for transit priority along Robie and Young Streets, options were developed and evaluated against the level of impact that they are expected to have on transit operation as well as on active transportation (AT), general traffic, parking, road safety, and implementation cost.

Following initial development of the options for each corridor, consultation was held to gather input from key stakeholders through several meetings as well as from the overall public through an open house and online consultation on the project's Shape Your City website.

Options preparation included a significant data collection phase that included topographic survey, as well as obtaining and reviewing data on transit vehicle and ridership volumes, volumes of traffic, pedestrians, and bicycle, as well as consideration of public and stakeholder input. Analysis was completed to evaluate the identified options using criteria developed through discussion with HRM staff as well as the methodology presented in Appendix E of *Moving Forward Together* (Halifax Transit, 2016).

6.2 RECOMMENDATIONS

Based on the background review, public and stakeholder consultation, functional design, various analysis frameworks, and comparative analysis, the recommendations have been developed for consideration by HRM.

Consideration was given to the phasing of corridor improvements. A proposed implementation plan has been identified with recommendations presented as Priority A, B, or C where items in Priority 'A' should generally be considered during the earlier years of the Action Plan, with those in Priority 'C' considered in the later years.

6.2.1 RECOMMENDATIONS - YOUNG STREET

1. HRM should plan for the installation of Option Y3 (Continuous transit lanes – full corridor) along the entire corridor between Windsor Street and Robie Street.

PRIORITY 'A'

- Design modifications to implement Option Y3 (Continuous transit lanes – full corridor). Initiate acquisition of identified properties to implement this option.
- HRM should facilitate negotiations with abutting property owners and seek opportunities to provide access management along this corridor with consolidated access and traffic signalization at the Monaghan Drive intersection.

PRIORITY 'B'

- Implement Option Y3 between Windsor Street and Kempt Road (Option Y2).

PRIORITY 'C'

- Implement remainder of Option Y3 between Kempt Road and Robie Street.

6.2.2 RECOMMENDATIONS – ROBIE STREET

Segment 1 – Young Street to Almon Street:

1. HRM should plan for the installation of curbside transit lanes in each direction (Option R2, Option 1 in this segment). It is expected that this option can be implemented with limited property impacts.

Segment 2 – Almon Street to Cunard Street:

2. HRM should plan for the installation of curbside transit lanes in each direction (Option R2, Option 2 in this segment).
   a. Given the property impacts associated with necessary widening HRM may wish to use a phased approach and implement Option 1 (curbside transit lanes, northbound only Cunard to Almon) initially with future plans to widen and provide the southbound transit lane through this segment as property becomes available.

Segment 3 – Cunard Street to Spring Garden Road:

3. HRM should plan for the installation of curbside transit lanes in each direction (Option R2, Option 1 in this segment).

Segment 4 – Spring Garden Road to Inglis Street:

4. HRM should plan for the installation of curbside transit lanes in each direction (Option R2, Option 1 in this segment).

PRIORITY 'A'

- Complete an analysis of parking utilization on adjacent streets to understand the impact to parking and consider options to offset parking loss.
- Design modifications to implement corridor Option R-2 (Curbside transit lanes, both directions, full corridor). Initiate acquisition of identified properties to implement this option and / or identify desired right-of-way lines to accommodate this option as properties redevelop.
- Implement modifications for continuous transit lanes in both directions for Young Street to Almon Street.
- Design and implement modifications for Option 1 for the segment (northbound transit lane) between Almon Street and Cunard Street.

PRIORITY 'B'

- Implement Option 1 (Curbside transit lanes) for the segment between Cunard Street and Spring Garden Road / Coburg Road.
- Implement Option 2 (Curbside transit lanes both directions) for the segment between Almon Street and Cunard Street when property is available.
- Implement Option 1 (Curbside transit lanes) for the segment between Spring Garden Road and South Street.

PRIORITY 'C'

- Implement Option 1 (Curbside transit lanes) for the segment between South Street and Inglis Street.

6.3 CONCLUSION

Curbside transit lanes in both directions along the full corridor (Options Y3 on Young Street and R2 on Robie Street) are expected to provide significant benefit to Halifax Transit and, when combined with the Regional Council approved transit priority on Bayers Road will provide continuous transit lanes between Highway 102 and south end Halifax. While these benefits are projected to be significant using existing routing and ridership, any increase in transit vehicle frequency expected along this corridor or increased transit ridership will result in additional benefits beyond what is projected with this study.

APPENDIX

D COST ESTIMATES

Attachment A

Attachment A

HRM TRANSIT PRIORITY CORRIDORS - YOUNG STREET
HIGH LEVEL ESTIMATE OF PROBABLE COSTS

PROJECT NO.	171-09619
DATE:	March 1, 2018
CLIENT:	HRM
CONSULTANT:	WSP
UNIT PRICE SOURCE:	WSP

Disclaimer: This estimate of probable construction cost is approximate only. Actual cost may vary significantly from this estimate due to market conditions such as material and labour costs, time of year, industry workload, competition, etc. This estimate has been prepared based on our experience with similar projects. This estimate has not been prepared by obtaining any estimates or quotes from contractors. Due to the uncertainties of what contractors bid, WSP cannot make any assurances that this estimate will be within a reasonable range of the tendered low bid. When assessing this project for business feasibility purposes this estimate should not be relied upon without considering these factors.

NOTES:

1. HST NOT INCLUDED IN INDICATED UNIT PRICES AND TOTALS.
2. ESTIMATE BASED ON FUNCTIONAL DESIGN DRAWINGS PROVIDED FOR PUBLIC OPEN HOUSE ON FEBRUARY 01, 2018.
3. ALL PRICES SHOWN ARE IN 2018 CANADIAN DOLLARS.
4. COST ESTIMATES DO NOT INCLUDE IMPROVEMENTS TO WINDSOR STREET INTERSECTION WHICH WERE INCLUDED IN THE BAYERS ROAD TRANSIT ESTIMATES.
5. ESTIMATE DOES NOT INCLUDE COST ALLOWANCES FOR PROPERTY ACQISITION, UTILITY POLE RELOCATION, ENGINEERING, ADMINISTRATION OR INSPECTION FEES.
6. STREET CONSTRUCTION UNIT PRICE INCLUDES EXCAVATION AND INSTALLATION OF TYPE I AND TYPE II GRAVELS, AND TYPE B-HF AND TYPE C-HF ASPHALT.
7. ESTIMATE DOES NOT INCLUDE MILLING OR STREET RESURFACING WORK THAT MAY BE DONE IN CONJUNCTION WITH TRANSIT PRIORITY MEASURES.
8. ESTIMATE INCLUDES ALLOWANCES FOR MODIFICATIONS TO PRIVATE PROPERTY PARKING AREAS IMPACTED BY ROAD WIDENING.
9. SIGNALIZATION OF THE MONAGHAN DRIVE INTERSECTION MAY BE COMPLETED INDEPENDENT OF TRANSIT PRIORITY UPGRADE AND HAS BEEN EXCLUDED FROM THE COST ESTIMATE.

				Option Y1 Low Investment		Option Y2 Medium Investment		Option Y3 High Investment	
ITEM	DESCRIPTION	UNITS	UNIT PRICE	QNTY.	COST	QNTY.	COST	QNTY.	COST
[redacted]									

	Option Y1	Option Y2	Option Y3
Sub-Total	$181,850	$483,750	$1,071,500
Contingency (30%)	$54,555	$145,125	$321,450
TOTAL COST (excl. HST)	$236,000	$629,000	$1,393,000

Attachment A

HRM TRANSIT PRIORITY CORRIDORS - ROBIE STREET

HIGH LEVEL ESTIMATE OF PROBABLE COSTS

PROJECT NO.	171-09619
DATE:	March 1, 2018
CLIENT:	HRM
CONSULTANT:	WSP
UNIT PRICE SOURCE:	WSP

Disclaimer: This estimate of probable construction cost is approximate only. Actual cost may vary significantly from this estimate due to market conditions such as material and labour costs, time of year, industry workload, competition, etc. This estimate has been prepared based on our experience with similar projects. This estimate has not been prepared by obtaining any estimates or quotes from contractors. Due to the uncertainties of what contractors bid, WSP cannot make any assurances that this estimate will be within a reasonable range of the tendered low bid. When assessing this project for business feasibility purposes this estimate should not be relied upon without considering these factors.

NOTES:

1. HST NOT INCLUDED IN INDICATED UNIT PRICES AND TOTALS.
2. ESTIMATE BASED ON FUNCTIONAL DESIGN DRAWINGS PROVIDED FOR PUBLIC OPEN HOUSE ON FEBRUARY 01, 2018.
3. ALL PRICES SHOWN ARE IN 2018 CANADIAN DOLLARS.
4. ESTIMATE DOES NOT INCLUDE COST ALLOWANCES FOR PROPERTY ACQISITION, UTILITY POLE RELOCATION, ENGINEERING, ADMINISTRATION OR INSPECTION FEES.
5. STREET CONSTRUCTION UNIT PRICE INCLUDES EXCAVATION AND INSTALLATION OF TYPE I AND TYPE II GRAVELS, AND TYPE B-HF AND TYPE C-HF ASPHALT.
6. ESTIMATE DOES NOT INCLUDE MILLING OR STREET RESURFACING WORK THAT MAY BE DONE IN CONJUNCTION WITH TRANSIT PRIORITY MEASURES.
7. COST ESTIMATES DO NOT INCLUDE IMPROVEMENTS TO YOUNG STREET INTERSECTION WHICH WERE INCLUDED IN THE YOUNG STREET TRANSIT ESTIMATES.
8. ESTIMATES GENERALLY INCLUDE ROADWAY CONSTRUCTION COSTS WITHIN THE PROPOSED RIGHT-OF-WAY AND EXCLUDE ANY COSTS ASSOCIATED DEMOLITION OR REINSTATEMENT ON PRIVATE PROPERTY.

				Option R1 Curbside NB		Option R2 Curbside Transit		Option R3 Median Transit	
ITEM	DESCRIPTION	UNITS	UNIT PRICE	QNTY.	COST	QNTY.	COST	QNTY.	COST
[redacted]									

	Option R1	Option R2	Option R3
Sub-Total	$3,345,800	$4,480,150	$8,515,550
Contingency (30%)	$1,003,740	$1,344,045	$2,554,665
TOTAL COST (excl. HST)	$4,350,000	$5,824,000	$11,070,000

Attachment A

APPENDIX

E METHODOLOGY FOR DELAY AND PAYBACK CALCULATIONS

Attachment A

Attachment A

Using the Net User Delay Methodology developed in the *Transit Priority Measures Study* (WSP, 2016) as well the Transit ridership data and delay estimates obtained for each location it is possible to calculate the net road user delay during the subject peak hour as well as the payback periods associated with each measure. These equations are included below.

Net Change in Road User Delay = Net Transit User Delay + Net Non Transit User Delay

Where:

Net Change in Transit User Delay = Delay/Transit Vehicle x # Transit Vehicles x Average Ridership per Transit Vehicle

And,

Net Change in Non Transit User Delay = Delay/Non Transit Vehicle x # Non Transit Vehicles x Average Vehicle Occupancy

Note: Delay reductions will be a negative value while delay increases will be a positive value.

Daily Change in Cost to Transit
= Average Change in Delay/Transit Vehicle x # Transit Vehicles x Cost/hour for Transit Vehicle

Annual Change in Cost to Transit = Daily Change in Cost to Transit x Days/Year TPM is in Use

Daily Change in Cost to Public = Daily Change in Person Cost + Daily Change in nonTransit Vehicle Cost

Where

Daily Change in Person Cost
= Net Change in Road User Delay x # hours TPM will be in effect per day x Cost/hour for Road User

Daily Change in nonTransit Vehicle Cost
= Average delay change per nonTransit user x # of NonTransit vehicles x Cost /hour for nonTransit Vehicle

Annual Change in Cost to Public = Daily Change in Cost to Public x Days/Year TPM is in Use

$$\text{Payback Period} = \frac{\text{TPM Capital Cost}}{\text{Annual Cost Savings to Transit} + \text{Annual Cost Savings to Public} - \text{Annual Change in Operating Cost}}$$

Attachment A

APPENDIX

F YOUNG STREET INTERSECTION CAPACITY ANALYSIS

Attachment A

Attachment A

Table F-1 – Young Street AM Peak Hour Intersection Analysis

Intersection		AM Peak Hour											
		Existing Conditions						Preferred Option					
		Scenario	Approach[1]	Delay	V/C	LOS	Queue	Option	Approach[1]	Delay	V/C	LOS	Queue
Young Street @	Kempt	Existing (Page F-2)	EB-L	16.7	0.15	B	9.9	High Invest[2] (Page F-6)	EB-L	21.8	0.21	C	12.4
			EB-TR	23.5	0.55	C	53.2		EB-T	24.3	0.49	C	58.3
									EB-R	7.8	0.15	A	11.3
			WB-LTR	30.9	0.78	C	33.4		WB-L	17.4	0.24	B	5.0
									WB-T	21.1	0.60	C	27.9
									WB-R	2.1	0.18	A	0.0
			NB-LTR	14.0	0.29	B	29.9		NB-L	56.4	0.49	E	26.8
									NB-TR	56.9	0.57	E	39.7
			SB-L	17.2	0.29	B	28.3		SB-L	11.4	0.17	B	24.7
			SB-TR	9.3	0.20	A	19.1		SB-TR	13.1	0.17	B	27.6
	Robie	Existing (Page F-3)	EB-L	14.4	0.41	B	11.6	Medium Invest[3] (Page F-7)	EB-L	27.0	0.39	C	26.7
			EB-T	24.8	0.79	C	109.2		EB-T	23.9	0.75	C	61.9
			EB-R	4.1	0.25	A	3.9		EB-R	2.0	0.22	A	0.9
			WB-L	20.5	0.13	C	5.6		WB-L	40.2	0.15	D	11.6
			WB-TR	41.2	0.79	D	95.5		WB-TR	84.3	0.96	F	121.9
			NB-L	28.7	0.53	C	19.5		NB-L	20.8	0.46	C	19.3
			NB-TR	18.0	0.40	B	37.3		NB-TR	15.0	0.33	B	47.0
			SB-L	17.8	0.24	B	16.3		SB-L	22.5	0.21	C	19.8
			SB-TR	21.0	0.67	C	85.5		SB-T	66.0	1.01	E	256.1
									SB-R	4.5	0.13	A	9.1

Notes:

1. Young Street is east/west for the full corridor
2. Installation of eastbound and westbound right turn (except buses) lanes at Kempt intersection.
3. Installation of eastbound and southbound right turn (except buses) lanes at Robie intersection. Modifications to eastbound right turn channel for bus-only.

Table F-2 – Young Street PM Peak Hour Intersection Analysis

Intersection		PM Peak Hour											
		Existing Conditions						Preferred Option					
		Scenario	Approach[1]	Delay	V/C	LOS	Queue	Option	Approach[1]	Delay	V/C	LOS	Queue
Young Street @	Kempt	Existing (Page F-4)	EB-L	30.4	0.69	C	36.2	High Invest[2] (Page F-8)	EB-L	26.0	0.59	C	54.6
			EB-TR	19.0	0.60	B	60.6		EB-T	13.3	0.30	B	38.5
									EB-R	2.9	0.28	A	11.9
			WB-LTR	51.0	0.88	D	44.7		WB-L	6.8	0.06	A	1.3
									WB-T	11.8	0.52	B	25.6
									WB-R	1.4	0.20	A	0.0
			NB-LTR	21.4	0.45	C	45.5		NB-L	48.3	0.62	D	34.2
									NB-TR	35.4	0.36	D	27.9
			SB-L	27.2	0.58	C	56.1		SB-L	24.7	0.52	C	45.0
			SB-TR	8.5	0.26	A	19.5		SB-TR	23.4	0.32	C	35.0
	Robie	Existing (Page F-5)	EB-L	25.3	0.66	C	33.5	Medium Invest[3] (Page F-9)	EB-L	31.8	0.64	C	41.0
			EB-T	17.3	0.50	B	45.3		EB-T	18.6	0.48	B	48.2
			EB-R	4.1	0.33	A	8.5		EB-R	4.7	0.24	A	13.7
			WB-L	24.6	0.07	C	7.1		WB-L	25.2	0.06	C	7.2
			WB-TR	63.9	0.95	E	140.5		WB-TR	56.1	0.90	E	134.3
			NB-L	25.6	0.77	C	13.8		NB-L	25.9	0.66	C	32.2
			NB-TR	14.3	0.81	B	36.7		NB-TR	22.7	0.65	C	85.3
			SB-L	32.6	0.40	C	15.0		SB-L	30.7	0.28	C	14.3
			SB-TR	20.4	0.49	C	48.3		SB-T	60.2	0.94	E	135.9
									SB-R	3.4	0.17	A	6.3

Notes:

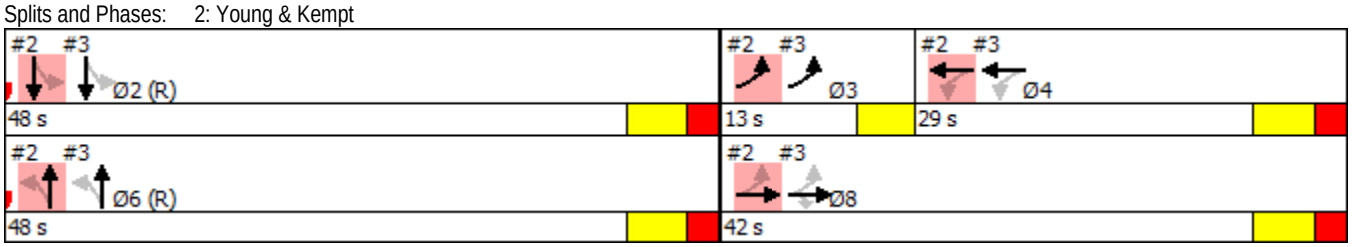
1. Young Street is east/west for the full corridor
2. Installation of eastbound and westbound right turn (except buses) lanes at Kempt intersection.
3. Installation of eastbound and southbound right turn (except buses) lanes at Robie intersection. Modifications to eastbound right turn channel for bus-only.

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	35	450	55	45	305	70	60	55	45	125	70	60
Future Volume (vph)	35	450	55	45	305	70	60	55	45	125	70	60
Satd. Flow (prot)	1371	2776	0	0	2837	0	0	1485	0	1456	1422	0
Flt Permitted	0.329				0.815			0.843		0.664		
Satd. Flow (perm)	457	2776	0	0	2318	0	0	1267	0	1003	1422	0
Satd. Flow (RTOR)		17			25			29			63	
Lane Group Flow (vph)	40	577	0	0	479	0	0	182	0	143	148	0
Turn Type	pm+pt	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases	3	8			4			6			2	
Permitted Phases	8			4			6			2		
Total Split (s)	13.0	42.0		29.0	29.0		48.0	48.0		48.0	48.0	
Total Lost Time (s)	4.0	6.4			6.4			6.4		6.4	6.4	
Act Effct Green (s)	36.0	33.6			23.2			43.6		43.6	43.6	
Actuated g/C Ratio	0.40	0.37			0.26			0.48		0.48	0.48	
v/c Ratio	0.15	0.55			0.78			0.29		0.29	0.20	
Control Delay	16.7	23.4			28.6			14.0		17.2	9.3	
Queue Delay	0.0	0.1			2.4			0.0		0.0	0.0	
Total Delay	16.7	23.5			30.9			14.0		17.2	9.3	
LOS	B	C			C			B		B	A	
Approach Delay		23.0			30.9			14.0			13.2	
Approach LOS		C			C			B			B	
Queue Length 50th (m)	3.8	36.3			18.5			16.4		15.7	8.5	
Queue Length 95th (m)	9.9	53.2			m#33.4			29.9		28.3	19.1	
Internal Link Dist (m)		97.3			50.7			102.8			408.6	
Turn Bay Length (m)										30.0		
Base Capacity (vph)	274	1121			616			635		491	728	
Starvation Cap Reductn	0	0			57			0		0	0	
Spillback Cap Reductn	0	68			0			0		0	0	
Storage Cap Reductn	0	0			0			0		0	0	
Reduced v/c Ratio	0.15	0.55			0.86			0.29		0.29	0.20	

Intersection Summary

Cycle Length: 90
Actuated Cycle Length: 90
Offset: 50 (56%), Referenced to phase 2:SBTL and 6:NBTL, Start of Green
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.79
Intersection Signal Delay: 22.6 — Intersection LOS: C
Intersection Capacity Utilization 94.7% — 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.
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 2: Young & Kempt

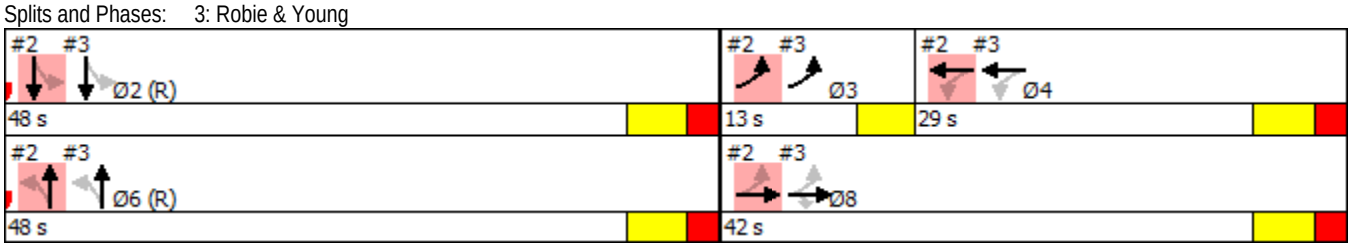


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	100	405	115	20	260	20	80	495	20	60	735	80
Future Volume (vph)	100	405	115	20	260	20	80	495	20	60	735	80
Satd. Flow (prot)	1439	1568	1348	1507	1559	0	1507	2990	0	1439	2861	0
Flt Permitted	0.316			0.460			0.227			0.396		
Satd. Flow (perm)	463	1568	1238	702	1559	0	359	2990	0	595	2861	0
Satd. Flow (RTOR)			92		4			6			17	
Lane Group Flow (vph)	114	462	131	23	320	0	91	588	0	68	930	0
Turn Type	pm+pt	NA	Perm	Perm	NA		Perm	NA		Perm	NA	
Protected Phases	3	8			4			6			2	
Permitted Phases	8		8	4			6			2		
Total Split (s)	13.0	42.0	42.0	29.0	29.0		48.0	48.0		48.0	48.0	
Total Lost Time (s)	4.0	6.4	6.4	6.4	6.4		6.4	6.4		6.4	6.4	
Act Effct Green (s)	36.0	33.6	33.6	23.2	23.2		43.6	43.6		43.6	43.6	
Actuated g/C Ratio	0.40	0.37	0.37	0.26	0.26		0.48	0.48		0.48	0.48	
v/c Ratio	0.41	0.79	0.25	0.13	0.79		0.53	0.40		0.24	0.67	
Control Delay	14.3	24.8	3.7	20.5	41.2		28.7	18.0		17.8	21.0	
Queue Delay	0.2	0.0	0.4	0.0	0.0		0.0	0.0		0.0	0.0	
Total Delay	14.4	24.8	4.1	20.5	41.2		28.7	18.0		17.8	21.0	
LOS	B	C	A	C	D		C	B		B	C	
Approach Delay		19.3			39.8			19.5			20.8	
Approach LOS		B			D			B			C	
Queue Length 50th (m)	6.3	28.5	0.9	1.7	52.3		8.5	27.0		7.2	66.6	
Queue Length 95th (m)	11.6	109.2	3.9	m5.6	#95.5		m#19.5	37.3		16.3	85.5	
Internal Link Dist (m)		50.7			118.4			360.9			410.5	
Turn Bay Length (m)	50.0						140.0			70.0		
Base Capacity (vph)	282	627	550	181	405		175	1466		291	1409	
Starvation Cap Reductn	13	0	169	0	0		0	0		0	0	
Spillback Cap Reductn	0	0	0	0	0		0	0		0	0	
Storage Cap Reductn	0	0	0	0	0		0	0		0	0	
Reduced v/c Ratio	0.42	0.74	0.34	0.13	0.79		0.52	0.40		0.23	0.66	

Intersection Summary

Cycle Length: 90
Actuated Cycle Length: 90
Offset: 50 (56%), Referenced to phase 2:SBTL and 6:NBTL, Start of Green
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.79
Intersection Signal Delay: 22.5 — Intersection LOS: C
Intersection Capacity Utilization 90.0% — ICU Level of Service E
Analysis Period (min) 15
\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 3: Robie & Young

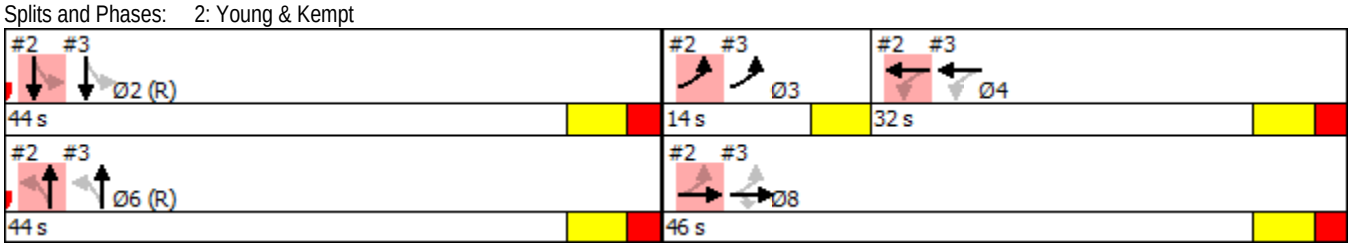


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	160	450	200	20	445	115	105	65	25	210	60	90
Future Volume (vph)	160	450	200	20	445	115	105	65	25	210	60	90
Satd. Flow (prot)	1411	2699	0	0	2857	0	0	1555	0	1498	1413	0
Flt Permitted	0.242				0.905			0.742		0.625		
Satd. Flow (perm)	342	2699	0	0	2588	0	0	1168	0	974	1413	0
Satd. Flow (RTOR)		100			34			10			103	
Lane Group Flow (vph)	183	742	0	0	662	0	0	223	0	240	171	0
Turn Type	pm+pt	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases	3	8			4			6			2	
Permitted Phases	8			4			6			2		
Total Split (s)	14.0	46.0		32.0	32.0		44.0	44.0		44.0	44.0	
Total Lost Time (s)	4.0	6.4			6.4			6.4		6.4	6.4	
Act Effct Green (s)	43.8	41.4			27.6			35.8		35.8	35.8	
Actuated g/C Ratio	0.49	0.46			0.31			0.40		0.40	0.40	
v/c Ratio	0.65	0.57			0.81			0.47		0.62	0.27	
Control Delay	26.8	17.8			29.6			22.6		29.3	8.6	
Queue Delay	0.0	0.1			9.9			0.0		0.0	0.0	
Total Delay	26.8	17.8			39.5			22.6		29.3	8.6	
LOS	C	B			D			C		C	A	
Approach Delay		19.6			39.5			22.6			20.7	
Approach LOS		B			D			C			C	
Queue Length 50th (m)	18.6	42.8			34.0			25.7		31.2	7.0	
Queue Length 95th (m)	#35.5	60.6			m39.1			45.5		56.2	19.5	
Internal Link Dist (m)		97.3			50.7			38.9			145.1	
Turn Bay Length (m)										30.0		
Base Capacity (vph)	286	1294			817			493		406	650	
Starvation Cap Reductn	0	0			133			0		0	0	
Spillback Cap Reductn	0	33			0			0		0	0	
Storage Cap Reductn	0	0			0			0		0	0	
Reduced v/c Ratio	0.64	0.59			0.97			0.45		0.59	0.26	

Intersection Summary

Cycle Length: 90
Actuated Cycle Length: 90
Offset: 56 (62%), Referenced to phase 2:SBTL and 6:NBTL, Start of Green
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.95
Intersection Signal Delay: 26.0 Intersection LOS: C
Intersection Capacity Utilization 103.3% ICU Level of Service G
Analysis Period (min) 15
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 2: Young & Kempt



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	160	325	200	15	340	60	165	850	15	35	420	75
Future Volume (vph)	160	325	200	15	340	60	165	850	15	35	420	75
Satd. Flow (prot)	1467	1598	1374	1536	1545	0	1536	3060	0	1467	2880	0
Flt Permitted	0.204			0.541			0.387			0.164		
Satd. Flow (perm)	302	1598	1242	830	1545	0	617	3060	0	252	2880	0
Satd. Flow (RTOR)			204		10			2			28	
Lane Group Flow (vph)	183	371	228	17	456	0	188	987	0	40	565	0
Turn Type	pm+pt	NA	Perm	Perm	NA		Perm	NA		Perm	NA	
Protected Phases	3	8			4			6			2	
Permitted Phases	8		8	4			6			2		
Total Split (s)	14.0	46.0	46.0	32.0	32.0		44.0	44.0		44.0	44.0	
Total Lost Time (s)	4.0	6.4	6.4	6.4	6.4		6.4	6.4		6.4	6.4	
Act Effct Green (s)	43.8	41.4	41.4	27.6	27.6		35.8	35.8		35.8	35.8	
Actuated g/C Ratio	0.49	0.46	0.46	0.31	0.31		0.40	0.40		0.40	0.40	
v/c Ratio	0.67	0.51	0.34	0.07	0.95		0.77	0.81		0.40	0.49	
Control Delay	26.6	15.8	3.6	24.6	63.1		25.6	14.2		32.6	20.4	
Queue Delay	0.0	1.5	0.5	0.0	0.0		0.0	0.0		0.0	0.0	
Total Delay	26.6	17.3	4.1	24.6	63.1		25.6	14.2		32.6	20.4	
LOS	C	B	A	C	E		C	B		C	C	
Approach Delay		15.6			61.7			16.0			21.2	
Approach LOS		B			E			B			C	
Queue Length 50th (m)	14.1	30.4	3.8	2.1	~80.5		9.6	26.5		4.7	34.2	
Queue Length 95th (m)	#34.8	45.3	8.5	7.1	#140.5		m13.8	m36.7		15.0	48.3	
Internal Link Dist (m)		50.7			216.3			360.9			146.5	
Turn Bay Length (m)	50.0						140.0			70.0		
Base Capacity (vph)	278	734	680	255	481		257	1279		105	1219	
Starvation Cap Reductn	0	198	178	0	0		0	0		0	0	
Spillback Cap Reductn	0	0	0	0	0		0	0		0	0	
Storage Cap Reductn	0	0	0	0	0		0	0		0	0	
Reduced v/c Ratio	0.66	0.69	0.45	0.07	0.95		0.73	0.77		0.38	0.46	

Intersection Summary

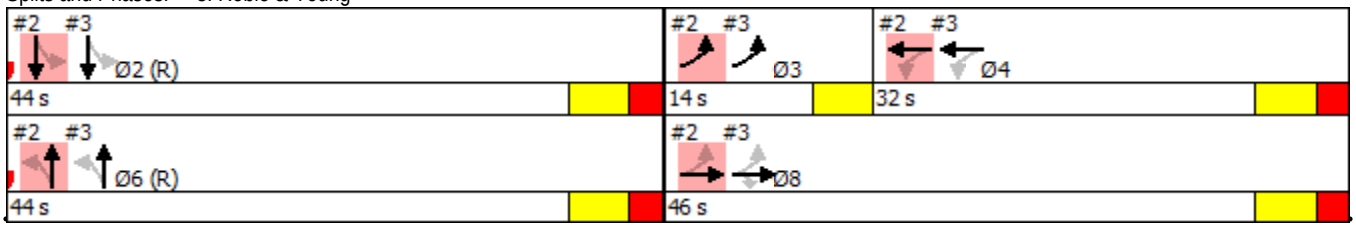
Cycle Length: 90
Actuated Cycle Length: 90
Offset: 56 (62%), Referenced to phase 2:SBTL and 6:NBTL, Start of Green
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.95
Intersection Signal Delay: 24.1
Intersection LOS: C
Intersection Capacity Utilization 92.4%
ICU Level of Service F
Analysis Period (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.

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

Splits and Phases: 3: Robie & Young

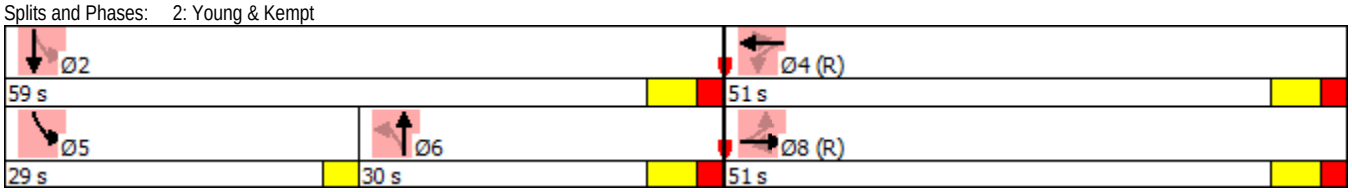


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL2	NBT	SBL2	SBT
Lane Configurations										
Traffic Volume (vph)	35	442	8	45	299	6	60	55	125	70
Future Volume (vph)	35	442	8	45	299	6	60	55	125	70
Lane Group Flow (vph)	40	504	72	51	341	87	68	114	143	148
Turn Type	Perm	NA	Perm	Perm	NA	Perm	Perm	NA	pm+pt	NA
Protected Phases		8			4			6	5	2
Permitted Phases	8		8	4		4	6		2	
Detector Phase	8	8	8	4	4	4	6	6	5	2
Switch Phase										
Minimum Initial (s)	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	8.0	10.0
Minimum Split (s)	27.4	27.4	27.4	27.4	27.4	27.4	29.4	29.4	13.0	29.4
Total Split (s)	51.0	51.0	51.0	51.0	51.0	51.0	30.0	30.0	29.0	59.0
Total Split (%)	46.4%	46.4%	46.4%	46.4%	46.4%	46.4%	27.3%	27.3%	26.4%	53.6%
Yellow Time (s)	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	3.0	4.1
All-Red Time (s)	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	0.0	2.3
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.4	6.4	6.4	6.4	6.4	6.4	6.4	6.4	3.0	6.4
Lead/Lag							Lag	Lag	Lead	
Lead-Lag Optimize?										
Recall Mode	C-Min	C-Min	C-Min	C-Min	C-Min	C-Min	Min	Min	Max	Min
Act Effct Green (s)	35.5	35.5	35.5	35.5	35.5	35.5	13.4	13.4	65.1	61.7
Actuated g/C Ratio	0.32	0.32	0.32	0.32	0.32	0.32	0.12	0.12	0.59	0.56
v/c Ratio	0.21	0.49	0.15	0.24	0.60	0.18	0.49	0.57	0.17	0.17
Control Delay	21.8	24.3	7.8	17.4	20.0	2.1	56.4	56.5	11.4	13.1
Queue Delay	0.0	0.0	0.0	0.0	1.1	0.0	0.0	0.3	0.0	0.0
Total Delay	21.8	24.3	7.8	17.4	21.1	2.1	56.4	56.9	11.4	13.1
LOS	C	C	A	B	C	A	E	E	B	B
Approach Delay		22.3			17.3			56.7		12.3
Approach LOS		C			B			E		B
Queue Length 50th (m)	6.7	48.2	4.8	3.8	26.1	0.0	13.9	23.6	13.0	14.8
Queue Length 95th (m)	m12.4	58.3	m11.3	m5.0	m27.9	m0.0	26.8	39.7	24.7	27.6
Internal Link Dist (m)		97.3			50.7			38.9		145.1
Turn Bay Length (m)	45.0			12.0					30.0	
Base Capacity (vph)	236	1288	598	266	710	580	243	349	837	879
Starvation Cap Reductn	0	0	0	0	181	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	46	79	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.17	0.39	0.12	0.19	0.64	0.15	0.28	0.38	0.19	0.17

Intersection Summary

Cycle Length: 110
Actuated Cycle Length: 110
Offset: 16 (15%), Referenced to phase 4:WBTL and 8:EBTL, Start of Green
Natural Cycle: 70
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.60
Intersection Signal Delay: 22.9 — Intersection LOS: C
Intersection Capacity Utilization 68.6% — ICU Level of Service C
Analysis Period (min) 15
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 2: Young & Kempt



Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	SBL	SBT	SBR
Lane Configurations										
Traffic Volume (vph)	100	405	107	20	260	80	495	60	731	80
Future Volume (vph)	100	405	107	20	260	80	495	60	731	80
Lane Group Flow (vph)	114	462	122	23	320	91	588	68	769	91
Turn Type	pm+pt	NA	Perm	Perm	NA	pm+pt	NA	Perm	NA	Perm
Protected Phases	3	8			4	1	6		2	
Permitted Phases	8		8	4		6		2		2
Detector Phase	3	8	8	4	4	1	6	2	2	2
Switch Phase										
Minimum Initial (s)	8.0	10.0	10.0	10.0	10.0	8.0	10.0	10.0	10.0	10.0
Minimum Split (s)	13.0	27.4	27.4	27.4	27.4	13.0	29.4	29.4	29.4	29.4
Total Split (s)	17.6	45.0	45.0	27.4	27.4	13.0	65.0	52.0	52.0	52.0
Total Split (%)	16.0%	40.9%	40.9%	24.9%	24.9%	11.8%	59.1%	47.3%	47.3%	47.3%
Yellow Time (s)	3.0	4.1	4.1	4.1	4.1	3.0	4.1	4.1	4.1	4.1
All-Red Time (s)	0.0	2.3	2.3	2.3	2.3	0.0	2.3	2.3	2.3	2.3
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	3.0	6.4	6.4	6.4	6.4	3.0	6.4	6.4	6.4	6.4
Lead/Lag	Lead			Lag	Lag					
Lead-Lag Optimize?										
Recall Mode	C-Max	C-Min	C-Min	Min	Min	None	Min	Min	Min	Min
Act Effct Green (s)	42.0	38.6	38.6	21.0	21.0	62.0	58.6	49.1	49.1	49.1
Actuated g/C Ratio	0.38	0.35	0.35	0.19	0.19	0.56	0.53	0.45	0.45	0.45
v/c Ratio	0.39	0.75	0.22	0.15	0.96	0.46	0.33	0.21	1.01	0.13
Control Delay	26.8	23.0	1.5	40.2	84.3	20.8	15.0	22.5	66.0	4.5
Queue Delay	0.2	0.9	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	27.0	23.9	2.0	40.2	84.3	20.8	15.0	22.5	66.0	4.5
LOS	C	C	A	D	F	C	B	C	E	A
Approach Delay		20.6			81.4		15.8		56.8	
Approach LOS		C			F		B		E	
Queue Length 50th (m)	5.8	31.1	0.1	4.2	68.0	8.6	35.5	9.0	~179.1	0.0
Queue Length 95th (m)	26.7	61.9	0.9	11.6	#121.9	19.3	47.0	19.8	#256.1	9.1
Internal Link Dist (m)		50.7			218.5		360.9		375.2	
Turn Bay Length (m)	25.0					140.0		70.0		60.0
Base Capacity (vph)	291	615	556	149	334	217	1783	321	765	705
Starvation Cap Reductn	17	34	185	0	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	0.42	0.80	0.33	0.15	0.96	0.42	0.33	0.21	1.01	0.13

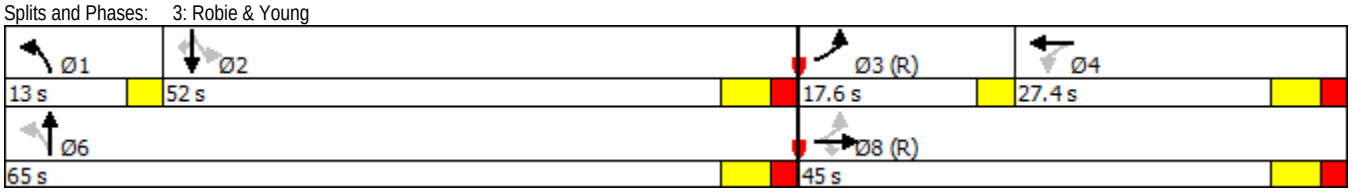
Intersection Summary

Cycle Length: 110
Actuated Cycle Length: 110
Offset: 108 (98%), Referenced to phase 3:EBL and 8:EBTL, Start of Green
Natural Cycle: 105
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 1.01
Intersection Signal Delay: 39.9 — Intersection LOS: D
Intersection Capacity Utilization 95.2% — 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.

Splits and Phases: 3: Robie & Young

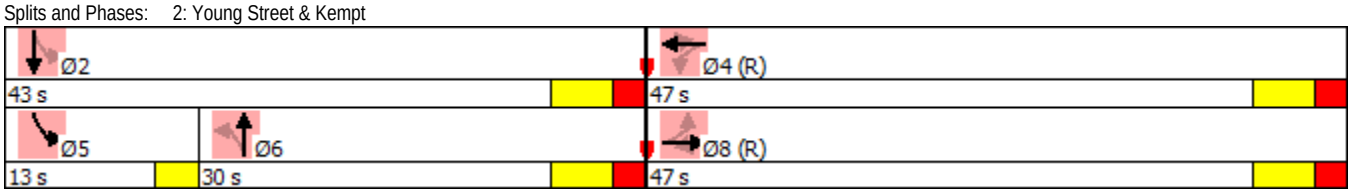


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL2	NBT	SBL2	SBT
Lane Configurations										
Traffic Volume (vph)	160	446	4	20	432	13	105	65	210	60
Future Volume (vph)	160	446	4	20	432	13	105	65	210	60
Lane Group Flow (vph)	183	509	233	23	493	146	120	103	240	171
Turn Type	Perm	NA	Perm	Perm	NA	Perm	Perm	NA	pm+pt	NA
Protected Phases		8			4			6	5	2
Permitted Phases	8		8	4		4	6		2	
Detector Phase	8	8	8	4	4	4	6	6	5	2
Switch Phase										
Minimum Initial (s)	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	8.0	10.0
Minimum Split (s)	27.4	27.4	27.4	27.4	27.4	27.4	29.4	29.4	13.0	29.4
Total Split (s)	47.0	47.0	47.0	47.0	47.0	47.0	30.0	30.0	13.0	43.0
Total Split (%)	52.2%	52.2%	52.2%	52.2%	52.2%	52.2%	33.3%	33.3%	14.4%	47.8%
Yellow Time (s)	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	3.0	4.1
All-Red Time (s)	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	0.0	2.3
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.4	6.4	6.4	6.4	6.4	6.4	6.4	6.4	3.0	6.4
Lead/Lag							Lag	Lag	Lead	
Lead-Lag Optimize?										
Recall Mode	C-Min	C-Min	C-Min	C-Min	C-Min	C-Min	Min	Min	None	Min
Act Effct Green (s)	47.0	47.0	47.0	47.0	47.0	47.0	15.0	15.0	33.6	30.2
Actuated g/C Ratio	0.52	0.52	0.52	0.52	0.52	0.52	0.17	0.17	0.37	0.34
v/c Ratio	0.59	0.30	0.28	0.06	0.52	0.20	0.62	0.36	0.52	0.32
Control Delay	26.0	13.3	2.9	6.8	9.4	0.9	48.3	35.3	24.5	23.4
Queue Delay	0.0	0.0	0.0	0.0	2.5	0.5	0.0	0.1	0.2	0.0
Total Delay	26.0	13.3	2.9	6.8	11.8	1.4	48.3	35.4	24.7	23.4
LOS	C	B	A	A	B	A	D	D	C	C
Approach Delay		13.2			9.4			42.4		24.2
Approach LOS		B			A			D		C
Queue Length 50th (m)	21.9	26.2	0.4	1.1	23.9	0.0	19.6	16.0	28.6	21.0
Queue Length 95th (m)	#54.6	38.5	11.9	m1.3	m25.6	m0.0	34.2	27.9	45.0	35.0
Internal Link Dist (m)		97.3			50.7			38.9		145.1
Turn Bay Length (m)	45.0			12.0					30.0	
Base Capacity (vph)	310	1708	831	413	942	719	302	454	464	642
Starvation Cap Reductn	0	0	0	0	317	308	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	42	24	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.59	0.30	0.28	0.06	0.79	0.36	0.40	0.25	0.55	0.27

Intersection Summary

Cycle Length: 90
Actuated Cycle Length: 90
Offset: 4 (4%), Referenced to phase 4:WBTL and 8:EBTL, Start of Green
Natural Cycle: 80
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.63
Intersection Signal Delay: 17.0 — Intersection LOS: B
Intersection Capacity Utilization 78.7% — ICU Level of Service D
Analysis Period (min) 15
\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 2: Young Street & Kempt

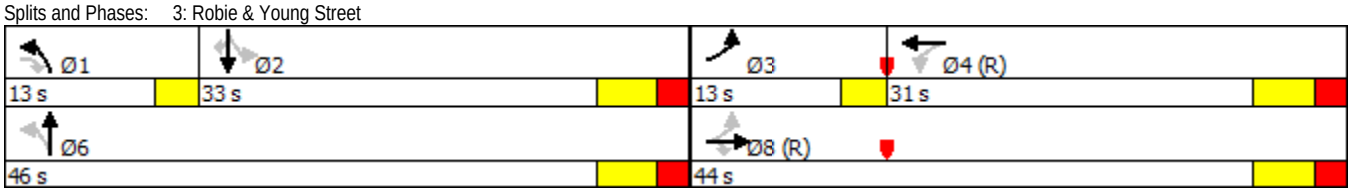


Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	SBL	SBT	SBR
Lane Configurations										
Traffic Volume (vph)	160	325	191	15	340	165	850	35	416	75
Future Volume (vph)	160	325	191	15	340	165	850	35	416	75
Lane Group Flow (vph)	183	371	218	17	456	188	956	40	475	86
Turn Type	pm+pt	NA	custom	Perm	NA	pm+pt	NA	Perm	NA	Perm
Protected Phases	3	8			4	1	6		2	
Permitted Phases	8		1 8	4		6		2		2
Detector Phase	3	8	1 8	4	4	1	6	2	2	2
Switch Phase										
Minimum Initial (s)	8.0	10.0		10.0	10.0	7.0	10.0	10.0	10.0	10.0
Minimum Split (s)	13.0	27.4		27.4	27.4	11.0	29.4	29.4	29.4	29.4
Total Split (s)	13.0	44.0		31.0	31.0	13.0	46.0	33.0	33.0	33.0
Total Split (%)	14.4%	48.9%		34.4%	34.4%	14.4%	51.1%	36.7%	36.7%	36.7%
Yellow Time (s)	3.0	4.1		4.1	4.1	3.0	4.1	4.1	4.1	4.1
All-Red Time (s)	0.0	2.3		2.3	2.3	0.0	2.3	2.3	2.3	2.3
Lost Time Adjust (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	3.0	6.4		6.4	6.4	3.0	6.4	6.4	6.4	6.4
Lead/Lag	Lead			Lag	Lag					
Lead-Lag Optimize?										
Recall Mode	None	C-Min		C-Min	C-Min	None	Min	Min	Min	Min
Act Effct Green (s)	42.0	38.6	54.5	26.0	26.0	42.0	38.6	26.1	26.1	26.1
Actuated g/C Ratio	0.47	0.43	0.61	0.29	0.29	0.47	0.43	0.29	0.29	0.29
v/c Ratio	0.64	0.48	0.24	0.06	0.90	0.66	0.65	0.28	0.94	0.17
Control Delay	31.7	16.5	4.2	25.2	54.5	25.9	22.7	30.7	60.2	3.4
Queue Delay	0.2	2.1	0.5	0.0	1.6	0.0	0.0	0.0	0.0	0.0
Total Delay	31.8	18.6	4.7	25.2	56.1	25.9	22.7	30.7	60.2	3.4
LOS	C	B	A	C	E	C	C	C	E	A
Approach Delay		17.8			54.9		23.2		50.1	
Approach LOS		B			D		C		D	
Queue Length 50th (m)	15.6	33.1	3.2	2.2	75.9	18.3	65.3	5.3	79.1	0.0
Queue Length 95th (m)	#41.0	48.2	13.7	7.2	#134.3	#32.2	85.3	14.3	#135.9	6.3
Internal Link Dist (m)		50.7			218.5		360.9		255.1	
Turn Bay Length (m)	25.0			15.0		140.0		70.0		60.0
Base Capacity (vph)	289	766	931	267	506	294	1505	145	517	515
Starvation Cap Reductn	4	254	389	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	10	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.64	0.72	0.40	0.06	0.92	0.64	0.64	0.28	0.92	0.17

Intersection Summary

Cycle Length: 90
Actuated Cycle Length: 90
Offset: 0 (0%), Referenced to phase 4:WBTL and 8:EBTL, Start of Green, Master Intersection
Natural Cycle: 85
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.94
Intersection Signal Delay: 32.2 — Intersection LOS: C
Intersection Capacity Utilization 85.7% — ICU Level of Service E
Analysis Period (min) 15
\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 3: Robie & Young Street

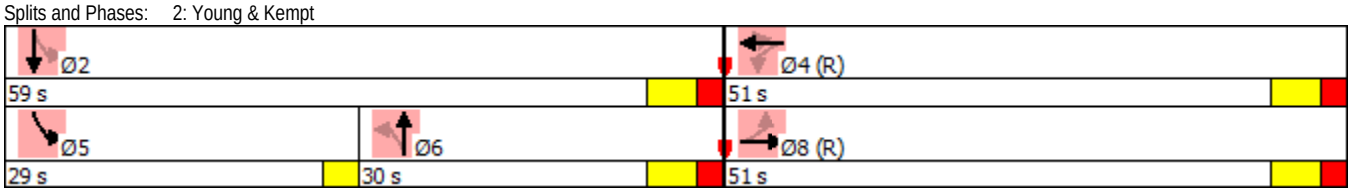


Lane Group	EBL	EBT	WBL	WBT	WBR	NBL2	NBT	SBL	SBT
Lane Configurations									
Traffic Volume (vph)	35	450	45	299	6	60	55	125	70
Future Volume (vph)	35	450	45	299	6	60	55	125	70
Lane Group Flow (vph)	40	577	51	341	87	68	114	143	148
Turn Type	Perm	NA	Perm	NA	Perm	Perm	NA	pm+pt	NA
Protected Phases		8		4			6	5	2
Permitted Phases	8		4		4	6		2	
Detector Phase	8	8	4	4	4	6	6	5	2
Switch Phase									
Minimum Initial (s)	10.0	10.0	10.0	10.0	10.0	10.0	10.0	8.0	10.0
Minimum Split (s)	27.4	27.4	27.4	27.4	27.4	29.4	29.4	13.0	29.4
Total Split (s)	51.0	51.0	51.0	51.0	51.0	30.0	30.0	29.0	59.0
Total Split (%)	46.4%	46.4%	46.4%	46.4%	46.4%	27.3%	27.3%	26.4%	53.6%
Yellow Time (s)	4.1	4.1	4.1	4.1	4.1	4.1	4.1	3.0	4.1
All-Red Time (s)	2.3	2.3	2.3	2.3	2.3	2.3	2.3	0.0	2.3
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.4	6.4	6.4	6.4	6.4	6.4	6.4	3.0	6.4
Lead/Lag						Lag	Lag	Lead	
Lead-Lag Optimize?									
Recall Mode	C-Min	C-Min	C-Min	C-Min	C-Min	None	None	Max	None
Act Effct Green (s)	36.3	36.3	36.3	36.3	36.3	12.8	12.8	64.3	60.9
Actuated g/C Ratio	0.33	0.33	0.33	0.33	0.33	0.12	0.12	0.58	0.55
v/c Ratio	0.21	0.56	0.27	0.59	0.18	0.52	0.52	0.17	0.17
Control Delay	20.6	23.9	17.9	19.5	2.1	59.1	39.9	11.8	13.5
Queue Delay	0.0	0.0	0.0	1.3	0.0	0.0	0.2	0.0	0.0
Total Delay	20.6	23.9	17.9	20.8	2.1	59.1	40.2	11.8	13.5
LOS	C	C	B	C	A	E	D	B	B
Approach Delay		23.7		17.1			47.2		12.7
Approach LOS		C		B			D		B
Queue Length 50th (m)	6.6	54.3	3.8	26.1	0.0	14.1	16.4	13.3	15.1
Queue Length 95th (m)	m12.3	64.8	m5.1	m28.2	m0.0	27.0	32.4	24.9	27.8
Internal Link Dist (m)		97.3		50.7			38.9		145.1
Turn Bay Length (m)	45.0		12.0					30.0	
Base Capacity (vph)	240	1264	232	710	580	243	375	827	868
Starvation Cap Reductn	0	0	0	193	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	47	64	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.17	0.46	0.22	0.66	0.15	0.28	0.35	0.19	0.17

Intersection Summary

Cycle Length: 110
Actuated Cycle Length: 110
Offset: 16 (15%), Referenced to phase 4:WBTL and 8:EBTL, Start of Green
Natural Cycle: 70
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.59
Intersection Signal Delay: 22.4 — Intersection LOS: C
Intersection Capacity Utilization 74.7% — ICU Level of Service D
Analysis Period (min) 15
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 2: Young & Kempt



Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	SBL	SBT	SBR
Lane Configurations										
Traffic Volume (vph)	100	405	115	20	260	80	495	60	731	80
Future Volume (vph)	100	405	115	20	260	80	495	60	731	80
Lane Group Flow (vph)	114	462	131	23	320	91	588	68	808	91
Turn Type	pm+pt	NA	Perm	Perm	NA	pm+pt	NA	Perm	NA	Perm
Protected Phases	3	8			4	1	6		2	
Permitted Phases	8		8	4		6		2		2
Detector Phase	3	8		4	4	1	6	2	2	2
Switch Phase										
Minimum Initial (s)	8.0	10.0	10.0	10.0	10.0	8.0	10.0	10.0	10.0	10.0
Minimum Split (s)	13.0	27.4	27.4	27.4	27.4	13.0	29.4	29.4	29.4	29.4
Total Split (s)	17.6	45.0	45.0	27.4	27.4	13.0	65.0	52.0	52.0	52.0
Total Split (%)	16.0%	40.9%	40.9%	24.9%	24.9%	11.8%	59.1%	47.3%	47.3%	47.3%
Yellow Time (s)	3.0	4.1	4.1	4.1	4.1	3.0	4.1	4.1	4.1	4.1
All-Red Time (s)	0.0	2.3	2.3	2.3	2.3	0.0	2.3	2.3	2.3	2.3
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	3.0	6.4	6.4	6.4	6.4	3.0	6.4	6.4	6.4	6.4
Lead/Lag	Lead			Lag	Lag	Lead		Lag	Lag	Lag
Lead-Lag Optimize?										
Recall Mode	C-Max	C-Min	C-Min	Min	Min	None	Min	Min	Min	Min
Act Effct Green (s)	42.0	38.6	38.6	21.0	21.0	62.0	58.6	49.1	49.1	49.1
Actuated g/C Ratio	0.38	0.35	0.35	0.19	0.19	0.56	0.53	0.45	0.45	0.45
v/c Ratio	0.39	0.75	0.23	0.15	0.96	0.46	0.33	0.21	1.06	0.13
Control Delay	26.0	23.0	1.8	40.2	84.3	20.8	15.0	22.5	80.0	4.5
Queue Delay	0.2	0.6	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	26.2	23.6	2.2	40.2	84.3	20.8	15.0	22.5	80.0	4.5
LOS	C	C	A	D	F	C	B	C	E	A
Approach Delay		20.0			81.4		15.8		68.8	
Approach LOS		C			F		B		E	
Queue Length 50th (m)	6.3	32.3	0.1	4.2	68.0	8.6	35.5	9.0	~196.6	0.0
Queue Length 95th (m)	26.6	59.1	1.2	11.6	#121.9	19.3	47.0	19.8	#274.5	9.1
Internal Link Dist (m)		50.7			218.5		360.9		413.0	
Turn Bay Length (m)	25.0					140.0		70.0		60.0
Base Capacity (vph)	291	615	562	149	334	217	1783	321	765	705
Starvation Cap Reductn	17	25	184	0	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	0.42	0.78	0.35	0.15	0.96	0.42	0.33	0.21	1.06	0.13

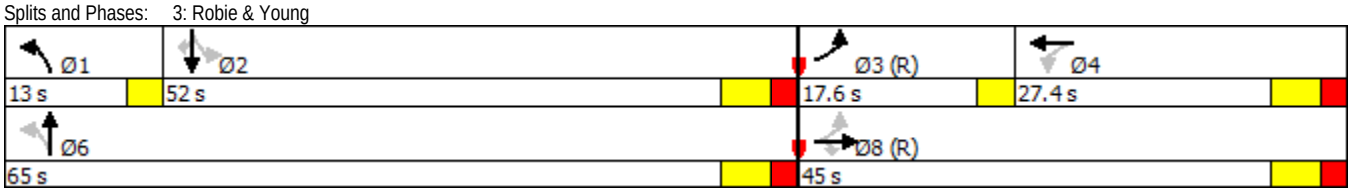
Intersection Summary

Cycle Length: 110
Actuated Cycle Length: 110
Offset: 108 (98%), Referenced to phase 3:EBL and 8:EBTL, Start of Green
Natural Cycle: 115
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 1.06
Intersection Signal Delay: 44.3 — Intersection LOS: D
Intersection Capacity Utilization 97.1% — 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.

Splits and Phases: 3: Robie & Young

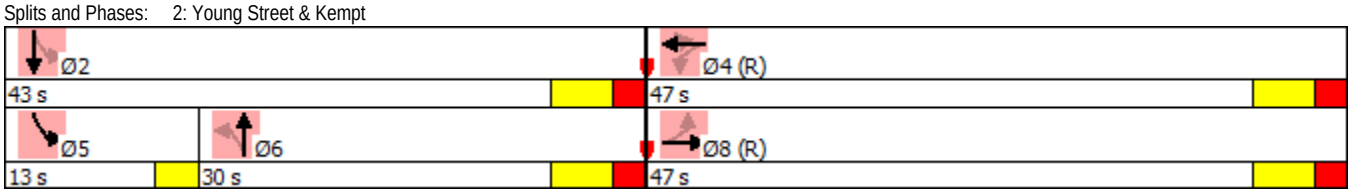


Lane Group	EBL	EBT	WBL	WBT	WBR	NBL2	NBT	SBL	SBT
Lane Configurations									
Traffic Volume (vph)	160	450	20	432	13	105	65	210	60
Future Volume (vph)	160	450	20	432	13	105	65	210	60
Lane Group Flow (vph)	183	742	23	493	146	120	103	240	171
Turn Type	Perm	NA	Perm	NA	Perm	Perm	NA	pm+pt	NA
Protected Phases		8		4			6	5	2
Permitted Phases	8		4		4	6		2	
Detector Phase	8	8	4	4	4	6	6	5	2
Switch Phase									
Minimum Initial (s)	10.0	10.0	10.0	10.0	10.0	10.0	10.0	8.0	10.0
Minimum Split (s)	27.4	27.4	27.4	27.4	27.4	29.4	29.4	13.0	29.4
Total Split (s)	47.0	47.0	47.0	47.0	47.0	30.0	30.0	13.0	43.0
Total Split (%)	52.2%	52.2%	52.2%	52.2%	52.2%	33.3%	33.3%	14.4%	47.8%
Yellow Time (s)	4.1	4.1	4.1	4.1	4.1	4.1	4.1	3.0	4.1
All-Red Time (s)	2.3	2.3	2.3	2.3	2.3	2.3	2.3	0.0	2.3
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.4	6.4	6.4	6.4	6.4	6.4	6.4	3.0	6.4
Lead/Lag						Lag	Lag	Lead	
Lead-Lag Optimize?									
Recall Mode	C-Min	C-Min	C-Min	C-Min	C-Min	Min	Min	None	Min
Act Effct Green (s)	47.0	47.0	47.0	47.0	47.0	15.0	15.0	33.6	30.2
Actuated g/C Ratio	0.52	0.52	0.52	0.52	0.52	0.17	0.17	0.37	0.34
v/c Ratio	0.59	0.46	0.08	0.52	0.20	0.62	0.34	0.52	0.32
Control Delay	26.0	13.0	7.0	9.4	0.9	48.3	27.8	24.5	23.4
Queue Delay	0.0	0.0	0.0	2.5	0.5	0.0	0.1	0.3	0.0
Total Delay	26.0	13.0	7.0	11.9	1.4	48.3	27.9	24.8	23.4
LOS	C	B	A	B	A	D	C	C	C
Approach Delay		15.6		9.4			38.9		24.2
Approach LOS		B		A			D		C
Queue Length 50th (m)	21.9	36.0	1.1	23.9	0.0	19.6	12.6	28.6	21.0
Queue Length 95th (m)	#54.6	53.0	m1.3	m25.6	m0.0	34.2	24.5	45.0	35.0
Internal Link Dist (m)		97.3		50.7			38.9		145.1
Turn Bay Length (m)	45.0		12.0					30.0	
Base Capacity (vph)	310	1624	302	942	719	302	469	464	642
Starvation Cap Reductn	0	0	0	317	308	0	0	0	0
Spillback Cap Reductn	0	3	0	0	0	0	54	31	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.59	0.46	0.08	0.79	0.36	0.40	0.25	0.55	0.27

Intersection Summary

Cycle Length: 90
Actuated Cycle Length: 90
Offset: 4 (4%), Referenced to phase 4:WBTL and 8:EBTL, Start of Green
Natural Cycle: 80
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.63
Intersection Signal Delay: 17.7 — Intersection LOS: B
Intersection Capacity Utilization 78.7% — ICU Level of Service D
Analysis Period (min) 15
\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 2: Young Street & Kempt

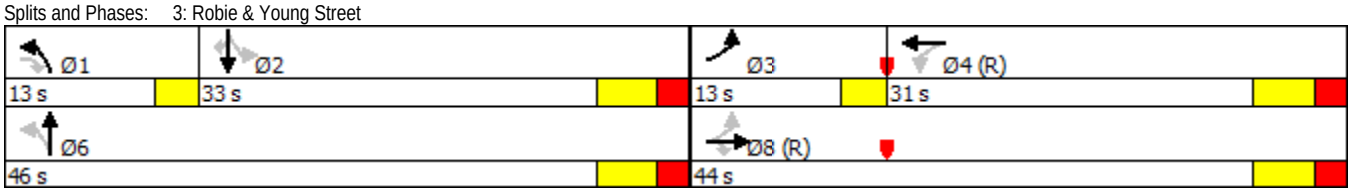


Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	SBL	SBT	SBR
Lane Configurations										
Traffic Volume (vph)	160	325	200	15	340	165	850	35	416	75
Future Volume (vph)	160	325	200	15	340	165	850	35	416	75
Lane Group Flow (vph)	183	371	228	17	456	188	956	40	475	86
Turn Type	pm+pt	NA	custom	Perm	NA	pm+pt	NA	Perm	NA	Perm
Protected Phases	3	8			4	1	6		2	
Permitted Phases	8		1 8	4		6		2		2
Detector Phase	3	8	1 8	4	4	1	6	2	2	2
Switch Phase										
Minimum Initial (s)	8.0	10.0		10.0	10.0	7.0	10.0	10.0	10.0	10.0
Minimum Split (s)	13.0	27.4		27.4	27.4	11.0	29.4	29.4	29.4	29.4
Total Split (s)	13.0	44.0		31.0	31.0	13.0	46.0	33.0	33.0	33.0
Total Split (%)	14.4%	48.9%		34.4%	34.4%	14.4%	51.1%	36.7%	36.7%	36.7%
Yellow Time (s)	3.0	4.1		4.1	4.1	3.0	4.1	4.1	4.1	4.1
All-Red Time (s)	0.0	2.3		2.3	2.3	0.0	2.3	2.3	2.3	2.3
Lost Time Adjust (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	3.0	6.4		6.4	6.4	3.0	6.4	6.4	6.4	6.4
Lead/Lag	Lead			Lag	Lag					
Lead-Lag Optimize?										
Recall Mode	None	C-Min		C-Min	C-Min	None	Min	Min	Min	Min
Act Effct Green (s)	42.0	38.6	54.5	26.0	26.0	42.0	38.6	26.1	26.1	26.1
Actuated g/C Ratio	0.47	0.43	0.61	0.29	0.29	0.47	0.43	0.29	0.29	0.29
v/c Ratio	0.64	0.48	0.25	0.06	0.90	0.66	0.65	0.28	0.94	0.17
Control Delay	29.2	17.7	4.6	25.2	54.5	25.9	22.7	30.7	60.2	3.4
Queue Delay	0.1	2.1	0.5	0.0	1.6	0.0	0.0	0.0	0.0	0.0
Total Delay	29.4	19.8	5.1	25.2	56.1	25.9	22.7	30.7	60.2	3.4
LOS	C	B	A	C	E	C	C	C	E	A
Approach Delay		17.8			54.9		23.2		50.1	
Approach LOS		B			D		C		D	
Queue Length 50th (m)	15.8	35.6	3.7	2.2	75.9	18.3	65.3	5.3	79.1	0.0
Queue Length 95th (m)	#40.0	54.6	16.2	7.2	#134.3	#32.2	85.3	14.3	#135.9	6.3
Internal Link Dist (m)		50.7			218.5		360.9		255.1	
Turn Bay Length (m)	25.0			15.0		140.0		70.0		60.0
Base Capacity (vph)	289	766	931	267	506	294	1505	145	517	515
Starvation Cap Reductn	3	257	380	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	10	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.64	0.73	0.41	0.06	0.92	0.64	0.64	0.28	0.92	0.17

Intersection Summary

Cycle Length: 90
Actuated Cycle Length: 90
Offset: 0 (0%), Referenced to phase 4:WBTL and 8:EBTL, Start of Green, Master Intersection
Natural Cycle: 85
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.94
Intersection Signal Delay: 32.2 — Intersection LOS: C
Intersection Capacity Utilization 85.7% — ICU Level of Service E
Analysis Period (min) 15
\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 3: Robie & Young Street

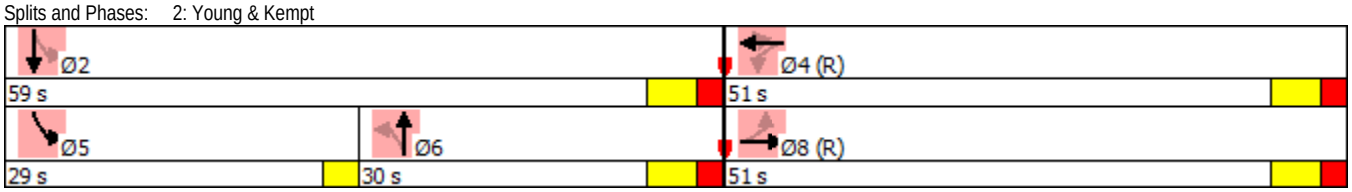


Lane Group	EBL	EBT	WBL	WBT	WBR	NBL2	NBT	SBL	SBT
Lane Configurations									
Traffic Volume (vph)	35	450	45	299	6	60	55	125	70
Future Volume (vph)	35	450	45	299	6	60	55	125	70
Lane Group Flow (vph)	40	577	51	341	87	68	114	143	148
Turn Type	Perm	NA	Perm	NA	Perm	Perm	NA	pm+pt	NA
Protected Phases		8		4			6	5	2
Permitted Phases	8		4		4	6		2	
Detector Phase	8	8	4	4	4	6	6	5	2
Switch Phase									
Minimum Initial (s)	10.0	10.0	10.0	10.0	10.0	10.0	10.0	8.0	10.0
Minimum Split (s)	27.4	27.4	27.4	27.4	27.4	29.4	29.4	13.0	29.4
Total Split (s)	51.0	51.0	51.0	51.0	51.0	30.0	30.0	29.0	59.0
Total Split (%)	46.4%	46.4%	46.4%	46.4%	46.4%	27.3%	27.3%	26.4%	53.6%
Yellow Time (s)	4.1	4.1	4.1	4.1	4.1	4.1	4.1	3.0	4.1
All-Red Time (s)	2.3	2.3	2.3	2.3	2.3	2.3	2.3	0.0	2.3
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.4	6.4	6.4	6.4	6.4	6.4	6.4	3.0	6.4
Lead/Lag						Lag	Lag	Lead	
Lead-Lag Optimize?									
Recall Mode	C-Min	C-Min	C-Min	C-Min	C-Min	Min	Min	None	Min
Act Effct Green (s)	67.1	67.1	67.1	67.1	67.1	12.8	12.8	33.5	30.1
Actuated g/C Ratio	0.61	0.61	0.61	0.61	0.61	0.12	0.12	0.30	0.27
v/c Ratio	0.08	0.30	0.12	0.32	0.10	0.52	0.52	0.39	0.35
Control Delay	20.8	22.1	14.3	15.8	5.9	59.1	39.9	30.7	32.7
Queue Delay	0.0	0.1	0.0	3.7	0.0	0.0	0.3	0.1	0.0
Total Delay	20.8	22.2	14.3	19.6	5.9	59.1	40.3	30.8	32.7
LOS	C	C	B	B	A	E	D	C	C
Approach Delay		22.1		16.5			47.3		31.8
Approach LOS		C		B			D		C
Queue Length 50th (m)	6.4	54.5	5.8	40.5	1.9	14.1	16.4	23.6	25.8
Queue Length 95th (m)	m9.9	m62.3	m5.2	m29.6	m0.1	27.0	32.4	34.0	37.3
Internal Link Dist (m)		97.3		50.7			38.9		145.1
Turn Bay Length (m)	45.0		12.0					30.0	
Base Capacity (vph)	489	1896	442	1070	833	243	375	448	750
Starvation Cap Reductn	0	0	0	628	0	0	0	0	0
Spillback Cap Reductn	0	443	0	0	0	0	56	22	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.08	0.40	0.12	0.77	0.10	0.28	0.36	0.34	0.20

Intersection Summary

Cycle Length: 110
Actuated Cycle Length: 110
Offset: 16 (15%), Referenced to phase 4:WBTL and 8:EBTL, Start of Green
Natural Cycle: 70
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.52
Intersection Signal Delay: 25.1 Intersection LOS: C
Intersection Capacity Utilization 68.6% ICU Level of Service C
Analysis Period (min) 15
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 2: Young & Kempt



Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	SBL	SBT	SBR
Lane Configurations										
Traffic Volume (vph)	100	405	115	20	260	80	495	60	731	80
Future Volume (vph)	100	405	115	20	260	80	495	60	731	80
Lane Group Flow (vph)	114	462	131	23	320	91	588	68	808	91
Turn Type	pm+pt	NA	Perm	Perm	NA	pm+pt	NA	Perm	NA	Perm
Protected Phases	3	8			4	1	6		2	
Permitted Phases	8		8	4		6		2		2
Detector Phase	3	8	8	4	4	1	6	2	2	2
Switch Phase										
Minimum Initial (s)	8.0	10.0	10.0	10.0	10.0	8.0	10.0	10.0	10.0	10.0
Minimum Split (s)	13.0	27.4	27.4	27.4	27.4	13.0	29.4	29.4	29.4	29.4
Total Split (s)	17.6	45.0	45.0	27.4	27.4	13.0	65.0	52.0	52.0	52.0
Total Split (%)	16.0%	40.9%	40.9%	24.9%	24.9%	11.8%	59.1%	47.3%	47.3%	47.3%
Yellow Time (s)	3.0	4.1	4.1	4.1	4.1	4.0	4.1	4.1	4.1	4.1
All-Red Time (s)	0.0	2.3	2.3	2.3	2.3	1.0	2.3	2.3	2.3	2.3
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	3.0	6.4	6.4	6.4	6.4	5.0	6.4	6.4	6.4	6.4
Lead/Lag	Lead			Lag	Lag					
Lead-Lag Optimize?										
Recall Mode	C-Max	C-Min	C-Min	Min	Min	None	Min	Min	Min	Min
Act Effct Green (s)	42.0	38.6	38.6	21.0	21.0	60.0	58.6	48.2	48.2	48.2
Actuated g/C Ratio	0.38	0.35	0.35	0.19	0.19	0.55	0.53	0.44	0.44	0.44
v/c Ratio	0.39	0.75	0.23	0.16	0.96	0.49	0.33	0.22	1.08	0.13
Control Delay	29.8	47.0	9.0	40.4	84.3	23.6	15.0	23.1	87.3	2.7
Queue Delay	0.4	13.6	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	30.2	60.7	9.6	40.4	84.3	23.6	15.0	23.1	87.3	2.7
LOS	C	E	A	D	F	C	B	C	F	A
Approach Delay		46.3			81.4		16.2		74.8	
Approach LOS		D			F		B		E	
Queue Length 50th (m)	24.2	104.4	12.6	4.2	68.0	9.0	35.5	9.3	~202.8	0.0
Queue Length 95th (m)	29.0	138.0	5.6	11.6	#121.9	20.4	47.0	19.8	#274.5	6.4
Internal Link Dist (m)		50.7			218.5		360.9		359.6	
Turn Bay Length (m)	25.0					140.0		70.0		60.0
Base Capacity (vph)	291	615	562	145	334	185	1783	315	750	705
Starvation Cap Reductn	27	138	217	0	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	0.43	0.97	0.38	0.16	0.96	0.49	0.33	0.22	1.08	0.13

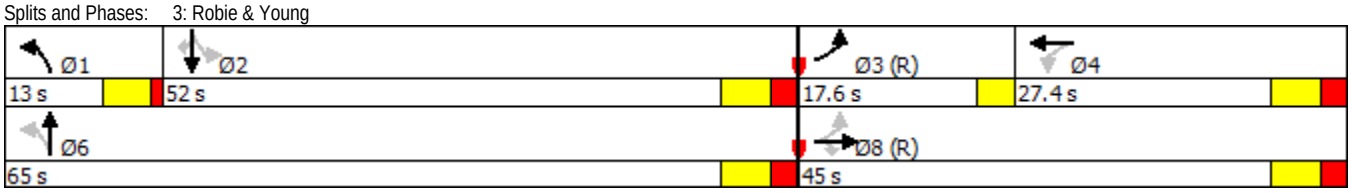
Intersection Summary

Cycle Length: 110
Actuated Cycle Length: 110
Offset: 108 (98%), Referenced to phase 3:EBL and 8:EBTL, Start of Green
Natural Cycle: 115
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 1.08
Intersection Signal Delay: 53.4 — Intersection LOS: D
Intersection Capacity Utilization 97.9% — 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.

Splits and Phases: 3: Robie & Young

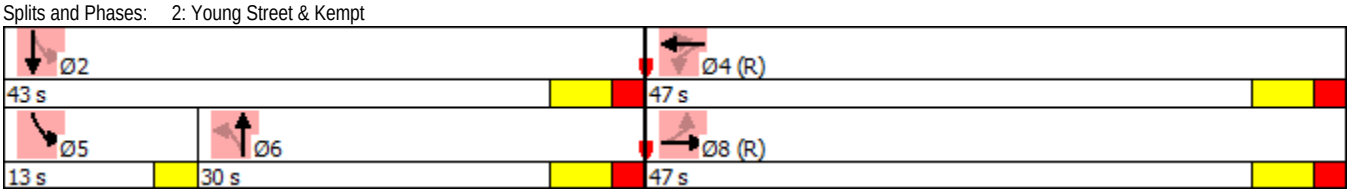


Lane Group	EBL	EBT	WBL	WBT	WBR	NBL2	NBT	SBL	SBT
Lane Configurations									
Traffic Volume (vph)	160	450	20	432	13	105	65	210	60
Future Volume (vph)	160	450	20	432	13	105	65	210	60
Lane Group Flow (vph)	183	742	23	493	146	120	103	240	171
Turn Type	Perm	NA	Perm	NA	Perm	Perm	NA	pm+pt	NA
Protected Phases		8		4			6	5	2
Permitted Phases	8		4		4	6		2	
Detector Phase	8	8	4	4	4	6	6	5	2
Switch Phase									
Minimum Initial (s)	10.0	10.0	10.0	10.0	10.0	10.0	10.0	8.0	10.0
Minimum Split (s)	27.4	27.4	27.4	27.4	27.4	29.4	29.4	13.0	29.4
Total Split (s)	47.0	47.0	47.0	47.0	47.0	30.0	30.0	13.0	43.0
Total Split (%)	52.2%	52.2%	52.2%	52.2%	52.2%	33.3%	33.3%	14.4%	47.8%
Yellow Time (s)	4.1	4.1	4.1	4.1	4.1	4.1	4.1	3.0	4.1
All-Red Time (s)	2.3	2.3	2.3	2.3	2.3	2.3	2.3	0.0	2.3
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.4	6.4	6.4	6.4	6.4	6.4	6.4	3.0	6.4
Lead/Lag						Lag	Lag	Lead	
Lead-Lag Optimize?									
Recall Mode	C-Min	C-Min	C-Min	C-Min	C-Min	Min	Min	None	Min
Act Effct Green (s)	46.9	46.9	46.9	46.9	46.9	15.2	15.2	33.7	30.3
Actuated g/C Ratio	0.52	0.52	0.52	0.52	0.52	0.17	0.17	0.37	0.34
v/c Ratio	0.59	0.46	0.08	0.53	0.20	0.63	0.33	0.52	0.33
Control Delay	26.3	13.2	7.1	9.5	0.9	48.6	27.5	24.3	23.4
Queue Delay	0.0	0.0	0.0	2.5	0.5	0.0	0.1	0.3	0.0
Total Delay	26.3	13.2	7.1	12.0	1.5	48.6	27.6	24.6	23.4
LOS	C	B	A	B	A	D	C	C	C
Approach Delay		15.8		9.5			38.9		24.1
Approach LOS		B		A			D		C
Queue Length 50th (m)	22.0	36.2	1.1	23.9	0.0	19.6	12.6	28.5	20.9
Queue Length 95th (m)	#54.9	53.4	m1.3	m25.6	m0.0	34.1	24.4	44.7	35.0
Internal Link Dist (m)		97.3		50.7			38.9		145.1
Turn Bay Length (m)	45.0		12.0					30.0	
Base Capacity (vph)	309	1619	301	939	717	297	469	466	630
Starvation Cap Reductn	0	0	0	316	307	0	0	0	0
Spillback Cap Reductn	0	3	0	0	0	0	56	32	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.59	0.46	0.08	0.79	0.36	0.40	0.25	0.55	0.27

Intersection Summary

Cycle Length: 90
Actuated Cycle Length: 90
Offset: 4 (4%), Referenced to phase 4:WBTL and 8:EBTL, Start of Green
Natural Cycle: 80
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.63
Intersection Signal Delay: 17.8 — Intersection LOS: B
Intersection Capacity Utilization 78.7% — ICU Level of Service D
Analysis Period (min) 15
\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 2: Young Street & Kempt

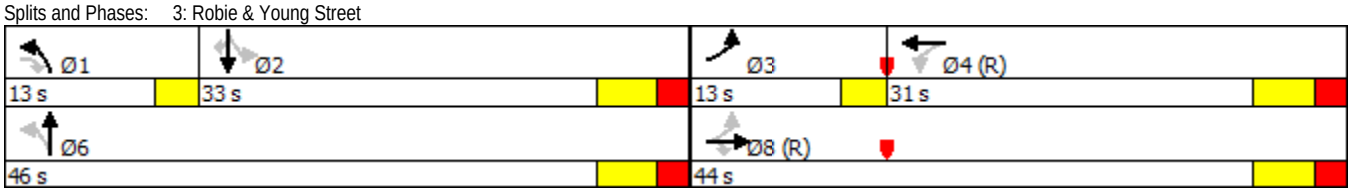


Lane Group	EBL	EBT	EBR	WBL	WBT	NBL	NBT	SBL	SBT	SBR
Lane Configurations										
Traffic Volume (vph)	160	325	200	15	340	165	850	35	416	75
Future Volume (vph)	160	325	200	15	340	165	850	35	416	75
Lane Group Flow (vph)	183	371	228	17	456	188	956	40	475	86
Turn Type	pm+pt	NA	custom	Perm	NA	pm+pt	NA	Perm	NA	Perm
Protected Phases	3	8			4	1	6		2	
Permitted Phases	8		1 8	4		6		2		2
Detector Phase	3	8	1 8	4	4	1	6	2	2	2
Switch Phase										
Minimum Initial (s)	8.0	10.0		10.0	10.0	7.0	10.0	10.0	10.0	10.0
Minimum Split (s)	13.0	27.4		27.4	27.4	11.0	29.4	29.4	29.4	29.4
Total Split (s)	13.0	44.0		31.0	31.0	13.0	46.0	33.0	33.0	33.0
Total Split (%)	14.4%	48.9%		34.4%	34.4%	14.4%	51.1%	36.7%	36.7%	36.7%
Yellow Time (s)	3.0	4.1		4.1	4.1	3.0	4.1	4.1	4.1	4.1
All-Red Time (s)	0.0	2.3		2.3	2.3	0.0	2.3	2.3	2.3	2.3
Lost Time Adjust (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	3.0	6.4		6.4	6.4	3.0	6.4	6.4	6.4	6.4
Lead/Lag	Lead			Lag	Lag					
Lead-Lag Optimize?										
Recall Mode	None	C-Min		C-Min	C-Min	None	Min	Min	Min	Min
Act Effct Green (s)	42.0	38.6	54.5	26.0	26.0	42.0	38.6	26.1	26.1	26.1
Actuated g/C Ratio	0.47	0.43	0.61	0.29	0.29	0.47	0.43	0.29	0.29	0.29
v/c Ratio	0.64	0.48	0.25	0.06	0.90	0.66	0.65	0.28	0.94	0.17
Control Delay	29.3	17.8	4.6	25.2	54.5	25.9	22.7	30.7	60.2	3.4
Queue Delay	0.2	2.2	0.5	0.0	1.7	0.0	0.0	0.0	0.0	0.0
Total Delay	29.5	19.9	5.1	25.2	56.2	25.9	22.7	30.7	60.2	3.4
LOS	C	B	A	C	E	C	C	C	E	A
Approach Delay		17.9			55.1		23.2		50.1	
Approach LOS		B			E		C		D	
Queue Length 50th (m)	15.7	35.4	3.7	2.2	75.9	18.3	65.3	5.3	79.1	0.0
Queue Length 95th (m)	#40.2	55.2	16.1	7.2	#134.3	#32.2	85.3	14.3	#135.9	6.3
Internal Link Dist (m)		50.7			218.5		360.9		255.1	
Turn Bay Length (m)	25.0			15.0		140.0		70.0		60.0
Base Capacity (vph)	289	766	931	267	506	294	1505	145	517	515
Starvation Cap Reductn	4	258	379	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	11	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.64	0.73	0.41	0.06	0.92	0.64	0.64	0.28	0.92	0.17

Intersection Summary

Cycle Length: 90
Actuated Cycle Length: 90
Offset: 0 (0%), Referenced to phase 4:WBTL and 8:EBTL, Start of Green, Master Intersection
Natural Cycle: 85
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.94
Intersection Signal Delay: 32.2 — Intersection LOS: C
Intersection Capacity Utilization 85.7% — ICU Level of Service E
Analysis Period (min) 15
\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 3: Robie & Young Street



Attachment A

APPENDIX

G ROBIE STREET INTERSECTION CAPACITY ANALYSIS

Attachment A

Attachment A

Table G-1 – Robie Street AM Peak Hour Intersection Analysis

Intersection		AM Peak Hour												
		Existing Conditions						Preferred Option						
		Scenario	Approach[1]	Delay	V/C	LOS	Queue	Option	Approach[1]	Delay	V/C	LOS	Queue
Robie Street @	Almon	Existing (Page G-3)	EB-L	45.2	0.68	D	57.8	Curbside Lanes both directions[2] (Page G-21)	EB-L	70.3	0.82	E	67.7
			EB-TR	45.3	0.80	D	112.8		EB-TR	56.7	0.84	E	115.3
			WB-LT	37.3	0.63	D	66.0		WB-LT	66.9	0.85	E	87.6
			WB-R	5.2	0.13	A	6.1		WB-R	9.0	0.14	A	9.0
			NB-LTR	14.0	0.46	B	45.0		NB-L	11.2	0.10	B	8.3
									NB-T	15.6	0.53	B	103.1
									NB-R	5.1	0.03	A	4.4
			SB-L	15.6	0.14	B	11.5		SB-L	7.6	0.10	A	1.1
			SB-T	35.7	0.86	D	173.2		SB-T	12.2	0.58	B	14.2
			SB-R	2.6	0.31	A	10.5		SB-R	5.2	0.25	A	18.4
	North	Existing (Page G-4)	EB-TR	47.8	0.89	D	118.0	Curbside Lanes both directions[2] (Page G-22)	EB-TR	42.8	0.85	D	99.8
			WB-TR	42.8	0.86	D	115.7		WB-TR	39.4	0.82	D	103.7
			NB-T	20.9	0.71	C	132.0		NB-T	32.9	0.60	C	116.9
									NB-Transit	10.3	0.01	B	3.6
			NB-R	2.9	0.18	A	8.4		NB-R	14.9	0.16	B	18.4
			SB-TR	26.5	0.77	C	159.8		SB-T	19.4	0.64	B	123.5
									SB-R	8.5	0.03	A	5.2
	Cunard	Existing (Page G-5)	EB-L	19.0	0.04	B	4.7	Curbside Lanes both directions[2] (Page G-23)	EB-L	13.4	0.03	B	3.8
			EB-TR	145.0	1.22	F	183.6		EB-TR	44.5	0.92	D	146.8
			WB-L	38.2	0.45	D	18.3		WB-L	18.4	0.23	B	12.2
			WB-T	23.2	0.35	C	39.6		WB-T	16.5	0.26	B	31.8
			WB-R	0.4	0.09	A	0.0		WB-R	4.0	0.08	A	4.9
			NB-L	56.1	0.55	E	23.8		NB-L	83.8	0.76	F	31.5
			NB-TR	24.8	0.51	C	56.2		NB-T	34.5	0.74	C	129.7
									NB-R	9.9	0.05	A	6.8
			SB-LTR	53.0	1.02	D	122.1		SB-L	34.0	0.45	C	22.7
									SB-T	67.9	1.03	E	207.2
									SB-R	9.1	0.04	A	4.2
	Quinpool	Existing (Page G-6)	EB-T	150.7	1.18	F	233.5	Curbside Lanes both directions[2] (Page G-24)	EB-T	110.2	1.05	F	219.0
			EB-R	41.9	0.79	D	183.0		EB-R	35.9	0.71	D	167.1
			EB-R2	70.7	1.01	E	144.7		EB-R2	55.8	0.95	E	135.6
			WB-TR	46.7	0.37	D	47.3		WB-TR	45.9	0.33	D	46.6
			NB-L	81.9	0.79	F	73.6		NB-L	47.7	0.73	D	52.5
			NB-TR	50.2	0.61	D	88.0		NB-T	49.8	0.51	D	77.3
									NB-R	43.8	0.21	D	25.6
			SB-L	193.6	1.28	F	163.0		SB-L	63.9	0.93	E	117.7
			SB-TR	120.9	1.13	F	201.6		SB-T	53.3	0.80	D	141.5
									SB-R	14.0	0.16	B	16.2
			NW-LR	74.3	0.84	E	85.9		NW-LR	66.5	0.75	E	78.2
	Jubilee	Existing (Page G-7)	EB-LTR	49.5	0.90	D	132.8	Curbside Lanes both directions[2] (Page G-25)	EB-LTR	50.5	0.86	D	140.4
			WB-LT	22.1	0.26	C	31.1		WB-LT	27.9	0.25	C	37.5
			WB-R	4.8	0.21	A	9.8		WB-R	5.4	0.20	A	11.2
			NB-L	35.8	0.38	D	18.6		NB-L	35.7	0.29	D	21.8
			NB-TR	30.3	0.64	C	85.7		NB-T	32.8	0.42	C	80.2
									NB-R	4.7	0.12	A	2.0
			SB-L	25.7	0.66	C	44.6		SB-L	19.6	0.53	B	43.1
			SB-T	22.9	0.69	C	109.8		SB-T	20.1	0.56	C	105.8
			SB-R	2.7	0.05	A	2.6		SB-R	6.9	0.06	A	7.3
	Spring Garden / Coburg	Existing (Page G-8)	EB-L	32.3	0.25	C	18.0	Curbside Lanes both directions[2] (Page G-26)	EB-L	54.2	0.44	D	22.5
			EB-TR	33.2	0.42	C	51.0		EB-T	52.3	0.60	D	62.0
			WB-LTR	23.1	0.52	C	33.8		WB-LTR	50.3	0.82	D	46.5
			NB-LT	20.5	0.58	C	42.5		NB-L	15.3	0.18	B	21.3
									NB-T	11.9	0.25	B	58.3
			NB-R	0.70	0.31	A	0.2		NB-R	1.6	0.05	A	1.7
			SB-LT	20.8	0.92	C	22.5		SB-L	10.9	0.41	B	65.7
									SB-T	23.8	0.69	C	242.7
			SB-R	0.20	0.08	A	0.00		SB-R	2.1	0.07	A	2.9
	University	Existing (Page G-9)	EB-L	31.2	0.17	C	13.3	Curbside Lanes both directions[2] (Page G-27)	EB-L	40.9	0.18	D	15.7
			EB-TR	36.2	0.53	D	52.6		EB-TR	47.3	0.56	D	62.8
			WB-L	31.5	0.17	C	13.4		WB-L	42.0	0.20	D	15.9
			WB-T	31.6	0.26	C	28.6		WB-T	41.3	0.27	D	34.1
			WB-R	9.9	0.37	A	13.6		WB-R	11.5	0.39	B	15.4
			NB-LT	20.3	0.36	C	25.5		NB-L	13.7	0.03	B	2.8
									NB-T	17.6	0.25	B	36.3
			NB-R	18.0	0.13	B	9.2		NB-R	2.2	0.08	A	2.1
			SB-L	10.7	0.69	B	18.4		SB-L	11.1	0.55	B	73.8
			SB-T	8.2	0.64	A	30.4		SB-T	10.3	0.51	B	102.4
			SB-R	3.0	0.09	A	1.0		SB-R	5.0	0.07	A	6.6
	South	Existing (Page G-10)	EB-LTR	34.3	0.76	C	101.5	Curbside Lanes both directions[2] (Page G-28)	EB-LTR	41.8	0.77	D	106.4
			WB-LTR	19.1	0.45	B	50.9		WB-LTR	24.9	0.45	C	55.9
			NB-LT	16.4	0.26	B	22.4		NB-L	32.1	0.10	C	14.2
									NB-T	34.2	0.41	C	83.8
			NB-R	3.6	0.08	A	3.0		NB-R	13.8	0.10	B	10.2
			SB-LT	25.0	0.63	C	48.6		SB-L	23.1	0.43	C	49.1
									SB-T	25.5	0.40	C	80.0
			SB-R	4.7	0.11	A	1.3		SB-R	0.2	0.07	A	0.0
	Inglis	Existing (Page G-11)	EB-LTR	40.9	0.77	D	83.4	Curbside Lanes both directions[2] (Page G-29)	EB-LTR	33.8	0.70	C	75.2
			WB-LR	59.8	0.88	E	75.6		WB-LR	44.2	0.79	D	67.0
			WB-R	5.3	0.38	A	12.8		WB-R	4.9	0.35	A	12.6
			NB-L	12.9	0.02	B	4.2		NB-L	11.3	0.02	B	3.7
			NB-TR	7.5	0.14	A	13.9		NB-TR	6.6	0.16	A	12.4
			SB-L	10.7	0.48	B	12.3		SB-L	16.2	0.43	B	49.1
			SB-T	4.6	0.15	A	6.3		SB-T	11.5	0.14	B	21.4
			SB-R	0.1	0.04	A	0.0		SB-R	1.7	0.03	A	1.9

Notes:

1. Robie Street is north/south for the full corridor
2. See Appendix A for modifcation option.

Attachment A

Table G-2 – Robie Street PM Peak Hour Intersection Analysis

Intersection		PM Peak Hour											
		Existing Conditions						Preferred Option					
		Scenario	Approach[1]	Delay	V/C	LOS	Queue	Option	Approach[1]	Delay	V/C	LOS	Queue
Robie Street @	Almon	Existing (Page G-12)	EB-L	43.3	0.80	D	68.5	Curbside Lanes both directions[2] (Page G-30)	EB-L	76.9	0.95	E	87.7
			EB-TR	18.4	0.36	B	55.7		EB-TR	27.8	0.42	C	72.1
			WB-LT	63.0	0.96	E	169.3		WB-LT	75.5	0.97	E	198.1
			WB-R	9.4	0.27	A	18.1		WB-R	18.7	0.33	B	29.1
			NB-LTR	34.2	0.84	C	101.3		NB-L	15.6	0.09	B	9.6
									NB-T	50.8	0.96	D	269.1
									NB-R	9.9	0.03	A	6.1
			SB-L	26.4	0.17	C	9.2		SB-L	17.4	0.33	B	1.9
			SB-T	37.1	0.72	D	99.3		SB-T	7.0	0.46	A	26.0
			SB-R	4.5	0.27	A	12.0		SB-R	5.9	0.36	A	18.8
	North	Existing (Page G-13)	EB-TR	36.5	0.75	D	95.4	Curbside Lanes both directions[2] (Page G-31)	EB-TR	36.5	0.75	D	95.4
			WB-TR	50.1	0.91	D	139.1		WB-TR	50.1	0.91	D	139.1
			NB-T	13.9	0.79	B	179.2		NB-T	23.0	0.77	C	150.8
									NB-Transit	9.8	0.02	A	3.9
			NB-R	48.3	0.98	D	124.9		NB-R	54.9	0.98	D	121.9
			SB-TR	17.9	0.64	B	110.6		SB-T	16.7	0.59	B	98.3
									SB-R	6.8	0.10	A	10.2
	Cunard	Existing (Page G-14)	EB-L	25.4	0.21	C	9.1	Curbside Lanes both directions[2] (Page G-32)	EB-L	47.0	0.35	D	12.8
			EB-TR	35.8	0.77	D	103.6		EB-TR	43.5	0.71	D	102.2
			WB-L	25.5	0.32	C	20.6		WB-L	34.7	0.34	C	26.3
			WB-T	38.3	0.82	D	135.4		WB-T	58.6	0.91	E	175.7
			WB-R	2.8	0.15	A	5.7		WB-R	12.7	0.18	B	16.1
			NB-L	50.6	0.44	D	21.4		NB-L	12.8	0.18	B	11.8
			NB-TR	29.4	0.74	C	98.9		NB-T	31.1	0.83	C	239.8
									NB-R	4.6	0.10	A	8.9
			SB-LTR	39.7	0.92	D	108.6		SB-L	37.0	0.45	D	27.5
									SB-T	30.5	0.69	C	164.0
									SB-R	6.9	0.09	A	10.0
	Quinpool	Existing (Page G-15)	EB-T	72.7	0.72	E	103.1	Curbside Lanes both directions[2] (Page G-33)	EB-T	66.1	0.68	E	98.6
			EB-R	26.0	0.43	C	89.8		EB-R	22.9	0.41	C	82.6
			EB-R2	8.6	0.34	A	19.0		EB-R2	13.7	0.46	B	24.6
			WB-TR	130.1	1.13	F	173.1		WB-TR	93.4	1.00	F	149.2
			NB-L	132.2	1.08	F	132.1		NB-L	80.9	0.97	F	107.9
			NB-TR	103.9	1.07	F	212.7		NB-T	89.6	1.02	F	183.5
									NB-R	47.9	0.28	D	37.8
			SB-L	132.2	1.05	F	122.7		SB-L	120.3	1.08	F	118.5
			SB-TR	61.9	0.83	E	132.4		SB-T	60.5	0.79	E	114.0
									SB-R	16.0	0.24	A	19.6
			NW-LR	99.5	1.06	F	204.1		NW-LR	87.8	1.02	F	193.6
	Jubilee	Existing (Page G-16)	EB-LTR	62.8	0.91	E	82.0	Curbside Lanes both directions[2] (Page G-34)	EB-LTR	30.1	0.53	C	74.9
			WB-LT	35.8	0.73	D	88.9		WB-LT	29.5	0.54	C	105.0
			WB-R	6.0	0.27	A	12.4		WB-R	9.7	0.23	A	20.1
			NB-L	5.2	0.51	A	9.9		NB-L	32.8	0.64	C	42.3
			NB-TR	14.8	0.66	B	74.3		NB-T	24.7	0.68	C	51.7
									NB-R	19.2	0.20	A	17.3
			SB-L	14.6	0.41	B	18.4		SB-L	24.7	0.50	C	24.6
			SB-T	23.6	0.54	C	71.7		SB-T	34.9	0.61	C	84.5
			SB-R	0.3	0.08	A	0.0		SB-R	8.8	0.09	A	9.7
	Spring Garden / Coburg	Existing (Page G-17)	EB-L	33.5	0.39	C	20.8	Curbside Lanes both directions[2] (Page G-35)	EB-L	45.3	0.47	D	24.8
			EB-T	25.3	0.27	C	35.4		EB-T	32.8	0.29	C	41.1
			WB-LTR	29.0	0.73	C	60.8		WB-LTR	42.5	0.80	D	76.5
			NB-LT	78.6	1.11	E	142.2		NB-L	14.2	0.38	B	33.6
									NB-T	24.7	0.54	C	99.1
			NB-R	0.3	0.08	A	0.0		NB-R	7.4	0.09	A	8.0
			SB-LT	6.9	0.57	A	18.3		SB-L	38.9	0.40	D	41.6
									SB-T	57.2	0.56	E	100.2
			SB-R	0.1	0.05	A	0.00		SB-R	3.7	0.07	A	4.5
	University	Existing (Page G-18)	EB-L	26.9	0.21	C	15.9	Curbside Lanes both directions[2] (Page G-36)	EB-L	38.5	0.27	D	19.7
			EB-TR	24.9	0.30	C	31.6		EB-TR	35.4	0.36	D	39.8
			WB-L	24.5	0.09	C	10.1		WB-L	34.0	0.12	C	12.5
			WB-T	27.9	0.35	C	39.3		WB-T	39.2	0.42	D	49.1
			WB-R	10.9	0.60	B	24.4		WB-R	12.4	0.64	B	25.1
			NB-LT	22.1	0.69	C	51.8		NB-L	11.8	0.07	B	7.0
									NB-T	14.3	0.49	B	52.2
			NB-R	13.5	0.08	B	5.5		NB-R	14.0	0.07	B	11.3
			SB-L	16.6	0.42	B	29.2		SB-L	9.2	0.35	A	19.4
			SB-T	16.6	0.36	B	56.0		SB-T	10.3	0.31	B	43.3
			SB-R	9.9	0.08	A	6.9		SB-R	8.2	0.08	A	9.7
	South	Existing (Page G-19)	EB-LTR	16.9	0.51	B	48.80	Curbside Lanes both directions[2] (Page G-37)	EB-LTR	25.1	0.58	C	71.6
			WB-LTR	24.8	0.81	C	118.80		WB-LT	38.0	0.88	D	178.1
			NB-LT	25.6	0.45	C	41.50		NB-L	23.8	0.18	C	16.3
									NB-T	28.9	0.54	C	93.1
			NB-R	1.8	0.04	A	0.20		NB-R	8.4	0.04	A	4.9
			SB-LT	23.3	0.47	C	34.30		SB-L	26.9	0.42	C	35.8
									SB-T	23.9	0.48	C	78.4
			SB-R	6.9	0.14	A	4.10		SB-R	1.4	0.10	A	0.0
	Inglis	Existing (Page G-20)	EB-LTR	24.4	0.52	C	56.7	Curbside Lanes both directions[2] (Page G-38)	EB-LTR	10.3	0.31	B	44.2
			WB-LR	41.2	0.83	D	87.0		WB-LR	12.9	0.47	B	64.9
			WB-R	4.1	0.44	A	13.7		WB-R	1.3	0.28	A	7.3
			NB-LTR	9.8	0.20	A	17.8		NB-LTR	30.2	0.62	C	26.1
			SB-L	9.1	0.45	A	12.2		SB-L	39.3	0.70	D	43.4
			SB-T	5.4	0.10	A	5.7		SB-T	26.5	0.20	C	20.7
			SB-R	0.1	0.03	A	0.0		SB-R	1.4	0.05	A	1.1

Notes:

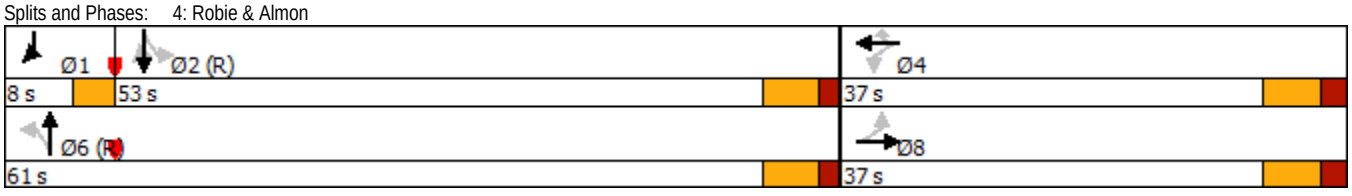
1. Robie Street is north/south for the full corridor
2. See Appendix A for modifcation option.

Lane Group	EBL	EBT	WBL2	WBT	WBR	NBL	NBT	SBL	SBT	SBR
Lane Configurations										
Traffic Volume (vph)	150	290	20	195	45	30	465	40	573	12
Future Volume (vph)	150	290	20	195	45	30	465	40	573	12
Lane Group Flow (vph)	171	388	0	246	51	0	582	46	654	248
Turn Type	Perm	NA	Perm	NA	Perm	Perm	NA	Perm	NA	custom
Protected Phases		8		4			6		2	1
Permitted Phases	8		4		4	6		2		2
Detector Phase	8	8	4	4	4	6	6	2	2	1
Switch Phase										
Minimum Initial (s)	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	5.0
Minimum Split (s)	37.0	37.0	37.0	37.0	37.0	53.0	53.0	53.0	53.0	8.0
Total Split (s)	37.0	37.0	37.0	37.0	37.0	61.0	61.0	53.0	53.0	8.0
Total Split (%)	37.8%	37.8%	37.8%	37.8%	37.8%	62.2%	62.2%	54.1%	54.1%	8.2%
Yellow Time (s)	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	3.0
All-Red Time (s)	2.1	2.1	2.1	2.1	2.1	1.7	1.7	1.7	1.7	0.0
Lost Time Adjust (s)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0
Total Lost Time (s)	6.2	6.2		6.2	6.2		5.8	5.8	5.8	3.0
Lead/Lag								Lag	Lag	Lead
Lead-Lag Optimize?										
Recall Mode	Max	Max	Max	Max	Max	C-Max	C-Max	C-Max	C-Max	Min
Act Effct Green (s)	30.8	30.8		30.8	30.8		55.2	47.2	47.2	55.0
Actuated g/C Ratio	0.31	0.31		0.31	0.31		0.56	0.48	0.48	0.56
v/c Ratio	0.68	0.80		0.63	0.13		0.46	0.14	0.86	0.31
Control Delay	45.2	45.3		37.3	5.2		14.0	15.6	35.7	2.6
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0
Total Delay	45.2	45.3		37.3	5.2		14.0	15.6	35.7	2.6
LOS	D	D		D	A		B	B	D	A
Approach Delay		45.3		31.8			14.0		26.0	
Approach LOS		D		C			B		C	
Queue Length 50th (m)	28.1	67.1		39.6	0.0		31.8	4.7	105.3	1.0
Queue Length 95th (m)	#57.8	#112.8		66.0	6.1		45.0	11.5	#173.2	10.5
Internal Link Dist (m)		208.6		311.8			93.8		360.9	
Turn Bay Length (m)	80.0				50.0			180.0		
Base Capacity (vph)	251	483		390	404		1260	327	763	809
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	0.68	0.80		0.63	0.13		0.46	0.14	0.86	0.31

Intersection Summary

Cycle Length: 98
Actuated Cycle Length: 98
Offset: 48 (49%), Referenced to phase 2:SBTL and 6:NBTL, Start of Green
Natural Cycle: 100
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.86
Intersection Signal Delay: 28.3 — Intersection LOS: C
Intersection Capacity Utilization 124.9% — 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: 4: Robie & Almon

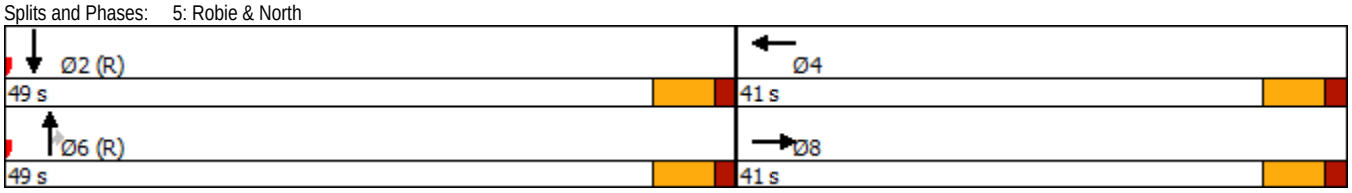


Lane Group	EBT	WBT	NBT	NBR	SBT
Lane Configurations					
Traffic Volume (vph)	375	420	470	110	565
Future Volume (vph)	375	420	470	110	565
Lane Group Flow (vph)	457	490	536	126	656
Turn Type	NA	NA	NA	Perm	NA
Protected Phases	8	4	6		2
Permitted Phases				6	
Detector Phase	8	4	6	6	2
Switch Phase					
Minimum Initial (s)	10.0	10.0	10.0	10.0	10.0
Minimum Split (s)	23.7	23.7	49.0	49.0	49.0
Total Split (s)	41.0	41.0	49.0	49.0	49.0
Total Split (%)	45.6%	45.6%	54.4%	54.4%	54.4%
Yellow Time (s)	4.1	4.1	4.1	4.1	4.1
All-Red Time (s)	1.6	1.6	1.5	1.5	1.5
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.7	5.7	5.6	5.6	5.6
Lead/Lag					
Lead-Lag Optimize?					
Recall Mode	Ped	Ped	C-Max	C-Max	C-Max
Act Effct Green (s)	31.7	31.7	47.0	47.0	47.0
Actuated g/C Ratio	0.35	0.35	0.52	0.52	0.52
v/c Ratio	0.89	0.86	0.71	0.18	0.77
Control Delay	47.8	42.8	20.9	2.9	26.5
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	47.8	42.8	20.9	2.9	26.5
LOS	D	D	C	A	C
Approach Delay	47.8	42.8	17.5		26.5
Approach LOS	D	D	B		C
Queue Length 50th (m)	69.9	74.1	96.6	2.6	91.1
Queue Length 95th (m)	#118.0	#115.7	#132.0	8.4	#159.8
Internal Link Dist (m)	492.1	538.5	386.8		285.2
Turn Bay Length (m)					
Base Capacity (vph)	571	633	756	686	847
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.80	0.77	0.71	0.18	0.77

Intersection Summary

Cycle Length: 90
Actuated Cycle Length: 90
Offset: 8 (9%), Referenced to phase 2:SBT and 6:NBT, Start of Green
Natural Cycle: 80
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.89
Intersection Signal Delay: 31.7 — Intersection LOS: C
Intersection Capacity Utilization 72.4% — ICU Level of Service C
Analysis Period (min) 15
\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 5: Robie & North



Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	SBL	SBT
Lane Configurations									
Traffic Volume (vph)	10	410	40	160	40	50	470	75	655
Future Volume (vph)	10	410	40	160	40	50	470	75	655
Lane Group Flow (vph)	11	571	46	183	46	57	559	0	845
Turn Type	Perm	NA	Perm	NA	Perm	Prot	NA	Perm	NA
Protected Phases		8		4		1	6		2
Permitted Phases	8		4		4			2	
Detector Phase	8	8	4	4	4	1	6	2	2
Switch Phase									
Minimum Initial (s)	10.0	10.0	10.0	10.0	10.0	7.0	10.0	10.0	10.0
Minimum Split (s)	39.1	39.1	39.1	39.1	39.1	12.0	38.0	38.0	38.0
Total Split (s)	40.0	40.0	40.0	40.0	40.0	12.0	38.0	38.0	38.0
Total Split (%)	44.4%	44.4%	44.4%	44.4%	44.4%	13.3%	42.2%	42.2%	42.2%
Yellow Time (s)	4.1	4.1	4.1	4.1	4.1	4.0	4.1	4.1	4.1
All-Red Time (s)	3.0	3.0	3.0	3.0	3.0	1.0	3.2	3.2	3.2
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0
Total Lost Time (s)	7.1	7.1	7.1	7.1	7.1	5.0	7.3		7.3
Lead/Lag									
Lead-Lag Optimize?									
Recall Mode	Ped	Ped	Ped	Ped	Ped	None	C-Max	C-Max	C-Max
Act Effct Green (s)	32.9	32.9	32.9	32.9	32.9	7.0	33.1		33.1
Actuated g/C Ratio	0.37	0.37	0.37	0.37	0.37	0.08	0.37		0.37
v/c Ratio	0.04	1.22	0.45	0.35	0.09	0.50	0.51		1.02
Control Delay	19.0	145.0	38.2	23.2	0.4	56.1	24.8		53.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0
Total Delay	19.0	145.0	38.2	23.2	0.4	56.1	24.8		53.0
LOS	B	F	D	C	A	E	C		D
Approach Delay		142.7		21.9			27.7		53.0
Approach LOS		F		C			C		D
Queue Length 50th (m)	1.2	~121.5	5.9	22.6	0.0	9.6	40.3		~88.5
Queue Length 95th (m)	4.7	#183.6	#18.3	39.6	0.0	#23.8	56.2		#122.1
Internal Link Dist (m)		72.7		213.1			124.0		35.4
Turn Bay Length (m)	50.0				50.0				
Base Capacity (vph)	297	468	103	521	489	113	1101		829
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	0.04	1.22	0.45	0.35	0.09	0.50	0.51		1.02

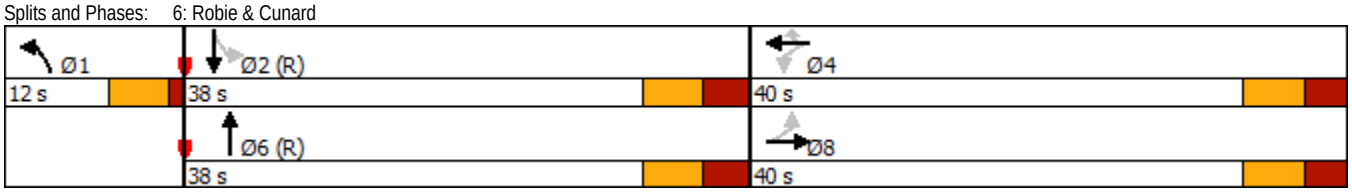
Intersection Summary

Cycle Length: 90
Actuated Cycle Length: 90
Offset: 55 (61%), Referenced to phase 2:SBTL and 6:NBT, Start of Green
Natural Cycle: 120
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 1.22
Intersection Signal Delay: 65.1 — Intersection LOS: E
Intersection Capacity Utilization 108.3% — ICU Level of Service G
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.

Splits and Phases: 6: Robie & Cunard

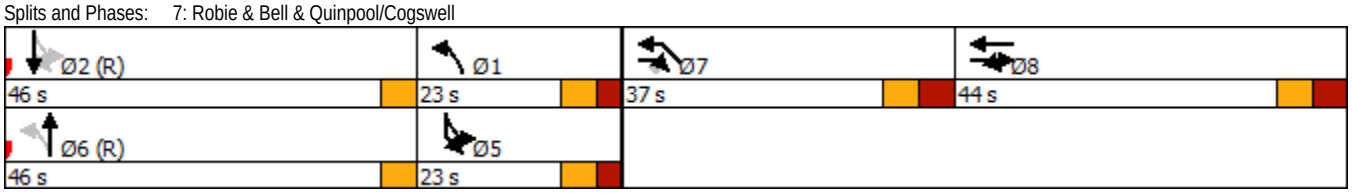


Lane Group	EBT	EBR	EBR2	WBT	NBL	NBT	SBL2	SBL	SBT	NWL
Lane Configurations										
Traffic Volume (vph)	410	470	400	205	150	405	68	240	730	245
Future Volume (vph)	410	470	400	205	150	405	68	240	730	245
Lane Group Flow (vph)	468	536	457	268	171	502	0	352	884	406
Turn Type	NA	pt+ov	custom	NA	pm+pt	NA	pm+pt	pm+pt	NA	Prot
Protected Phases	8	7 8		8	1	6	5	5	2	7
Permitted Phases			7		6		2	2		
Minimum Split (s)	36.0		37.0	36.0	14.0	33.0	14.0	14.0	46.0	37.0
Total Split (s)	44.0		37.0	44.0	23.0	46.0	23.0	23.0	46.0	37.0
Total Split (%)	29.3%		24.7%	29.3%	15.3%	30.7%	15.3%	15.3%	30.7%	24.7%
Yellow Time (s)	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	4.0		4.0	4.0	3.0	0.0	3.0	3.0	0.0	4.0
Lost Time Adjust (s)	-1.0		-1.0	-1.0	-1.0	-1.0		-1.0	-1.0	-1.0
Total Lost Time (s)	7.0		7.0	7.0	6.0	3.0		6.0	3.0	7.0
Lead/Lag	Lag		Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lead
Lead-Lag Optimize?										
Act Effct Green (s)	37.0	74.0	30.0	37.0	57.0	43.0		57.0	43.0	30.0
Actuated g/C Ratio	0.25	0.49	0.20	0.25	0.38	0.29		0.38	0.29	0.20
v/c Ratio	1.18	0.79	1.01	0.37	0.79	0.61		1.28	1.13	0.84
Control Delay	150.7	41.9	70.7	46.7	81.9	50.2		193.6	120.9	74.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Total Delay	150.7	41.9	70.7	46.7	81.9	50.2		193.6	120.9	74.3
LOS	F	D	E	D	F	D		F	F	E
Approach Delay	85.8			46.7		58.2			141.6	74.3
Approach LOS	F			D		E			F	E
Queue Length 50th (m)	~165.7	130.0	~73.3	33.6	37.2	68.3		~107.8	~159.4	60.6
Queue Length 95th (m)	#233.5	183.0	#144.7	47.3	#73.6	88.0		#163.0	#201.6	#85.9
Internal Link Dist (m)	1002.5			532.1		189.5			254.3	700.6
Turn Bay Length (m)		70.0	70.0							
Base Capacity (vph)	398	677	451	731	216	818		275	784	481
Starvation Cap Reductn	0	0	0	0	0	0		0	0	0
Spillback Cap Reductn	0	0	0	0	0	0		0	0	0
Storage Cap Reductn	0	0	0	0	0	0		0	0	0
Reduced v/c Ratio	1.18	0.79	1.01	0.37	0.79	0.61		1.28	1.13	0.84

Intersection Summary

Cycle Length: 150
Actuated Cycle Length: 150
Offset: 0 (0%), Referenced to phase 2:SBTL and 6:NBTL, Start of Green
Natural Cycle: 135
Control Type: Pretimed
Maximum v/c Ratio: 1.28
Intersection Signal Delay: 94.5
Intersection LOS: F
Intersection Capacity Utilization 114.2%
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.

Splits and Phases: 7: Robie & Bell & Quinpool/Cogswell

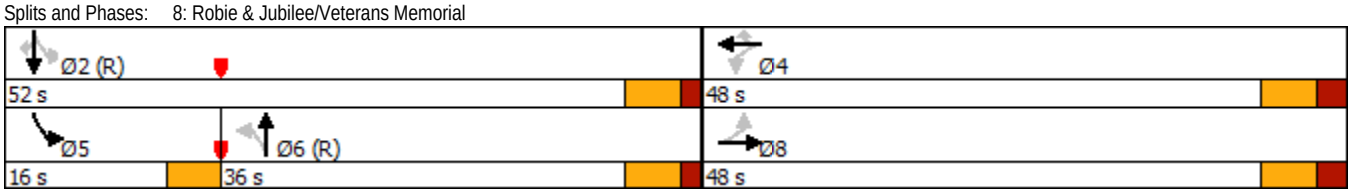


Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	SBL	SBT	SBR
Lane Configurations										
Traffic Volume (vph)	65	275	20	105	95	45	510	195	905	20
Future Volume (vph)	65	275	20	105	95	45	510	195	905	20
Lane Group Flow (vph)	0	485	0	143	108	51	639	223	1033	23
Turn Type	Perm	NA	Perm	NA	Perm	Perm	NA	pm+pt	NA	Perm
Protected Phases		8		4			6	5	2	
Permitted Phases	8		4		4	6		2		2
Detector Phase	8	8	4	4	4	6	6	5	2	2
Switch Phase										
Minimum Initial (s)	10.0	10.0	10.0	10.0	10.0	10.0	10.0	7.0	10.0	10.0
Minimum Split (s)	31.6	31.6	31.6	31.6	31.6	22.8	22.8	11.0	22.8	22.8
Total Split (s)	48.0	48.0	48.0	48.0	48.0	36.0	36.0	16.0	52.0	52.0
Total Split (%)	48.0%	48.0%	48.0%	48.0%	48.0%	36.0%	36.0%	16.0%	52.0%	52.0%
Yellow Time (s)	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.0	4.1	4.1
All-Red Time (s)	2.4	2.4	2.4	2.4	2.4	1.7	1.7	0.0	1.7	1.7
Lost Time Adjust (s)		0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)		6.5		6.5	6.5	5.8	5.8	4.0	5.8	5.8
Lead/Lag						Lag	Lag	Lead		
Lead-Lag Optimize?										
Recall Mode	Ped	Ped	Ped	Ped	Ped	C-Max	C-Max	None	C-Max	C-Max
Act Effct Green (s)		37.1		37.1	37.1	34.8	34.8	52.4	50.6	50.6
Actuated g/C Ratio		0.37		0.37	0.37	0.35	0.35	0.52	0.51	0.51
v/c Ratio		0.90		0.26	0.21	0.38	0.64	0.66	0.69	0.05
Control Delay		49.5		22.1	4.8	35.8	30.3	25.7	22.9	2.7
Queue Delay		0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay		49.5		22.1	4.8	35.8	30.3	25.7	22.9	2.7
LOS		D		C	A	D	C	C	C	A
Approach Delay		49.5		14.7			30.8		23.1	
Approach LOS		D		B			C		C	
Queue Length 50th (m)		81.3		18.2	0.0	8.9	67.1	24.6	81.4	0.0
Queue Length 95th (m)		#132.8		31.1	9.8	m18.6	85.7	#44.6	109.8	2.6
Internal Link Dist (m)		189.8		183.6			355.1		199.9	
Turn Bay Length (m)					40.0	50.0		90.0		60.0
Base Capacity (vph)		601		606	556	133	994	343	1493	467
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		0.81		0.24	0.19	0.38	0.64	0.65	0.69	0.05

Intersection Summary

Cycle Length: 100
Actuated Cycle Length: 100
Offset: 71 (71%), Referenced to phase 2:SBTL and 6:NBTL, Start of Green
Natural Cycle: 70
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.90
Intersection Signal Delay: 29.0 — Intersection LOS: C
Intersection Capacity Utilization 87.5% — ICU Level of Service E
Analysis Period (min) 15
\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 8: Robie & Jubilee/Veterans Memorial

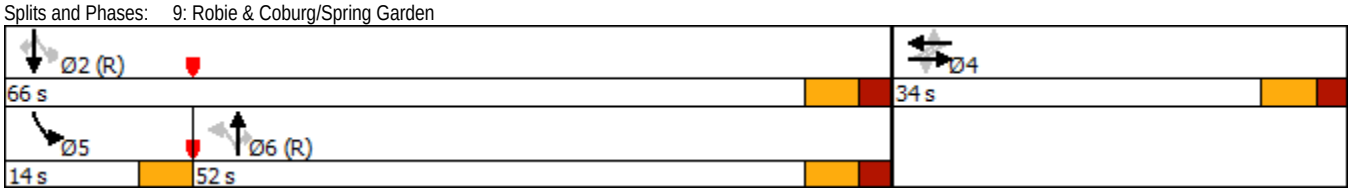


Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations										
Traffic Volume (vph)	45	170	45	150	50	420	25	215	750	50
Future Volume (vph)	45	170	45	150	50	420	25	215	750	50
Lane Group Flow (vph)	51	194	0	353	0	536	29	0	1101	57
Turn Type	Perm	NA	Perm	NA	Perm	NA	Perm	pm+pt	NA	Perm
Protected Phases		4		4		6		5	2	
Permitted Phases	4		4		6		6	2		2
Minimum Split (s)	34.0	34.0	34.0	34.0	34.5	34.5	34.5	13.0	34.5	34.5
Total Split (s)	34.0	34.0	34.0	34.0	52.0	52.0	52.0	14.0	66.0	66.0
Total Split (%)	34.0%	34.0%	34.0%	34.0%	52.0%	52.0%	52.0%	14.0%	66.0%	66.0%
Yellow Time (s)	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.0	4.1	4.1
All-Red Time (s)	2.4	2.4	2.4	2.4	2.4	2.4	2.4	0.0	2.4	2.4
Lost Time Adjust (s)	0.0	0.0		0.0		0.0	0.0		0.0	0.0
Total Lost Time (s)	6.5	6.5		6.5		6.5	6.5		6.5	6.5
Lead/Lag					Lag	Lag	Lag	Lead		
Lead-Lag Optimize?										
Act Effct Green (s)	27.5	27.5		27.5		45.5	45.5		59.5	59.5
Actuated g/C Ratio	0.28	0.28		0.28		0.46	0.46		0.60	0.60
v/c Ratio	0.25	0.42		0.52		0.58	0.07		0.92	0.08
Control Delay	32.3	33.2		23.1		20.5	0.7		20.8	0.2
Queue Delay	0.0	0.0		0.0		0.0	0.0		0.0	0.0
Total Delay	32.3	33.2		23.1		20.5	0.7		20.8	0.2
LOS	C	C		C		C	A		C	A
Approach Delay		33.0		23.1		19.5			19.8	
Approach LOS		C		C		B			B	
Queue Length 50th (m)	7.7	30.8		19.8		23.8	0.0		9.8	0.0
Queue Length 95th (m)	18.0	51.0		33.8		42.5	0.2		#22.5	m0.0
Internal Link Dist (m)		121.4		321.4		240.3			355.1	
Turn Bay Length (m)	30.0						30.0			70.0
Base Capacity (vph)	204	457		679		931	440		1196	714
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	0.25	0.42		0.52		0.58	0.07		0.92	0.08

Intersection Summary

Cycle Length: 100
Actuated Cycle Length: 100
Offset: 94 (94%), Referenced to phase 2:SBTL and 6:NBTL, Start of Green
Natural Cycle: 85
Control Type: Pretimed
Maximum v/c Ratio: 0.92
Intersection Signal Delay: 21.6 — Intersection LOS: C
Intersection Capacity Utilization 122.5% — 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.
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 9: Robie & Coburg/Spring Garden

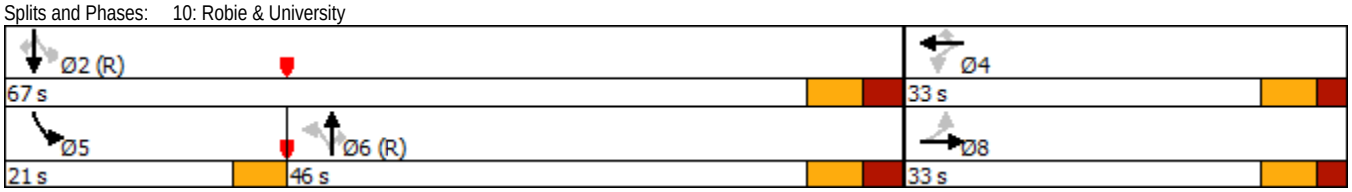


Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations											
Traffic Volume (vph)	30	145	30	85	95	10	310	40	345	455	50
Future Volume (vph)	30	145	30	85	95	10	310	40	345	455	50
Lane Group Flow (vph)	34	194	34	97	108	0	365	46	394	519	57
Turn Type	Perm	NA	Perm	NA	Perm	Perm	NA	Perm	pm+pt	NA	Perm
Protected Phases		8		4			6		5	2	
Permitted Phases	8		4		4	6		6	2		2
Detector Phase	8	8	4	4	4	6	6	6	5	2	2
Switch Phase											
Minimum Initial (s)	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	7.0	10.0	10.0
Minimum Split (s)	32.5	32.5	32.5	32.5	32.5	43.3	43.3	43.3	11.0	43.3	43.3
Total Split (s)	33.0	33.0	33.0	33.0	33.0	46.0	46.0	46.0	21.0	67.0	67.0
Total Split (%)	33.0%	33.0%	33.0%	33.0%	33.0%	46.0%	46.0%	46.0%	21.0%	67.0%	67.0%
Yellow Time (s)	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.0	4.1	4.1
All-Red Time (s)	2.4	2.4	2.4	2.4	2.4	3.2	3.2	3.2	0.0	3.2	3.2
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.5	6.5	6.5	6.5	6.5		7.3	7.3	4.0	7.3	7.3
Lead/Lag						Lag	Lag	Lag	Lead		
Lead-Lag Optimize?											
Recall Mode	Ped	Ped	Ped	Ped	Ped	C-Max	C-Max	C-Max	None	C-Max	C-Max
Act Effct Green (s)	26.0	26.0	26.0	26.0	26.0		40.2	40.2	63.5	60.2	60.2
Actuated g/C Ratio	0.26	0.26	0.26	0.26	0.26		0.40	0.40	0.64	0.60	0.60
v/c Ratio	0.17	0.53	0.17	0.26	0.37		0.36	0.13	0.69	0.64	0.09
Control Delay	31.2	36.2	31.5	31.6	9.9		20.3	18.0	10.7	8.2	3.0
Queue Delay	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0
Total Delay	31.2	36.2	31.5	31.6	9.9		20.3	18.0	10.7	8.2	3.0
LOS	C	D	C	C	A		C	B	B	A	A
Approach Delay		35.5		21.8			20.1			8.9	
Approach LOS		D		C			C			A	
Queue Length 50th (m)	5.1	30.7	5.1	14.9	0.0		31.6	7.1	10.5	20.0	0.1
Queue Length 95th (m)	13.3	52.6	13.4	28.6	13.6		25.5	m9.2	m18.3	m30.4	m1.0
Internal Link Dist (m)		178.0		171.4			167.5			240.3	
Turn Bay Length (m)	15.0		15.0		60.0			70.0			40.0
Base Capacity (vph)	210	376	203	385	295		1005	348	582	816	633
Starvation Cap Reductn	0	0	0	0	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	0.16	0.52	0.17	0.25	0.37		0.36	0.13	0.68	0.64	0.09

Intersection Summary

Cycle Length: 100
Actuated Cycle Length: 100
Offset: 7 (7%), Referenced to phase 2:SBTL and 6:NBTL, Start of Green
Natural Cycle: 90
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.69
Intersection Signal Delay: 16.3 — Intersection LOS: B
Intersection Capacity Utilization 106.8% — ICU Level of Service G
Analysis Period (min) 15
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 10: Robie & University

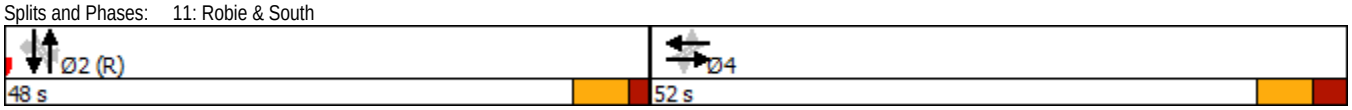


Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations										
Traffic Volume (vph)	50	290	10	135	25	225	30	175	275	40
Future Volume (vph)	50	290	10	135	25	225	30	175	275	40
Lane Group Flow (vph)	0	422	0	285	0	286	34	0	514	46
Turn Type	Perm	NA	Perm	NA	Perm	NA	Perm	Perm	NA	Perm
Protected Phases		4		4		2			2	
Permitted Phases	4		4		2		2	2		2
Detector Phase	4	4	4	4	2	2	2	2	2	2
Switch Phase										
Minimum Initial (s)	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Minimum Split (s)	47.8	47.8	47.8	47.8	24.7	24.7	24.7	24.7	24.7	24.7
Total Split (s)	52.0	52.0	52.0	52.0	48.0	48.0	48.0	48.0	48.0	48.0
Total Split (%)	52.0%	52.0%	52.0%	52.0%	48.0%	48.0%	48.0%	48.0%	48.0%	48.0%
Yellow Time (s)	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1
All-Red Time (s)	2.7	2.7	2.7	2.7	1.6	1.6	1.6	1.6	1.6	1.6
Lost Time Adjust (s)		0.0		0.0		0.0	0.0		0.0	0.0
Total Lost Time (s)		6.8		6.8		5.7	5.7		5.7	5.7
Lead/Lag										
Lead-Lag Optimize?										
Recall Mode	Ped	Ped	Ped	Ped	C-Min	C-Min	C-Min	C-Min	C-Min	C-Min
Act Effct Green (s)		42.5		42.5		45.0	45.0		45.0	45.0
Actuated g/C Ratio		0.42		0.42		0.45	0.45		0.45	0.45
v/c Ratio		0.76		0.45		0.26	0.08		0.63	0.11
Control Delay		34.3		19.1		16.4	3.6		25.0	4.7
Queue Delay		0.0		0.0		0.0	0.0		0.0	0.0
Total Delay		34.3		19.1		16.4	3.6		25.0	4.7
LOS		C		B		B	A		C	A
Approach Delay		34.3		19.1		15.1			23.3	
Approach LOS		C		B		B			C	
Queue Length 50th (m)		69.0		32.3		15.7	0.0		29.6	0.9
Queue Length 95th (m)		101.5		50.9		22.4	m3.0		48.6	m1.3
Internal Link Dist (m)		115.5		183.6		422.3			167.5	
Turn Bay Length (m)							100.0			50.0
Base Capacity (vph)		589		673		1098	415		813	431
Starvation Cap Reductn		0		0		0	0		0	0
Spillback Cap Reductn		0		0		0	0		0	0
Storage Cap Reductn		0		0		0	0		0	0
Reduced v/c Ratio		0.72		0.42		0.26	0.08		0.63	0.11

Intersection Summary

Cycle Length: 100
Actuated Cycle Length: 100
Offset: 0 (0%), Referenced to phase 2:NBSB and 6:, Start of Green
Natural Cycle: 80
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.76
Intersection Signal Delay: 23.8 Intersection LOS: C
Intersection Capacity Utilization 91.8% ICU Level of Service F
Analysis Period (min) 15
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 11: Robie & South

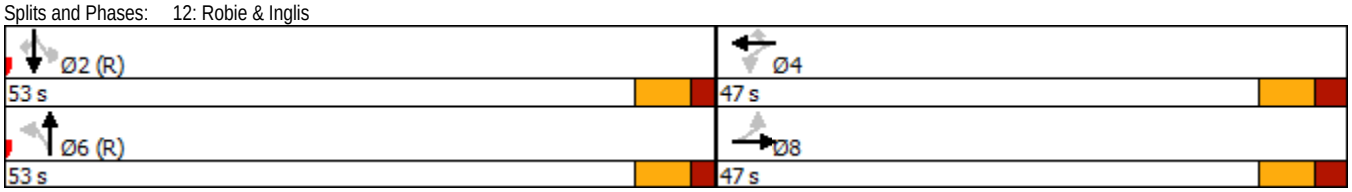


Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	SBL	SBT	SBR
Lane Configurations										
Traffic Volume (vph)	20	260	65	185	170	10	40	210	105	20
Future Volume (vph)	20	260	65	185	170	10	40	210	105	20
Lane Group Flow (vph)	0	371	0	285	194	11	97	240	120	23
Turn Type	Perm	NA	Perm	NA	Perm	Perm	NA	Perm	NA	Perm
Protected Phases		8		4			6		2	
Permitted Phases	8		4		4	6		2		2
Detector Phase	8	8	4	4	4	6	6	2	2	2
Switch Phase										
Minimum Initial (s)	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Minimum Split (s)	31.7	31.7	31.7	31.7	31.7	23.1	23.1	23.1	23.1	23.1
Total Split (s)	47.0	47.0	47.0	47.0	47.0	53.0	53.0	53.0	53.0	53.0
Total Split (%)	47.0%	47.0%	47.0%	47.0%	47.0%	53.0%	53.0%	53.0%	53.0%	53.0%
Yellow Time (s)	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1
All-Red Time (s)	2.6	2.6	2.6	2.6	2.6	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)		0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)		6.7		6.7	6.7	6.1	6.1	6.1	6.1	6.1
Lead/Lag										
Lead-Lag Optimize?										
Recall Mode	Ped	Ped	Ped	Ped	Ped	C-Min	C-Min	C-Min	C-Min	C-Min
Act Effct Green (s)		31.2		31.2	31.2	56.0	56.0	56.0	56.0	56.0
Actuated g/C Ratio		0.31		0.31	0.31	0.56	0.56	0.56	0.56	0.56
v/c Ratio		0.77		0.88	0.38	0.02	0.14	0.48	0.15	0.04
Control Delay		40.9		59.8	5.3	12.9	7.5	10.7	7.6	0.1
Queue Delay		0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay		40.9		59.8	5.3	12.9	7.5	10.7	7.6	0.1
LOS		D		E	A	B	A	B	A	A
Approach Delay		40.9		37.7			8.1		9.1	
Approach LOS		D		D			A		A	
Queue Length 50th (m)		63.7		52.6	0.0	0.9	3.8	15.5	7.3	0.0
Queue Length 95th (m)		83.4		75.6	12.8	4.2	13.9	m12.3	m6.3	m0.0
Internal Link Dist (m)		113.9		142.4			118.8		422.3	
Turn Bay Length (m)					50.0	20.0				20.0
Base Capacity (vph)		620		418	608	578	688	495	776	618
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		0.60		0.68	0.32	0.02	0.14	0.48	0.15	0.04

Intersection Summary

Cycle Length: 100
Actuated Cycle Length: 100
Offset: 28 (28%), Referenced to phase 2:SBTL and 6:NBTL, Start of Green
Natural Cycle: 60
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.88
Intersection Signal Delay: 28.0 Intersection LOS: C
Intersection Capacity Utilization 72.3% ICU Level of Service C
Analysis Period (min) 15
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 12: Robie & Inglis

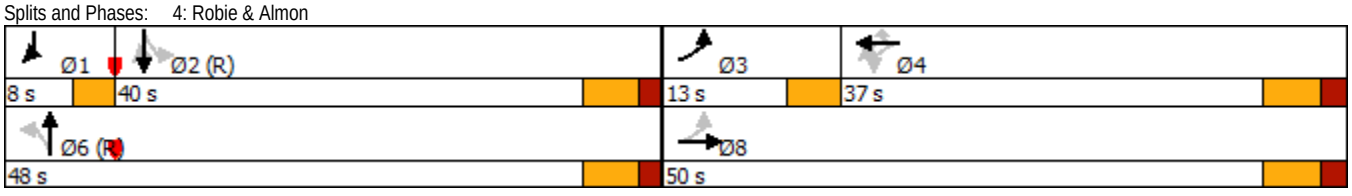


Lane Group	EBL	EBT	WBL2	WBT	WBR	NBL	NBT	SBL	SBT	SBR
Lane Configurations										
Traffic Volume (vph)	190	195	15	470	125	30	760	20	369	11
Future Volume (vph)	190	195	15	470	125	30	760	20	369	11
Lane Group Flow (vph)	217	291	0	553	143	0	912	23	421	161
Turn Type	pm+pt	NA	Perm	NA	Perm	Perm	NA	Perm	NA	custom
Protected Phases	3	8		4			6		2	1
Permitted Phases	8		4		4	6		2		2
Detector Phase	3	8	4	4	4	6	6	2	2	1
Switch Phase										
Minimum Initial (s)	7.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	4.0
Minimum Split (s)	11.0	50.0	37.0	37.0	37.0	40.0	40.0	40.0	40.0	8.0
Total Split (s)	13.0	50.0	37.0	37.0	37.0	48.0	48.0	40.0	40.0	8.0
Total Split (%)	13.3%	51.0%	37.8%	37.8%	37.8%	49.0%	49.0%	40.8%	40.8%	8.2%
Yellow Time (s)	4.0	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	3.0
All-Red Time (s)	0.0	2.1	2.1	2.1	2.1	1.7	1.7	1.7	1.7	0.0
Lost Time Adjust (s)	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	6.2		6.2	6.2		5.8	5.8	5.8	3.0
Lead/Lag	Lead		Lag	Lag	Lag			Lag	Lag	Lead
Lead-Lag Optimize?										
Recall Mode	None	None	None	None	None	C-Min	C-Min	C-Min	C-Min	None
Act Effct Green (s)	48.7	46.5		31.5	31.5		39.5	31.4	31.4	39.3
Actuated g/C Ratio	0.50	0.47		0.32	0.32		0.40	0.32	0.32	0.40
v/c Ratio	0.80	0.36		0.96	0.27		0.84	0.17	0.72	0.27
Control Delay	43.3	18.4		63.0	9.4		34.2	26.4	37.1	4.5
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0
Total Delay	43.3	18.4		63.0	9.4		34.2	26.4	37.1	4.5
LOS	D	B		E	A		C	C	D	A
Approach Delay		29.0		52.0			34.2		28.0	
Approach LOS		C		D			C		C	
Queue Length 50th (m)	23.9	33.5		103.4	4.5		80.6	3.1	70.3	1.4
Queue Length 95th (m)	#68.5	55.7		#169.3	18.1		101.3	9.2	99.3	12.0
Internal Link Dist (m)		253.6		109.0			402.8		360.9	
Turn Bay Length (m)	80.0				50.0			180.0		
Base Capacity (vph)	271	816		576	530		1162	149	636	600
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	0.80	0.36		0.96	0.27		0.78	0.15	0.66	0.27

Intersection Summary

Cycle Length: 98
Actuated Cycle Length: 98
Offset: 29 (30%), Referenced to phase 2:SBTL and 6:NBTL, Start of Green
Natural Cycle: 100
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.96
Intersection Signal Delay: 36.4 — Intersection LOS: D
Intersection Capacity Utilization 121.9% — 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: 4: Robie & Almon



Lane Group	EBT	WBT	NBT	NBR	SBT
Lane Configurations					
Traffic Volume (vph)	345	445	670	375	525
Future Volume (vph)	345	445	670	375	525
Lane Group Flow (vph)	423	531	765	428	633
Turn Type	NA	NA	NA	Perm	NA
Protected Phases	8	4	6		2
Permitted Phases				6	
Detector Phase	8	4	6	6	2
Switch Phase					
Minimum Initial (s)	10.0	10.0	10.0	10.0	10.0
Minimum Split (s)	23.7	23.7	54.0	54.0	54.0
Total Split (s)	36.0	36.0	54.0	54.0	54.0
Total Split (%)	40.0%	40.0%	60.0%	60.0%	60.0%
Yellow Time (s)	4.1	4.1	4.1	4.1	4.1
All-Red Time (s)	1.6	1.6	1.5	1.5	1.5
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.7	5.7	5.6	5.6	5.6
Lead/Lag					
Lead-Lag Optimize?					
Recall Mode	Ped	Ped	C-Max	C-Max	C-Max
Act Effct Green (s)	28.5	28.5	50.2	50.2	50.2
Actuated g/C Ratio	0.32	0.32	0.56	0.56	0.56
v/c Ratio	0.75	0.91	0.79	0.98	0.64
Control Delay	36.5	50.1	13.9	48.3	17.9
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	36.5	50.1	13.9	48.3	17.9
LOS	D	D	B	D	B
Approach Delay	36.5	50.1	26.3		17.9
Approach LOS	D	D	C		B
Queue Length 50th (m)	62.4	84.0	130.7	~38.3	73.5
Queue Length 95th (m)	95.4	#139.1	#179.2	#124.9	110.6
Internal Link Dist (m)	171.5	181.9	446.6		402.8
Turn Bay Length (m)					
Base Capacity (vph)	597	623	971	438	989
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.71	0.85	0.79	0.98	0.64

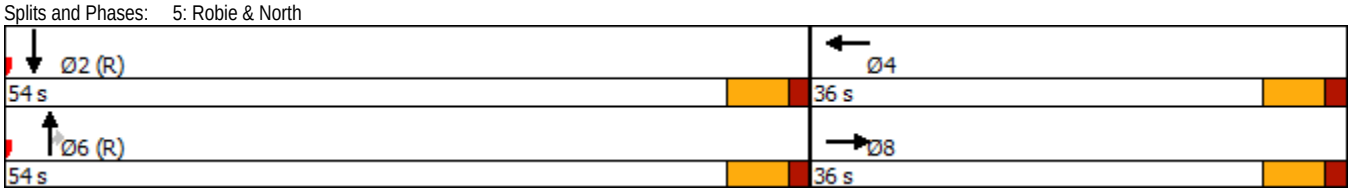
Intersection Summary

Cycle Length: 90
Actuated Cycle Length: 90
Offset: 74 (82%), Referenced to phase 2:SBT and 6:NBT, Start of Green
Natural Cycle: 90
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.98
Intersection Signal Delay: 30.5 Intersection LOS: C
Intersection Capacity Utilization 81.6% ICU Level of Service D
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.

Splits and Phases: 5: Robie & North

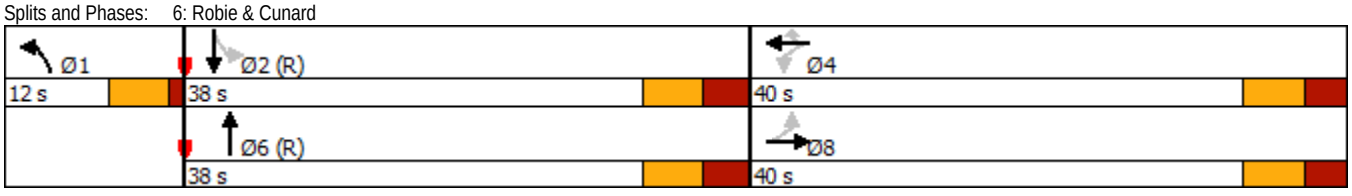


Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	SBL	SBT
Lane Configurations									
Traffic Volume (vph)	20	300	65	475	75	50	760	55	545
Future Volume (vph)	20	300	65	475	75	50	760	55	545
Lane Group Flow (vph)	23	410	74	542	86	57	935	0	742
Turn Type	Perm	NA	Perm	NA	Perm	Prot	NA	Perm	NA
Protected Phases		8		4		1	6		2
Permitted Phases	8		4		4			2	
Detector Phase	8	8	4	4	4	1	6	2	2
Switch Phase									
Minimum Initial (s)	10.0	10.0	10.0	10.0	10.0	7.0	10.0	10.0	10.0
Minimum Split (s)	39.1	39.1	39.1	39.1	39.1	12.0	38.0	38.0	38.0
Total Split (s)	40.0	40.0	40.0	40.0	40.0	12.0	38.0	38.0	38.0
Total Split (%)	44.4%	44.4%	44.4%	44.4%	44.4%	13.3%	42.2%	42.2%	42.2%
Yellow Time (s)	4.1	4.1	4.1	4.1	4.1	4.0	4.1	4.1	4.1
All-Red Time (s)	3.0	3.0	3.0	3.0	3.0	1.0	3.2	3.2	3.2
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0
Total Lost Time (s)	7.1	7.1	7.1	7.1	7.1	5.0	7.3		7.3
Lead/Lag									
Lead-Lag Optimize?									
Recall Mode	Ped	Ped	Ped	Ped	Ped	None	C-Max	C-Max	C-Max
Act Effct Green (s)	32.5	32.5	32.5	32.5	32.5	7.0	33.4		33.4
Actuated g/C Ratio	0.36	0.36	0.36	0.36	0.36	0.08	0.37		0.37
v/c Ratio	0.21	0.77	0.32	0.82	0.15	0.44	0.74		0.92
Control Delay	25.4	35.8	25.5	38.3	2.8	50.6	29.4		39.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0
Total Delay	25.4	35.8	25.5	38.3	2.8	50.6	29.4		39.7
LOS	C	D	C	D	A	D	C		D
Approach Delay		35.2		32.6			30.6		39.7
Approach LOS		D		C			C		D
Queue Length 50th (m)	2.7	59.4	9.0	83.3	0.0	9.6	75.4		72.5
Queue Length 95th (m)	9.1	#103.6	20.6	#135.4	5.7	21.4	98.9		#108.6
Internal Link Dist (m)		72.7		213.1			402.3		446.6
Turn Bay Length (m)	50.0				50.0				
Base Capacity (vph)	114	540	233	666	596	130	1271		810
Starvation Cap Reductn	0	0	0	0	0	0	0		0
Spillback Cap Reductn	0	0	0	0	0	0	0		0
Storage Cap Reductn	0	0	0	0	0	0	0		0
Reduced v/c Ratio	0.20	0.76	0.32	0.81	0.14	0.44	0.74		0.92

Intersection Summary

Cycle Length: 90
Actuated Cycle Length: 90
Offset: 43 (48%), Referenced to phase 2:SBTL and 6:NBT, Start of Green
Natural Cycle: 90
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.92
Intersection Signal Delay: 34.1 — Intersection LOS: C
Intersection Capacity Utilization 110.2% — 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: 6: Robie & Cunard



Lane Group	EBT	EBR	EBR2	WBT	NBL	NBT	SBL2	SBL	SBT	NWL
Lane Configurations										
Traffic Volume (vph)	215	295	140	565	245	775	70	140	560	625
Future Volume (vph)	215	295	140	565	245	775	70	140	560	625
Lane Group Flow (vph)	245	337	160	713	280	953	0	240	707	941
Turn Type	NA	pt+ov	custom	NA	pm+pt	NA	pm+pt	pm+pt	NA	Prot
Protected Phases	8	7 8		8	1	6	5	5	2	7
Permitted Phases			7		6		2	2		
Minimum Split (s)	36.0		37.0	36.0	14.0	33.0	14.0	14.0	46.0	37.0
Total Split (s)	36.0		50.0	36.0	23.0	46.0	23.0	23.0	46.0	50.0
Total Split (%)	23.2%		32.3%	23.2%	14.8%	29.7%	14.8%	14.8%	29.7%	32.3%
Yellow Time (s)	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	4.0		4.0	4.0	3.0	0.0	3.0	3.0	0.0	4.0
Lost Time Adjust (s)	-1.0		-1.0	-1.0	-1.0	-1.0		-1.0	-1.0	-1.0
Total Lost Time (s)	7.0		7.0	7.0	6.0	3.0		6.0	3.0	7.0
Lead/Lag	Lag		Lead	Lag	Lag	Lead	Lag	Lag	Lead	Lead
Lead-Lag Optimize?										
Act Effct Green (s)	29.0	79.0	43.0	29.0	57.0	43.0		57.0	43.0	43.0
Actuated g/C Ratio	0.19	0.51	0.28	0.19	0.37	0.28		0.37	0.28	0.28
v/c Ratio	0.72	0.43	0.34	1.12	1.08	1.07		1.05	0.83	1.06
Control Delay	72.7	26.0	8.6	130.1	132.2	103.9		132.2	61.9	99.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Total Delay	72.7	26.0	8.6	130.1	132.2	103.9		132.2	61.9	99.5
LOS	E	C	A	F	F	F		F	E	F
Approach Delay	37.7			130.1		110.3			79.7	99.5
Approach LOS	D			F		F			E	F
Queue Length 50th (m)	71.8	63.8	0.9	~132.3	~72.6	~170.7		~66.5	107.3	~163.0
Queue Length 95th (m)	103.1	89.8	19.0	#173.1	#132.1	#212.7		#122.7	132.4	#204.1
Internal Link Dist (m)	472.7			207.4		413.3			402.3	324.9
Turn Bay Length (m)		70.0	70.0		200.0					
Base Capacity (vph)	338	782	466	634	260	888		228	848	889
Starvation Cap Reductn	0	0	0	0	0	0		0	0	0
Spillback Cap Reductn	0	0	0	0	0	0		0	0	0
Storage Cap Reductn	0	0	0	0	0	0		0	0	0
Reduced v/c Ratio	0.72	0.43	0.34	1.12	1.08	1.07		1.05	0.83	1.06

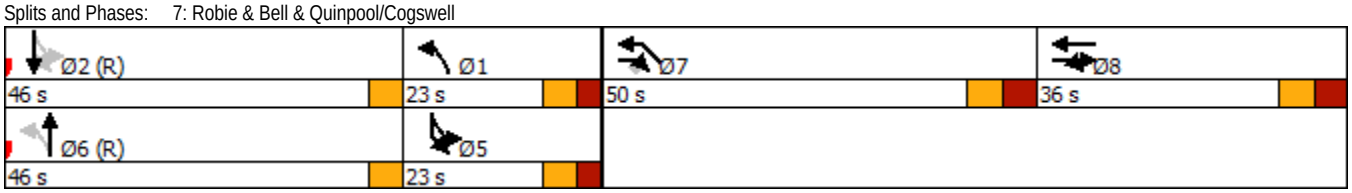
Intersection Summary

Cycle Length: 155
Actuated Cycle Length: 155
Offset: 0 (0%), Referenced to phase 2:SBTL and 6:NBTL, Start of Green
Natural Cycle: 135
Control Type: Pretimed
Maximum v/c Ratio: 1.12
Intersection Signal Delay: 93.1 — Intersection LOS: F
Intersection Capacity Utilization 119.3% — 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.

Splits and Phases: 7: Robie & Bell & Quinpool/Cogswell

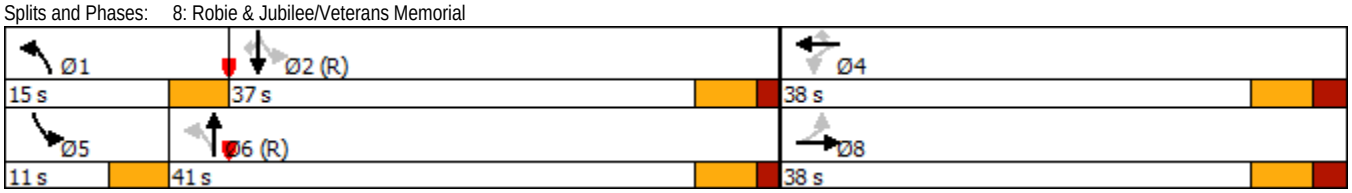


Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	SBL	SBT	SBR
Lane Configurations										
Traffic Volume (vph)	60	135	15	340	120	160	740	105	625	30
Future Volume (vph)	60	135	15	340	120	160	740	105	625	30
Lane Group Flow (vph)	0	268	0	405	137	183	896	120	713	34
Turn Type	Perm	NA	Perm	NA	Perm	pm+pt	NA	pm+pt	NA	Perm
Protected Phases		8		4		1	6	5	2	
Permitted Phases	8		4		4	6		2		2
Detector Phase	8	8	4	4	4	1	6	5	2	2
Switch Phase										
Minimum Initial (s)	10.0	10.0	10.0	10.0	10.0	7.0	10.0	7.0	10.0	10.0
Minimum Split (s)	31.6	31.6	31.6	31.6	31.6	11.0	22.8	11.0	22.8	22.8
Total Split (s)	38.0	38.0	38.0	38.0	38.0	15.0	41.0	11.0	37.0	37.0
Total Split (%)	42.2%	42.2%	42.2%	42.2%	42.2%	16.7%	45.6%	12.2%	41.1%	41.1%
Yellow Time (s)	4.1	4.1	4.1	4.1	4.1	4.0	4.1	4.0	4.1	4.1
All-Red Time (s)	2.4	2.4	2.4	2.4	2.4	0.0	1.7	0.0	1.7	1.7
Lost Time Adjust (s)		0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)		6.5		6.5	6.5	4.0	5.8	4.0	5.8	5.8
Lead/Lag						Lead	Lag	Lead	Lag	Lag
Lead-Lag Optimize?										
Recall Mode	Ped	Ped	Ped	Ped	Ped	None	C-Max	None	C-Max	C-Max
Act Effct Green (s)		28.0		28.0	28.0	49.8	38.3	45.1	35.9	35.9
Actuated g/C Ratio		0.31		0.31	0.31	0.55	0.43	0.50	0.40	0.40
v/c Ratio		0.91		0.73	0.27	0.51	0.66	0.41	0.54	0.08
Control Delay		62.8		35.8	6.0	5.2	14.8	14.6	23.6	0.3
Queue Delay		0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay		62.8		35.8	6.0	5.2	14.8	14.6	23.6	0.3
LOS		E		D	A	A	B	B	C	A
Approach Delay		62.8		28.3			13.2		21.4	
Approach LOS		E		C			B		C	
Queue Length 50th (m)		42.8		62.8	0.8	3.9	67.5	8.7	48.6	0.0
Queue Length 95th (m)		#82.0		88.9	12.4	m9.9	m74.3	18.4	71.7	0.0
Internal Link Dist (m)		189.8		183.6			355.1		413.3	
Turn Bay Length (m)					40.0	50.0		90.0		60.0
Base Capacity (vph)		330		624	551	379	1358	292	1315	453
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		0.81		0.65	0.25	0.48	0.66	0.41	0.54	0.08

Intersection Summary

Cycle Length: 90
Actuated Cycle Length: 90
Offset: 1 (1%), Referenced to phase 2:SBTL and 6:NBTL, Start of Green
Natural Cycle: 70
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.91
Intersection Signal Delay: 23.6 — Intersection LOS: C
Intersection Capacity Utilization 90.1% — ICU Level of Service E
Analysis Period (min) 15
\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 8: Robie & Jubilee/Veterans Memorial



Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations										
Traffic Volume (vph)	55	135	40	315	160	730	30	120	385	35
Future Volume (vph)	55	135	40	315	160	730	30	120	385	35
Lane Group Flow (vph)	63	154	0	611	0	1016	34	0	576	40
Turn Type	Perm	NA	Perm	NA	Perm	NA	Perm	pm+pt	NA	Perm
Protected Phases		4		4		6		5	2	
Permitted Phases	4		4		6		6	2		2
Minimum Split (s)	33.5	33.5	33.5	33.5	34.5	34.5	34.5	13.0	34.5	34.5
Total Split (s)	34.0	34.0	34.0	34.0	43.0	43.0	43.0	13.0	56.0	56.0
Total Split (%)	37.8%	37.8%	37.8%	37.8%	47.8%	47.8%	47.8%	14.4%	62.2%	62.2%
Yellow Time (s)	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.0	4.1	4.1
All-Red Time (s)	2.4	2.4	2.4	2.4	2.4	2.4	2.4	0.0	2.4	2.4
Lost Time Adjust (s)	0.0	0.0		0.0		0.0	0.0		0.0	0.0
Total Lost Time (s)	6.5	6.5		6.5		6.5	6.5		6.5	6.5
Lead/Lag					Lag	Lag	Lag	Lead		
Lead-Lag Optimize?										
Act Effct Green (s)	27.5	27.5		27.5		36.5	36.5		49.5	49.5
Actuated g/C Ratio	0.31	0.31		0.31		0.41	0.41		0.55	0.55
v/c Ratio	0.39	0.27		0.73		1.11	0.08		0.57	0.05
Control Delay	33.5	25.3		29.0		78.6	0.3		6.9	0.1
Queue Delay	0.0	0.0		0.0		0.0	0.0		0.0	0.0
Total Delay	33.5	25.3		29.0		78.6	0.3		6.9	0.1
LOS	C	C		C		E	A		A	A
Approach Delay		27.7		29.0		76.1			6.5	
Approach LOS		C		C		E			A	
Queue Length 50th (m)	8.5	20.0		41.3		~109.2	0.0		3.6	0.0
Queue Length 95th (m)	20.8	35.4		60.8		#142.2	m0.0		m18.3	m0.0
Internal Link Dist (m)		121.4		124.9		240.3			355.1	
Turn Bay Length (m)	30.0						30.0			70.0
Base Capacity (vph)	161	563		840		915	409		1012	737
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	0.39	0.27		0.73		1.11	0.08		0.57	0.05

Intersection Summary

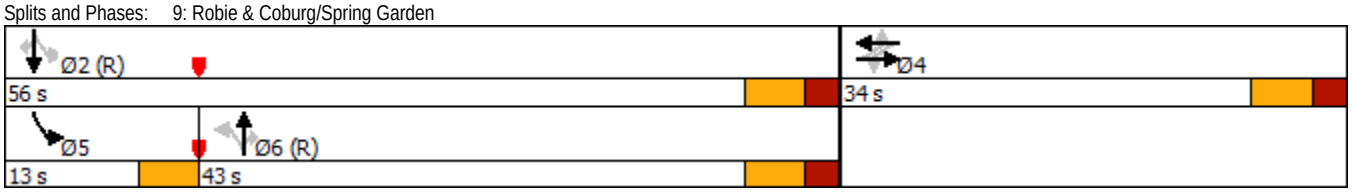
Cycle Length: 90
Actuated Cycle Length: 90
Offset: 36 (40%), Referenced to phase 2:SBTL and 6:NBTL, Start of Green
Natural Cycle: 95
Control Type: Pretimed
Maximum v/c Ratio: 1.11
Intersection Signal Delay: 43.1 Intersection LOS: D
Intersection Capacity Utilization 116.1% ICU Level of Service H
Analysis 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.

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

Splits and Phases: 9: Robie & Coburg/Spring Garden

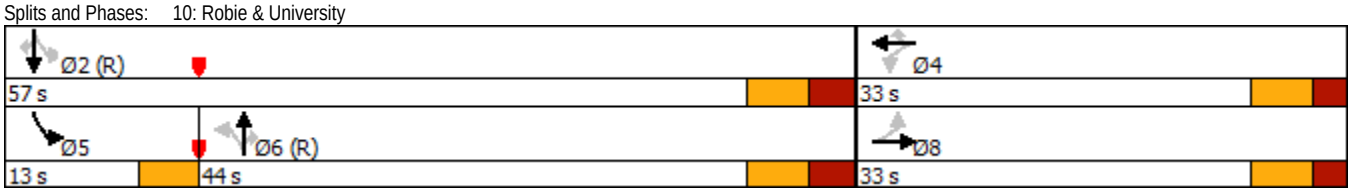


Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations											
Traffic Volume (vph)	45	100	25	145	225	30	670	30	135	270	45
Future Volume (vph)	45	100	25	145	225	30	670	30	135	270	45
Lane Group Flow (vph)	51	137	29	165	257	0	799	34	154	308	51
Turn Type	Perm	NA	Perm	NA	Perm	Perm	NA	Perm	pm+pt	NA	Perm
Protected Phases		8		4			6		5	2	
Permitted Phases	8		4		4	6		6	2		2
Detector Phase	8	8	4	4	4	6	6	6	5	2	2
Switch Phase											
Minimum Initial (s)	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	7.0	10.0	10.0
Minimum Split (s)	32.5	32.5	32.5	32.5	32.5	43.3	43.3	43.3	11.0	43.3	43.3
Total Split (s)	33.0	33.0	33.0	33.0	33.0	44.0	44.0	44.0	13.0	57.0	57.0
Total Split (%)	36.7%	36.7%	36.7%	36.7%	36.7%	48.9%	48.9%	48.9%	14.4%	63.3%	63.3%
Yellow Time (s)	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.0	4.1	4.1
All-Red Time (s)	2.4	2.4	2.4	2.4	2.4	3.2	3.2	3.2	0.0	3.2	3.2
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.5	6.5	6.5	6.5	6.5		7.3	7.3	4.0	7.3	7.3
Lead/Lag						Lag	Lag	Lag	Lead		
Lead-Lag Optimize?											
Recall Mode	Ped	Ped	Ped	Ped	Ped	C-Max	C-Max	C-Max	None	C-Max	C-Max
Act Effct Green (s)	26.1	26.1	26.1	26.1	26.1		37.6	37.6	53.4	50.1	50.1
Actuated g/C Ratio	0.29	0.29	0.29	0.29	0.29		0.42	0.42	0.59	0.56	0.56
v/c Ratio	0.21	0.30	0.09	0.35	0.60		0.69	0.08	0.42	0.36	0.08
Control Delay	26.9	24.9	24.5	27.9	10.9		22.1	13.5	16.6	16.6	9.9
Queue Delay	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0
Total Delay	26.9	24.9	24.5	27.9	10.9		22.1	13.5	16.6	16.6	9.9
LOS	C	C	C	C	B		C	B	B	B	A
Approach Delay		25.4		18.0			21.7			15.9	
Approach LOS		C		B			C			B	
Queue Length 50th (m)	6.6	16.8	3.7	22.5	1.9		70.3	3.1	10.3	22.3	1.4
Queue Length 95th (m)	15.9	31.6	10.1	39.3	24.4		51.8	m5.5	m29.2	m56.0	m6.9
Internal Link Dist (m)		178.0		171.4			167.5			240.3	
Turn Bay Length (m)	15.0		15.0		60.0			70.0			40.0
Base Capacity (vph)	251	470	311	478	434		1154	428	380	844	657
Starvation Cap Reductn	0	0	0	0	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	0.20	0.29	0.09	0.35	0.59		0.69	0.08	0.41	0.36	0.08

Intersection Summary

Cycle Length: 90
Actuated Cycle Length: 90
Offset: 20 (22%), Referenced to phase 2:SBTL and 6:NBTL, Start of Green
Natural Cycle: 90
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.69
Intersection Signal Delay: 19.7 — Intersection LOS: B
Intersection Capacity Utilization 113.0% — ICU Level of Service H
Analysis Period (min) 15
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 10: Robie & University

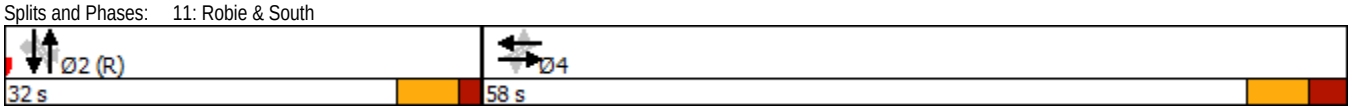


Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations										
Traffic Volume (vph)	55	205	20	345	45	330	15	95	195	50
Future Volume (vph)	55	205	20	345	45	330	15	95	195	50
Lane Group Flow (vph)	0	320	0	697	0	428	17	0	331	57
Turn Type	Perm	NA	Perm	NA	Perm	NA	Perm	Perm	NA	Perm
Protected Phases		4		4		2			2	
Permitted Phases	4		4		2		2	2		2
Detector Phase	4	4	4	4	2	2	2	2	2	2
Switch Phase										
Minimum Initial (s)	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Minimum Split (s)	47.8	47.8	47.8	47.8	24.7	24.7	24.7	24.7	24.7	24.7
Total Split (s)	58.0	58.0	58.0	58.0	32.0	32.0	32.0	32.0	32.0	32.0
Total Split (%)	64.4%	64.4%	64.4%	64.4%	35.6%	35.6%	35.6%	35.6%	35.6%	35.6%
Yellow Time (s)	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1
All-Red Time (s)	2.7	2.7	2.7	2.7	1.6	1.6	1.6	1.6	1.6	1.6
Lost Time Adjust (s)		0.0		0.0		0.0	0.0		0.0	0.0
Total Lost Time (s)		6.8		6.8		5.7	5.7		5.7	5.7
Lead/Lag										
Lead-Lag Optimize?										
Recall Mode	Ped	Ped	Ped	Ped	C-Min	C-Min	C-Min	C-Min	C-Min	C-Min
Act Effct Green (s)		45.5		45.5		32.0	32.0		32.0	32.0
Actuated g/C Ratio		0.51		0.51		0.36	0.36		0.36	0.36
v/c Ratio		0.51		0.81		0.45	0.04		0.47	0.14
Control Delay		16.9		24.8		25.6	1.8		23.3	6.9
Queue Delay		0.0		0.0		0.0	0.0		0.0	0.0
Total Delay		16.9		24.8		25.6	1.8		23.3	6.9
LOS		B		C		C	A		C	A
Approach Delay		16.9		24.8		24.7			20.9	
Approach LOS		B		C		C			C	
Queue Length 50th (m)		35.6		92.0		30.3	0.0		20.1	2.2
Queue Length 95th (m)		48.8		118.8		41.5	m0.2		34.3	4.1
Internal Link Dist (m)		115.5		183.6		422.3			167.5	
Turn Bay Length (m)							100.0			50.0
Base Capacity (vph)		712		961		956	433		708	402
Starvation Cap Reductn		0		0		0	0		0	0
Spillback Cap Reductn		0		0		0	0		0	0
Storage Cap Reductn		0		0		0	0		0	0
Reduced v/c Ratio		0.45		0.73		0.45	0.04		0.47	0.14

Intersection Summary

Cycle Length: 90
Actuated Cycle Length: 90
Offset: 22 (24%), Referenced to phase 2:NBSB and 6:, Start of Green
Natural Cycle: 75
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.81
Intersection Signal Delay: 22.6 — Intersection LOS: C
Intersection Capacity Utilization 87.5% — ICU Level of Service E
Analysis Period (min) 15
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 11: Robie & South

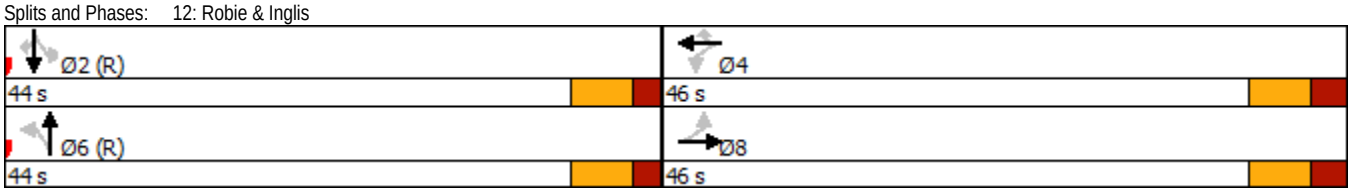


Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	SBL	SBT	SBR
Lane Configurations										
Traffic Volume (vph)	20	235	80	275	275	30	125	175	70	15
Future Volume (vph)	20	235	80	275	275	30	125	175	70	15
Lane Group Flow (vph)	0	320	0	405	314	0	268	200	80	17
Turn Type	Perm	NA	Perm	NA	Perm	Perm	NA	Perm	NA	Perm
Protected Phases		8		4			6		2	
Permitted Phases	8		4		4	6		2		2
Detector Phase	8	8	4	4	4	6	6	2	2	2
Switch Phase										
Minimum Initial (s)	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Minimum Split (s)	31.7	31.7	31.7	31.7	31.7	23.1	23.1	23.1	23.1	23.1
Total Split (s)	46.0	46.0	46.0	46.0	46.0	44.0	44.0	44.0	44.0	44.0
Total Split (%)	51.1%	51.1%	51.1%	51.1%	51.1%	48.9%	48.9%	48.9%	48.9%	48.9%
Yellow Time (s)	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1
All-Red Time (s)	2.6	2.6	2.6	2.6	2.6	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)		0.0		0.0	0.0		0.0	0.0	0.0	0.0
Total Lost Time (s)		6.7		6.7	6.7		6.1	6.1	6.1	6.1
Lead/Lag										
Lead-Lag Optimize?										
Recall Mode	Ped	Ped	Ped	Ped	Ped	C-Min	C-Min	C-Min	C-Min	C-Min
Act Effct Green (s)		32.4		32.4	32.4		44.8	44.8	44.8	44.8
Actuated g/C Ratio		0.36		0.36	0.36		0.50	0.50	0.50	0.50
v/c Ratio		0.52		0.83	0.44		0.20	0.45	0.10	0.03
Control Delay		24.4		41.2	4.1		9.8	9.1	5.4	0.1
Queue Delay		0.0		0.0	0.0		0.0	0.0	0.0	0.0
Total Delay		24.4		41.2	4.1		9.8	9.1	5.4	0.1
LOS		C		D	A		A	A	A	A
Approach Delay		24.4		25.0			9.8		7.6	
Approach LOS		C		C			A		A	
Queue Length 50th (m)		41.6		62.6	0.0		8.3	7.4	2.8	0.0
Queue Length 95th (m)		56.7		87.0	13.7		17.8	m12.2	m5.7	m0.0
Internal Link Dist (m)		113.9		142.4			118.8		422.3	
Turn Bay Length (m)					50.0					20.0
Base Capacity (vph)		749		592	800		1346	444	774	588
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		0.43		0.68	0.39		0.20	0.45	0.10	0.03

Intersection Summary

Cycle Length: 90
Actuated Cycle Length: 90
Offset: 48 (53%), Referenced to phase 2:SBTL and 6:NBTL, Start of Green
Natural Cycle: 55
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.83
Intersection Signal Delay: 19.1 — Intersection LOS: B
Intersection Capacity Utilization 85.9% — ICU Level of Service E
Analysis Period (min) 15
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 12: Robie & Inglis

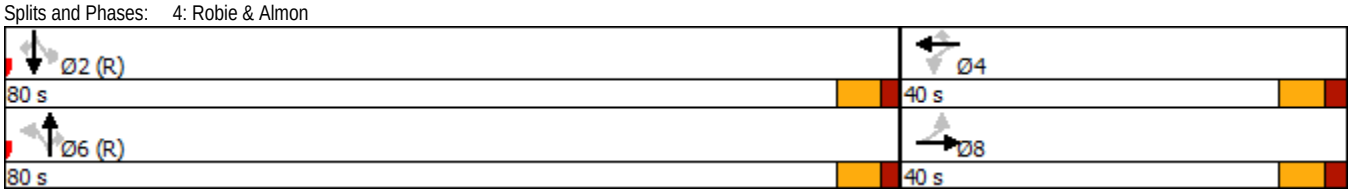


Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations											
Traffic Volume (vph)	150	290	20	195	45	30	456	15	40	573	205
Future Volume (vph)	150	290	20	195	45	30	456	15	40	573	205
Lane Group Flow (vph)	171	388	0	246	51	34	520	17	46	654	234
Turn Type	Perm	NA	Perm	NA	Perm	Perm	NA	Perm	Perm	NA	Perm
Protected Phases		8		4			6			2	
Permitted Phases	8		4		4	6		6	2		2
Detector Phase	8	8	4	4	4	6	6	6	2	2	2
Switch Phase											
Minimum Initial (s)	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Minimum Split (s)	37.0	37.0	37.0	37.0	37.0	53.0	53.0	53.0	53.0	53.0	53.0
Total Split (s)	40.0	40.0	40.0	40.0	40.0	80.0	80.0	80.0	80.0	80.0	80.0
Total Split (%)	33.3%	33.3%	33.3%	33.3%	33.3%	66.7%	66.7%	66.7%	66.7%	66.7%	66.7%
Yellow Time (s)	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1
All-Red Time (s)	2.1	2.1	2.1	2.1	2.1	1.7	1.7	1.7	1.7	1.7	1.7
Lost Time Adjust (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.2	6.2		6.2	6.2	5.8	5.8	5.8	5.8	5.8	5.8
Lead/Lag											
Lead-Lag Optimize?											
Recall Mode	None	None	None	None	None	C-Min	C-Min	C-Min	C-Min	C-Min	C-Min
Act Effct Green (s)	31.9	31.9		31.9	31.9	76.1	76.1	76.1	76.1	76.1	76.1
Actuated g/C Ratio	0.27	0.27		0.27	0.27	0.63	0.63	0.63	0.63	0.63	0.63
v/c Ratio	0.82	0.84		0.85	0.14	0.10	0.53	0.02	0.10	0.58	0.26
Control Delay	70.3	56.7		66.9	9.0	11.2	15.6	1.8	7.6	12.2	1.9
Queue Delay	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	70.3	56.7		66.9	9.0	11.2	15.6	1.8	7.6	12.2	1.9
LOS	E	E		E	A	B	B	A	A	B	A
Approach Delay		60.9		56.9			15.0			9.4	
Approach LOS		E		E			B			A	
Queue Length 50th (m)	37.4	84.1		54.4	0.0	3.0	64.4	0.0	4.5	67.6	7.5
Queue Length 95th (m)	#67.7	115.3		#87.6	9.0	8.3	103.1	1.9	m1.1	m14.2	m0.0
Internal Link Dist (m)		233.7		226.4			402.8			360.9	
Turn Bay Length (m)	80.0				50.0	30.0			180.0		
Base Capacity (vph)	231	512		321	408	353	1001	951	449	1146	925
Starvation Cap Reductn	0	0		0	0	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	0.74	0.76		0.77	0.13	0.10	0.52	0.02	0.10	0.57	0.25

Intersection Summary

Cycle Length: 120
Actuated Cycle Length: 120
Offset: 84 (70%), Referenced to phase 2:SBTL and 6:NBTL, Start of Green
Natural Cycle: 90
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.85
Intersection Signal Delay: 28.9 — Intersection LOS: C
Intersection Capacity Utilization 99.8% — 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.
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 4: Robie & Almon

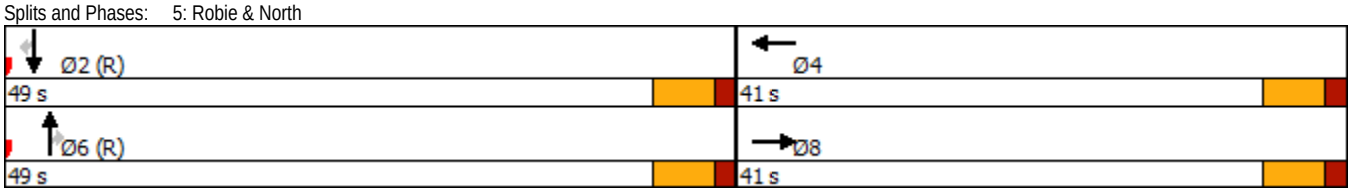


Lane Group	EBT	WBT	NBT	NBR	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	375	420	461	110	553	10
Future Volume (vph)	375	420	461	110	553	10
Lane Group Flow (vph)	457	490	526	126	631	11
Turn Type	NA	NA	NA	Perm	NA	Perm
Protected Phases	8	4	6		2	
Permitted Phases				6		2
Detector Phase	8	4	6	6	2	2
Switch Phase						
Minimum Initial (s)	10.0	10.0	10.0	10.0	10.0	10.0
Minimum Split (s)	23.7	23.7	49.0	49.0	49.0	49.0
Total Split (s)	41.0	41.0	49.0	49.0	49.0	49.0
Total Split (%)	45.6%	45.6%	54.4%	54.4%	54.4%	54.4%
Yellow Time (s)	4.1	4.1	4.1	4.1	4.1	4.1
All-Red Time (s)	1.6	1.6	1.5	1.5	1.5	1.5
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.7	5.7	5.6	5.6	5.6	5.6
Lead/Lag						
Lead-Lag Optimize?						
Recall Mode	Ped	Ped	C-Min	C-Min	C-Min	C-Min
Act Effct Green (s)	29.6	29.6	49.1	49.1	49.1	49.1
Actuated g/C Ratio	0.33	0.33	0.55	0.55	0.55	0.55
v/c Ratio	0.85	0.82	0.60	0.16	0.64	0.01
Control Delay	42.8	39.4	32.9	14.9	19.4	0.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	42.8	39.4	32.9	14.9	19.4	0.9
LOS	D	D	C	B	B	A
Approach Delay	42.8	39.4	29.4		19.0	
Approach LOS	D	D	C		B	
Queue Length 50th (m)	71.0	75.6	94.4	10.9	73.1	0.0
Queue Length 95th (m)	99.8	103.7	116.9	m18.4	123.5	0.7
Internal Link Dist (m)	320.4	272.5	446.6		402.8	
Turn Bay Length (m)				50.0		
Base Capacity (vph)	641	709	882	788	991	806
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.71	0.69	0.60	0.16	0.64	0.01

Intersection Summary

Cycle Length: 90
Actuated Cycle Length: 90
Offset: 14 (16%), Referenced to phase 2:SBT and 6:NBT, Start of Green
Natural Cycle: 80
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.85
Intersection Signal Delay: 31.3 Intersection LOS: C
Intersection Capacity Utilization 69.6% ICU Level of Service C
Analysis Period (min) 15
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 5: Robie & North



Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations											
Traffic Volume (vph)	10	410	40	160	40	50	461	20	75	643	10
Future Volume (vph)	10	410	40	160	40	50	461	20	75	643	10
Lane Group Flow (vph)	11	571	46	183	46	57	526	23	86	734	11
Turn Type	Perm	NA	Perm	NA	Perm	Perm	NA	Perm	Perm	NA	Perm
Protected Phases		8		4			6			2	
Permitted Phases	8		4		4	6		6	2		2
Detector Phase	8	8	4	4	4	6	6	6	2	2	2
Switch Phase											
Minimum Initial (s)	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Minimum Split (s)	39.1	39.1	39.1	39.1	39.1	38.0	38.0	38.0	38.0	38.0	38.0
Total Split (s)	49.0	49.0	49.0	49.0	49.0	41.0	41.0	41.0	41.0	41.0	41.0
Total Split (%)	54.4%	54.4%	54.4%	54.4%	54.4%	45.6%	45.6%	45.6%	45.6%	45.6%	45.6%
Yellow Time (s)	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1
All-Red Time (s)	3.0	3.0	3.0	3.0	3.0	3.2	3.2	3.2	3.2	3.2	3.2
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	7.1	7.1	7.1	7.1	7.1	7.3	7.3	7.3	7.3	7.3	7.3
Lead/Lag											
Lead-Lag Optimize?											
Recall Mode	Ped	Ped	Ped	Ped	Ped	C-Min	C-Min	C-Min	C-Min	C-Min	C-Min
Act Effct Green (s)	39.3	39.3	39.3	39.3	39.3	36.3	36.3	36.3	36.3	36.3	36.3
Actuated g/C Ratio	0.44	0.44	0.44	0.44	0.44	0.40	0.40	0.40	0.40	0.40	0.40
v/c Ratio	0.03	0.92	0.23	0.26	0.08	0.76	0.74	0.04	0.45	1.03	0.02
Control Delay	13.4	44.5	18.4	16.5	4.0	83.8	31.5	1.8	34.0	67.9	3.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	13.4	44.5	18.4	16.5	4.0	83.8	31.5	1.8	34.0	67.9	3.2
LOS	B	D	B	B	A	F	C	A	C	E	A
Approach Delay		43.9		14.7			35.3			63.5	
Approach LOS		D		B			D			E	
Queue Length 50th (m)	1.0	82.8	4.6	18.4	0.0	8.7	79.5	0.0	5.8	~145.5	0.0
Queue Length 95th (m)	3.8	#146.8	12.2	31.8	4.9	#31.5	#129.7	1.7	m22.7	#207.2	m0.0
Internal Link Dist (m)		362.5		213.1			165.3			446.6	
Turn Bay Length (m)	50.0				50.0	40.0		60.0	40.0		
Base Capacity (vph)	412	662	209	742	598	75	714	593	193	714	660
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.03	0.86	0.22	0.25	0.08	0.76	0.74	0.04	0.45	1.03	0.02

Intersection Summary

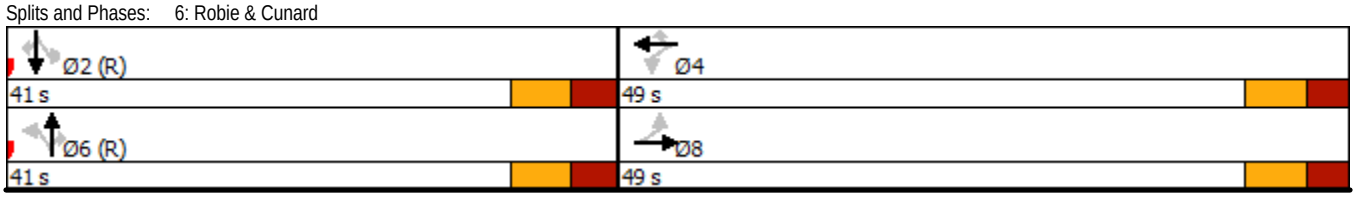
Cycle Length: 90
Actuated Cycle Length: 90
Offset: 20 (22%), Referenced to phase 2:SBTL and 6:NBTL, Start of Green
Natural Cycle: 90
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 1.03
Intersection Signal Delay: 45.3 — Intersection LOS: D
Intersection Capacity Utilization 96.9% — ICU Level of 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.

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

Splits and Phases: 6: Robie & Cunard



Lane Group	EBT	EBR	EBR2	WBT	NBL	NBT	NBR	SBL2	SBL	SBT	SBR	NWL
Lane Configurations												
Traffic Volume (vph)	410	470	400	205	150	390	25	68	240	710	45	245
Future Volume (vph)	410	470	400	205	150	390	25	68	240	710	45	245
Lane Group Flow (vph)	468	536	457	268	171	445	40	0	352	810	51	406
Turn Type	NA	pt+ov	custom	NA	pm+pt	NA	Perm	pm+pt	pm+pt	NA	Perm	Prot
Protected Phases	8	7 8		8	1	6		5	5	2		7
Permitted Phases			7		6		6	2	2		2	
Minimum Split (s)	36.0		37.0	36.0	14.0	36.0	36.0	14.0	14.0	49.0	49.0	37.0
Total Split (s)	44.0		37.0	44.0	14.0	45.0	45.0	24.0	24.0	55.0	55.0	37.0
Total Split (%)	29.3%		24.7%	29.3%	9.3%	30.0%	30.0%	16.0%	16.0%	36.7%	36.7%	24.7%
Yellow Time (s)	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	4.0		4.0	4.0	0.0	3.0	3.0	0.0	0.0	3.0	3.0	4.0
Lost Time Adjust (s)	-1.0		-1.0	-1.0	-1.0	-1.0	0.0		-1.0	-1.0	0.0	-1.0
Total Lost Time (s)	7.0		7.0	7.0	3.0	6.0	7.0		3.0	6.0	7.0	7.0
Lead/Lag	Lag		Lead	Lag	Lead	Lag	Lag	Lead	Lead	Lag	Lag	Lead
Lead-Lag Optimize?												
Act Effct Green (s)	37.0	74.0	30.0	37.0	53.0	39.0	38.0		66.0	49.0	48.0	30.0
Actuated g/C Ratio	0.25	0.49	0.20	0.25	0.35	0.26	0.25		0.44	0.33	0.32	0.20
v/c Ratio	1.05	0.71	0.95	0.33	0.73	0.51	0.21		0.93	0.80	0.10	0.75
Control Delay	110.2	35.9	55.8	45.9	47.7	49.8	47.7		63.9	53.3	0.4	66.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0
Total Delay	110.2	35.9	55.8	45.9	47.7	49.8	47.7		63.9	53.3	0.4	66.5
LOS	F	D	E	D	D	D	D		E	D	A	E
Approach Delay	65.9			45.9		49.1				54.2		66.5
Approach LOS	E			D		D				D		E
Queue Length 50th (m)	~151.2	121.7	66.2	33.3	31.2	59.8	9.5		73.2	115.8	0.0	59.3
Queue Length 95th (m)	#219.0	167.1	#135.6	46.6	#52.5	77.3	20.6		#117.7	141.5	0.0	78.2
Internal Link Dist (m)	932.3			207.4		413.3				213.0		150.4
Turn Bay Length (m)		70.0	70.0		100.0				150.0			
Base Capacity (vph)	445	757	480	816	233	875	193		378	1009	486	538
Starvation Cap Reductn	0	0	0	0	0	0	0		0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0		0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0		0	0	0	0
Reduced v/c Ratio	1.05	0.71	0.95	0.33	0.73	0.51	0.21		0.93	0.80	0.10	0.75

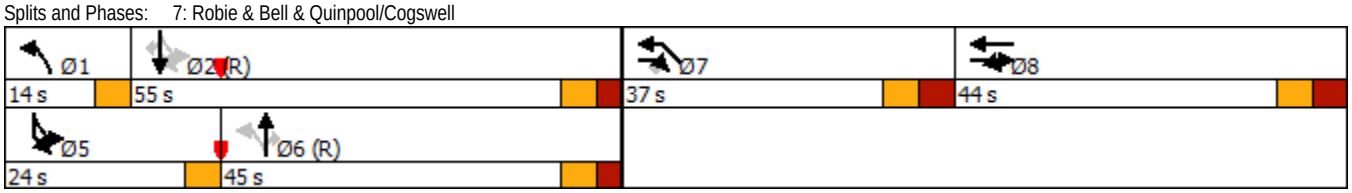
Intersection Summary

Cycle Length: 150
Actuated Cycle Length: 150
Offset: 0 (0%), Referenced to phase 2:SBTL and 6:NBTL, Start of Green
Natural Cycle: 140
Control Type: Pretimed
Maximum v/c Ratio: 1.05
Intersection Signal Delay: 58.3 — Intersection LOS: E
Intersection Capacity Utilization 111.2% — 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.

Splits and Phases: 7: Robie & Bell & Quinpool/Cogswell

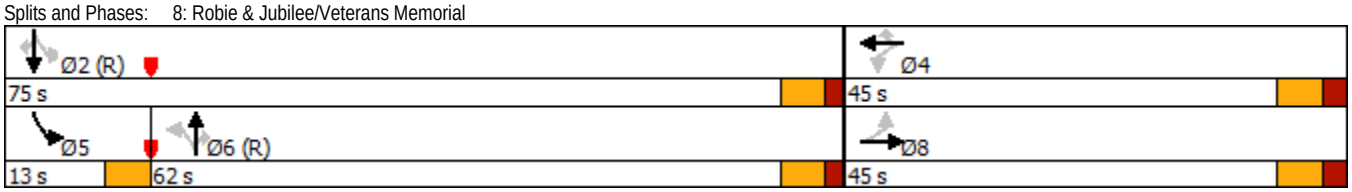


Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations											
Traffic Volume (vph)	65	275	20	105	95	45	495	50	195	885	20
Future Volume (vph)	65	275	20	105	95	45	495	50	195	885	20
Lane Group Flow (vph)	0	485	0	143	108	51	565	57	223	1010	23
Turn Type	Perm	NA	Perm	NA	Perm	Perm	NA	Perm	pm+pt	NA	Perm
Protected Phases		8		4			6		5	2	
Permitted Phases	8		4		4	6		6	2		2
Detector Phase	8	8	4	4	4	6	6	6	5	2	2
Switch Phase											
Minimum Initial (s)	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	8.0	10.0	10.0
Minimum Split (s)	31.6	31.6	31.6	31.6	31.6	22.8	22.8	22.8	13.0	22.8	22.8
Total Split (s)	45.0	45.0	45.0	45.0	45.0	62.0	62.0	62.0	13.0	75.0	75.0
Total Split (%)	37.5%	37.5%	37.5%	37.5%	37.5%	51.7%	51.7%	51.7%	10.8%	62.5%	62.5%
Yellow Time (s)	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.0	4.1	4.1
All-Red Time (s)	2.4	2.4	2.4	2.4	2.4	1.7	1.7	1.7	0.0	1.7	1.7
Lost Time Adjust (s)		0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)		6.5		6.5	6.5	5.8	5.8	5.8	4.0	5.8	5.8
Lead/Lag						Lag	Lag	Lag	Lead		
Lead-Lag Optimize?											
Recall Mode	Ped	Ped	Ped	Ped	Ped	C-Min	C-Min	C-Min	None	C-Min	C-Min
Act Effct Green (s)		42.3		42.3	42.3	49.1	49.1	49.1	67.2	65.4	65.4
Actuated g/C Ratio		0.35		0.35	0.35	0.41	0.41	0.41	0.56	0.54	0.54
v/c Ratio		0.86		0.25	0.20	0.29	0.42	0.11	0.53	0.56	0.04
Control Delay		50.5		27.9	5.4	35.2	32.0	11.8	19.6	20.1	3.7
Queue Delay		0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay		50.5		27.9	5.4	35.2	32.0	11.8	19.6	20.1	3.7
LOS		D		C	A	D	C	B	B	C	A
Approach Delay		50.5		18.2			30.5			19.7	
Approach LOS		D		B			C			B	
Queue Length 50th (m)		100.5		23.2	0.0	9.3	54.9	2.1	26.5	81.7	0.0
Queue Length 95th (m)		140.4		37.5	11.2	m21.8	80.2	m11.4	43.1	105.8	3.1
Internal Link Dist (m)		189.8		183.6			355.1			413.3	
Turn Bay Length (m)					40.0	50.0			90.0		
Base Capacity (vph)		577		577	535	202	1552	598	421	1923	555
Starvation Cap Reductn		0		0	0	0	0	0	0	0	0
Spillback Cap Reductn		0		0	0	0	0	0	0	0	0
Storage Cap Reductn		0		0	0	0	0	0	0	0	0
Reduced v/c Ratio		0.84		0.25	0.20	0.25	0.36	0.10	0.53	0.53	0.04

Intersection Summary

Cycle Length: 120
Actuated Cycle Length: 120
Offset: 43 (36%), Referenced to phase 2:SBTL and 6:NBTL, Start of Green
Natural Cycle: 70
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.86
Intersection Signal Delay: 27.9 — Intersection LOS: C
Intersection Capacity Utilization 80.9% — ICU Level of Service D
Analysis Period (min) 15
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 8: Robie & Jubilee/Veterans Memorial

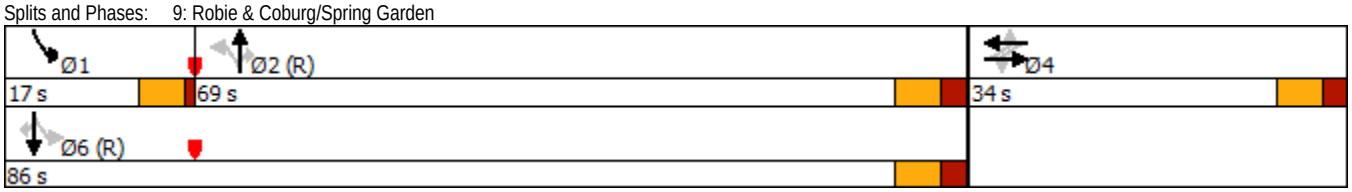


Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations										
Traffic Volume (vph)	45	170	45	150	50	409	25	215	741	50
Future Volume (vph)	45	170	45	150	50	409	25	215	741	50
Lane Group Flow (vph)	51	194	0	353	57	467	29	245	846	57
Turn Type	Perm	NA	Perm	NA	Perm	NA	Perm	pm+pt	NA	Perm
Protected Phases		4		4		2		1	6	
Permitted Phases	4		4		2		2	6		6
Detector Phase	4	4	4	4	2	2	2	1	6	6
Switch Phase										
Minimum Initial (s)	10.0	10.0	10.0	10.0	10.0	10.0	10.0	8.0	10.0	10.0
Minimum Split (s)	34.0	34.0	34.0	34.0	34.5	34.5	34.5	13.0	34.5	34.5
Total Split (s)	34.0	34.0	34.0	34.0	69.0	69.0	69.0	17.0	86.0	86.0
Total Split (%)	28.3%	28.3%	28.3%	28.3%	57.5%	57.5%	57.5%	14.2%	71.7%	71.7%
Yellow Time (s)	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.0	4.1	4.1
All-Red Time (s)	2.4	2.4	2.4	2.4	2.4	2.4	2.4	1.0	2.4	2.4
Lost Time Adjust (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.5	6.5		6.5	6.5	6.5	6.5	5.0	6.5	6.5
Lead/Lag					Lag	Lag	Lag	Lead		
Lead-Lag Optimize?										
Recall Mode	None	None	None	None	C-Min	C-Min	C-Min	None	C-Min	C-Min
Act Effct Green (s)	21.0	21.0		21.0	70.3	70.3	70.3	87.5	86.0	86.0
Actuated g/C Ratio	0.18	0.18		0.18	0.59	0.59	0.59	0.73	0.72	0.72
v/c Ratio	0.44	0.60		0.82	0.18	0.25	0.03	0.41	0.69	0.06
Control Delay	54.2	52.3		50.3	14.7	11.4	4.5	10.9	23.8	5.3
Queue Delay	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	54.2	52.3		50.3	14.7	11.4	4.5	10.9	23.8	5.3
LOS	D	D		D	B	B	A	B	C	A
Approach Delay		52.7		50.3		11.4			20.1	
Approach LOS		D		D		B			C	
Queue Length 50th (m)	10.7	42.1		31.4	2.4	10.5	0.0	21.2	188.9	2.1
Queue Length 95th (m)	22.5	62.0		46.5	21.2	58.3	4.9	m65.7	242.7	m12.8
Internal Link Dist (m)		121.4		435.9		240.3			355.1	
Turn Bay Length (m)	30.0				60.0		30.0			70.0
Base Capacity (vph)	153	426		533	324	1848	963	611	1233	923
Starvation Cap Reductn	0	0		0	0	0	0	0	0	0
Spillback Cap Reductn	0	0		0	0	0	0	0	0	0
Storage Cap Reductn	0	0		0	0	0	0	0	0	0
Reduced v/c Ratio	0.33	0.46		0.66	0.18	0.25	0.03	0.40	0.69	0.06

Intersection Summary

Cycle Length: 120
Actuated Cycle Length: 120
Offset: 104 (87%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle: 85
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.82
Intersection Signal Delay: 26.1 — Intersection LOS: C
Intersection Capacity Utilization 114.5% — ICU Level of Service H
Analysis Period (min) 15
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 9: Robie & Coburg/Spring Garden

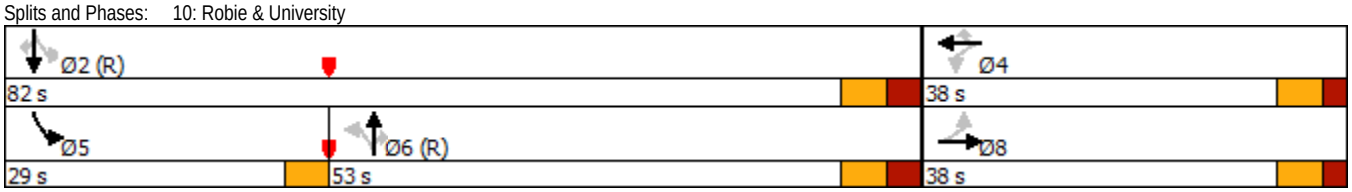


Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations											
Traffic Volume (vph)	30	145	30	85	95	10	301	40	345	449	50
Future Volume (vph)	30	145	30	85	95	10	301	40	345	449	50
Lane Group Flow (vph)	34	194	34	97	108	11	344	46	394	512	57
Turn Type	Perm	NA	Perm	NA	Perm	Perm	NA	Perm	pm+pt	NA	Perm
Protected Phases		8		4			6		5	2	
Permitted Phases	8		4		4	6		6	2		2
Detector Phase	8	8	4	4	4	6	6	6	5	2	2
Switch Phase											
Minimum Initial (s)	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	7.0	10.0	10.0
Minimum Split (s)	32.5	32.5	32.5	32.5	32.5	43.3	43.3	43.3	11.0	43.3	43.3
Total Split (s)	38.0	38.0	38.0	38.0	38.0	53.0	53.0	53.0	29.0	82.0	82.0
Total Split (%)	31.7%	31.7%	31.7%	31.7%	31.7%	44.2%	44.2%	44.2%	24.2%	68.3%	68.3%
Yellow Time (s)	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.0	4.1	4.1
All-Red Time (s)	2.4	2.4	2.4	2.4	2.4	3.2	3.2	3.2	0.0	3.2	3.2
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.5	6.5	6.5	6.5	6.5	7.3	7.3	7.3	4.0	7.3	7.3
Lead/Lag						Lag	Lag	Lag	Lead		
Lead-Lag Optimize?											
Recall Mode	Ped	Ped	Ped	Ped	Ped	C-Min	C-Min	C-Min	None	C-Min	C-Min
Act Effct Green (s)	26.2	26.2	26.2	26.2	26.2	59.3	59.3	59.3	83.3	80.0	80.0
Actuated g/C Ratio	0.22	0.22	0.22	0.22	0.22	0.49	0.49	0.49	0.69	0.67	0.67
v/c Ratio	0.18	0.56	0.20	0.27	0.39	0.03	0.23	0.06	0.59	0.51	0.05
Control Delay	40.9	47.3	42.0	41.3	11.5	9.6	12.4	3.0	14.0	15.8	6.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	40.9	47.3	42.0	41.3	11.5	9.6	12.4	3.0	14.0	15.8	6.8
LOS	D	D	D	D	B	A	B	A	B	B	A
Approach Delay		46.4		28.0			11.2			14.5	
Approach LOS		D		C			B			B	
Queue Length 50th (m)	6.6	39.6	6.6	19.2	0.0	1.4	25.0	1.7	27.4	44.3	1.6
Queue Length 95th (m)	15.7	62.8	15.9	34.1	15.4	m1.8	23.3	m2.2	0.0	152.4	m7.1
Internal Link Dist (m)		178.0		171.4			167.5			240.3	
Turn Bay Length (m)	15.0		15.0		60.0	60.0		70.0	60.0		40.0
Base Capacity (vph)	227	413	200	426	312	395	1479	796	736	1010	1054
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.15	0.47	0.17	0.23	0.35	0.03	0.23	0.06	0.54	0.51	0.05

Intersection Summary

Cycle Length: 120
Actuated Cycle Length: 120
Offset: 67 (56%), Referenced to phase 2:SBTL and 6:NBTL, Start of Green
Natural Cycle: 90
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.59
Intersection Signal Delay: 19.5 — Intersection LOS: B
Intersection Capacity Utilization 76.9% — ICU Level of Service D
Analysis Period (min) 15
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 10: Robie & University

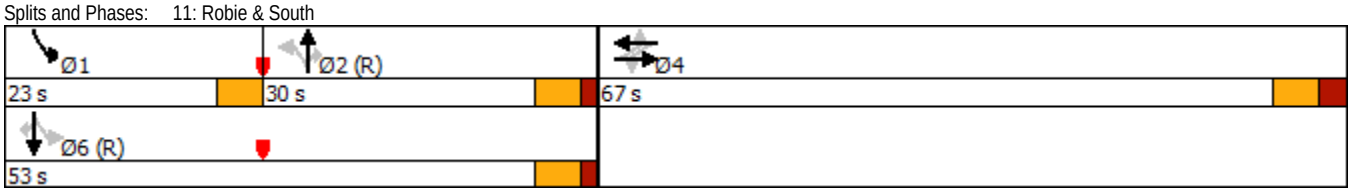


Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations										
Traffic Volume (vph)	50	290	10	135	25	221	30	175	275	40
Future Volume (vph)	50	290	10	135	25	221	30	175	275	40
Lane Group Flow (vph)	0	422	0	285	29	252	34	200	314	46
Turn Type	Perm	NA	Perm	NA	Perm	NA	Perm	pm+pt	NA	Perm
Protected Phases		4		4		2		1	6	
Permitted Phases	4		4		2		2	6		6
Detector Phase	4	4	4	4	2	2	2	1	6	6
Switch Phase										
Minimum Initial (s)	10.0	10.0	10.0	10.0	10.0	10.0	10.0	8.0	10.0	10.0
Minimum Split (s)	47.8	47.8	47.8	47.8	24.7	24.7	24.7	13.0	24.7	24.7
Total Split (s)	67.0	67.0	67.0	67.0	30.0	30.0	30.0	23.0	53.0	53.0
Total Split (%)	55.8%	55.8%	55.8%	55.8%	25.0%	25.0%	25.0%	19.2%	44.2%	44.2%
Yellow Time (s)	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.0	4.1	4.1
All-Red Time (s)	2.7	2.7	2.7	2.7	1.6	1.6	1.6	0.0	1.6	1.6
Lost Time Adjust (s)		0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)		6.8		6.8	5.7	5.7	5.7	4.0	5.7	5.7
Lead/Lag					Lag	Lag	Lag	Lead		
Lead-Lag Optimize?										
Recall Mode	Ped	Ped	Ped	Ped	C-Min	C-Min	C-Min	None	C-Min	C-Min
Act Effct Green (s)		45.6		45.6	44.0	44.0	44.0	63.6	61.9	61.9
Actuated g/C Ratio		0.38		0.38	0.37	0.37	0.37	0.53	0.52	0.52
v/c Ratio		0.77		0.45	0.10	0.41	0.09	0.43	0.40	0.09
Control Delay		41.8		24.9	32.1	34.2	1.3	23.1	25.5	12.3
Queue Delay		0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay		41.8		24.9	32.1	34.2	1.3	23.1	25.5	12.3
LOS		D		C	C	C	A	C	C	B
Approach Delay		41.8		24.9		30.4			23.6	
Approach LOS		D		C		C			C	
Queue Length 50th (m)		90.9		44.6	4.1	40.3	0.0	20.1	42.8	1.1
Queue Length 95th (m)		106.4		55.9	14.2	83.8	1.3	49.1	80.0	m10.1
Internal Link Dist (m)		115.5		183.6		422.3			167.5	
Turn Bay Length (m)					40.0			60.0		
Base Capacity (vph)		723		818	292	608	372	503	782	515
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		0.58		0.35	0.10	0.41	0.09	0.40	0.40	0.09

Intersection Summary

Cycle Length: 120
Actuated Cycle Length: 120
Offset: 28 (23%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle: 90
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.77
Intersection Signal Delay: 30.0 Intersection LOS: C
Intersection Capacity Utilization 80.1% ICU Level of Service D
Analysis Period (min) 15
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 11: Robie & South

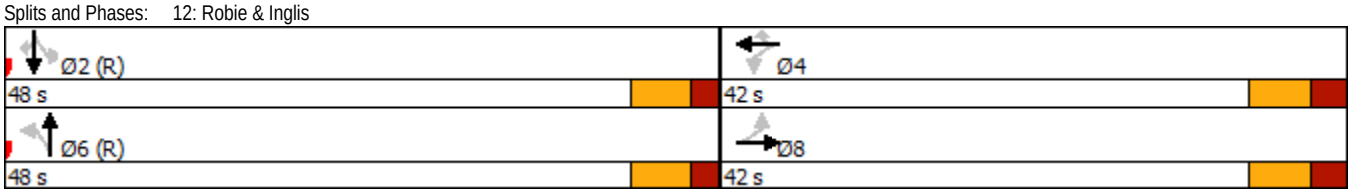


Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	SBL	SBT	SBR
Lane Configurations										
Traffic Volume (vph)	20	260	65	185	170	10	40	210	105	20
Future Volume (vph)	20	260	65	185	170	10	40	210	105	20
Lane Group Flow (vph)	0	371	0	285	194	11	97	240	120	23
Turn Type	Perm	NA	Perm	NA	Perm	Perm	NA	Perm	NA	Perm
Protected Phases		8		4			6		2	
Permitted Phases	8		4		4	6		2		2
Detector Phase	8	8	4	4	4	6	6	2	2	2
Switch Phase										
Minimum Initial (s)	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Minimum Split (s)	31.7	31.7	31.7	31.7	31.7	23.1	23.1	23.1	23.1	23.1
Total Split (s)	42.0	42.0	42.0	42.0	42.0	48.0	48.0	48.0	48.0	48.0
Total Split (%)	46.7%	46.7%	46.7%	46.7%	46.7%	53.3%	53.3%	53.3%	53.3%	53.3%
Yellow Time (s)	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1
All-Red Time (s)	2.6	2.6	2.6	2.6	2.6	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)		0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)		6.7		6.7	6.7	6.1	6.1	6.1	6.1	6.1
Lead/Lag										
Lead-Lag Optimize?										
Recall Mode	Ped	Ped	Ped	Ped	Ped	C-Min	C-Min	C-Min	C-Min	C-Min
Act Effct Green (s)		27.8		27.8	27.8	49.4	49.4	49.4	49.4	49.4
Actuated g/C Ratio		0.31		0.31	0.31	0.55	0.55	0.55	0.55	0.55
v/c Ratio		0.70		0.79	0.35	0.02	0.13	0.43	0.14	0.03
Control Delay		33.8		44.2	4.9	11.3	6.6	16.2	11.5	1.7
Queue Delay		0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay		33.8		44.2	4.9	11.3	6.6	16.2	11.5	1.7
LOS		C		D	A	B	A	B	B	A
Approach Delay		33.8		28.3			7.1		13.9	
Approach LOS		C		C			A		B	
Queue Length 50th (m)		57.4		46.9	0.0	0.8	3.2	21.2	8.7	0.0
Queue Length 95th (m)		75.2		67.0	12.6	3.7	12.4	49.1	21.4	1.9
Internal Link Dist (m)		113.9		142.4			118.8		422.3	
Turn Bay Length (m)					50.0	60.0		60.0		
Base Capacity (vph)		674		460	654	637	760	554	851	684
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		0.55		0.62	0.30	0.02	0.13	0.43	0.14	0.03

Intersection Summary

Cycle Length: 90
Actuated Cycle Length: 90
Offset: 0 (0%), Referenced to phase 2:SBTL and 6:NBTL, Start of Green
Natural Cycle: 55
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.79
Intersection Signal Delay: 24.0 — Intersection LOS: C
Intersection Capacity Utilization 72.1% — ICU Level of Service C
Analysis Period (min) 15

Splits and Phases: 12: Robie & Inglis



Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations											
Traffic Volume (vph)	190	195	15	470	125	30	747	10	20	369	130
Future Volume (vph)	190	195	15	470	125	30	747	10	20	369	130
Lane Group Flow (vph)	217	291	0	553	143	34	853	11	23	421	148
Turn Type	pm+pt	NA	Perm	NA	Perm	Perm	NA	Perm	Perm	NA	Perm
Protected Phases	3	8		4			6			2	
Permitted Phases	8		4		4	6		6	2		2
Detector Phase	3	8	4	4	4	6	6	6	2	2	2
Switch Phase											
Minimum Initial (s)	7.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Minimum Split (s)	11.0	50.0	37.0	37.0	37.0	40.0	40.0	40.0	40.0	40.0	40.0
Total Split (s)	14.0	52.0	38.0	38.0	38.0	68.0	68.0	68.0	68.0	68.0	68.0
Total Split (%)	11.7%	43.3%	31.7%	31.7%	31.7%	56.7%	56.7%	56.7%	56.7%	56.7%	56.7%
Yellow Time (s)	4.0	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1
All-Red Time (s)	0.0	2.1	2.1	2.1	2.1	1.7	1.7	1.7	1.7	1.7	1.7
Lost Time Adjust (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	6.2		6.2	6.2	5.8	5.8	5.8	5.8	5.8	5.8
Lead/Lag	Lead		Lag	Lag	Lag						
Lead-Lag Optimize?											
Recall Mode	None	None	None	None	None	C-Min	C-Min	C-Min	C-Min	C-Min	C-Min
Act Effct Green (s)	49.4	47.2		31.8	31.8	60.8	60.8	60.8	60.8	60.8	60.8
Actuated g/C Ratio	0.41	0.39		0.26	0.26	0.51	0.51	0.51	0.51	0.51	0.51
v/c Ratio	0.95	0.42		0.97	0.33	0.09	0.96	0.01	0.33	0.46	0.37
Control Delay	76.9	27.8		75.5	18.7	15.6	50.8	0.0	17.4	7.0	2.0
Queue Delay	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	76.9	27.8		75.5	18.7	15.6	50.8	0.0	17.4	7.0	2.0
LOS	E	C		E	B	B	D	A	B	A	A
Approach Delay		48.8		63.8			48.8			6.2	
Approach LOS		D		E			D			A	
Queue Length 50th (m)	~38.8	47.6		129.3	11.5	3.9	181.6	0.0	0.7	12.7	0.0
Queue Length 95th (m)	#87.7	72.1		#198.1	29.1	9.6	#269.1	0.0	m1.9	m26.0	m0.0
Internal Link Dist (m)		253.6		180.4			402.8			360.9	
Turn Bay Length (m)	80.0				50.0	40.0			50.0		
Base Capacity (vph)	229	690		569	427	370	909	773	72	945	405
Starvation Cap Reductn	0	0		0	0	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	0.95	0.42		0.97	0.33	0.09	0.94	0.01	0.32	0.45	0.37

Intersection Summary

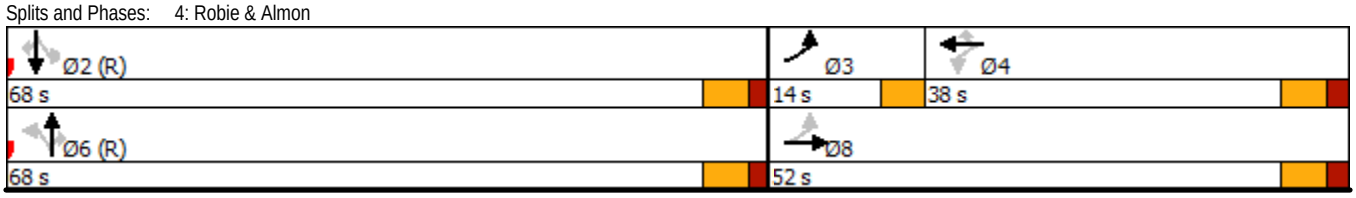
Cycle Length: 120
Actuated Cycle Length: 120
Offset: 85 (71%), Referenced to phase 2:SBTL and 6:NBTL, Start of Green
Natural Cycle: 100
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.97
Intersection Signal Delay: 43.3 — Intersection LOS: D
Intersection Capacity Utilization 116.3% — ICU Level 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.

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

Splits and Phases: 4: Robie & Almon



Lane Group	EBT	WBT	NBT	NBR	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	345	445	657	375	514	30
Future Volume (vph)	345	445	657	375	514	30
Lane Group Flow (vph)	423	531	750	428	587	34
Turn Type	NA	NA	NA	Perm	NA	Perm
Protected Phases	8	4	6		2	
Permitted Phases				6		2
Detector Phase	8	4	6	6	2	2
Switch Phase						
Minimum Initial (s)	10.0	10.0	10.0	10.0	10.0	10.0
Minimum Split (s)	23.7	23.7	54.0	54.0	54.0	54.0
Total Split (s)	36.0	36.0	54.0	54.0	54.0	54.0
Total Split (%)	40.0%	40.0%	60.0%	60.0%	60.0%	60.0%
Yellow Time (s)	4.1	4.1	4.1	4.1	4.1	4.1
All-Red Time (s)	1.6	1.6	1.5	1.5	1.5	1.5
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.7	5.7	5.6	5.6	5.6	5.6
Lead/Lag						
Lead-Lag Optimize?						
Recall Mode	Ped	Ped	C-Min	C-Min	C-Min	C-Min
Act Effct Green (s)	28.5	28.5	50.2	50.2	50.2	50.2
Actuated g/C Ratio	0.32	0.32	0.56	0.56	0.56	0.56
v/c Ratio	0.75	0.91	0.77	0.98	0.59	0.04
Control Delay	36.5	50.1	23.0	54.9	16.7	3.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	36.5	50.1	23.0	54.9	16.7	3.6
LOS	D	D	C	D	B	A
Approach Delay	36.5	50.1	34.6		16.0	
Approach LOS	D	D	C		B	
Queue Length 50th (m)	62.4	84.0	99.1	~54.7	65.8	0.0
Queue Length 95th (m)	95.4	#139.1	150.8	#121.9	98.3	4.1
Internal Link Dist (m)	320.4	233.6	68.2		402.8	
Turn Bay Length (m)				50.0		
Base Capacity (vph)	597	623	971	438	997	836
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.71	0.85	0.77	0.98	0.59	0.04

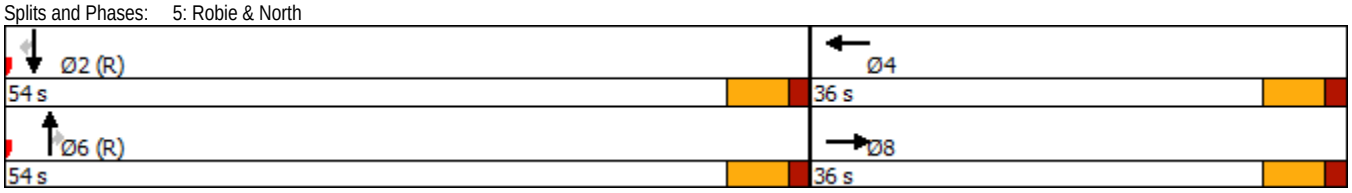
Intersection Summary

Cycle Length: 90
Actuated Cycle Length: 90
Offset: 0 (0%), Referenced to phase 2:SBT and 6:NBT, Start of Green
Natural Cycle: 90
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.98
Intersection Signal Delay: 33.7 Intersection LOS: C
Intersection Capacity Utilization 81.6% ICU Level of Service D
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.

Splits and Phases: 5: Robie & North

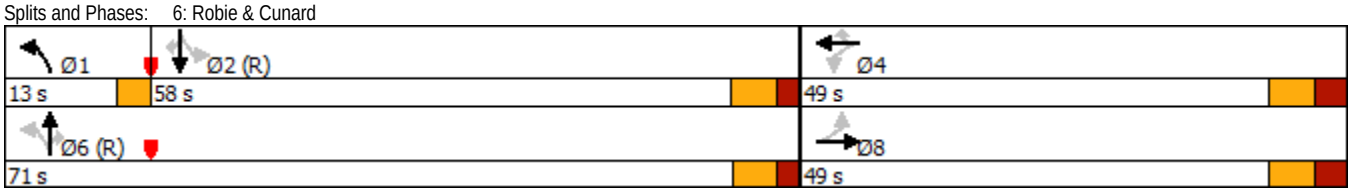


Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations											
Traffic Volume (vph)	20	300	65	475	75	50	747	60	55	534	50
Future Volume (vph)	20	300	65	475	75	50	747	60	55	534	50
Lane Group Flow (vph)	23	349	74	542	86	57	853	68	63	609	57
Turn Type	Perm	NA	Perm	NA	Perm	pm+pt	NA	Perm	Perm	NA	Perm
Protected Phases		8		4		1	6			2	
Permitted Phases	8		4		4	6		6	2		2
Detector Phase	8	8	4	4	4	1	6	6	2	2	2
Switch Phase											
Minimum Initial (s)	10.0	10.0	10.0	10.0	10.0	8.0	8.0	8.0	10.0	10.0	10.0
Minimum Split (s)	39.1	39.1	39.1	39.1	39.1	13.0	24.0	24.0	37.9	37.9	37.9
Total Split (s)	49.0	49.0	49.0	49.0	49.0	13.0	71.0	71.0	58.0	58.0	58.0
Total Split (%)	40.8%	40.8%	40.8%	40.8%	40.8%	10.8%	59.2%	59.2%	48.3%	48.3%	48.3%
Yellow Time (s)	4.1	4.1	4.1	4.1	4.1	3.0	4.0	4.0	4.1	4.1	4.1
All-Red Time (s)	3.0	3.0	3.0	3.0	3.0	0.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	7.1	7.1	7.1	7.1	7.1	3.0	6.0	6.0	6.1	6.1	6.1
Lead/Lag						Lead			Lag	Lag	Lag
Lead-Lag Optimize?											
Recall Mode	Ped	Ped	Ped	Ped	Ped	None	C-Min	C-Min	C-Min	C-Min	C-Min
Act Effct Green (s)	39.3	39.3	39.3	39.3	39.3	70.6	67.6	67.6	58.4	58.4	58.4
Actuated g/C Ratio	0.33	0.33	0.33	0.33	0.33	0.59	0.56	0.56	0.49	0.49	0.49
v/c Ratio	0.35	0.71	0.34	0.91	0.18	0.18	0.83	0.09	0.45	0.69	0.07
Control Delay	47.0	43.5	34.7	58.6	12.7	12.8	31.1	4.7	37.0	30.5	4.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	47.0	43.5	34.7	58.6	12.7	12.8	31.1	4.7	37.0	30.5	4.1
LOS	D	D	C	E	B	B	C	A	D	C	A
Approach Delay		43.7		50.4			28.2			29.0	
Approach LOS		D		D			C			C	
Queue Length 50th (m)	3.9	68.3	12.6	116.3	4.8	5.8	168.3	1.2	10.4	117.3	0.0
Queue Length 95th (m)	12.8	102.2	26.3	#175.7	16.1	11.8	#239.8	7.8	27.5	164.0	6.4
Internal Link Dist (m)		72.7		213.1			210.2			354.7	
Turn Bay Length (m)	50.0				50.0	40.0			40.0		
Base Capacity (vph)	69	528	230	638	494	343	1029	743	139	888	796
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.33	0.66	0.32	0.85	0.17	0.17	0.83	0.09	0.45	0.69	0.07

Intersection Summary

Cycle Length: 120
Actuated Cycle Length: 120
Offset: 0 (0%), Referenced to phase 2:SBTL and 6:NBTL, Start of Green
Natural Cycle: 90
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.91
Intersection Signal Delay: 36.1 — Intersection LOS: D
Intersection Capacity Utilization 99.9% — 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: 6: Robie & Cunard



Lane Group	EBT	EBR	EBR2	WBT	NBL	NBT	NBR	SBL2	SBL	SBT	SBR	NWL
Lane Configurations												
Traffic Volume (vph)	215	295	140	535	245	756	30	70	140	542	60	625
Future Volume (vph)	215	295	140	535	245	756	30	70	140	542	60	625
Lane Group Flow (vph)	245	337	160	679	280	863	68	0	240	619	68	941
Turn Type	NA	pt+ov	Perm	NA	pm+pt	NA	Perm	pm+pt	pm+pt	NA	Perm	Prot
Protected Phases	7	7 8		7	1	6		5	5	2		8
Permitted Phases			7		6		6	2	2		2	
Minimum Split (s)	37.0		37.0	37.0	14.0	36.0	36.0	14.0	14.0	49.0	49.0	36.0
Total Split (s)	37.0		37.0	37.0	19.0	44.0	44.0	19.0	19.0	44.0	44.0	50.0
Total Split (%)	24.7%		24.7%	24.7%	12.7%	29.3%	29.3%	12.7%	12.7%	29.3%	29.3%	33.3%
Yellow Time (s)	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	4.0		4.0	4.0	0.0	3.0	3.0	0.0	0.0	3.0	3.0	4.0
Lost Time Adjust (s)	-1.0		-1.0	-1.0	-1.0	-1.0	0.0		0.0	-1.0	0.0	-1.0
Total Lost Time (s)	7.0		7.0	7.0	3.0	6.0	7.0		4.0	6.0	7.0	7.0
Lead/Lag	Lead		Lead	Lead	Lead	Lag	Lag	Lead	Lead	Lag	Lag	Lag
Lead-Lag Optimize?												
Act Effct Green (s)	30.0	80.0	30.0	30.0	57.0	38.0	37.0		55.0	38.0	37.0	43.0
Actuated g/C Ratio	0.20	0.53	0.20	0.20	0.38	0.25	0.25		0.37	0.25	0.25	0.29
v/c Ratio	0.68	0.41	0.43	1.00	0.97	1.02	0.22		1.08	0.79	0.17	1.02
Control Delay	66.1	22.9	13.7	93.4	80.9	89.6	47.5		120.3	60.5	0.9	87.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0
Total Delay	66.1	22.9	13.7	93.4	80.9	89.6	47.5		120.3	60.5	0.9	87.8
LOS	E	C	B	F	F	F	D		F	E	A	F
Approach Delay	35.2			93.4		85.2				71.6		87.8
Approach LOS	D			F		F				E		F
Queue Length 50th (m)	68.3	58.3	3.7	~106.8	59.2	~142.3	16.3		~62.8	91.1	0.0	~152.9
Queue Length 95th (m)	98.6	82.6	24.6	#149.2	#107.9	#183.5	30.3		#118.5	114.0	0.0	#193.6
Internal Link Dist (m)	274.0			207.4		413.3				168.1		150.4
Turn Bay Length (m)		70.0	70.0		180.0				80.0			
Base Capacity (vph)	361	819	372	678	289	849	305		223	786	408	919
Starvation Cap Reductn	0	0	0	0	0	0	0		0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0		0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0		0	0	0	0
Reduced v/c Ratio	0.68	0.41	0.43	1.00	0.97	1.02	0.22		1.08	0.79	0.17	1.02

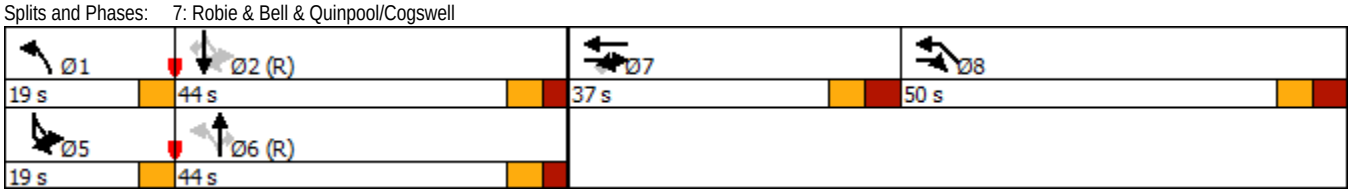
Intersection Summary

Cycle Length: 150
Actuated Cycle Length: 150
Offset: 0 (0%), Referenced to phase 2:SBTL and 6:NBTL, Start of Green
Natural Cycle: 140
Control Type: Pretimed
Maximum v/c Ratio: 1.08
Intersection Signal Delay: 75.9 — Intersection LOS: E
Intersection Capacity Utilization 119.4% — 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.

Splits and Phases: 7: Robie & Bell & Quinpool/Cogswell

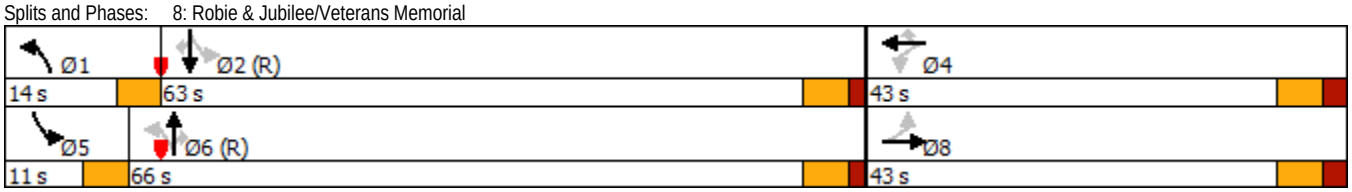


Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations											
Traffic Volume (vph)	60	135	15	340	120	160	721	45	105	607	30
Future Volume (vph)	60	135	15	340	120	160	721	45	105	607	30
Lane Group Flow (vph)	0	268	0	405	137	183	823	51	120	693	34
Turn Type	Perm	NA	Perm	NA	Perm	pm+pt	NA	Perm	pm+pt	NA	Perm
Protected Phases		8		4		1	6		5	2	
Permitted Phases	8		4		4	6		6	2		2
Detector Phase	8	8	4	4	4	1	6	6	5	2	2
Switch Phase											
Minimum Initial (s)	10.0	10.0	10.0	10.0	10.0	7.0	10.0	10.0	7.0	10.0	10.0
Minimum Split (s)	31.6	31.6	31.6	31.6	31.6	11.0	22.8	22.8	11.0	22.8	22.8
Total Split (s)	43.0	43.0	43.0	43.0	43.0	14.0	66.0	66.0	11.0	63.0	63.0
Total Split (%)	35.8%	35.8%	35.8%	35.8%	35.8%	11.7%	55.0%	55.0%	9.2%	52.5%	52.5%
Yellow Time (s)	4.1	4.1	4.1	4.1	4.1	4.0	4.1	4.1	4.0	4.1	4.1
All-Red Time (s)	2.4	2.4	2.4	2.4	2.4	0.0	1.7	1.7	0.0	1.7	1.7
Lost Time Adjust (s)		0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)		6.5		6.5	6.5	4.0	5.8	5.8	4.0	5.8	5.8
Lead/Lag						Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?											
Recall Mode	Ped	Ped	Ped	Ped	Ped	None	C-Min	C-Min	None	C-Min	C-Min
Act Effct Green (s)		50.9		50.9	50.9	57.5	44.4	44.4	51.8	41.5	41.5
Actuated g/C Ratio		0.42		0.42	0.42	0.48	0.37	0.37	0.43	0.35	0.35
v/c Ratio		0.53		0.54	0.23	0.64	0.68	0.23	0.50	0.61	0.10
Control Delay		30.1		29.5	9.7	32.8	24.7	3.0	24.7	34.9	1.5
Queue Delay		0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay		30.1		29.5	9.7	32.8	24.7	3.0	24.7	34.9	1.5
LOS		C		C	A	C	C	A	C	C	A
Approach Delay		30.1		24.5			25.1			32.1	
Approach LOS		C		C			C			C	
Queue Length 50th (m)		45.3		71.0	6.5	13.7	83.8	0.0	14.8	71.7	0.0
Queue Length 95th (m)		74.9		105.0	20.1	m42.3	51.7	m1.0	24.6	84.5	1.5
Internal Link Dist (m)		189.8		183.6			355.1			413.3	
Turn Bay Length (m)					40.0	50.0			90.0		
Base Capacity (vph)		506		757	597	288	1637	278	239	1571	463
Starvation Cap Reductn		0		0	0	0	0	0	0	0	0
Spillback Cap Reductn		0		0	0	0	0	0	0	0	0
Storage Cap Reductn		0		0	0	0	0	0	0	0	0
Reduced v/c Ratio		0.53		0.54	0.23	0.64	0.50	0.18	0.50	0.44	0.07

Intersection Summary

Cycle Length: 120
Actuated Cycle Length: 120
Offset: 76 (63%), Referenced to phase 2:SBTL and 6:NBTL, Start of Green
Natural Cycle: 70
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.68
Intersection Signal Delay: 27.7 — Intersection LOS: C
Intersection Capacity Utilization 87.7% — ICU Level of Service E
Analysis Period (min) 15
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 8: Robie & Jubilee/Veterans Memorial

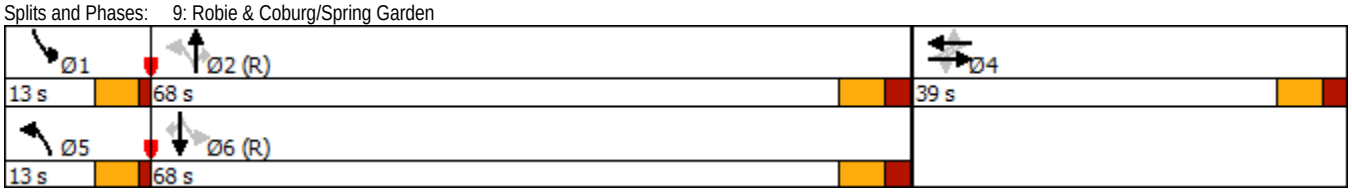


Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations										
Traffic Volume (vph)	55	135	40	315	160	717	30	120	375	35
Future Volume (vph)	55	135	40	315	160	717	30	120	375	35
Lane Group Flow (vph)	63	154	0	611	183	818	34	137	428	40
Turn Type	Perm	NA	Perm	NA	pm+pt	NA	Perm	pm+pt	NA	Perm
Protected Phases		4		4	5	2		1	6	
Permitted Phases	4		4		2		2	6		6
Detector Phase	4	4	4	4	5	2	2	1	6	6
Switch Phase										
Minimum Initial (s)	10.0	10.0	10.0	10.0	8.0	10.0	10.0	8.0	10.0	10.0
Minimum Split (s)	33.5	33.5	33.5	33.5	13.0	34.5	34.5	13.0	34.5	34.5
Total Split (s)	39.0	39.0	39.0	39.0	13.0	68.0	68.0	13.0	68.0	68.0
Total Split (%)	32.5%	32.5%	32.5%	32.5%	10.8%	56.7%	56.7%	10.8%	56.7%	56.7%
Yellow Time (s)	4.1	4.1	4.1	4.1	4.0	4.1	4.1	4.0	4.1	4.1
All-Red Time (s)	2.4	2.4	2.4	2.4	1.0	2.4	2.4	1.0	2.4	2.4
Lost Time Adjust (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.5	6.5		6.5	5.0	6.5	6.5	5.0	6.5	6.5
Lead/Lag					Lead	Lag	Lag	Lead	Lag	Lag
Lead-Lag Optimize?										
Recall Mode	None	None	None	None	None	C-Min	C-Min	None	C-Min	C-Min
Act Effct Green (s)	35.0	35.0		35.0	69.4	57.9	57.9	67.6	57.1	57.1
Actuated g/C Ratio	0.29	0.29		0.29	0.58	0.48	0.48	0.56	0.48	0.48
v/c Ratio	0.47	0.29		0.80	0.38	0.54	0.09	0.40	0.53	0.06
Control Delay	45.3	32.8		42.5	14.2	24.7	0.4	38.9	57.2	17.3
Queue Delay	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	45.3	32.8		42.5	14.2	24.7	0.4	38.9	57.2	17.3
LOS	D	C		D	B	C	A	D	E	B
Approach Delay		36.5		42.5		22.1			50.4	
Approach LOS		D		D		C			D	
Queue Length 50th (m)	12.1	27.8		61.8	17.8	70.6	0.0	32.1	107.7	3.4
Queue Length 95th (m)	24.8	41.1		76.5	33.6	99.1	0.1	41.6	100.2	m7.5
Internal Link Dist (m)		121.4		242.2		240.3			355.1	
Turn Bay Length (m)	30.0				60.0					
Base Capacity (vph)	140	563		795	479	1643	423	341	893	699
Starvation Cap Reductn	0	0		0	0	0	0	0	0	0
Spillback Cap Reductn	0	0		0	0	0	0	0	0	0
Storage Cap Reductn	0	0		0	0	0	0	0	0	0
Reduced v/c Ratio	0.45	0.27		0.77	0.38	0.50	0.08	0.40	0.48	0.06

Intersection Summary

Cycle Length: 120
Actuated Cycle Length: 120
Offset: 64 (53%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle: 85
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.80
Intersection Signal Delay: 35.3 — Intersection LOS: D
Intersection Capacity Utilization 98.0% — ICU Level of Service F
Analysis Period (min) 15
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 9: Robie & Coburg/Spring Garden

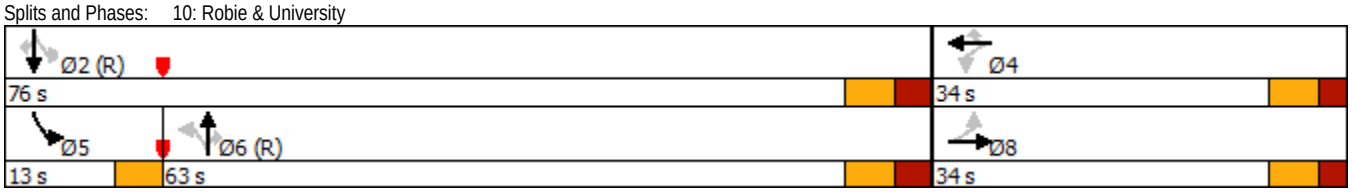


Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations											
Traffic Volume (vph)	45	100	25	145	225	30	659	30	135	263	45
Future Volume (vph)	45	100	25	145	225	30	659	30	135	263	45
Lane Group Flow (vph)	51	137	29	165	257	34	752	34	154	300	51
Turn Type	Perm	NA	Perm	NA	Perm	Perm	NA	Perm	pm+pt	NA	Perm
Protected Phases		8		4			6		5	2	
Permitted Phases	8		4		4	6		6	2		2
Detector Phase	8	8	4	4	4	6	6	6	5	2	2
Switch Phase											
Minimum Initial (s)	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	8.0	10.0	10.0
Minimum Split (s)	32.5	32.5	32.5	32.5	32.5	43.3	43.3	43.3	13.0	43.3	43.3
Total Split (s)	34.0	34.0	34.0	34.0	34.0	63.0	63.0	63.0	13.0	76.0	76.0
Total Split (%)	30.9%	30.9%	30.9%	30.9%	30.9%	57.3%	57.3%	57.3%	11.8%	69.1%	69.1%
Yellow Time (s)	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.0	4.1	4.1
All-Red Time (s)	2.4	2.4	2.4	2.4	2.4	3.2	3.2	3.2	0.0	3.2	3.2
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.5	6.5	6.5	6.5	6.5	7.3	7.3	7.3	4.0	7.3	7.3
Lead/Lag						Lag	Lag	Lag	Lead		
Lead-Lag Optimize?											
Recall Mode	Ped	Ped	Ped	Ped	Ped	C-Min	C-Min	C-Min	None	C-Min	C-Min
Act Effct Green (s)	26.4	26.4	26.4	26.4	26.4	56.5	56.5	56.5	73.1	69.8	69.8
Actuated g/C Ratio	0.24	0.24	0.24	0.24	0.24	0.51	0.51	0.51	0.66	0.63	0.63
v/c Ratio	0.27	0.36	0.12	0.42	0.64	0.07	0.49	0.04	0.35	0.31	0.07
Control Delay	38.5	35.4	34.0	39.2	12.4	12.8	16.1	12.4	9.2	10.3	4.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	38.5	35.4	34.0	39.2	12.4	12.8	16.1	12.4	9.2	10.3	4.0
LOS	D	D	C	D	B	B	B	B	A	B	A
Approach Delay		36.2		23.6			15.8			9.3	
Approach LOS		D		C			B			A	
Queue Length 50th (m)	9.0	23.0	4.9	30.2	0.0	3.3	45.3	3.2	10.9	26.7	1.2
Queue Length 95th (m)	19.7	39.8	12.5	49.1	25.1	m6.2	m62.4	m6.1	19.4	43.3	5.7
Internal Link Dist (m)		178.0		171.4			167.5			240.3	
Turn Bay Length (m)	15.0		15.0		60.0	60.0			60.0		
Base Capacity (vph)	195	400	259	407	408	493	1554	799	439	963	725
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.26	0.34	0.11	0.41	0.63	0.07	0.48	0.04	0.35	0.31	0.07

Intersection Summary

Cycle Length: 110
Actuated Cycle Length: 110
Offset: 0 (0%), Referenced to phase 2:SBTL and 6:NBTL, Start of Green
Natural Cycle: 90
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.64
Intersection Signal Delay: 17.9 — Intersection LOS: B
Intersection Capacity Utilization 91.3% — ICU Level of Service F
Analysis Period (min) 15
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 10: Robie & University

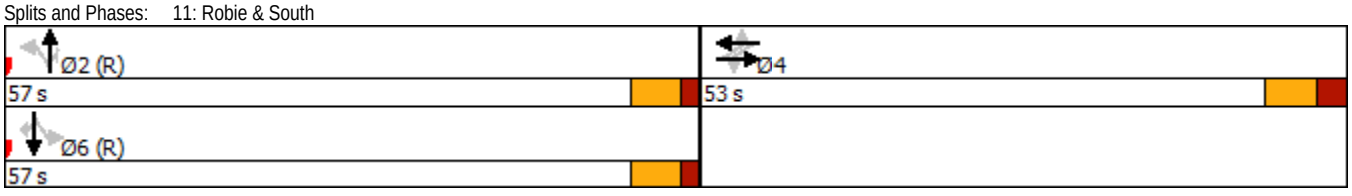


Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations										
Traffic Volume (vph)	55	205	20	345	45	326	15	95	263	50
Future Volume (vph)	55	205	20	345	45	326	15	95	263	50
Lane Group Flow (vph)	0	320	0	697	51	372	17	108	300	57
Turn Type	Perm	NA	Perm	NA	Perm	NA	Perm	Perm	NA	Perm
Protected Phases		4		4		2			6	
Permitted Phases	4		4		2		2	6		6
Detector Phase	4	4	4	4	2	2	2	6	6	6
Switch Phase										
Minimum Initial (s)	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Minimum Split (s)	47.8	47.8	47.8	47.8	24.7	24.7	24.7	24.7	24.7	24.7
Total Split (s)	53.0	53.0	53.0	53.0	57.0	57.0	57.0	57.0	57.0	57.0
Total Split (%)	48.2%	48.2%	48.2%	48.2%	51.8%	51.8%	51.8%	51.8%	51.8%	51.8%
Yellow Time (s)	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1
All-Red Time (s)	2.7	2.7	2.7	2.7	1.6	1.6	1.6	1.6	1.6	1.6
Lost Time Adjust (s)		0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)		6.8		6.8	5.7	5.7	5.7	5.7	5.7	5.7
Lead/Lag										
Lead-Lag Optimize?										
Recall Mode	Ped	Ped	Ped	Ped	C-Min	C-Min	C-Min	C-Min	C-Min	C-Min
Act Effct Green (s)		52.2		52.2	45.3	45.3	45.3	45.3	45.3	45.3
Actuated g/C Ratio		0.47		0.47	0.41	0.41	0.41	0.41	0.41	0.41
v/c Ratio		0.58		0.88	0.18	0.54	0.04	0.42	0.48	0.13
Control Delay		25.1		38.0	23.8	28.9	2.1	26.9	23.9	4.3
Queue Delay		0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay		25.1		38.0	23.8	28.9	2.1	26.9	23.9	4.3
LOS		C		D	C	C	A	C	C	A
Approach Delay		25.1		38.0		27.2			22.2	
Approach LOS		C		D		C			C	
Queue Length 50th (m)		47.7		125.4	6.8	59.3	0.0	17.3	49.5	0.0
Queue Length 95th (m)		71.6		#178.1	16.3	93.1	1.6	35.8	78.4	9.1
Internal Link Dist (m)		115.5		183.6		422.3			167.5	
Turn Bay Length (m)					40.0			60.0		
Base Capacity (vph)		556		795	327	774	524	288	707	484
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		0.58		0.88	0.16	0.48	0.03	0.38	0.42	0.12

Intersection Summary

Cycle Length: 110
Actuated Cycle Length: 110
Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle: 75
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.88
Intersection Signal Delay: 29.6 Intersection LOS: C
Intersection Capacity Utilization 82.2% ICU Level of Service E
Analysis Period (min) 15
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 11: Robie & South

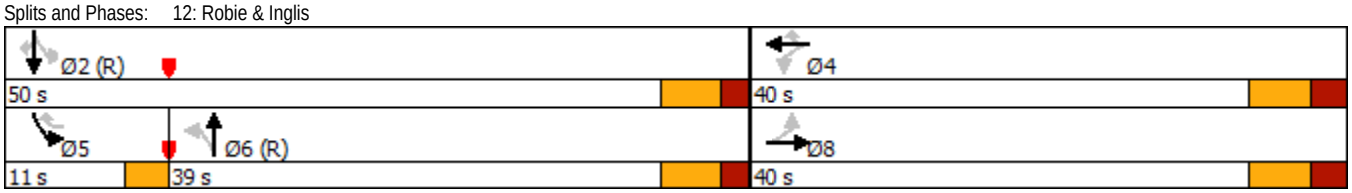


Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	SBL	SBT	SBR
Lane Configurations										
Traffic Volume (vph)	20	235	80	275	275	30	125	175	70	15
Future Volume (vph)	20	235	80	275	275	30	125	175	70	15
Lane Group Flow (vph)	0	320	0	405	314	0	268	200	80	17
Turn Type	Perm	NA	Perm	NA	custom	Perm	NA	pm+pt	NA	Perm
Protected Phases		8		4			6	5	2	
Permitted Phases	8		4		4 5	6		2		2
Detector Phase	8	8	4	4	4 5	6	6	5	2	2
Switch Phase										
Minimum Initial (s)	10.0	10.0	10.0	10.0		10.0	10.0	8.0	10.0	10.0
Minimum Split (s)	31.7	31.7	31.7	31.7		23.1	23.1	11.0	23.1	23.1
Total Split (s)	40.0	40.0	40.0	40.0		39.0	39.0	11.0	50.0	50.0
Total Split (%)	44.4%	44.4%	44.4%	44.4%		43.3%	43.3%	12.2%	55.6%	55.6%
Yellow Time (s)	4.1	4.1	4.1	4.1		4.1	4.1	3.0	4.1	4.1
All-Red Time (s)	2.6	2.6	2.6	2.6		2.0	2.0	0.0	2.0	2.0
Lost Time Adjust (s)		0.0		0.0			0.0	0.0	0.0	0.0
Total Lost Time (s)		6.7		6.7			6.1	3.0	6.1	6.1
Lead/Lag						Lag	Lag	Lead		
Lead-Lag Optimize?										
Recall Mode	Ped	Ped	Max	Max		C-Min	C-Min	None	C-Min	C-Min
Act Effct Green (s)		53.8		53.8	64.8		12.4	26.5	23.4	23.4
Actuated g/C Ratio		0.60		0.60	0.72		0.14	0.29	0.26	0.26
v/c Ratio		0.31		0.47	0.28		0.62	0.70	0.20	0.05
Control Delay		10.3		12.9	1.3		30.2	39.3	26.5	1.4
Queue Delay		0.0		0.0	0.0		0.0	0.0	0.0	0.0
Total Delay		10.3		12.9	1.3		30.2	39.3	26.5	1.4
LOS		B		B	A		C	D	C	A
Approach Delay		10.3		7.8			30.2		33.7	
Approach LOS		B		A			C		C	
Queue Length 50th (m)		24.0		35.1	0.0		15.2	28.0	10.9	0.0
Queue Length 95th (m)		44.2		64.9	7.3		26.1	43.4	20.7	1.1
Internal Link Dist (m)		113.9		142.4			118.8		422.3	
Turn Bay Length (m)					50.0					20.0
Base Capacity (vph)		1025		864	1112		993	287	756	576
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		0.31		0.47	0.28		0.27	0.70	0.11	0.03

Intersection Summary

Cycle Length: 90
Actuated Cycle Length: 90
Offset: 0 (0%), Referenced to phase 2:SBTL and 6:NBTL, Start of Green
Natural Cycle: 70
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.70
Intersection Signal Delay: 16.8
Intersection LOS: B
Intersection Capacity Utilization 85.9%
ICU Level of Service E
Analysis Period (min) 15

Splits and Phases: 12: Robie & Inglis



Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	SBL	SBT
Lane Configurations									
Traffic Volume (vph)	150	290	20	195	45	30	9	40	573
Future Volume (vph)	150	290	20	195	45	30	9	40	573
Lane Group Flow (vph)	171	388	0	246	51	34	10	46	888
Turn Type	pm+pt	NA	Perm	NA	Perm	Prot	NA	Prot	NA
Protected Phases	3	8		4		1	2	1	2
Permitted Phases	8		4		4				
Detector Phase	3	8	4	4	4	1	2	1	2
Switch Phase									
Minimum Initial (s)	7.0	10.0	10.0	10.0	10.0	8.0	10.0	8.0	10.0
Minimum Split (s)	11.0	50.0	37.0	37.0	37.0	13.0	40.0	13.0	40.0
Total Split (s)	13.0	51.0	38.0	38.0	38.0	13.0	56.0	13.0	56.0
Total Split (%)	10.8%	42.5%	31.7%	31.7%	31.7%	10.8%	46.7%	10.8%	46.7%
Yellow Time (s)	4.0	4.1	4.1	4.1	4.1	4.0	4.1	4.0	4.1
All-Red Time (s)	0.0	2.1	2.1	2.1	2.1	1.0	1.7	1.0	1.7
Lost Time Adjust (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	6.2		6.2	6.2	5.0	5.8	5.0	5.8
Lead/Lag	Lead		Lag	Lag	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize?									
Recall Mode	None	None	None	None	None	None	C-Min	None	C-Min
Act Effct Green (s)	35.5	33.3		20.3	20.3	9.1	63.2	9.1	63.2
Actuated g/C Ratio	0.30	0.28		0.17	0.17	0.08	0.53	0.08	0.53
v/c Ratio	0.74	0.79		0.76	0.16	0.25	0.01	0.35	1.00
Control Delay	52.3	50.9		62.2	1.0	56.5	18.2	67.0	46.0
Queue Delay	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	52.3	50.9		62.2	1.0	56.5	18.2	67.0	46.0
LOS	D	D		E	A	E	B	E	D
Approach Delay		51.3		51.7			47.8		47.0
Approach LOS		D		D			D		D
Queue Length 50th (m)	31.7	83.5		56.1	0.0	7.7	1.1	11.1	~222.0
Queue Length 95th (m)	45.4	107.8		76.7	0.0	17.7	4.7	m18.2	#327.7
Internal Link Dist (m)		253.6		227.2			402.8		360.9
Turn Bay Length (m)	80.0				50.0			180.0	
Base Capacity (vph)	231	660		508	447	134	923	131	892
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	0.74	0.59		0.48	0.11	0.25	0.01	0.35	1.00

Intersection Summary

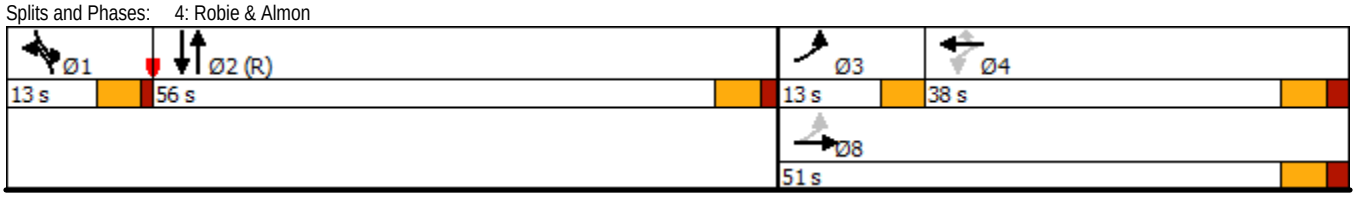
Cycle Length: 120
Actuated Cycle Length: 120
Offset: 78 (65%), Referenced to phase 2:NBSB and 6:, Start of Green
Natural Cycle: 125
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 1.00
Intersection Signal Delay: 49.1 — Intersection LOS: D
Intersection Capacity Utilization 120.7% — ICU Level of 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.

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

Splits and Phases: 4: Robie & Almon

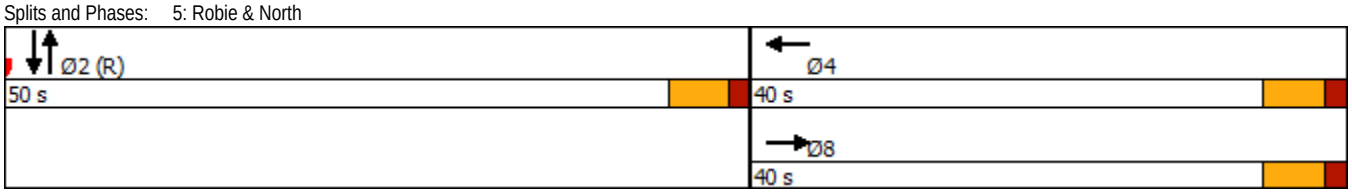


Lane Group	EBT	WBT	NBT	SBT
Lane Configurations				
Traffic Volume (vph)	375	420	9	553
Future Volume (vph)	375	420	9	553
Lane Group Flow (vph)	457	490	10	642
Turn Type	NA	NA	NA	NA
Protected Phases	8	4	2	2
Permitted Phases				
Detector Phase	8	4	2	2
Switch Phase				
Minimum Initial (s)	10.0	10.0	10.0	10.0
Minimum Split (s)	23.7	23.7	49.0	49.0
Total Split (s)	40.0	40.0	50.0	50.0
Total Split (%)	44.4%	44.4%	55.6%	55.6%
Yellow Time (s)	4.1	4.1	4.1	4.1
All-Red Time (s)	1.6	1.6	1.5	1.5
Lost Time Adjust (s)	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.7	5.7	5.6	5.6
Lead/Lag				
Lead-Lag Optimize?				
Recall Mode	Ped	Ped	C-Min	C-Min
Act Effct Green (s)	28.6	28.6	50.1	50.1
Actuated g/C Ratio	0.32	0.32	0.56	0.56
v/c Ratio	0.81	0.83	0.01	0.65
Control Delay	39.7	40.6	11.2	19.0
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	39.7	40.6	11.2	19.0
LOS	D	D	B	B
Approach Delay	39.7	40.6	11.2	19.0
Approach LOS	D	D	B	B
Queue Length 50th (m)	70.0	76.1	0.8	74.3
Queue Length 95th (m)	97.5	104.2	3.4	125.4
Internal Link Dist (m)	171.5	199.1	446.6	402.8
Turn Bay Length (m)				
Base Capacity (vph)	673	708	969	992
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.68	0.69	0.01	0.65

Intersection Summary

Cycle Length: 90
Actuated Cycle Length: 90
Offset: 0 (0%), Referenced to phase 2:NBSB, Start of Green
Natural Cycle: 80
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.83
Intersection Signal Delay: 31.5
Intersection LOS: C
Intersection Capacity Utilization 69.6%
ICU Level of Service C
Analysis Period (min) 15

Splits and Phases: 5: Robie & North



Lane Group	EBL	EBT	WBL2	WBT	WBR	NBL2	NBL	NBT	SBL	SBT
Lane Configurations										
Traffic Volume (vph)	10	410	40	160	40	50	6	9	75	643
Future Volume (vph)	10	410	40	160	40	50	6	9	75	643
Lane Group Flow (vph)	11	571	46	183	46	51	0	23	86	745
Turn Type	Perm	NA	Perm	NA	Perm	Prot	Perm	NA	Prot	NA
Protected Phases		8		4		9		2	1	6
Permitted Phases	8		4		4		2			
Detector Phase	8	8	4	4	4	9	2	2	1	6
Switch Phase										
Minimum Initial (s)	10.0	10.0	10.0	10.0	10.0	8.0	10.0	10.0	8.0	8.0
Minimum Split (s)	39.1	39.1	39.1	39.1	39.1	13.0	37.9	37.9	13.0	24.0
Total Split (s)	49.0	49.0	49.0	49.0	49.0	15.0	56.0	56.0	15.0	56.0
Total Split (%)	40.8%	40.8%	40.8%	40.8%	40.8%	12.5%	46.7%	46.7%	12.5%	46.7%
Yellow Time (s)	4.1	4.1	4.1	4.1	4.1	4.0	4.1	4.1	4.0	4.0
All-Red Time (s)	3.0	3.0	3.0	3.0	3.0	1.0	2.0	2.0	1.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Total Lost Time (s)	7.1	7.1	7.1	7.1	7.1	5.0		6.1	5.0	6.0
Lead/Lag							Lag	Lag	Lead	
Lead-Lag Optimize?										
Recall Mode	Ped	Ped	Ped	Ped	Ped	None	C-Min	C-Min	None	C-Min
Act Effct Green (s)	44.8	44.8	44.8	44.8	44.8	9.0		47.5	9.5	50.7
Actuated g/C Ratio	0.37	0.37	0.37	0.37	0.37	0.08		0.40	0.08	0.42
v/c Ratio	0.04	1.06	0.41	0.27	0.09	0.41		0.06	0.63	0.91
Control Delay	26.4	93.2	43.8	28.7	2.5	63.0		21.8	73.7	45.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Total Delay	26.4	93.2	43.8	28.7	2.5	63.0		21.8	73.7	45.9
LOS	C	F	D	C	A	E		C	E	D
Approach Delay		92.0		26.8				50.2		48.8
Approach LOS		F		C				D		D
Queue Length 50th (m)	1.7	~156.3	8.3	31.0	0.0	12.3		3.3	19.9	147.3
Queue Length 95th (m)	5.9	#222.9	21.4	49.3	3.4	25.6		8.9	#39.6	#227.8
Internal Link Dist (m)		72.7		213.1				402.3		446.6
Turn Bay Length (m)	50.0				50.0	40.0			40.0	
Base Capacity (vph)	313	539	112	680	535	138		385	144	817
Starvation Cap Reductn	0	0	0	0	0	0		0	0	0
Spillback Cap Reductn	0	0	0	0	0	0		0	0	0
Storage Cap Reductn	0	0	0	0	0	0		0	0	0
Reduced v/c Ratio	0.04	1.06	0.41	0.27	0.09	0.37		0.06	0.60	0.91

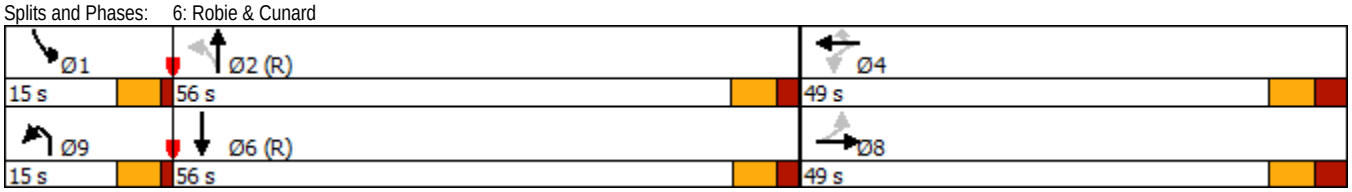
Intersection Summary

Cycle Length: 120
Actuated Cycle Length: 120
Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBT, Start of Green
Natural Cycle: 120
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 1.06
Intersection Signal Delay: 59.7 — Intersection LOS: E
Intersection Capacity Utilization 82.0% — ICU Level of Service D
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.

Splits and Phases: 6: Robie & Cunard



Lane Group	EBT	EBR	EBR2	WBT	NBL	NBT	SBL	SBT	NWL
Lane Configurations									
Traffic Volume (vph)	410	470	400	205	150	15	238	710	245
Future Volume (vph)	410	470	400	205	150	15	238	710	245
Lane Group Flow (vph)	468	536	457	268	171	17	350	861	406
Turn Type	NA	pt+ov	Perm	NA	Prot	NA	Prot	NA	Prot
Protected Phases	7	7 8		7	1	6	5	2	8
Permitted Phases			7						
Minimum Split (s)	37.0		37.0	37.0	14.0	36.0	14.0	44.0	36.0
Total Split (s)	44.0		44.0	44.0	18.0	37.0	33.0	52.0	36.0
Total Split (%)	29.3%		29.3%	29.3%	12.0%	24.7%	22.0%	34.7%	24.0%
Yellow Time (s)	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	4.0		4.0	4.0	1.0	3.0	1.0	3.0	4.0
Lost Time Adjust (s)	-1.0		-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0
Total Lost Time (s)	7.0		7.0	7.0	4.0	6.0	4.0	6.0	7.0
Lead/Lag	Lead		Lead	Lead	Lead	Lag	Lead	Lag	Lag
Lead-Lag Optimize?									
Act Effct Green (s)	37.0	73.0	37.0	37.0	14.0	31.0	29.0	46.0	29.0
Actuated g/C Ratio	0.25	0.49	0.25	0.25	0.09	0.21	0.19	0.31	0.19
v/c Ratio	1.05	0.72	0.87	0.32	1.06	0.05	1.07	0.91	0.73
Control Delay	110.2	37.1	38.9	45.8	148.9	48.4	126.4	64.7	65.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	110.2	37.1	38.9	45.8	148.9	48.4	126.4	64.7	65.5
LOS	F	D	D	D	F	D	F	E	E
Approach Delay	61.0			45.8		139.8		82.5	65.5
Approach LOS	E			D		F		F	E
Queue Length 50th (m)	~151.2	123.4	57.7	33.3	~55.3	4.1	~115.0	129.7	59.1
Queue Length 95th (m)	#219.0	169.4	#121.3	46.6	#102.8	11.0	#177.3	#167.1	77.7
Internal Link Dist (m)	112.3			207.4		413.3		402.3	600.3
Turn Bay Length (m)		70.0	70.0				80.0		
Base Capacity (vph)	445	747	525	828	162	350	326	942	556
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	1.05	0.72	0.87	0.32	1.06	0.05	1.07	0.91	0.73

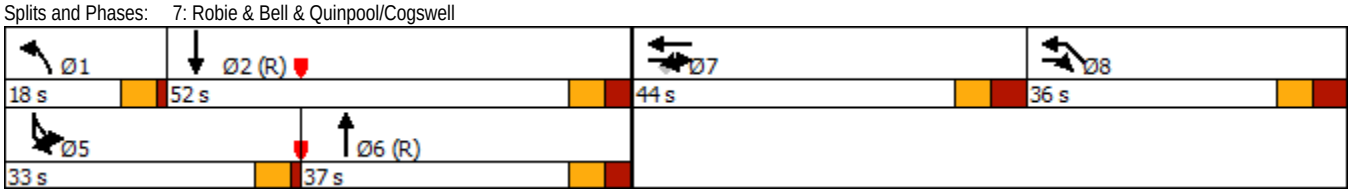
Intersection Summary

Cycle Length: 150
Actuated Cycle Length: 150
Offset: 0 (0%), Referenced to phase 2:SBT and 6:NBT, Start of Green
Natural Cycle: 135
Control Type: Pretimed
Maximum v/c Ratio: 1.07
Intersection Signal Delay: 71.9 — Intersection LOS: E
Intersection Capacity Utilization 111.2% — 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.

Splits and Phases: 7: Robie & Bell & Quinpool/Cogswell

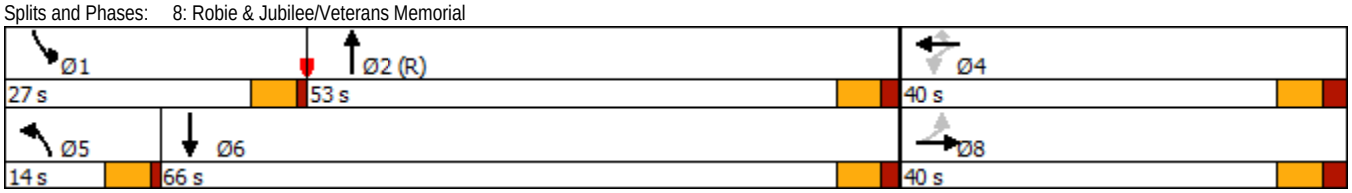


Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	SBL	SBT
Lane Configurations									
Traffic Volume (vph)	65	275	20	105	95	45	15	195	885
Future Volume (vph)	65	275	20	105	95	45	15	195	885
Lane Group Flow (vph)	0	485	0	143	108	51	17	223	1033
Turn Type	Perm	NA	Perm	NA	Perm	Prot	NA	Prot	NA
Protected Phases		8		4		5	2	1	6
Permitted Phases	8		4		4				
Detector Phase	8	8	4	4	4	5	2	1	6
Switch Phase									
Minimum Initial (s)	10.0	10.0	10.0	10.0	10.0	7.0	10.0	7.0	10.0
Minimum Split (s)	31.6	31.6	31.6	31.6	31.6	12.0	22.8	12.0	22.8
Total Split (s)	40.0	40.0	40.0	40.0	40.0	14.0	53.0	27.0	66.0
Total Split (%)	33.3%	33.3%	33.3%	33.3%	33.3%	11.7%	44.2%	22.5%	55.0%
Yellow Time (s)	4.1	4.1	4.1	4.1	4.1	4.0	4.1	4.0	4.1
All-Red Time (s)	2.4	2.4	2.4	2.4	2.4	1.0	1.7	1.0	1.7
Lost Time Adjust (s)		0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)		6.5		6.5	6.5	5.0	5.8	5.0	5.8
Lead/Lag						Lead	Lag	Lead	Lag
Lead-Lag Optimize?									
Recall Mode	Ped	Ped	Ped	Ped	Ped	None	C-Min	None	Min
Act Effct Green (s)		44.7		44.7	44.7	8.3	38.2	19.8	52.1
Actuated g/C Ratio		0.37		0.37	0.37	0.07	0.32	0.16	0.43
v/c Ratio		0.82		0.24	0.20	0.48	0.03	0.82	0.73
Control Delay		47.4		29.1	5.5	82.7	25.9	71.9	31.6
Queue Delay		0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Delay		47.4		29.1	5.5	82.7	25.9	71.9	31.6
LOS		D		C	A	F	C	E	C
Approach Delay		47.4		19.0			68.5		38.7
Approach LOS		D		B			E		D
Queue Length 50th (m)		100.1		22.9	0.0	12.7	2.7	50.2	109.0
Queue Length 95th (m)		#180.5		42.8	11.3	m23.7	m5.5	#83.8	118.6
Internal Link Dist (m)		189.8		183.6			355.1		413.3
Turn Bay Length (m)					40.0	50.0		90.0	
Base Capacity (vph)		593		605	551	116	676	302	1638
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		0.82		0.24	0.20	0.44	0.03	0.74	0.63

Intersection Summary

Cycle Length: 120
Actuated Cycle Length: 120
Offset: 48 (40%), Referenced to phase 2:NBT, Start of Green
Natural Cycle: 80
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.82
Intersection Signal Delay: 39.3 Intersection LOS: D
Intersection Capacity Utilization 78.7% ICU Level of Service D
Analysis Period (min) 15
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 8: Robie & Jubilee/Veterans Memorial

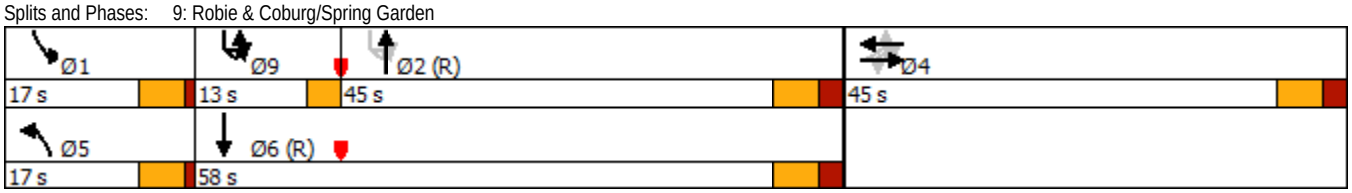


Lane Group	EBL2	EBT	WBL	WBT	NBL	NBT	SBU	SBL2	SBL	SBT
Lane Configurations										
Traffic Volume (vph)	45	170	45	150	50	11	20	0	204	741
Future Volume (vph)	45	170	45	150	50	11	20	0	204	741
Lane Group Flow (vph)	0	245	0	353	57	13	0	23	233	903
Turn Type	Perm	NA	Perm	NA	Prot	NA	D.P+P	D.P+P	Prot	NA
Protected Phases		4		4	5	2	9	9	1	6
Permitted Phases	4		4				2	2		
Detector Phase	4	4	4	4	5	2	9	9	1	6
Switch Phase										
Minimum Initial (s)	10.0	10.0	10.0	10.0	8.0	10.0	8.0	8.0	8.0	10.0
Minimum Split (s)	33.5	33.5	33.5	33.5	13.0	34.5	13.0	13.0	13.0	34.5
Total Split (s)	45.0	45.0	45.0	45.0	17.0	45.0	13.0	13.0	17.0	58.0
Total Split (%)	37.5%	37.5%	37.5%	37.5%	14.2%	37.5%	10.8%	10.8%	14.2%	48.3%
Yellow Time (s)	4.1	4.1	4.1	4.1	4.0	4.1	3.0	3.0	4.0	4.1
All-Red Time (s)	2.4	2.4	2.4	2.4	1.0	2.4	0.0	0.0	1.0	2.4
Lost Time Adjust (s)		0.0		0.0	0.0	0.0		0.0	0.0	0.0
Total Lost Time (s)		6.5		6.5	5.0	6.5		3.0	5.0	6.5
Lead/Lag					Lead		Lag	Lag	Lead	Lag
Lead-Lag Optimize?										
Recall Mode	None	None	None	None	None	C-Max	None	None	None	C-Max
Act Effct Green (s)		26.8		26.8	9.8	44.9		53.2	23.7	68.0
Actuated g/C Ratio		0.22		0.22	0.08	0.37		0.44	0.20	0.57
v/c Ratio		0.84		0.60	0.40	0.02		0.04	0.69	0.95
Control Delay		68.2		32.2	60.3	26.6		5.5	76.1	32.8
Queue Delay		0.0		0.0	0.0	0.0		0.0	0.0	0.0
Total Delay		68.2		32.2	60.3	26.6		5.5	76.1	32.8
LOS		E		C	E	C		A	E	C
Approach Delay		68.2		32.2		54.0				41.0
Approach LOS		E		C		D				D
Queue Length 50th (m)		55.3		27.5	13.0	2.0		0.6	56.6	85.7
Queue Length 95th (m)		76.9		38.5	25.8	6.5		m1.3	m#115.8	#343.8
Internal Link Dist (m)		121.4		124.9		240.3				355.1
Turn Bay Length (m)					60.0					
Base Capacity (vph)		418		797	176	582		656	339	952
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		0.59		0.44	0.32	0.02		0.04	0.69	0.95

Intersection Summary

Cycle Length: 120
Actuated Cycle Length: 120
Offset: 82 (68%), Referenced to phase 2:NBSB and 6:SBT, Start of Green
Natural Cycle: 115
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.95
Intersection Signal Delay: 43.4 — Intersection LOS: D
Intersection Capacity Utilization 105.6% — ICU Level of Service G
Analysis Period (min) 15
\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 9: Robie & Coburg/Spring Garden

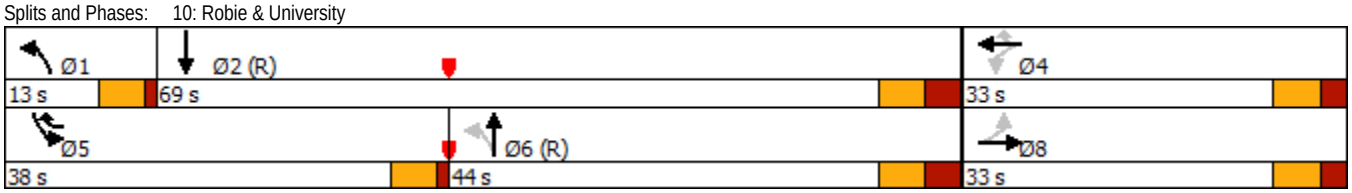


Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	SBL	SBT
Lane Configurations									
Traffic Volume (vph)	30	145	30	85	95	10	9	345	455
Future Volume (vph)	30	145	30	85	95	10	9	345	455
Lane Group Flow (vph)	34	194	34	97	108	11	10	394	576
Turn Type	Perm	NA	Perm	NA	pm+ov	pm+pt	NA	Prot	NA
Protected Phases		8		4	5	1	6	5	2
Permitted Phases	8		4		4	6			
Detector Phase	8	8	4	4	5	1	6	5	2
Switch Phase									
Minimum Initial (s)	10.0	10.0	10.0	10.0	8.0	8.0	10.0	8.0	10.0
Minimum Split (s)	32.5	32.5	32.5	32.5	13.0	13.0	43.3	13.0	43.3
Total Split (s)	33.0	33.0	33.0	33.0	38.0	13.0	44.0	38.0	69.0
Total Split (%)	28.7%	28.7%	28.7%	28.7%	33.0%	11.3%	38.3%	33.0%	60.0%
Yellow Time (s)	4.1	4.1	4.1	4.1	4.0	4.0	4.1	4.0	4.1
All-Red Time (s)	2.4	2.4	2.4	2.4	1.0	1.0	3.2	1.0	3.2
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.5	6.5	6.5	6.5	5.0	5.0	7.3	5.0	7.3
Lead/Lag						Lead			Lag
Lead-Lag Optimize?									
Recall Mode	Ped	Ped	Ped	Ped	None	None	C-Max	None	C-Max
Act Effct Green (s)	26.0	26.0	26.0	26.0	57.6	50.4	40.1	30.0	72.6
Actuated g/C Ratio	0.23	0.23	0.23	0.23	0.50	0.44	0.35	0.26	0.63
v/c Ratio	0.27	0.54	0.18	0.26	0.20	0.03	0.02	0.88	0.62
Control Delay	43.2	44.2	39.1	38.9	3.3	11.4	32.6	61.9	17.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	43.2	44.2	39.1	38.9	3.3	11.4	32.6	61.9	17.4
LOS	D	D	D	D	A	B	C	E	B
Approach Delay		44.0		22.9			21.5		35.5
Approach LOS		D		C			C		D
Queue Length 50th (m)	6.3	37.3	6.2	18.1	0.0	1.0	1.8	83.1	66.6
Queue Length 95th (m)	16.1	60.7	15.3	33.0	7.3	m2.5	m5.7	#126.5	136.9
Internal Link Dist (m)		178.0		171.4			167.5		240.3
Turn Bay Length (m)	15.0		15.0		60.0	60.0		60.0	
Base Capacity (vph)	130	366	189	374	570	396	521	495	933
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.26	0.53	0.18	0.26	0.19	0.03	0.02	0.80	0.62

Intersection Summary

Cycle Length: 115
Actuated Cycle Length: 115
Offset: 108 (94%), Referenced to phase 2:SBT and 6:NBTL, Start of Green
Natural Cycle: 100
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.88
Intersection Signal Delay: 34.5 — Intersection LOS: C
Intersection Capacity Utilization 70.2% — ICU Level of Service C
Analysis Period (min) 15
\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 10: Robie & University

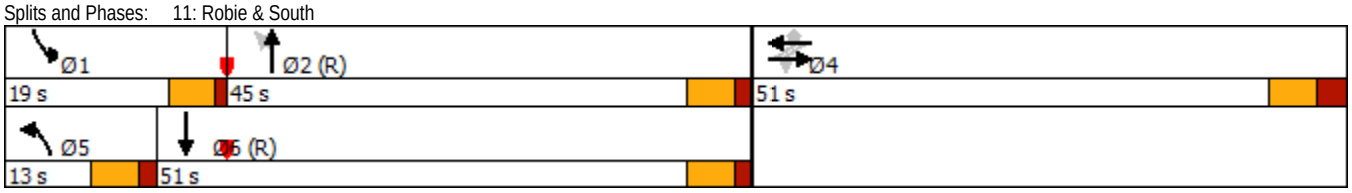


Lane Group	EBL	EBT	WBL	WBT	WBR2	NBL2	NBL	NBT	SBL	SBT
Lane Configurations										
Traffic Volume (vph)	50	290	10	135	105	22	3	4	171	275
Future Volume (vph)	50	290	10	135	105	22	3	4	171	275
Lane Group Flow (vph)	0	422	0	165	120	17	0	16	195	357
Turn Type	Perm	NA	Perm	NA	Perm	Prot	Perm	NA	Prot	NA
Protected Phases		4		4		5		2	1	6
Permitted Phases	4		4		4		2			
Detector Phase	4	4	4	4	4	5	2	2	1	6
Switch Phase										
Minimum Initial (s)	10.0	10.0	10.0	10.0	10.0	7.3	10.0	10.0	8.0	10.0
Minimum Split (s)	47.8	47.8	47.8	47.8	47.8	13.0	24.7	24.7	13.0	24.7
Total Split (s)	51.0	51.0	51.0	51.0	51.0	13.0	45.0	45.0	19.0	51.0
Total Split (%)	44.3%	44.3%	44.3%	44.3%	44.3%	11.3%	39.1%	39.1%	16.5%	44.3%
Yellow Time (s)	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.0	4.1
All-Red Time (s)	2.7	2.7	2.7	2.7	2.7	1.6	1.6	1.6	1.0	1.6
Lost Time Adjust (s)		0.0		0.0	0.0	0.0		0.0	0.0	0.0
Total Lost Time (s)		6.8		6.8	6.8	5.7		5.7	5.0	5.7
Lead/Lag						Lead	Lag	Lag	Lead	Lag
Lead-Lag Optimize?										
Recall Mode	Ped	Ped	Ped	Ped	Ped	Min	C-Min	C-Min	None	C-Min
Act Effct Green (s)		42.5		42.5	42.5	7.4		34.9	20.1	47.0
Actuated g/C Ratio		0.37		0.37	0.37	0.06		0.30	0.17	0.41
v/c Ratio		0.78		0.26	0.20	0.18		0.04	0.70	0.60
Control Delay		42.8		26.2	4.4	55.6		28.9	62.9	21.2
Queue Delay		0.0		0.0	0.0	0.0		0.0	0.0	0.0
Total Delay		42.8		26.2	4.4	55.6		28.9	62.9	21.2
LOS		D		C	A	E		C	E	C
Approach Delay		42.8		17.0				42.7		35.9
Approach LOS		D		B				D		D
Queue Length 50th (m)		84.2		26.2	0.0	3.8		2.7	33.9	51.1
Queue Length 95th (m)		117.8		40.3	10.2	11.6		7.8	#90.2	69.5
Internal Link Dist (m)		115.5		183.6				422.3		167.5
Turn Bay Length (m)					50.0				60.0	
Base Capacity (vph)		568		669	613	96		404	280	600
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		0.74		0.25	0.20	0.18		0.04	0.70	0.59

Intersection Summary

Cycle Length: 115
Actuated Cycle Length: 115
Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBT, Start of Green
Natural Cycle: 90
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.78
Intersection Signal Delay: 34.1 — Intersection LOS: C
Intersection Capacity Utilization 100.3% — ICU Level of Service G
Analysis Period (min) 15
\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 11: Robie & South

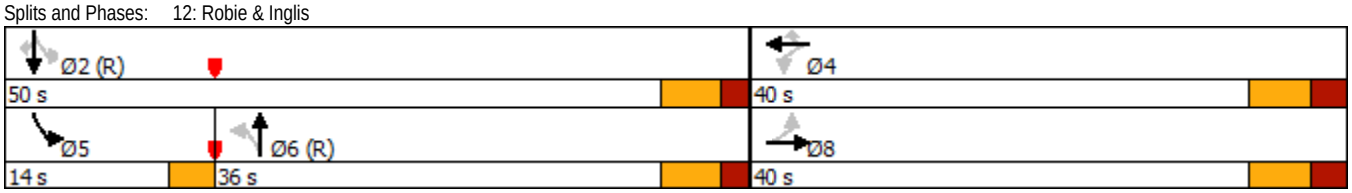


Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	SBL	SBT	SBR
Lane Configurations										
Traffic Volume (vph)	20	260	65	185	170	10	40	210	105	20
Future Volume (vph)	20	260	65	185	170	10	40	210	105	20
Lane Group Flow (vph)	0	371	0	285	194	0	108	240	120	23
Turn Type	Perm	NA	Perm	NA	Perm	Perm	NA	pm+pt	NA	Perm
Protected Phases		8		4			6	5	2	
Permitted Phases	8		4		4	6		2		2
Detector Phase	8	8	4	4	4	6	6	5	2	2
Switch Phase										
Minimum Initial (s)	10.0	10.0	10.0	10.0	10.0	10.0	10.0	8.0	10.0	10.0
Minimum Split (s)	31.7	31.7	31.7	31.7	31.7	23.1	23.1	13.0	23.1	23.1
Total Split (s)	40.0	40.0	40.0	40.0	40.0	36.0	36.0	14.0	50.0	50.0
Total Split (%)	44.4%	44.4%	44.4%	44.4%	44.4%	40.0%	40.0%	15.6%	55.6%	55.6%
Yellow Time (s)	4.1	4.1	4.1	4.1	4.1	4.1	4.1	3.0	4.1	4.1
All-Red Time (s)	2.6	2.6	2.6	2.6	2.6	2.0	2.0	0.0	2.0	2.0
Lost Time Adjust (s)		0.0		0.0	0.0		0.0	0.0	0.0	0.0
Total Lost Time (s)		6.7		6.7	6.7		6.1	3.0	6.1	6.1
Lead/Lag						Lag	Lag	Lead		
Lead-Lag Optimize?										
Recall Mode	Ped	Ped	Ped	Ped	Ped	C-Min	C-Min	None	C-Min	C-Min
Act Effct Green (s)		27.8		27.8	27.8		34.1	52.5	49.4	49.4
Actuated g/C Ratio		0.31		0.31	0.31		0.38	0.58	0.55	0.55
v/c Ratio		0.70		0.78	0.34		0.20	0.35	0.14	0.04
Control Delay		33.8		43.3	4.8		14.3	11.6	11.5	1.7
Queue Delay		0.0		0.0	0.0		0.0	0.0	0.0	0.0
Total Delay		33.8		43.3	4.8		14.3	11.6	11.5	1.7
LOS		C		D	A		B	B	B	A
Approach Delay		33.8		27.7			14.3		11.0	
Approach LOS		C		C			B		B	
Queue Length 50th (m)		57.3		46.6	0.0		5.8	17.1	8.8	0.0
Queue Length 95th (m)		75.5		66.8	12.6		21.3	37.2	21.3	1.9
Internal Link Dist (m)		113.9		142.4			118.8		422.3	
Turn Bay Length (m)					50.0			60.0		20.0
Base Capacity (vph)		640		442	651		560	684	855	645
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		0.58		0.64	0.30		0.19	0.35	0.14	0.04

Intersection Summary

Cycle Length: 90
Actuated Cycle Length: 90
Offset: 0 (0%), Referenced to phase 2:SBTL and 6:NBTL, Start of Green
Natural Cycle: 70
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.78
Intersection Signal Delay: 23.5 Intersection LOS: C
Intersection Capacity Utilization 72.1% ICU Level of Service C
Analysis Period (min) 15

Splits and Phases: 12: Robie & Inglis

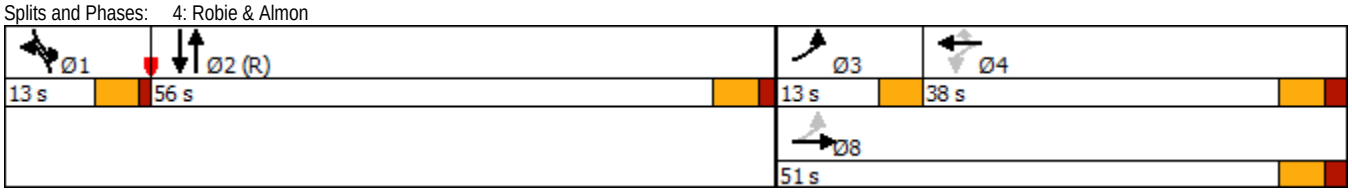


Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	SBL	SBT
Lane Configurations									
Traffic Volume (vph)	150	290	20	195	45	30	456	40	12
Future Volume (vph)	150	290	20	195	45	30	456	40	12
Lane Group Flow (vph)	171	388	0	246	51	34	537	46	14
Turn Type	pm+pt	NA	Perm	NA	Perm	Prot	NA	Prot	NA
Protected Phases	3	8		4		1	2	1	2
Permitted Phases	8		4		4				
Detector Phase	3	8	4	4	4	1	2	1	2
Switch Phase									
Minimum Initial (s)	7.0	10.0	10.0	10.0	10.0	8.0	10.0	8.0	10.0
Minimum Split (s)	11.0	50.0	37.0	37.0	37.0	13.0	40.0	13.0	40.0
Total Split (s)	13.0	51.0	38.0	38.0	38.0	13.0	56.0	13.0	56.0
Total Split (%)	10.8%	42.5%	31.7%	31.7%	31.7%	10.8%	46.7%	10.8%	46.7%
Yellow Time (s)	4.0	4.1	4.1	4.1	4.1	4.0	4.1	4.0	4.1
All-Red Time (s)	0.0	2.1	2.1	2.1	2.1	1.0	1.7	1.0	1.7
Lost Time Adjust (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	6.2		6.2	6.2	5.0	5.8	5.0	5.8
Lead/Lag	Lead		Lag	Lag	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize?									
Recall Mode	None	None	None	None	None	None	C-Min	None	C-Min
Act Effct Green (s)	38.7	36.5		20.3	20.3	9.1	60.0	9.1	60.0
Actuated g/C Ratio	0.32	0.30		0.17	0.17	0.08	0.50	0.08	0.50
v/c Ratio	0.62	0.72		0.72	0.16	0.25	0.62	0.35	0.02
Control Delay	40.5	44.0		58.8	1.0	56.5	28.3	72.6	9.8
Queue Delay	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	40.5	44.0		58.8	1.0	56.5	28.3	72.6	9.8
LOS	D	D		E	A	E	C	E	A
Approach Delay		42.9		48.9			30.0		58.0
Approach LOS		D		D			C		E
Queue Length 50th (m)	29.6	78.3		55.8	0.0	7.7	94.0	11.5	1.1
Queue Length 95th (m)	45.4	107.8		75.9	0.0	17.7	146.7	m13.1	m0.8
Internal Link Dist (m)		253.6		204.8			402.8		360.9
Turn Bay Length (m)	80.0				50.0	25.0		180.0	
Base Capacity (vph)	277	660		534	447	134	871	131	911
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	0.62	0.59		0.46	0.11	0.25	0.62	0.35	0.02

Intersection Summary

Cycle Length: 120
Actuated Cycle Length: 120
Offset: 78 (65%), Referenced to phase 2:NBSB and 6:, Start of Green
Natural Cycle: 105
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.72
Intersection Signal Delay: 39.7 Intersection LOS: D
Intersection Capacity Utilization 109.4% ICU Level of Service H
Analysis Period (min) 15
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 4: Robie & Almon

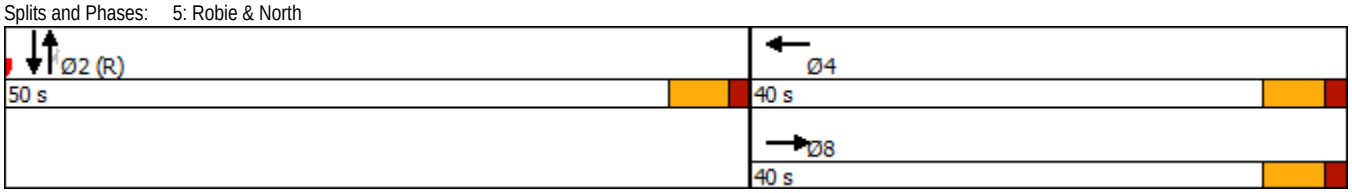


Lane Group	EBT	WBT	NBT	NBR	SBT
Lane Configurations					
Traffic Volume (vph)	375	420	461	110	12
Future Volume (vph)	375	420	461	110	12
Lane Group Flow (vph)	457	490	526	126	14
Turn Type	NA	NA	NA	Perm	NA
Protected Phases	8	4	2		2
Permitted Phases				2	
Detector Phase	8	4	2	2	2
Switch Phase					
Minimum Initial (s)	10.0	10.0	10.0	10.0	10.0
Minimum Split (s)	23.7	23.7	50.0	50.0	50.0
Total Split (s)	40.0	40.0	50.0	50.0	50.0
Total Split (%)	44.4%	44.4%	55.6%	55.6%	55.6%
Yellow Time (s)	4.1	4.1	4.1	4.1	4.1
All-Red Time (s)	1.6	1.6	1.5	1.5	1.5
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.7	5.7	5.6	5.6	5.6
Lead/Lag					
Lead-Lag Optimize?					
Recall Mode	Ped	Ped	C-Min	C-Min	C-Min
Act Effct Green (s)	28.8	28.8	49.9	49.9	49.9
Actuated g/C Ratio	0.32	0.32	0.55	0.55	0.55
v/c Ratio	0.81	0.82	0.55	0.29	0.01
Control Delay	38.9	39.9	16.9	4.5	11.4
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	38.9	39.9	16.9	4.5	11.4
LOS	D	D	B	A	B
Approach Delay	38.9	39.9	14.5		11.4
Approach LOS	D	D	B		B
Queue Length 50th (m)	70.0	76.1	55.9	0.0	1.1
Queue Length 95th (m)	95.6	102.3	97.7	9.5	4.2
Internal Link Dist (m)	171.5	198.8	446.6		402.8
Turn Bay Length (m)				50.0	
Base Capacity (vph)	677	711	968	430	993
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.68	0.69	0.54	0.29	0.01

Intersection Summary

Cycle Length: 90
Actuated Cycle Length: 90
Offset: 0 (0%), Referenced to phase 2:NBSB, Start of Green
Natural Cycle: 80
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.82
Intersection Signal Delay: 29.1 — Intersection LOS: C
Intersection Capacity Utilization 69.6% — ICU Level of Service C
Analysis Period (min) 15

Splits and Phases: 5: Robie & North

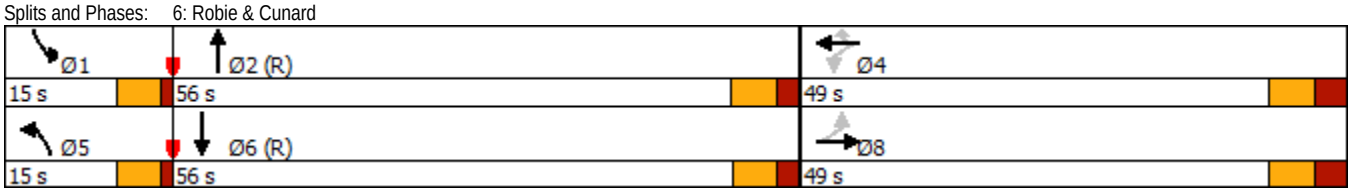


Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	SBL	SBT
Lane Configurations									
Traffic Volume (vph)	10	410	40	160	40	44	461	75	11
Future Volume (vph)	10	410	40	160	40	44	461	75	11
Lane Group Flow (vph)	11	571	46	183	46	50	549	86	13
Turn Type	Perm	NA	Perm	NA	Perm	Prot	NA	Prot	NA
Protected Phases		8		4		5	2	1	6
Permitted Phases	8		4		4				
Detector Phase	8	8	4	4	4	5	2	1	6
Switch Phase									
Minimum Initial (s)	10.0	10.0	10.0	10.0	10.0	8.0	10.0	8.0	8.0
Minimum Split (s)	39.1	39.1	39.1	39.1	39.1	13.0	37.9	13.0	24.0
Total Split (s)	49.0	49.0	49.0	49.0	49.0	15.0	56.0	15.0	56.0
Total Split (%)	40.8%	40.8%	40.8%	40.8%	40.8%	12.5%	46.7%	12.5%	46.7%
Yellow Time (s)	4.1	4.1	4.1	4.1	4.1	4.0	4.1	4.0	4.0
All-Red Time (s)	3.0	3.0	3.0	3.0	3.0	1.0	2.0	1.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	7.1	7.1	7.1	7.1	7.1	5.0	6.1	5.0	6.0
Lead/Lag							Lag	Lead	
Lead-Lag Optimize?									
Recall Mode	Ped	Ped	Ped	Ped	Ped	None	C-Min	None	C-Min
Act Effct Green (s)	49.8	49.8	49.8	49.8	49.8	9.0	42.5	9.5	45.7
Actuated g/C Ratio	0.42	0.42	0.42	0.42	0.42	0.08	0.35	0.08	0.38
v/c Ratio	0.03	0.97	0.29	0.24	0.08	0.40	0.86	0.63	0.02
Control Delay	25.0	65.8	33.3	25.8	2.5	62.5	49.3	73.7	22.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	25.0	65.8	33.3	25.8	2.5	62.5	49.3	73.7	22.1
LOS	C	E	C	C	A	E	D	E	C
Approach Delay		65.0		23.1			50.4		67.0
Approach LOS		E		C			D		E
Queue Length 50th (m)	1.5	131.6	7.2	28.1	0.0	11.5	117.5	19.9	1.9
Queue Length 95th (m)	5.9	#224.5	19.5	49.3	3.4	24.1	148.5	#39.6	5.7
Internal Link Dist (m)		72.7		213.1			210.2		446.6
Turn Bay Length (m)	50.0				50.0	40.0		40.0	
Base Capacity (vph)	354	591	159	756	586	139	751	144	760
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.03	0.97	0.29	0.24	0.08	0.36	0.73	0.60	0.02

Intersection Summary

Cycle Length: 120
Actuated Cycle Length: 120
Offset: 0 (0%), Referenced to phase 2:NBT and 6:SBT, Start of Green
Natural Cycle: 90
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.97
Intersection Signal Delay: 52.1 — Intersection LOS: D
Intersection Capacity Utilization 83.7% — ICU Level of Service E
Analysis Period (min) 15
\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 6: Robie & Cunard



Lane Group	EBT	EBR	EBR2	WBT	NBL	NBT	SBL	SBT	NWL	Ø9
Lane Configurations										
Traffic Volume (vph)	410	470	400	205	150	390	238	20	245	
Future Volume (vph)	410	470	400	205	150	390	238	20	245	
Lane Group Flow (vph)	468	536	457	268	171	485	350	23	406	
Turn Type	NA	pt+ov	Perm	NA	Prot	NA	Prot	NA	Prot	
Protected Phases	7	7 8		7	1	6	5	2	8	9
Permitted Phases			7							
Minimum Split (s)	37.0		37.0	37.0	14.0	36.0	14.0	49.0	36.0	13.0
Total Split (s)	44.0		44.0	44.0	18.0	37.0	33.0	37.0	36.0	15.0
Total Split (%)	29.3%		29.3%	29.3%	12.0%	24.7%	22.0%	24.7%	24.0%	10%
Yellow Time (s)	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	4.0		4.0	4.0	1.0	3.0	1.0	3.0	4.0	1.0
Lost Time Adjust (s)	-1.0		-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	
Total Lost Time (s)	7.0		7.0	7.0	4.0	6.0	4.0	6.0	7.0	
Lead/Lag	Lead		Lead	Lead	Lead	Lag	Lead		Lag	Lag
Lead-Lag Optimize?										
Act Effct Green (s)	37.0	73.0	37.0	37.0	14.0	31.0	29.0	31.0	29.0	
Actuated g/C Ratio	0.25	0.49	0.25	0.25	0.09	0.21	0.19	0.21	0.19	
v/c Ratio	1.05	0.72	0.87	0.32	1.06	0.74	1.07	0.07	0.73	
Control Delay	110.2	37.1	38.9	45.7	148.9	63.3	126.4	48.9	65.5	
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Total Delay	110.2	37.1	38.9	45.7	148.9	63.3	126.4	48.9	65.5	
LOS	F	D	D	D	F	E	F	D	E	
Approach Delay	61.0			45.7		85.6		121.6	65.5	
Approach LOS	E			D		F		F	E	
Queue Length 50th (m)	~151.2	123.4	57.7	33.2	~55.3	71.8	~115.0	5.6	59.1	
Queue Length 95th (m)	#219.0	169.4	#121.3	46.5	#102.8	92.0	#177.3	13.9	77.7	
Internal Link Dist (m)	112.3			207.4		413.3		168.1	600.3	
Turn Bay Length (m)		70.0	70.0		100.0					
Base Capacity (vph)	445	747	525	832	162	658	326	308	556	
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	
Reduced v/c Ratio	1.05	0.72	0.87	0.32	1.06	0.74	1.07	0.07	0.73	

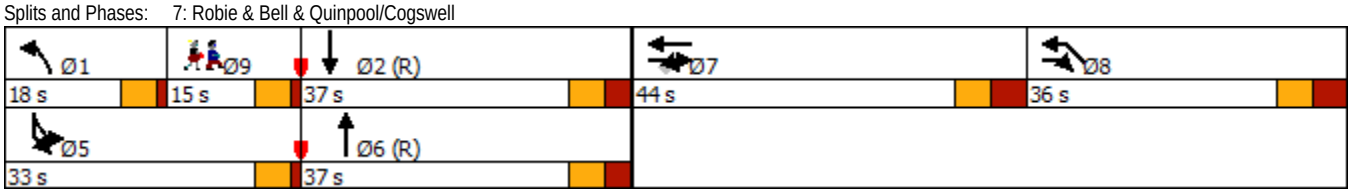
Intersection Summary

Cycle Length: 150
Actuated Cycle Length: 150
Offset: 0 (0%), Referenced to phase 2:SBT and 6:NBT, Start of Green
Natural Cycle: 150
Control Type: Pretimed
Maximum v/c Ratio: 1.07
Intersection Signal Delay: 72.6
Intersection LOS: E
Intersection Capacity Utilization 111.2%
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.

Splits and Phases: 7: Robie & Bell & Quinpool/Cogswell

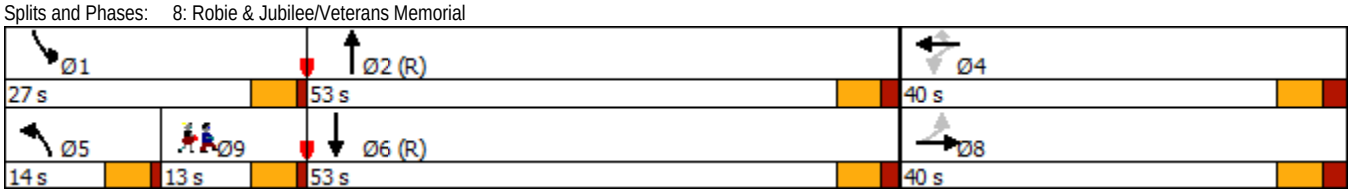


Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	SBL	SBT	Ø9
Lane Configurations										
Traffic Volume (vph)	65	275	20	105	95	45	495	195	20	
Future Volume (vph)	65	275	20	105	95	45	495	195	20	
Lane Group Flow (vph)	0	485	0	143	108	51	622	223	23	
Turn Type	Perm	NA	Perm	NA	Perm	Prot	NA	Prot	NA	
Protected Phases		8		4		5	2	1	6	9
Permitted Phases	8		4		4					
Detector Phase	8	8	4	4	4	5	2	1	6	
Switch Phase										
Minimum Initial (s)	10.0	10.0	10.0	10.0	10.0	7.0	10.0	7.0	10.0	8.0
Minimum Split (s)	31.6	31.6	31.6	31.6	31.6	12.0	22.8	12.0	22.8	13.0
Total Split (s)	40.0	40.0	40.0	40.0	40.0	14.0	53.0	27.0	53.0	13.0
Total Split (%)	33.3%	33.3%	33.3%	33.3%	33.3%	11.7%	44.2%	22.5%	44.2%	11%
Yellow Time (s)	4.1	4.1	4.1	4.1	4.1	4.0	4.1	4.0	4.1	4.0
All-Red Time (s)	2.4	2.4	2.4	2.4	2.4	1.0	1.7	1.0	1.7	1.0
Lost Time Adjust (s)		0.0		0.0	0.0	0.0	0.0	0.0	0.0	
Total Lost Time (s)		6.5		6.5	6.5	5.0	5.8	5.0	5.8	
Lead/Lag						Lead	Lag	Lead		Lag
Lead-Lag Optimize?										
Recall Mode	Ped	Ped	Ped	Ped	Ped	None	C-Min	None	C-Min	None
Act Effct Green (s)		47.4		47.4	47.4	8.4	35.5	19.8	49.3	
Actuated g/C Ratio		0.40		0.40	0.40	0.07	0.30	0.16	0.41	
v/c Ratio		0.77		0.22	0.19	0.47	0.67	0.82	0.03	
Control Delay		41.6		26.3	4.9	67.6	48.7	71.9	21.6	
Queue Delay		0.0		0.0	0.0	0.0	0.0	0.0	0.0	
Total Delay		41.6		26.3	4.9	67.6	48.7	71.9	21.6	
LOS		D		C	A	E	D	E	C	
Approach Delay		41.6		17.1			50.1		67.2	
Approach LOS		D		B			D		E	
Queue Length 50th (m)		96.7		22.2	0.0	12.0	79.6	50.2	3.3	
Queue Length 95th (m)		#162.6		39.8	10.6	m24.6	98.5	#83.8	8.1	
Internal Link Dist (m)		189.8		183.6			355.1		413.3	
Turn Bay Length (m)					40.0	50.0				
Base Capacity (vph)		628		642	577	117	1229	302	716	
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		0.77		0.22	0.19	0.44	0.51	0.74	0.03	

Intersection Summary

Cycle Length: 120
Actuated Cycle Length: 120
Offset: 48 (40%), Referenced to phase 2:NBT and 6:SBT, Start of Green
Natural Cycle: 80
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.82
Intersection Signal Delay: 45.1 Intersection LOS: D
Intersection Capacity Utilization 78.4% ICU Level of Service D
Analysis Period (min) 15
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 8: Robie & Jubilee/Veterans Memorial

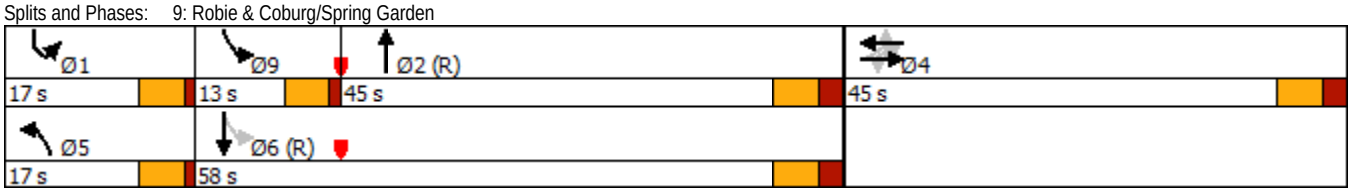


Lane Group	EBL2	EBT	WBL	WBT	NBL	NBT	SBL2	SBL	SBT
Lane Configurations									
Traffic Volume (vph)	45	170	45	150	50	409	204	8	10
Future Volume (vph)	45	170	45	150	50	409	204	8	10
Lane Group Flow (vph)	46	199	0	353	57	496	128	0	125
Turn Type	Perm	NA	Perm	NA	Prot	NA	Prot	pm+pt	NA
Protected Phases		4		4	5	2	1	9	6
Permitted Phases	4		4					6	
Detector Phase	4	4	4	4	5	2	1	9	6
Switch Phase									
Minimum Initial (s)	10.0	10.0	10.0	10.0	8.0	10.0	8.0	8.0	10.0
Minimum Split (s)	33.5	33.5	33.5	33.5	13.0	34.5	13.0	13.0	34.5
Total Split (s)	45.0	45.0	45.0	45.0	17.0	45.0	17.0	13.0	58.0
Total Split (%)	37.5%	37.5%	37.5%	37.5%	14.2%	37.5%	14.2%	10.8%	48.3%
Yellow Time (s)	4.1	4.1	4.1	4.1	4.0	4.1	4.0	4.0	4.1
All-Red Time (s)	2.4	2.4	2.4	2.4	1.0	2.4	1.0	1.0	2.4
Lost Time Adjust (s)	0.0	0.0		0.0	0.0	0.0	0.0		0.0
Total Lost Time (s)	6.5	6.5		6.5	5.0	6.5	5.0		6.5
Lead/Lag					Lead		Lead	Lag	Lag
Lead-Lag Optimize?									
Recall Mode	None	None	None	None	None	C-Max	Max	None	C-Max
Act Effct Green (s)	26.0	26.0		26.0	9.8	51.5	24.5		68.8
Actuated g/C Ratio	0.22	0.22		0.22	0.08	0.43	0.20		0.57
v/c Ratio	0.33	0.53		0.82	0.40	0.35	0.38		0.45
Control Delay	43.8	45.9		60.5	60.3	17.7	42.6		35.7
Queue Delay	0.0	0.0		0.0	0.0	0.0	0.0		0.0
Total Delay	43.8	45.9		60.5	60.3	17.7	42.6		35.7
LOS	D	D		E	E	B	D		D
Approach Delay		45.5		60.5		22.1			39.2
Approach LOS		D		E		C			D
Queue Length 50th (m)	9.6	43.8		41.8	13.0	29.8	29.5		20.5
Queue Length 95th (m)	19.8	62.3		54.4	25.8	42.8	m47.3		m45.2
Internal Link Dist (m)		121.4		124.9		240.3			355.1
Turn Bay Length (m)	30.0				60.0				
Base Capacity (vph)	209	552		633	176	1400	339		276
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	0.22	0.36		0.56	0.32	0.35	0.38		0.45

Intersection Summary

Cycle Length: 120
Actuated Cycle Length: 120
Offset: 82 (68%), Referenced to phase 2:NBT and 6:SBTL, Start of Green
Natural Cycle: 95
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.82
Intersection Signal Delay: 38.9 Intersection LOS: D
Intersection Capacity Utilization 101.5% ICU Level of Service G
Analysis Period (min) 15
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 9: Robie & Coburg/Spring Garden

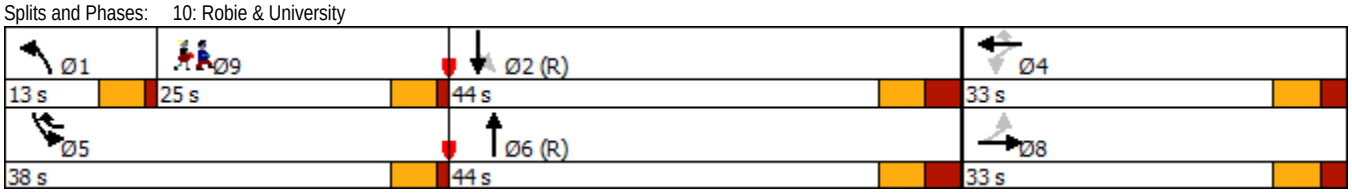


Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	SBL2	SBL	SBT	Ø9
Lane Configurations											
Traffic Volume (vph)	30	145	30	85	95	10	301	342	3	6	
Future Volume (vph)	30	145	30	85	95	10	301	342	3	6	
Lane Group Flow (vph)	34	194	34	97	108	11	390	199	0	201	
Turn Type	Perm	NA	Perm	NA	pm+ov	Prot	NA	Prot	Perm	NA	
Protected Phases		8		4	5	1	6	5		2	9
Permitted Phases	8		4		4				2		
Detector Phase	8	8	4	4	5	1	6	5	2	2	
Switch Phase											
Minimum Initial (s)	10.0	10.0	10.0	10.0	8.0	8.0	10.0	8.0	10.0	10.0	8.0
Minimum Split (s)	32.5	32.5	32.5	32.5	13.0	13.0	43.3	13.0	43.3	43.3	13.0
Total Split (s)	33.0	33.0	33.0	33.0	38.0	13.0	44.0	38.0	44.0	44.0	25.0
Total Split (%)	28.7%	28.7%	28.7%	28.7%	33.0%	11.3%	38.3%	33.0%	38.3%	38.3%	22%
Yellow Time (s)	4.1	4.1	4.1	4.1	4.0	4.0	4.1	4.0	4.1	4.1	4.0
All-Red Time (s)	2.4	2.4	2.4	2.4	1.0	1.0	3.2	1.0	3.2	3.2	1.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	
Total Lost Time (s)	6.5	6.5	6.5	6.5	5.0	5.0	7.3	5.0		7.3	
Lead/Lag					Lead	Lead	Lag	Lead			Lag
Lead-Lag Optimize?											
Recall Mode	Ped	Ped	Ped	Ped	None	None	C-Max	None	C-Max	C-Max	None
Act Effct Green (s)	26.0	26.0	26.0	26.0	46.9	8.0	50.8	19.4		72.6	
Actuated g/C Ratio	0.23	0.23	0.23	0.23	0.41	0.07	0.44	0.17		0.63	
v/c Ratio	0.18	0.42	0.18	0.26	0.22	0.09	0.31	0.73		0.68	
Control Delay	38.9	15.7	39.1	39.0	6.9	47.2	27.7	59.9		29.8	
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	
Total Delay	38.9	15.7	39.1	39.0	6.9	47.2	27.7	59.9		29.8	
LOS	D	B	D	D	A	D	C	E		C	
Approach Delay		19.1		24.5			28.2			44.7	
Approach LOS		B		C			C			D	
Queue Length 50th (m)	6.2	10.6	6.2	18.1	3.5	2.4	28.4	45.1		26.4	
Queue Length 95th (m)	15.3	31.1	15.3	33.1	11.9	m6.2	38.1	66.4		#84.3	
Internal Link Dist (m)		178.0		171.4			167.5			240.3	
Turn Bay Length (m)	15.0		15.0		60.0	60.0		60.0			
Base Capacity (vph)	193	465	189	374	639	117	1277	467		296	
Starvation Cap Reductn	0	0	0	0	0	0	0	0		0	
Spillback Cap Reductn	0	0	0	0	0	0	0	0		0	
Storage Cap Reductn	0	0	0	0	0	0	0	0		0	
Reduced v/c Ratio	0.18	0.42	0.18	0.26	0.17	0.09	0.31	0.43		0.68	

Intersection Summary

Cycle Length: 115
Actuated Cycle Length: 115
Offset: 108 (94%), Referenced to phase 2:SBTL and 6:NBT, Start of Green
Natural Cycle: 105
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.73
Intersection Signal Delay: 31.1 Intersection LOS: C
Intersection Capacity Utilization 103.8% ICU Level of Service G
Analysis Period (min) 15
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 10: Robie & University

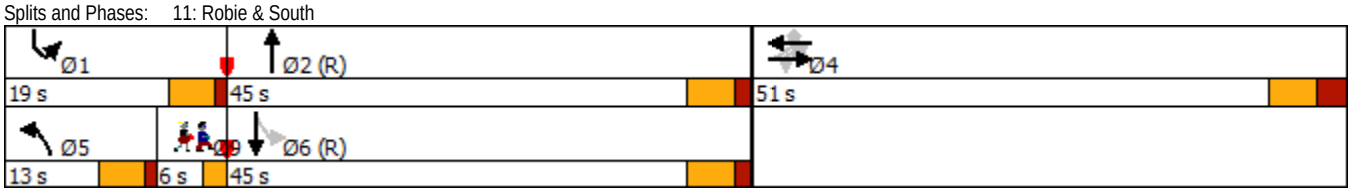


Lane Group	EBL2	EBT	WBL	WBT	WBR	NBL	NBT	SBL2	SBL	SBT	Ø9
Lane Configurations											
Traffic Volume (vph)	50	290	10	135	105	22	221	171	4	0	
Future Volume (vph)	50	290	10	135	105	22	221	171	4	0	
Lane Group Flow (vph)	0	422	0	165	120	25	286	101	0	101	
Turn Type	Perm	NA	Perm	NA	Perm	Prot	NA	Prot	Perm	NA	
Protected Phases		4		4		5	2	1		6	9
Permitted Phases	4		4		4				6		
Detector Phase	4	4	4	4	4	5	2	1	6	6	
Switch Phase											
Minimum Initial (s)	10.0	10.0	10.0	10.0	10.0	8.0	10.0	8.0	10.0	10.0	4.0
Minimum Split (s)	47.8	47.8	47.8	47.8	47.8	13.0	24.7	13.0	24.7	24.7	6.0
Total Split (s)	51.0	51.0	51.0	51.0	51.0	13.0	45.0	19.0	45.0	45.0	6.0
Total Split (%)	44.3%	44.3%	44.3%	44.3%	44.3%	11.3%	39.1%	16.5%	39.1%	39.1%	5%
Yellow Time (s)	4.1	4.1	4.1	4.1	4.1	4.0	4.1	4.0	4.1	4.1	2.0
All-Red Time (s)	2.7	2.7	2.7	2.7	2.7	1.0	1.6	1.0	1.6	1.6	0.0
Lost Time Adjust (s)		0.0		0.0	0.0	0.0	0.0	0.0		0.0	
Total Lost Time (s)		6.8		6.8	6.8	5.0	5.7	5.0		5.7	
Lead/Lag						Lead	Lag	Lead			Lag
Lead-Lag Optimize?											
Recall Mode	Ped	Ped	Ped	Ped	Ped	None	C-Min	Min	C-Min	C-Min	None
Act Effct Green (s)		43.2		43.2	43.2	8.4	41.9	12.4		51.1	
Actuated g/C Ratio		0.38		0.38	0.38	0.07	0.36	0.11		0.44	
v/c Ratio		0.76		0.25	0.23	0.22	0.43	0.57		0.32	
Control Delay		41.1		25.4	25.2	54.7	18.2	56.7		9.4	
Queue Delay		0.0		0.0	0.0	0.0	0.0	0.0		0.0	
Total Delay		41.1		25.4	25.2	54.7	18.2	56.7		9.4	
LOS		D		C	C	D	B	E		A	
Approach Delay		41.1		25.3			21.1			33.0	
Approach LOS		D		C			C			C	
Queue Length 50th (m)		84.2		26.2	18.9	5.4	23.9	23.4		0.0	
Queue Length 95th (m)		111.2		38.0	29.5	14.0	56.0	m40.8		m11.6	
Internal Link Dist (m)		115.5		183.6			422.3			167.5	
Turn Bay Length (m)					50.0			60.0			
Base Capacity (vph)		577		680	544	115	680	212		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		0.73		0.24	0.22	0.22	0.42	0.48		0.32	

Intersection Summary

Cycle Length: 115
Actuated Cycle Length: 115
Offset: 0 (0%), Referenced to phase 2:NBT and 6:SBTL, Start of Green
Natural Cycle: 95
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.76
Intersection Signal Delay: 31.0 Intersection LOS: C
Intersection Capacity Utilization 120.8% ICU Level of Service H
Analysis Period (min) 15
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 11: Robie & South

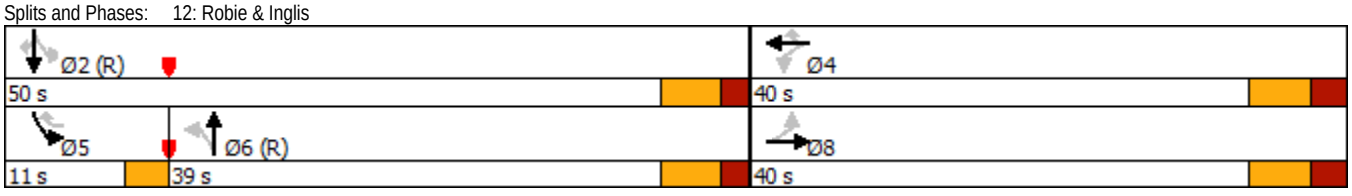


Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	SBL	SBT	SBR
Lane Configurations										
Traffic Volume (vph)	20	260	65	185	170	10	40	210	105	20
Future Volume (vph)	20	260	65	185	170	10	40	210	105	20
Lane Group Flow (vph)	0	371	0	285	194	0	108	240	120	23
Turn Type	Perm	NA	Perm	NA	custom	Perm	NA	pm+pt	NA	Perm
Protected Phases		8		4			6	5	2	
Permitted Phases	8		4		4 5	6		2		2
Detector Phase	8	8	4	4	4 5	6	6	5	2	2
Switch Phase										
Minimum Initial (s)	10.0	10.0	10.0	10.0		10.0	10.0	8.0	10.0	10.0
Minimum Split (s)	31.7	31.7	31.7	31.7		23.1	23.1	11.0	23.1	23.1
Total Split (s)	40.0	40.0	40.0	40.0		39.0	39.0	11.0	50.0	50.0
Total Split (%)	44.4%	44.4%	44.4%	44.4%		43.3%	43.3%	12.2%	55.6%	55.6%
Yellow Time (s)	4.1	4.1	4.1	4.1		4.1	4.1	3.0	4.1	4.1
All-Red Time (s)	2.6	2.6	2.6	2.6		2.0	2.0	0.0	2.0	2.0
Lost Time Adjust (s)		0.0		0.0			0.0	0.0	0.0	0.0
Total Lost Time (s)		6.7		6.7			6.1	3.0	6.1	6.1
Lead/Lag						Lag	Lag	Lead		
Lead-Lag Optimize?										
Recall Mode	Ped	Ped	Max	Max		C-Min	C-Min	None	C-Min	C-Min
Act Effct Green (s)		54.8		54.8	65.8		11.4	25.5	22.4	22.4
Actuated g/C Ratio		0.61		0.61	0.73		0.13	0.28	0.25	0.25
v/c Ratio		0.35		0.33	0.18		0.51	0.78	0.31	0.07
Control Delay		10.1		10.4	1.1		29.5	46.9	29.5	3.4
Queue Delay		0.0		0.0	0.0		0.0	0.0	0.0	0.0
Total Delay		10.1		10.4	1.1		29.5	46.9	29.5	3.4
LOS		B		B	A		C	D	C	A
Approach Delay		10.1		6.6			29.5		38.8	
Approach LOS		B		A			C		D	
Queue Length 50th (m)		26.9		21.0	0.0		9.3	35.6	17.3	0.0
Queue Length 95th (m)		50.2		41.2	5.6		23.7	#57.7	29.8	2.6
Internal Link Dist (m)		113.9		142.4			118.8		422.3	
Turn Bay Length (m)					50.0			60.0		20.0
Base Capacity (vph)		1047		854	1092		509	306	756	576
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		0.35		0.33	0.18		0.21	0.78	0.16	0.04

Intersection Summary

Cycle Length: 90
Actuated Cycle Length: 90
Offset: 0 (0%), Referenced to phase 2:SBTL and 6:NBTL, Start of Green
Natural Cycle: 70
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.78
Intersection Signal Delay: 18.6 — Intersection LOS: B
Intersection Capacity Utilization 72.1% — ICU Level of Service C
Analysis Period (min) 15
\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 12: Robie & Inglis

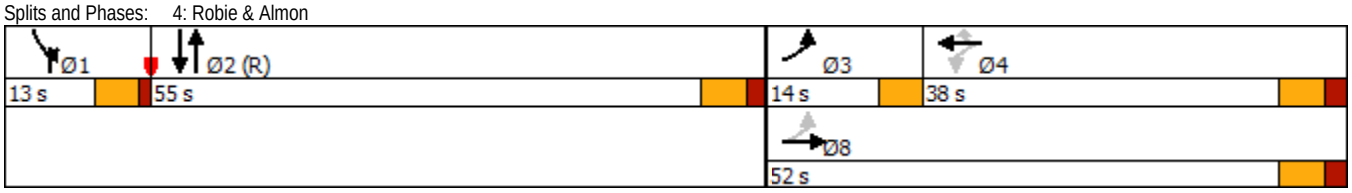


Lane Group	EBL	EBT	WBL	WBT	WBR	NBT	SBL	SBT
Lane Configurations								
Traffic Volume (vph)	190	195	15	470	125	13	20	369
Future Volume (vph)	190	195	15	470	125	13	20	369
Lane Group Flow (vph)	217	291	0	553	143	15	23	569
Turn Type	pm+pt	NA	Perm	NA	Perm	NA	Prot	NA
Protected Phases	3	8		4		2	1!	2
Permitted Phases	8		4		4			
Detector Phase	3	8	4	4	4	2	1	2
Switch Phase								
Minimum Initial (s)	7.0	10.0	10.0	10.0	10.0	10.0	8.0	10.0
Minimum Split (s)	11.0	50.0	37.0	37.0	37.0	40.0	13.0	40.0
Total Split (s)	14.0	52.0	38.0	38.0	38.0	55.0	13.0	55.0
Total Split (%)	11.7%	43.3%	31.7%	31.7%	31.7%	45.8%	10.8%	45.8%
Yellow Time (s)	4.0	4.1	4.1	4.1	4.1	4.1	4.0	4.1
All-Red Time (s)	0.0	2.1	2.1	2.1	2.1	1.7	1.0	1.7
Lost Time Adjust (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	6.2		6.2	6.2	5.8	5.0	5.8
Lead/Lag	Lead		Lag	Lag	Lag	Lag	Lead	Lag
Lead-Lag Optimize?								
Recall Mode	None	None	None	None	None	C-Min	None	C-Min
Act Effct Green (s)	53.1	50.9		32.6	32.6	49.3	8.0	49.3
Actuated g/C Ratio	0.44	0.42		0.27	0.27	0.41	0.07	0.41
v/c Ratio	0.80	0.40		0.95	0.31	0.02	0.20	0.81
Control Delay	50.4	25.8		69.8	12.9	21.6	73.0	20.6
Queue Delay	0.0	0.0		0.0	0.0	0.0	0.0	0.0
Total Delay	50.4	25.8		69.8	12.9	21.6	73.0	20.6
LOS	D	C		E	B	C	E	C
Approach Delay		36.3		58.1		21.6		22.7
Approach LOS		D		E		C		C
Queue Length 50th (m)	34.8	45.7		129.3	6.4	2.2	5.8	34.1
Queue Length 95th (m)	#88.5	72.4		#198.2	23.1	6.3	m9.6	#48.2
Internal Link Dist (m)		253.6		227.2		402.8		360.9
Turn Bay Length (m)	80.0				50.0		180.0	
Base Capacity (vph)	270	735		584	456	729	115	709
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	0.80	0.40		0.95	0.31	0.02	0.20	0.80

Intersection Summary

Cycle Length: 120
Actuated Cycle Length: 120
Offset: 76 (63%), Referenced to phase 2:NBSB and 6:, Start of Green
Natural Cycle: 105
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.95
Intersection Signal Delay: 40.1 Intersection LOS: D
Intersection Capacity Utilization 105.1% ICU Level of Service G
Analysis Period (min) 15
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.
! Phase conflict between lane groups.

Splits and Phases: 4: Robie & Almon

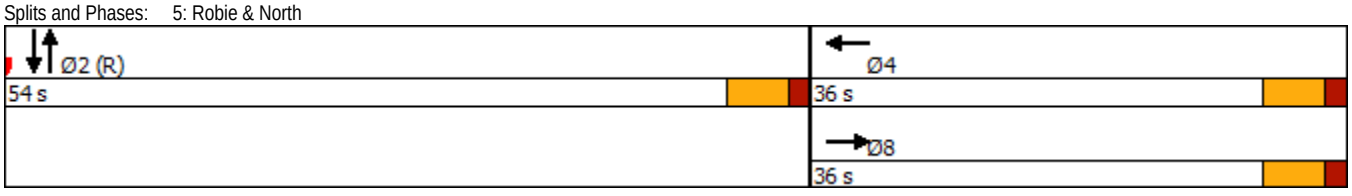


Lane Group	EBT	WBT	NBT	SBT
Lane Configurations				
Traffic Volume (vph)	345	445	13	514
Future Volume (vph)	345	445	13	514
Lane Group Flow (vph)	423	531	15	621
Turn Type	NA	NA	NA	NA
Protected Phases	8	4	2	2
Permitted Phases				
Detector Phase	8	4	2	2
Switch Phase				
Minimum Initial (s)	10.0	10.0	10.0	10.0
Minimum Split (s)	23.7	23.7	54.0	54.0
Total Split (s)	36.0	36.0	54.0	54.0
Total Split (%)	40.0%	40.0%	60.0%	60.0%
Yellow Time (s)	4.1	4.1	4.1	4.1
All-Red Time (s)	1.6	1.6	1.5	1.5
Lost Time Adjust (s)	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.7	5.7	5.6	5.6
Lead/Lag				
Lead-Lag Optimize?				
Recall Mode	Ped	Ped	C-Max	C-Max
Act Effct Green (s)	28.5	28.5	50.2	50.2
Actuated g/C Ratio	0.32	0.32	0.56	0.56
v/c Ratio	0.76	0.91	0.02	0.63
Control Delay	36.8	50.1	9.8	17.6
Queue Delay	0.0	0.0	0.0	0.0
Total Delay	36.8	50.1	9.8	17.6
LOS	D	D	A	B
Approach Delay	36.8	50.1	9.8	17.6
Approach LOS	D	D	A	B
Queue Length 50th (m)	62.5	84.0	1.2	71.3
Queue Length 95th (m)	95.6	#139.1	3.9	107.2
Internal Link Dist (m)	171.5	199.1	446.6	402.8
Turn Bay Length (m)				
Base Capacity (vph)	594	623	971	989
Starvation Cap Reductn	0	0	0	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.71	0.85	0.02	0.63

Intersection Summary

Cycle Length: 90
Actuated Cycle Length: 90
Offset: 0 (0%), Referenced to phase 2:NBSB, Start of Green
Natural Cycle: 90
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.91
Intersection Signal Delay: 33.5 Intersection LOS: C
Intersection Capacity Utilization 75.9% 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: 5: Robie & North

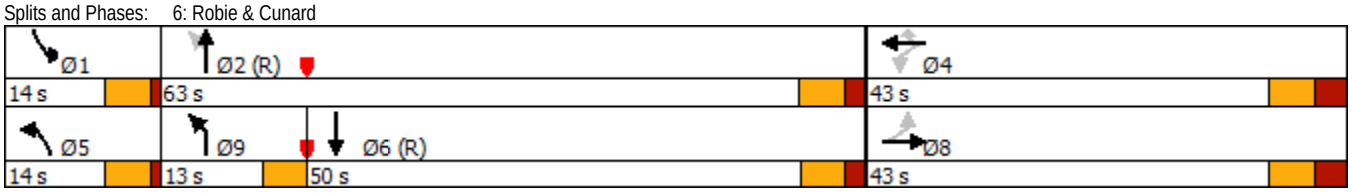


Lane Group	EBL	EBT	WBL	WBT	WBR2	NBL2	NBL	NBT	SBL	SBT
Lane Configurations										
Traffic Volume (vph)	20	300	65	475	75	42	8	13	55	534
Future Volume (vph)	20	300	65	475	75	42	8	13	55	534
Lane Group Flow (vph)	23	410	74	542	86	38	0	34	63	666
Turn Type	Perm	NA	Perm	NA	Perm	Prot	pm+pt	NA	Prot	NA
Protected Phases		8		4		5	9	2	1	6
Permitted Phases	8		4		4		2			
Detector Phase	8	8	4	4	4	5	9	2	1	6
Switch Phase										
Minimum Initial (s)	10.0	10.0	10.0	10.0	10.0	8.0	8.0	10.0	8.0	8.0
Minimum Split (s)	39.1	39.1	39.1	39.1	39.1	13.0	13.0	37.9	13.0	24.0
Total Split (s)	43.0	43.0	43.0	43.0	43.0	14.0	13.0	63.0	14.0	50.0
Total Split (%)	35.8%	35.8%	35.8%	35.8%	35.8%	11.7%	10.8%	52.5%	11.7%	41.7%
Yellow Time (s)	4.1	4.1	4.1	4.1	4.1	4.0	4.0	4.1	4.0	4.0
All-Red Time (s)	3.0	3.0	3.0	3.0	3.0	1.0	0.0	2.0	1.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Total Lost Time (s)	7.1	7.1	7.1	7.1	7.1	5.0		6.1	5.0	6.0
Lead/Lag						Lead	Lag	Lag	Lead	
Lead-Lag Optimize?										
Recall Mode	Ped	Ped	Ped	Ped	Ped	None	None	C-Max	None	C-Max
Act Effct Green (s)	35.9	35.9	35.9	35.9	35.9	8.4		59.9	8.6	62.8
Actuated g/C Ratio	0.30	0.30	0.30	0.30	0.30	0.07		0.50	0.07	0.52
v/c Ratio	0.48	0.95	0.54	0.99	0.18	0.34		0.06	0.51	0.71
Control Delay	70.5	73.7	51.7	79.6	4.0	61.7		17.5	68.2	28.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0
Total Delay	70.5	73.7	51.7	79.6	4.0	61.7		17.5	68.2	28.4
LOS	E	E	D	E	A	E		B	E	C
Approach Delay		73.5		67.4				40.8		31.8
Approach LOS		E		E				D		C
Queue Length 50th (m)	4.4	94.3	14.5	127.2	0.0	9.1		4.4	14.5	125.4
Queue Length 95th (m)	#17.0	#155.0	32.1	#198.0	7.3	20.9		10.6	29.1	176.9
Internal Link Dist (m)		72.7		213.1				402.3		446.6
Turn Bay Length (m)	50.0				50.0	40.0			40.0	
Base Capacity (vph)	48	433	138	545	468	119		605	129	942
Starvation Cap Reductn	0	0	0	0	0	0		0	0	0
Spillback Cap Reductn	0	0	0	0	0	0		0	0	0
Storage Cap Reductn	0	0	0	0	0	0		0	0	0
Reduced v/c Ratio	0.48	0.95	0.54	0.99	0.18	0.32		0.06	0.49	0.71

Intersection Summary

Cycle Length: 120
Actuated Cycle Length: 120
Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBT, Start of Green
Natural Cycle: 120
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.99
Intersection Signal Delay: 54.4 — Intersection LOS: D
Intersection Capacity Utilization 84.5% — 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: 6: Robie & Cunard

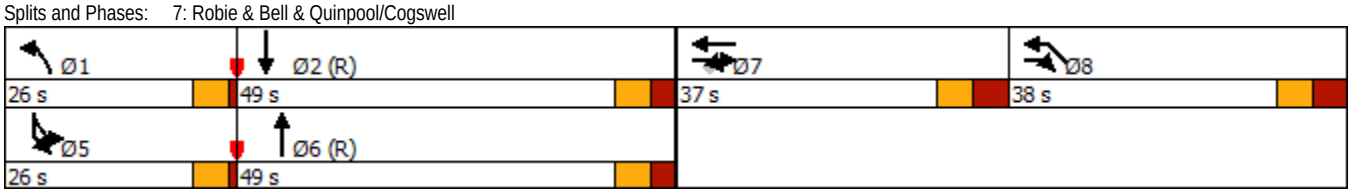


Lane Group	EBT	EBR	EBR2	WBT	NBL	NBT	SBL	SBT	NWL
Lane Configurations									
Traffic Volume (vph)	215	295	140	535	245	19	140	542	625
Future Volume (vph)	215	295	140	535	245	19	140	542	625
Lane Group Flow (vph)	245	337	160	679	280	22	240	687	941
Turn Type	NA	pt+ov	Perm	NA	Prot	NA	Prot	NA	Prot
Protected Phases	7	7 8		7	1	6	5	2	8
Permitted Phases			7						
Minimum Split (s)	37.0		37.0	37.0	14.0	36.0	14.0	49.0	36.0
Total Split (s)	37.0		37.0	37.0	26.0	49.0	26.0	49.0	38.0
Total Split (%)	24.7%		24.7%	24.7%	17.3%	32.7%	17.3%	32.7%	25.3%
Yellow Time (s)	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	4.0		4.0	4.0	1.0	3.0	1.0	3.0	4.0
Lost Time Adjust (s)	-1.0		-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0
Total Lost Time (s)	7.0		7.0	7.0	4.0	6.0	4.0	6.0	7.0
Lead/Lag	Lead		Lead	Lead	Lead	Lag	Lead	Lag	Lag
Lead-Lag Optimize?									
Act Effct Green (s)	30.0	68.0	30.0	30.0	22.0	43.0	22.0	43.0	31.0
Actuated g/C Ratio	0.20	0.45	0.20	0.20	0.15	0.29	0.15	0.29	0.21
v/c Ratio	0.68	0.48	0.43	1.01	1.10	0.05	0.97	0.78	1.43
Control Delay	66.1	31.7	13.7	94.4	142.3	39.2	112.1	56.1	245.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	66.1	31.7	13.7	94.4	142.3	39.2	112.1	56.1	245.7
LOS	E	C	B	F	F	D	F	E	F
Approach Delay	39.2			94.4		134.8		70.6	245.7
Approach LOS	D			F		F		E	F
Queue Length 50th (m)	68.3	69.3	3.7	~107.5	~93.9	4.8	72.0	98.4	~194.7
Queue Length 95th (m)	98.6	98.1	24.6	#149.6	#151.9	11.9	#126.4	122.2	#235.4
Internal Link Dist (m)	112.3			207.4		413.3		402.3	600.3
Turn Bay Length (m)		70.0	70.0				80.0		
Base Capacity (vph)	361	696	372	675	255	485	248	876	656
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.68	0.48	0.43	1.01	1.10	0.05	0.97	0.78	1.43

Intersection Summary

Cycle Length: 150
Actuated Cycle Length: 150
Offset: 0 (0%), Referenced to phase 2:SBT and 6:NBT, Start of Green
Natural Cycle: 140
Control Type: Pretimed
Maximum v/c Ratio: 1.43
Intersection Signal Delay: 119.9
Intersection LOS: F
Intersection Capacity Utilization 120.2%
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.

Splits and Phases: 7: Robie & Bell & Quinpool/Cogswell

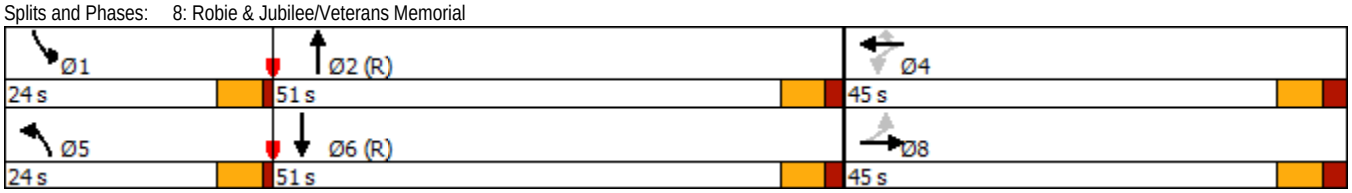


Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	SBL	SBT
Lane Configurations									
Traffic Volume (vph)	60	135	15	340	120	160	19	105	607
Future Volume (vph)	60	135	15	340	120	160	19	105	607
Lane Group Flow (vph)	0	268	0	405	137	183	22	120	727
Turn Type	Perm	NA	Perm	NA	Perm	Prot	NA	Prot	NA
Protected Phases		8		4		5	2	1	6
Permitted Phases	8		4		4				
Detector Phase	8	8	4	4	4	5	2	1	6
Switch Phase									
Minimum Initial (s)	10.0	10.0	10.0	10.0	10.0	7.0	10.0	7.0	10.0
Minimum Split (s)	31.6	31.6	31.6	31.6	31.6	12.0	22.8	12.0	22.8
Total Split (s)	45.0	45.0	45.0	45.0	45.0	24.0	51.0	24.0	51.0
Total Split (%)	37.5%	37.5%	37.5%	37.5%	37.5%	20.0%	42.5%	20.0%	42.5%
Yellow Time (s)	4.1	4.1	4.1	4.1	4.1	4.0	4.1	4.0	4.1
All-Red Time (s)	2.4	2.4	2.4	2.4	2.4	1.0	1.7	1.0	1.7
Lost Time Adjust (s)		0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)		6.5		6.5	6.5	5.0	5.8	5.0	5.8
Lead/Lag						Lead	Lag	Lead	Lag
Lead-Lag Optimize?									
Recall Mode	Ped	Ped	Ped	Ped	Ped	None	C-Min	None	C-Min
Act Effct Green (s)		41.6		41.6	41.6	17.5	47.2	13.9	43.6
Actuated g/C Ratio		0.35		0.35	0.35	0.15	0.39	0.12	0.36
v/c Ratio		0.79		0.66	0.27	0.81	0.03	0.63	0.62
Control Delay		51.3		38.5	11.1	83.2	9.6	64.6	35.1
Queue Delay		0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Delay		51.3		38.5	11.1	83.2	9.6	64.6	35.1
LOS		D		D	B	F	A	E	D
Approach Delay		51.3		31.6			75.3		39.3
Approach LOS		D		C			E		D
Queue Length 50th (m)		51.8		76.1	6.5	34.2	1.1	27.3	79.1
Queue Length 95th (m)		#98.5		114.2	21.4	m42.3	m3.3	44.9	95.1
Internal Link Dist (m)		189.8		183.6			355.1		413.3
Turn Bay Length (m)					40.0	50.0		90.0	
Base Capacity (vph)		348		634	517	248	703	260	1279
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		0.77		0.64	0.26	0.74	0.03	0.46	0.57

Intersection Summary

Cycle Length: 120
Actuated Cycle Length: 120
Offset: 47 (39%), Referenced to phase 2:NBT and 6:SBT, Start of Green
Natural Cycle: 70
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.81
Intersection Signal Delay: 42.7 Intersection LOS: D
Intersection Capacity Utilization 89.7% ICU Level of Service E
Analysis Period (min) 15
\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 8: Robie & Jubilee/Veterans Memorial



Lane Group	EBL2	EBT	WBL	WBT	NBL	NBT	SBU	SBL2	SBL	SBT
Lane Configurations										
Traffic Volume (vph)	55	135	40	315	160	13	18	0	112	375
Future Volume (vph)	55	135	40	315	160	13	18	0	112	375
Lane Group Flow (vph)	0	217	0	611	183	15	0	21	128	468
Turn Type	Perm	NA	Perm	NA	Prot	NA	D.P+P	D.P+P	Prot	NA
Protected Phases		4		4	5	2	9	9	1	6
Permitted Phases	4		4				2	2		
Detector Phase	4	4	4	4	5	2	9	9	1	6
Switch Phase										
Minimum Initial (s)	10.0	10.0	10.0	10.0	8.0	10.0	8.0	8.0	8.0	10.0
Minimum Split (s)	33.5	33.5	33.5	33.5	13.0	34.5	13.0	13.0	13.0	34.5
Total Split (s)	45.0	45.0	45.0	45.0	17.0	45.0	13.0	13.0	17.0	58.0
Total Split (%)	37.5%	37.5%	37.5%	37.5%	14.2%	37.5%	10.8%	10.8%	14.2%	48.3%
Yellow Time (s)	4.1	4.1	4.1	4.1	4.0	4.1	4.0	4.0	4.0	4.1
All-Red Time (s)	2.4	2.4	2.4	2.4	1.0	2.4	1.0	1.0	1.0	2.4
Lost Time Adjust (s)		0.0		0.0	0.0	0.0		0.0	0.0	0.0
Total Lost Time (s)		6.5		6.5	5.0	6.5		5.0	5.0	6.5
Lead/Lag					Lead		Lag	Lag	Lead	Lag
Lead-Lag Optimize?										
Recall Mode	None	None	None	None	None	C-Max	None	None	None	C-Max
Act Effct Green (s)		36.5		36.5	14.0	48.7		53.4	11.6	51.5
Actuated g/C Ratio		0.30		0.30	0.12	0.41		0.44	0.10	0.43
v/c Ratio		0.76		0.91	0.91	0.02		0.03	0.78	0.65
Control Delay		55.6		58.3	95.9	26.4		3.8	101.4	12.4
Queue Delay		0.0		0.0	0.0	0.0		0.0	0.0	0.0
Total Delay		55.6		58.3	95.9	26.4		3.8	101.4	12.4
LOS		E		E	F	C		A	F	B
Approach Delay		55.6		58.3		90.7				30.6
Approach LOS		E		E		F				C
Queue Length 50th (m)		45.0		70.7	~47.0	2.0		0.4	32.4	10.6
Queue Length 95th (m)		#80.6		#102.0	#92.1	7.4		m0.8	m#60.3	16.3
Internal Link Dist (m)		121.4		124.9		240.3				355.1
Turn Bay Length (m)					60.0					
Base Capacity (vph)		301		710	202	631		637	173	717
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		0.72		0.86	0.91	0.02		0.03	0.74	0.65

Intersection Summary

Cycle Length: 120
Actuated Cycle Length: 120
Offset: 76 (63%), Referenced to phase 2:NBSB and 6:SBT, Start of Green
Natural Cycle: 95
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.91
Intersection Signal Delay: 51.4 Intersection LOS: D
Intersection Capacity Utilization 98.1% 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.

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

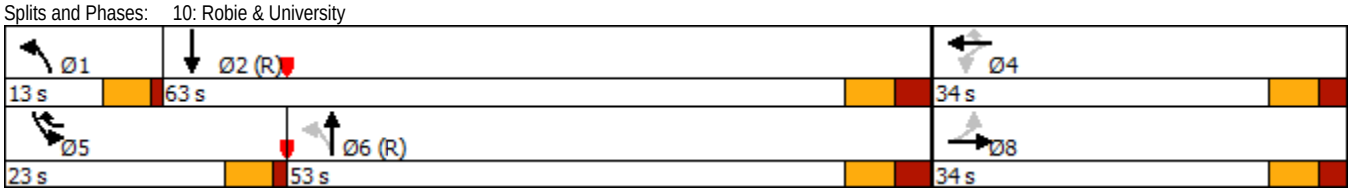
Splits and Phases: 9: Robie & Coburg/Spring Garden

Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	SBL	SBT
Lane Configurations									
Traffic Volume (vph)	45	100	25	145	225	30	11	132	263
Future Volume (vph)	45	100	25	145	225	30	11	132	263
Lane Group Flow (vph)	51	137	29	165	257	34	13	151	351
Turn Type	Perm	NA	Perm	NA	pm+ov	pm+pt	NA	Prot	NA
Protected Phases		8		4	5	1	6	5	2
Permitted Phases	8		4		4	6			
Detector Phase	8	8	4	4	5	1	6	5	2
Switch Phase									
Minimum Initial (s)	10.0	10.0	10.0	10.0	8.0	8.0	10.0	8.0	10.0
Minimum Split (s)	32.5	32.5	32.5	32.5	13.0	13.0	43.3	13.0	43.3
Total Split (s)	34.0	34.0	34.0	34.0	23.0	13.0	53.0	23.0	63.0
Total Split (%)	30.9%	30.9%	30.9%	30.9%	20.9%	11.8%	48.2%	20.9%	57.3%
Yellow Time (s)	4.1	4.1	4.1	4.1	4.0	4.0	4.1	4.0	4.1
All-Red Time (s)	2.4	2.4	2.4	2.4	1.0	1.0	3.2	1.0	3.2
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.5	6.5	6.5	6.5	5.0	5.0	7.3	5.0	7.3
Lead/Lag						Lead			Lag
Lead-Lag Optimize?									
Recall Mode	Ped	Ped	Ped	Ped	None	None	C-Max	None	C-Max
Act Effct Green (s)	26.0	26.0	26.0	26.0	42.2	60.8	50.5	14.7	62.4
Actuated g/C Ratio	0.24	0.24	0.24	0.24	0.38	0.55	0.46	0.13	0.57
v/c Ratio	0.38	0.36	0.12	0.43	0.54	0.06	0.02	0.66	0.42
Control Delay	44.9	36.0	34.8	39.8	7.7	8.0	20.1	58.5	16.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	44.9	36.0	34.8	39.8	7.7	8.0	20.1	58.5	16.3
LOS	D	D	C	D	A	A	C	E	B
Approach Delay		38.4		21.2			11.3		29.0
Approach LOS		D		C			B		C
Queue Length 50th (m)	9.2	23.0	4.9	30.2	0.0	2.7	1.7	31.1	44.1
Queue Length 95th (m)	21.4	40.8	12.8	50.3	13.1	m5.4	m5.0	49.8	67.7
Internal Link Dist (m)		178.0		171.4			167.5		240.3
Turn Bay Length (m)	15.0		15.0		60.0	60.0		60.0	
Base Capacity (vph)	143	397	252	406	509	561	685	285	829
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.36	0.35	0.12	0.41	0.50	0.06	0.02	0.53	0.42

Intersection Summary

Cycle Length: 110
Actuated Cycle Length: 110
Offset: 88 (80%), Referenced to phase 2:SBT and 6:NBTL, Start of Green
Natural Cycle: 90
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.66
Intersection Signal Delay: 26.8 — Intersection LOS: C
Intersection Capacity Utilization 78.6% — ICU Level of Service D
Analysis Period (min) 15
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 10: Robie & University

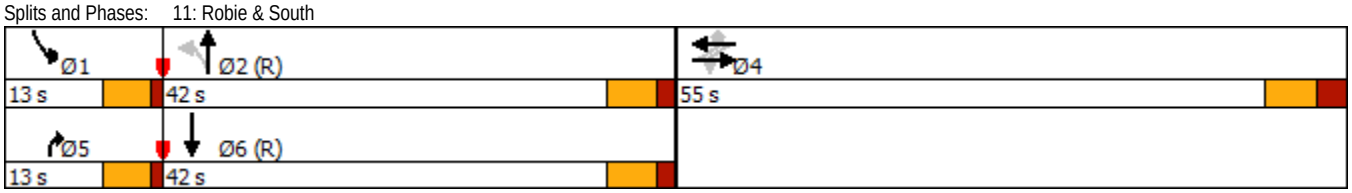


Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT
Lane Configurations										
Traffic Volume (vph)	55	205	20	345	245	3	4	42	91	195
Future Volume (vph)	55	205	20	345	245	3	4	42	91	195
Lane Group Flow (vph)	0	320	0	417	280	0	8	48	104	277
Turn Type	Perm	NA	Perm	NA	Perm	Perm	NA	custom	Prot	NA
Protected Phases		4		4			2	5!	1!	6
Permitted Phases	4		4		4	2				
Detector Phase	4	4	4	4	4	2	2	5	1	6
Switch Phase										
Minimum Initial (s)	10.0	10.0	10.0	10.0	10.0	10.0	10.0	8.0	8.0	10.0
Minimum Split (s)	47.8	47.8	47.8	47.8	47.8	24.7	24.7	13.0	13.0	24.7
Total Split (s)	55.0	55.0	55.0	55.0	55.0	42.0	42.0	13.0	13.0	42.0
Total Split (%)	50.0%	50.0%	50.0%	50.0%	50.0%	38.2%	38.2%	11.8%	11.8%	38.2%
Yellow Time (s)	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.0	4.0	4.1
All-Red Time (s)	2.7	2.7	2.7	2.7	2.7	1.6	1.6	1.0	1.0	1.6
Lost Time Adjust (s)		0.0		0.0	0.0		0.0	0.0	0.0	0.0
Total Lost Time (s)		6.8		6.8	6.8		5.7	5.0	5.0	5.7
Lead/Lag						Lag	Lag	Lead	Lead	Lag
Lead-Lag Optimize?										
Recall Mode	Ped	Ped	Ped	Ped	Ped	C-Min	C-Min	Min	None	C-Min
Act Effct Green (s)		43.2		43.2	43.2		37.2	8.0	12.1	41.3
Actuated g/C Ratio		0.39		0.39	0.39		0.34	0.07	0.11	0.38
v/c Ratio		0.75		0.61	0.39		0.02	0.25	0.59	0.52
Control Delay		40.3		30.7	4.0		26.0	4.2	73.3	22.2
Queue Delay		0.0		0.0	0.0		0.0	0.0	0.0	0.0
Total Delay		40.3		30.7	4.0		26.0	4.2	73.3	22.2
LOS		D		C	A		C	A	E	C
Approach Delay		40.3		20.0			7.3			36.1
Approach LOS		D		B			A			D
Queue Length 50th (m)		59.5		72.9	0.0		1.2	0.0	23.8	19.0
Queue Length 95th (m)		84.8		92.7	14.3		4.7	1.6	#53.5	78.7
Internal Link Dist (m)		115.5		183.6			422.3			167.5
Turn Bay Length (m)					50.0				60.0	
Base Capacity (vph)		477		765	769		504	189	175	535
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		0.67		0.55	0.36		0.02	0.25	0.59	0.52

Intersection Summary

Cycle Length: 110
Actuated Cycle Length: 110
Offset: 108 (98%), Referenced to phase 2:NBTL and 6:SBT, Start of Green
Natural Cycle: 90
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.75
Intersection Signal Delay: 28.2 Intersection LOS: C
Intersection Capacity Utilization 100.3% ICU Level of Service G
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: 11: Robie & South

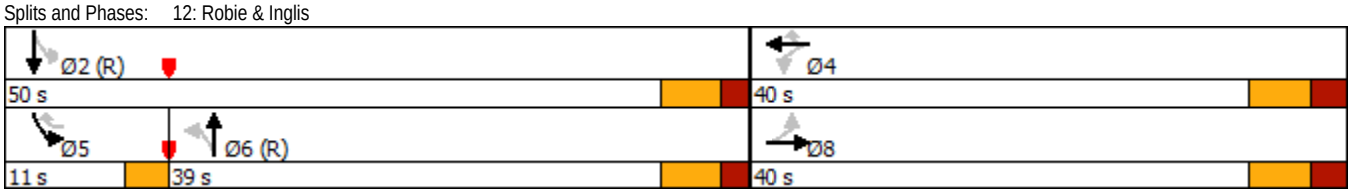


Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	SBL	SBT
Lane Configurations									
Traffic Volume (vph)	20	235	80	275	275	30	125	175	70
Future Volume (vph)	20	235	80	275	275	30	125	175	70
Lane Group Flow (vph)	0	320	0	405	314	0	268	200	97
Turn Type	Perm	NA	Perm	NA	custom	Perm	NA	pm+pt	NA
Protected Phases		8		4			6	5	2
Permitted Phases	8		4		4 5	6		2	
Detector Phase	8	8	4	4	4 5	6	6	5	2
Switch Phase									
Minimum Initial (s)	10.0	10.0	10.0	10.0		10.0	10.0	8.0	10.0
Minimum Split (s)	31.7	31.7	31.7	31.7		23.1	23.1	11.0	23.1
Total Split (s)	40.0	40.0	40.0	40.0		39.0	39.0	11.0	50.0
Total Split (%)	44.4%	44.4%	44.4%	44.4%		43.3%	43.3%	12.2%	55.6%
Yellow Time (s)	4.1	4.1	4.1	4.1		4.1	4.1	3.0	4.1
All-Red Time (s)	2.6	2.6	2.6	2.6		2.0	2.0	0.0	2.0
Lost Time Adjust (s)		0.0		0.0			0.0	0.0	0.0
Total Lost Time (s)		6.7		6.7			6.1	3.0	6.1
Lead/Lag						Lag	Lag	Lead	
Lead-Lag Optimize?									
Recall Mode	Ped	Ped	Max	Max		C-Min	C-Min	None	C-Min
Act Effct Green (s)		44.9		44.9	55.9		21.3	35.4	32.3
Actuated g/C Ratio		0.50		0.50	0.62		0.24	0.39	0.36
v/c Ratio		0.37		0.56	0.31		0.78	0.60	0.18
Control Delay		16.9		21.4	2.2		42.8	25.4	15.0
Queue Delay		0.0		0.0	0.0		0.0	0.0	0.0
Total Delay		16.9		21.4	2.2		42.8	25.4	15.0
LOS		B		C	A		D	C	B
Approach Delay		16.9		13.0			42.8		22.0
Approach LOS		B		B			D		C
Queue Length 50th (m)		31.9		46.6	0.0		38.4	23.3	9.2
Queue Length 95th (m)		61.8		90.5	11.5		57.6	32.4	16.5
Internal Link Dist (m)		113.9		142.4			118.8		422.3
Turn Bay Length (m)					50.0			60.0	
Base Capacity (vph)		854		722	1002		515	336	726
Starvation Cap Reductn		0		0	0		0	0	0
Spillback Cap Reductn		0		0	0		0	0	0
Storage Cap Reductn		0		0	0		0	0	0
Reduced v/c Ratio		0.37		0.56	0.31		0.52	0.60	0.13

Intersection Summary

Cycle Length: 90
Actuated Cycle Length: 90
Offset: 0 (0%), Referenced to phase 2:SBTL and 6:NBTL, Start of Green
Natural Cycle: 70
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.78
Intersection Signal Delay: 20.5 Intersection LOS: C
Intersection Capacity Utilization 87.2% ICU Level of Service E
Analysis Period (min) 15

Splits and Phases: 12: Robie & Inglis



Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	SBL	SBT
Lane Configurations									
Traffic Volume (vph)	190	195	15	470	125	30	747	20	11
Future Volume (vph)	190	195	15	470	125	30	747	20	11
Lane Group Flow (vph)	217	291	0	553	143	34	864	23	13
Turn Type	pm+pt	NA	Perm	NA	Perm	Prot	NA	Prot	NA
Protected Phases	3	8		4		1	2	1	2
Permitted Phases	8		4		4				
Detector Phase	3	8	4	4	4	1	2	1	2
Switch Phase									
Minimum Initial (s)	7.0	10.0	10.0	10.0	10.0	8.0	10.0	8.0	10.0
Minimum Split (s)	11.0	50.0	37.0	37.0	37.0	13.0	40.0	13.0	40.0
Total Split (s)	14.0	52.0	38.0	38.0	38.0	13.0	55.0	13.0	55.0
Total Split (%)	11.7%	43.3%	31.7%	31.7%	31.7%	10.8%	45.8%	10.8%	45.8%
Yellow Time (s)	4.0	4.1	4.1	4.1	4.1	4.0	4.1	4.0	4.1
All-Red Time (s)	0.0	2.1	2.1	2.1	2.1	1.0	1.7	1.0	1.7
Lost Time Adjust (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	6.2		6.2	6.2	5.0	5.8	5.0	5.8
Lead/Lag	Lead		Lag	Lag	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize?									
Recall Mode	None	None	None	None	None	None	C-Min	None	C-Min
Act Effct Green (s)	48.0	45.8		31.8	31.8	8.0	51.8	8.0	51.8
Actuated g/C Ratio	0.40	0.38		0.26	0.26	0.07	0.43	0.07	0.43
v/c Ratio	1.04	0.44		0.97	0.32	0.29	1.14	0.20	0.02
Control Delay	101.8	28.6		75.5	13.0	60.1	112.9	73.0	10.2
Queue Delay	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	101.8	28.6		75.5	13.0	60.1	112.9	73.0	10.2
LOS	F	C		E	B	E	F	E	B
Approach Delay		59.9		62.7			110.9		50.3
Approach LOS		E		E			F		D
Queue Length 50th (m)	~38.8	47.6		129.3	6.4	7.8	~248.5	5.8	0.8
Queue Length 95th (m)	#87.7	72.4		#198.2	23.1	18.3	#324.2	m9.6	m1.6
Internal Link Dist (m)		253.6		204.8			402.8		360.9
Turn Bay Length (m)	80.0				50.0	25.0		180.0	
Base Capacity (vph)	209	663		569	447	117	756	115	787
Starvation Cap Reductn	0	0		0	0	0	0	0	0
Spillback Cap Reductn	0	0		0	0	0	0	0	0
Storage Cap Reductn	0	0		0	0	0	0	0	0
Reduced v/c Ratio	1.04	0.44		0.97	0.32	0.29	1.14	0.20	0.02

Intersection Summary

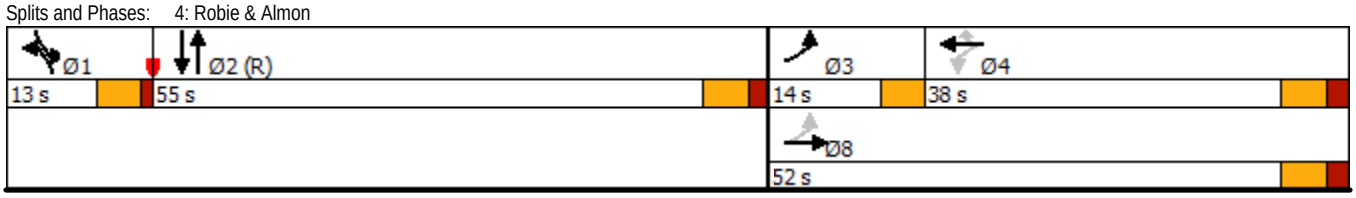
Cycle Length: 120
Actuated Cycle Length: 120
Offset: 76 (63%), Referenced to phase 2:NBSB and 6:, Start of Green
Natural Cycle: 125
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 1.14
Intersection Signal Delay: 82.0 Intersection LOS: F
Intersection Capacity Utilization 117.0% ICU Level of Service 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.

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

Splits and Phases: 4: Robie & Almon



Lane Group	EBT	WBT	NBT	NBR	SBT
Lane Configurations					
Traffic Volume (vph)	345	445	657	375	11
Future Volume (vph)	345	445	657	375	11
Lane Group Flow (vph)	423	531	750	428	13
Turn Type	NA	NA	NA	Perm	NA
Protected Phases	8	4	2		2
Permitted Phases				2	
Detector Phase	8	4	2	2	2
Switch Phase					
Minimum Initial (s)	10.0	10.0	10.0	10.0	10.0
Minimum Split (s)	23.7	23.7	54.0	54.0	54.0
Total Split (s)	36.0	36.0	54.0	54.0	54.0
Total Split (%)	40.0%	40.0%	60.0%	60.0%	60.0%
Yellow Time (s)	4.1	4.1	4.1	4.1	4.1
All-Red Time (s)	1.6	1.6	1.5	1.5	1.5
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	5.7	5.7	5.6	5.6	5.6
Lead/Lag					
Lead-Lag Optimize?					
Recall Mode	Ped	Ped	C-Max	C-Max	C-Max
Act Effct Green (s)	28.6	28.6	50.1	50.1	50.1
Actuated g/C Ratio	0.32	0.32	0.56	0.56	0.56
v/c Ratio	0.76	0.91	0.77	0.98	0.01
Control Delay	36.6	50.4	23.1	55.1	9.8
Queue Delay	0.0	0.0	0.0	0.0	0.0
Total Delay	36.6	50.4	23.1	55.1	9.8
LOS	D	D	C	E	A
Approach Delay	36.6	50.4	34.7		9.8
Approach LOS	D	D	C		A
Queue Length 50th (m)	62.5	84.2	99.1	~54.7	1.0
Queue Length 95th (m)	95.6	#139.6	150.8	#121.9	3.6
Internal Link Dist (m)	171.5	198.8	446.6		402.8
Turn Bay Length (m)				50.0	
Base Capacity (vph)	594	620	970	438	995
Starvation Cap Reductn	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0
Reduced v/c Ratio	0.71	0.86	0.77	0.98	0.01

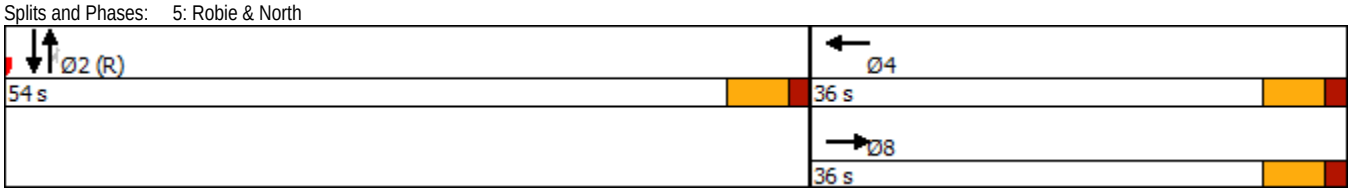
Intersection Summary

Cycle Length: 90
Actuated Cycle Length: 90
Offset: 0 (0%), Referenced to phase 2:NBSB, Start of Green
Natural Cycle: 90
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.98
Intersection Signal Delay: 38.8 Intersection LOS: D
Intersection Capacity Utilization 81.6% ICU Level of Service D
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.

Splits and Phases: 5: Robie & North



Lane Group	EBL	EBT	WBL2	WBT	WBR	SBL2	SBL	NWL2	NWL	NWR
Lane Configurations										
Traffic Volume (vph)	20	300	65	475	75	55	11	21	42	747
Future Volume (vph)	20	300	65	475	75	55	11	21	42	747
Lane Group Flow (vph)	23	410	74	542	86	63	13	24	48	921
Turn Type	Perm	NA	Perm	NA	Perm	Prot	Prot	pm+pt	Prot	Prot
Protected Phases		8		4		1	6	9	5	2
Permitted Phases	8		4		4			2		
Detector Phase	8	8	4	4	4	1	6	9	5	2
Switch Phase										
Minimum Initial (s)	10.0	10.0	10.0	10.0	10.0	8.0	8.0	8.0	8.0	10.0
Minimum Split (s)	39.1	39.1	39.1	39.1	39.1	13.0	24.0	13.0	13.0	37.9
Total Split (s)	43.0	43.0	43.0	43.0	43.0	14.0	50.0	13.0	14.0	63.0
Total Split (%)	35.8%	35.8%	35.8%	35.8%	35.8%	11.7%	41.7%	10.8%	11.7%	52.5%
Yellow Time (s)	4.1	4.1	4.1	4.1	4.1	4.0	4.0	4.0	4.0	4.1
All-Red Time (s)	3.0	3.0	3.0	3.0	3.0	1.0	2.0	0.0	1.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	7.1	7.1	7.1	7.1	7.1	5.0	6.0	4.0	5.0	6.1
Lead/Lag						Lead		Lag	Lead	Lag
Lead-Lag Optimize?										
Recall Mode	Ped	Ped	Ped	Ped	Ped	None	C-Max	None	None	C-Max
Act Effct Green (s)	35.9	35.9	35.9	35.9	35.9	8.6	52.8	62.0	8.6	59.9
Actuated g/C Ratio	0.30	0.30	0.30	0.30	0.30	0.07	0.44	0.52	0.07	0.50
v/c Ratio	0.48	0.96	0.55	0.99	0.18	0.51	0.02	0.03	0.40	1.13
Control Delay	70.5	76.2	53.2	79.6	4.0	68.2	23.5	15.9	63.7	101.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	70.5	76.2	53.2	79.6	4.0	68.2	23.5	15.9	63.7	101.6
LOS	E	E	D	E	A	E	C	B	E	F
Approach Delay		75.9		67.6					97.7	
Approach LOS		E		E					F	
Queue Length 50th (m)	4.4	94.7	14.6	127.2	0.0	14.5	1.9	2.8	11.0	~250.6
Queue Length 95th (m)	#17.0	#156.2	#33.2	#198.0	7.3	29.1	6.1	7.4	23.3	#327.3
Internal Link Dist (m)		72.7		213.1					210.2	
Turn Bay Length (m)	50.0				50.0	40.0	40.0	40.0	40.0	
Base Capacity (vph)	48	428	134	545	468	129	762	695	125	815
Starvation Cap Reductn	0	0	0	0	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	0.48	0.96	0.55	0.99	0.18	0.49	0.02	0.03	0.38	1.13

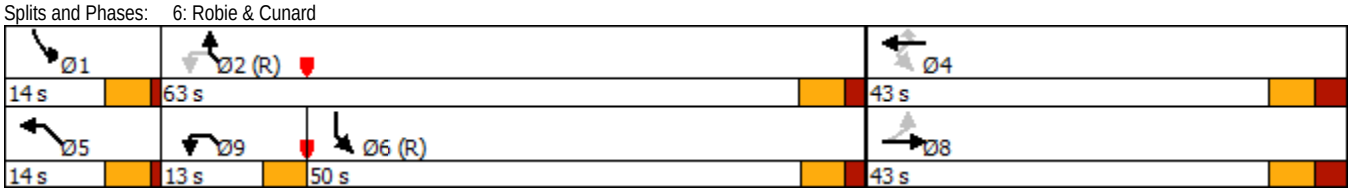
Intersection Summary

Cycle Length: 120
Actuated Cycle Length: 120
Offset: 0 (0%), Referenced to phase 2:NWL and 6:SBL, Start of Green
Natural Cycle: 120
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 1.13
Intersection Signal Delay: 82.6 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.

Splits and Phases: 6: Robie & Cunard



Lane Group	EBT	EBR	EBR2	WBT	NBL	NBT	SBL	SBT	NWL
Lane Configurations									
Traffic Volume (vph)	215	295	140	535	245	756	140	18	625
Future Volume (vph)	215	295	140	535	245	756	140	18	625
Lane Group Flow (vph)	245	337	160	679	280	931	240	21	941
Turn Type	NA	pt+ov	Perm	NA	Prot	NA	Prot	NA	Prot
Protected Phases	7	7 8		7	1	6	5	2	8
Permitted Phases			7						
Minimum Split (s)	37.0		37.0	37.0	14.0	36.0	14.0	49.0	36.0
Total Split (s)	37.0		37.0	37.0	26.0	49.0	26.0	49.0	38.0
Total Split (%)	24.7%		24.7%	24.7%	17.3%	32.7%	17.3%	32.7%	25.3%
Yellow Time (s)	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0
All-Red Time (s)	4.0		4.0	4.0	1.0	3.0	1.0	3.0	4.0
Lost Time Adjust (s)	-1.0		-1.0	-1.0	-1.0	-1.0	-1.0	-1.0	-1.0
Total Lost Time (s)	7.0		7.0	7.0	4.0	6.0	4.0	6.0	7.0
Lead/Lag	Lead		Lead	Lead	Lead	Lag	Lead	Lag	Lag
Lead-Lag Optimize?									
Act Effct Green (s)	30.0	68.0	30.0	30.0	22.0	43.0	22.0	43.0	31.0
Actuated g/C Ratio	0.20	0.45	0.20	0.20	0.15	0.29	0.15	0.29	0.21
v/c Ratio	0.68	0.48	0.43	1.00	1.10	1.01	0.97	0.05	1.43
Control Delay	66.1	31.7	13.7	93.4	142.3	85.5	112.1	39.3	245.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	66.1	31.7	13.7	93.4	142.3	85.5	112.1	39.3	245.7
LOS	E	C	B	F	F	F	F	D	F
Approach Delay	39.2			93.4		98.7		106.2	245.7
Approach LOS	D			F		F		F	F
Queue Length 50th (m)	68.3	69.3	3.7	~106.8	~93.9	~150.2	72.0	4.6	~194.7
Queue Length 95th (m)	98.6	98.1	24.6	#149.2	#151.9	#194.6	#126.4	11.5	#235.4
Internal Link Dist (m)	112.3			207.4		413.3		168.1	600.3
Turn Bay Length (m)		70.0	70.0		100.0				
Base Capacity (vph)	361	696	372	678	255	918	248	427	656
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.68	0.48	0.43	1.00	1.10	1.01	0.97	0.05	1.43

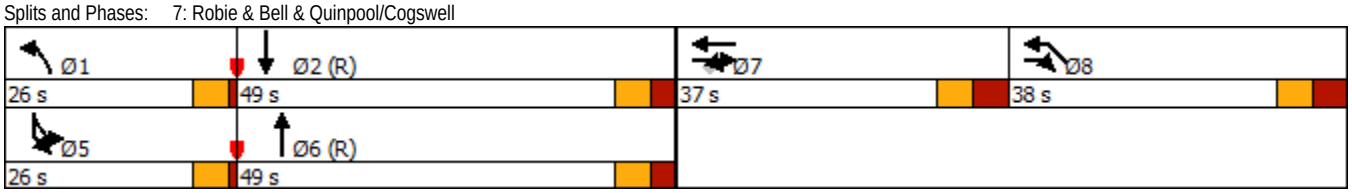
Intersection Summary

Cycle Length: 150
Actuated Cycle Length: 150
Offset: 0 (0%), Referenced to phase 2:SBT and 6:NBT, Start of Green
Natural Cycle: 140
Control Type: Pretimed
Maximum v/c Ratio: 1.43
Intersection Signal Delay: 122.8
Intersection LOS: F
Intersection Capacity Utilization 120.2%
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.

Splits and Phases: 7: Robie & Bell & Quinpool/Cogswell

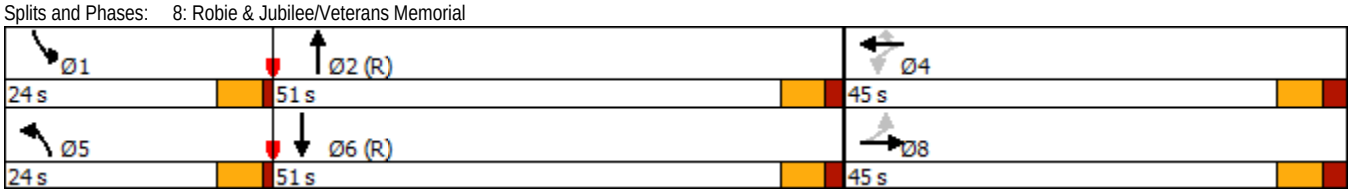


Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	SBL	SBT
Lane Configurations									
Traffic Volume (vph)	60	135	15	340	120	160	721	105	18
Future Volume (vph)	60	135	15	340	120	160	721	105	18
Lane Group Flow (vph)	0	268	0	405	137	183	874	120	21
Turn Type	Perm	NA	Perm	NA	Perm	Prot	NA	Prot	NA
Protected Phases		8		4		5	2	1	6
Permitted Phases	8		4		4				
Detector Phase	8	8	4	4	4	5	2	1	6
Switch Phase									
Minimum Initial (s)	10.0	10.0	10.0	10.0	10.0	7.0	10.0	7.0	10.0
Minimum Split (s)	31.6	31.6	31.6	31.6	31.6	12.0	22.8	12.0	22.8
Total Split (s)	45.0	45.0	45.0	45.0	45.0	24.0	51.0	24.0	51.0
Total Split (%)	37.5%	37.5%	37.5%	37.5%	37.5%	20.0%	42.5%	20.0%	42.5%
Yellow Time (s)	4.1	4.1	4.1	4.1	4.1	4.0	4.1	4.0	4.1
All-Red Time (s)	2.4	2.4	2.4	2.4	2.4	1.0	1.7	1.0	1.7
Lost Time Adjust (s)		0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)		6.5		6.5	6.5	5.0	5.8	5.0	5.8
Lead/Lag						Lead	Lag	Lead	Lag
Lead-Lag Optimize?									
Recall Mode	Ped	Ped	Ped	Ped	Ped	None	C-Min	None	C-Min
Act Effct Green (s)		40.0		40.0	40.0	17.3	48.8	13.9	45.4
Actuated g/C Ratio		0.33		0.33	0.33	0.14	0.41	0.12	0.38
v/c Ratio		0.86		0.68	0.28	0.82	0.68	0.63	0.03
Control Delay		62.7		41.2	12.0	68.8	49.4	64.6	25.3
Queue Delay		0.0		0.0	0.0	0.0	0.0	0.0	0.0
Total Delay		62.7		41.2	12.0	68.8	49.4	64.6	25.3
LOS		E		D	B	E	D	E	C
Approach Delay		62.7		33.8			52.7		58.8
Approach LOS		E		C			D		E
Queue Length 50th (m)		53.0		76.2	6.5	41.1	114.3	27.3	3.4
Queue Length 95th (m)		#108.8		119.2	22.4	m#69.9	130.4	44.9	8.4
Internal Link Dist (m)		189.8		183.6			355.1		413.3
Turn Bay Length (m)					40.0	50.0			
Base Capacity (vph)		319		610	501	246	1299	260	686
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		0.84		0.66	0.27	0.74	0.67	0.46	0.03

Intersection Summary

Cycle Length: 120
Actuated Cycle Length: 120
Offset: 47 (39%), Referenced to phase 2:NBT and 6:SBT, Start of Green
Natural Cycle: 70
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.86
Intersection Signal Delay: 49.4 Intersection LOS: D
Intersection Capacity Utilization 90.4% ICU Level of Service E
Analysis Period (min) 15
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 8: Robie & Jubilee/Veterans Memorial



Lane Group	EBL2	EBT	WBL	WBT	NBL	NBT	SBL2	SBL	SBT
Lane Configurations									
Traffic Volume (vph)	55	135	40	315	160	717	112	8	10
Future Volume (vph)	55	135	40	315	160	717	112	8	10
Lane Group Flow (vph)	0	217	0	611	183	852	77	0	71
Turn Type	Perm	NA	Perm	NA	Prot	NA	Prot	pm+pt	NA
Protected Phases		4		4	5	2	1	9	6
Permitted Phases	4		4					6	
Detector Phase	4	4	4	4	5	2	1	9	6
Switch Phase									
Minimum Initial (s)	10.0	10.0	10.0	10.0	8.0	10.0	8.0	8.0	10.0
Minimum Split (s)	33.5	33.5	33.5	33.5	13.0	34.5	13.0	13.0	34.5
Total Split (s)	45.0	45.0	45.0	45.0	17.0	45.0	17.0	13.0	58.0
Total Split (%)	37.5%	37.5%	37.5%	37.5%	14.2%	37.5%	14.2%	10.8%	48.3%
Yellow Time (s)	4.1	4.1	4.1	4.1	4.0	4.1	4.0	4.0	4.1
All-Red Time (s)	2.4	2.4	2.4	2.4	1.0	2.4	1.0	1.0	2.4
Lost Time Adjust (s)		0.0		0.0	0.0	0.0	0.0		0.0
Total Lost Time (s)		6.5		6.5	5.0	6.5	5.0		6.5
Lead/Lag					Lead		Lead	Lag	Lag
Lead-Lag Optimize?									
Recall Mode	None	None	None	None	None	C-Max	Max	None	C-Max
Act Effct Green (s)		35.5		35.5	14.7	51.5	15.0		51.9
Actuated g/C Ratio		0.30		0.30	0.12	0.43	0.12		0.43
v/c Ratio		0.79		0.86	0.86	0.61	0.37		0.29
Control Delay		59.2		53.2	87.1	24.4	52.3		34.9
Queue Delay		0.0		0.0	0.0	0.0	0.0		0.0
Total Delay		59.2		53.2	87.1	24.4	52.3		34.9
LOS		E		D	F	C	D		C
Approach Delay		59.2		53.2		35.5			44.0
Approach LOS		E		D		D			D
Queue Length 50th (m)		45.2		69.0	~46.3	68.6	19.5		13.0
Queue Length 95th (m)		#81.1		91.8	#92.1	89.2	m31.5		m24.8
Internal Link Dist (m)		121.4		124.9		240.3			355.1
Turn Bay Length (m)					60.0				
Base Capacity (vph)		299		768	213	1404	208		243
Starvation Cap Reductn		0		0	0	0	0		0
Spillback Cap Reductn		0		0	0	0	0		0
Storage Cap Reductn		0		0	0	0	0		0
Reduced v/c Ratio		0.73		0.80	0.86	0.61	0.37		0.29

Intersection Summary

Cycle Length: 120
Actuated Cycle Length: 120
Offset: 76 (63%), Referenced to phase 2:NBT and 6:SBTL, Start of Green
Natural Cycle: 95
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.86
Intersection Signal Delay: 44.1 Intersection LOS: D
Intersection Capacity Utilization 111.8% 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.

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

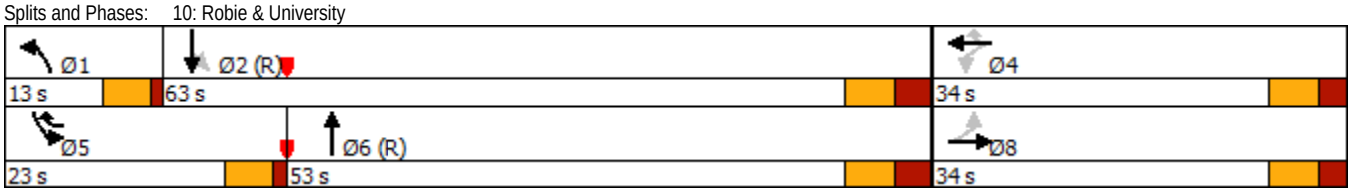
Splits and Phases: 9: Robie & Coburg/Spring Garden

Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	SBL2	SBL	SBT
Lane Configurations										
Traffic Volume (vph)	45	100	25	145	225	30	659	132	3	7
Future Volume (vph)	45	100	25	145	225	30	659	132	3	7
Lane Group Flow (vph)	51	137	29	165	257	34	786	89	0	73
Turn Type	Perm	NA	Perm	NA	pm+ov	Prot	NA	Prot	Perm	NA
Protected Phases		8		4	5	1	6	5		2
Permitted Phases	8		4		4				2	
Detector Phase	8	8	4	4	4	1	6	5	2	2
Switch Phase										
Minimum Initial (s)	10.0	10.0	10.0	10.0	8.0	8.0	10.0	8.0	10.0	10.0
Minimum Split (s)	32.5	32.5	32.5	32.5	13.0	13.0	43.3	13.0	43.3	43.3
Total Split (s)	34.0	34.0	34.0	34.0	23.0	13.0	53.0	23.0	63.0	63.0
Total Split (%)	30.9%	30.9%	30.9%	30.9%	20.9%	11.8%	48.2%	20.9%	57.3%	57.3%
Yellow Time (s)	4.1	4.1	4.1	4.1	4.0	4.0	4.1	4.0	4.1	4.1
All-Red Time (s)	2.4	2.4	2.4	2.4	1.0	1.0	3.2	1.0	3.2	3.2
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0
Total Lost Time (s)	6.5	6.5	6.5	6.5	5.0	5.0	7.3	5.0		7.3
Lead/Lag						Lead			Lag	Lag
Lead-Lag Optimize?										
Recall Mode	Ped	Ped	Ped	Ped	None	None	C-Max	None	C-Max	C-Max
Act Effct Green (s)	26.9	26.9	26.9	26.9	38.4	8.0	55.3	11.6		61.5
Actuated g/C Ratio	0.24	0.24	0.24	0.24	0.35	0.07	0.50	0.11		0.56
v/c Ratio	0.27	0.28	0.12	0.42	0.68	0.28	0.53	0.52		0.23
Control Delay	37.8	6.7	33.6	38.6	32.8	47.1	24.5	56.8		17.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0
Total Delay	37.8	6.7	33.6	38.6	32.8	47.1	24.5	56.8		17.0
LOS	D	A	C	D	C	D	C	E		B
Approach Delay		15.1		34.9			25.5			38.9
Approach LOS		B		C			C			D
Queue Length 50th (m)	8.8	0.0	4.8	29.7	31.9	7.2	56.8	19.4		9.0
Queue Length 95th (m)	19.8	13.6	12.5	49.3	49.7	m12.7	94.0	34.7		19.5
Internal Link Dist (m)		178.0		171.4			167.5			240.3
Turn Bay Length (m)	15.0		15.0		60.0	60.0		60.0		
Base Capacity (vph)	196	497	253	406	380	122	1488	266		315
Starvation Cap Reductn	0	0	0	0	0	0	0	0		0
Spillback Cap Reductn	0	0	0	0	0	0	0	0		0
Storage Cap Reductn	0	0	0	0	0	0	0	0		0
Reduced v/c Ratio	0.26	0.28	0.11	0.41	0.68	0.28	0.53	0.33		0.23

Intersection Summary

Cycle Length: 110
Actuated Cycle Length: 110
Offset: 88 (80%), Referenced to phase 2:SBTL and 6:NBT, Start of Green
Natural Cycle: 90
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.68
Intersection Signal Delay: 28.2 — Intersection LOS: C
Intersection Capacity Utilization 106.7% — ICU Level of Service G
Analysis Period (min) 15
m Volume for 95th percentile queue is metered by upstream signal.

Splits and Phases: 10: Robie & University

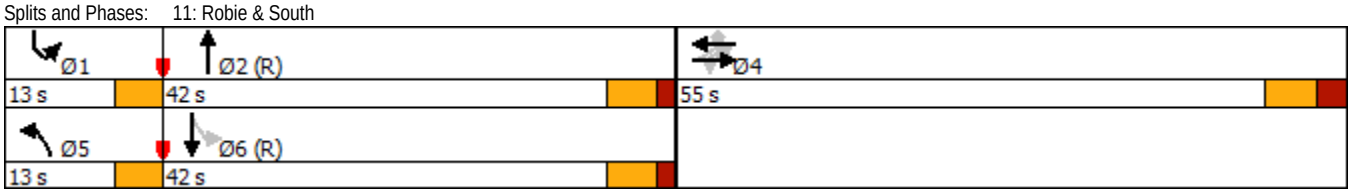


Lane Group	EBL2	EBT	WBL	WBT	WBR	NBL	NBT	SBL2	SBL	SBT
Lane Configurations										
Traffic Volume (vph)	55	205	20	345	245	42	326	91	4	0
Future Volume (vph)	55	205	20	345	245	42	326	91	4	0
Lane Group Flow (vph)	0	320	0	417	280	48	389	58	0	54
Turn Type	Perm	NA	Perm	NA	Perm	Prot	NA	Prot	Perm	NA
Protected Phases		4		4		5	2	1		6
Permitted Phases	4		4		4				6	
Detector Phase	4	4	4	4	4	5	2	1	6	6
Switch Phase										
Minimum Initial (s)	10.0	10.0	10.0	10.0	10.0	8.0	10.0	8.0	10.0	10.0
Minimum Split (s)	47.8	47.8	47.8	47.8	47.8	13.0	24.7	13.0	24.7	24.7
Total Split (s)	55.0	55.0	55.0	55.0	55.0	13.0	42.0	13.0	42.0	42.0
Total Split (%)	50.0%	50.0%	50.0%	50.0%	50.0%	11.8%	38.2%	11.8%	38.2%	38.2%
Yellow Time (s)	4.1	4.1	4.1	4.1	4.1	4.0	4.1	4.0	4.1	4.1
All-Red Time (s)	2.7	2.7	2.7	2.7	2.7	0.0	1.6	0.0	1.6	1.6
Lost Time Adjust (s)		0.0		0.0	0.0	0.0	0.0	0.0		0.0
Total Lost Time (s)		6.8		6.8	6.8	4.0	5.7	4.0		5.7
Lead/Lag						Lead	Lag	Lead	Lag	Lag
Lead-Lag Optimize?										
Recall Mode	Ped	Ped	Ped	Ped	Ped	None	C-Min	Min	C-Min	C-Min
Act Effct Green (s)		43.0		43.0	43.0	8.8	41.5	9.0		44.1
Actuated g/C Ratio		0.39		0.39	0.39	0.08	0.38	0.08		0.40
v/c Ratio		0.76		0.61	0.51	0.38	0.59	0.43		0.17
Control Delay		41.0		30.9	29.0	57.1	26.7	56.6		12.2
Queue Delay		0.0		0.0	0.0	0.0	0.0	0.0		0.0
Total Delay		41.0		30.9	29.0	57.1	26.7	56.6		12.2
LOS		D		C	C	E	C	E		B
Approach Delay		41.0		30.2			30.1			35.2
Approach LOS		D		C			C			D
Queue Length 50th (m)		59.6		72.9	46.6	10.0	51.2	13.2		0.0
Queue Length 95th (m)		86.5		94.2	64.6	21.9	91.0	26.6		8.8
Internal Link Dist (m)		115.5		183.6			422.3			167.5
Turn Bay Length (m)					50.0			60.0		
Base Capacity (vph)		472		762	609	132	662	141		320
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		0.68		0.55	0.46	0.36	0.59	0.41		0.17

Intersection Summary

Cycle Length: 110
Actuated Cycle Length: 110
Offset: 108 (98%), Referenced to phase 2:NBT and 6:SBTL, Start of Green
Natural Cycle: 90
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.76
Intersection Signal Delay: 32.7 — Intersection LOS: C
Intersection Capacity Utilization 124.2% — ICU Level of Service H
Analysis Period (min) 15

Splits and Phases: 11: Robie & South

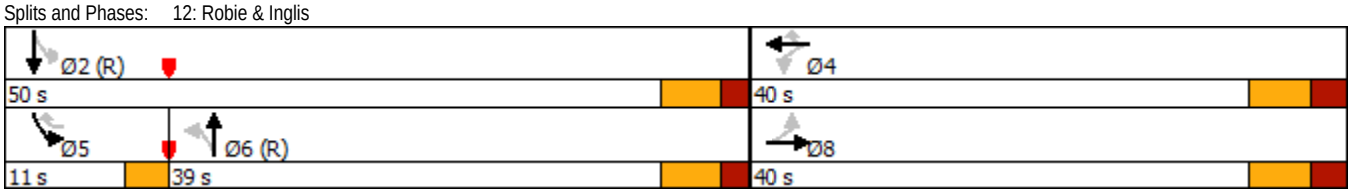


Lane Group	EBL	EBT	WBL	WBT	WBR	NBL	NBT	SBL	SBT
Lane Configurations									
Traffic Volume (vph)	20	235	80	275	275	30	125	175	70
Future Volume (vph)	20	235	80	275	275	30	125	175	70
Lane Group Flow (vph)	0	320	0	405	314	0	268	200	97
Turn Type	Perm	NA	Perm	NA	custom	Perm	NA	pm+pt	NA
Protected Phases		8		4			6	5	2
Permitted Phases	8		4		4 5	6		2	
Detector Phase	8	8	4	4	4 5	6	6	5	2
Switch Phase									
Minimum Initial (s)	10.0	10.0	10.0	10.0		10.0	10.0	8.0	10.0
Minimum Split (s)	31.7	31.7	31.7	31.7		23.1	23.1	11.0	23.1
Total Split (s)	40.0	40.0	40.0	40.0		39.0	39.0	11.0	50.0
Total Split (%)	44.4%	44.4%	44.4%	44.4%		43.3%	43.3%	12.2%	55.6%
Yellow Time (s)	4.1	4.1	4.1	4.1		4.1	4.1	3.0	4.1
All-Red Time (s)	2.6	2.6	2.6	2.6		2.0	2.0	0.0	2.0
Lost Time Adjust (s)		0.0		0.0			0.0	0.0	0.0
Total Lost Time (s)		6.7		6.7			6.1	3.0	6.1
Lead/Lag						Lag	Lag	Lead	
Lead-Lag Optimize?									
Recall Mode	Ped	Ped	Max	Max		C-Min	C-Min	None	C-Min
Act Effct Green (s)		44.9		44.9	55.9		21.3	35.4	32.3
Actuated g/C Ratio		0.50		0.50	0.62		0.24	0.39	0.36
v/c Ratio		0.37		0.56	0.31		0.78	0.60	0.18
Control Delay		16.9		21.4	2.2		42.8	25.4	15.0
Queue Delay		0.0		0.0	0.0		0.0	0.0	0.0
Total Delay		16.9		21.4	2.2		42.8	25.4	15.0
LOS		B		C	A		D	C	B
Approach Delay		16.9		13.0			42.8		22.0
Approach LOS		B		B			D		C
Queue Length 50th (m)		31.9		46.6	0.0		38.4	23.3	9.2
Queue Length 95th (m)		61.8		90.5	11.5		57.6	32.4	16.5
Internal Link Dist (m)		113.9		142.4			118.8		422.3
Turn Bay Length (m)					50.0			60.0	
Base Capacity (vph)		854		722	1002		515	336	726
Starvation Cap Reductn		0		0	0		0	0	0
Spillback Cap Reductn		0		0	0		0	0	0
Storage Cap Reductn		0		0	0		0	0	0
Reduced v/c Ratio		0.37		0.56	0.31		0.52	0.60	0.13

Intersection Summary

Cycle Length: 90
Actuated Cycle Length: 90
Offset: 0 (0%), Referenced to phase 2:SBTL and 6:NBTL, Start of Green
Natural Cycle: 70
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.78
Intersection Signal Delay: 20.5 — Intersection LOS: C
Intersection Capacity Utilization 87.2% — ICU Level of Service E
Analysis Period (min) 15

Splits and Phases: 12: Robie & Inglis



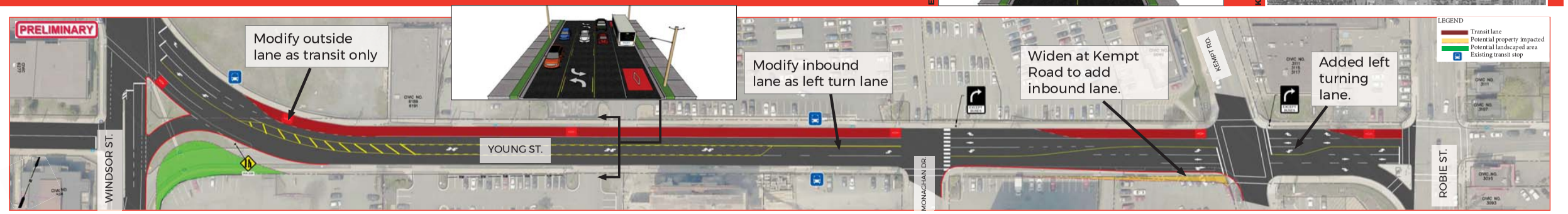
ATTACHMENT B

YOUNG STREET - WINDSOR STREET TO ROBIE STREET

Existing Cross Section

Key Map - Young Street

LOW INVESTMENT: OUTBOUND TRANSIT LANE



IMPACTS

- Provides curbside transit lanes in westbound direction.
- Longer pedestrian crossing at Kempt Road and Windsor Street.
- No impact.
- Fewer through lanes increase vehicle queues. Additional left turn lanes at driveways.
- Slight widening at Kempt Road intersection may impact adjacent property
- No impact.

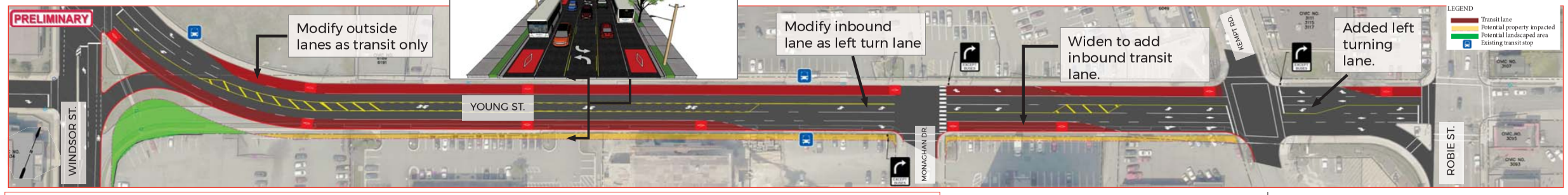
PROS

- Improves flow of transit vehicles in westbound direction.
- Reduces potential for rear end conflicts with added left turn lanes at driveways.

CONS

- Road widening may impact adjacent property.
- Longer pedestrian crossings at Kempt Road.

MEDIUM INVESTMENT: INBOUND AND OUTBOUND TRANSIT LANE



IMPACTS

- Provides curbside transit lanes in both directions.
- Longer pedestrian crossings at Monaghan Drive, Kempt Road, and Windsor Street.
- No impact.
- Fewer through lanes increase vehicle queues. Additional left turn lanes at driveways.
- Widening may impact properties along the corridor
- No impact.

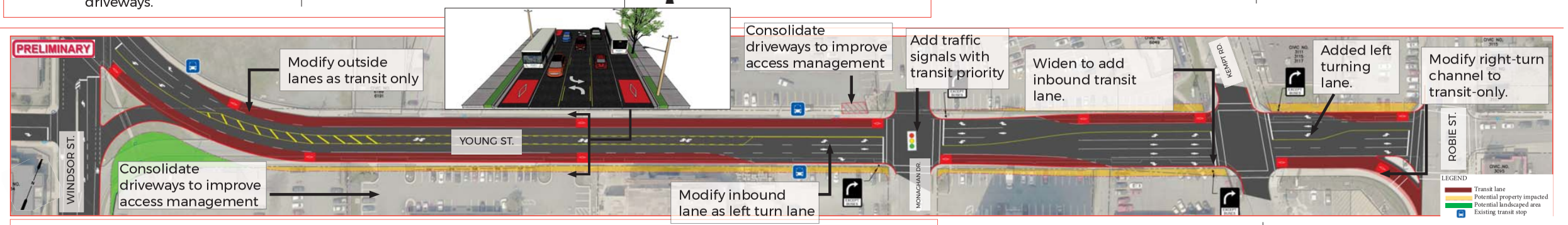
PROS

- Improves flow of transit vehicles in both directions.
- Reduces potential for rear end conflicts with added left turn lanes.

CONS

- Road widening may impact adjacent properties.
- Longer pedestrian crossings at Monaghan Drive, Kempt Road, and Windsor Street.

HIGH INVESTMENT: OUTBOUND AND EXTENDED INBOUND TRANSIT



IMPACTS

- Provides curbside transit lanes in both directions.
- Longer pedestrian crossings. Signalized pedestrian crossing added at Monaghan Drive.
- No impact.
- Fewer through lanes increase vehicle queues. Improved driveway access management.
- Widening may impact properties along the corridor. Access modifications impact adjacent properties.
- Impacts 3 large trees.

PROS

- Improves flow of transit vehicles in both directions.
- Access management improvements reduce conflict points.
- Reduces potential for rear end conflicts with added left turn lanes at driveways.
- Improves access to Robie Street (southbound) for transit vehicles.

CONS

- Road widening may impact adjacent properties.
- Longer pedestrian crossings at Monaghan Drive, Kempt Road, and Robie Street.

HALIFAX

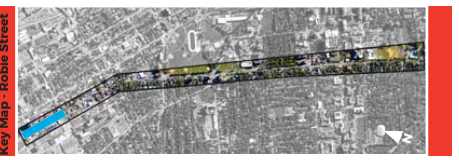
wsp

ATTACHMENT B

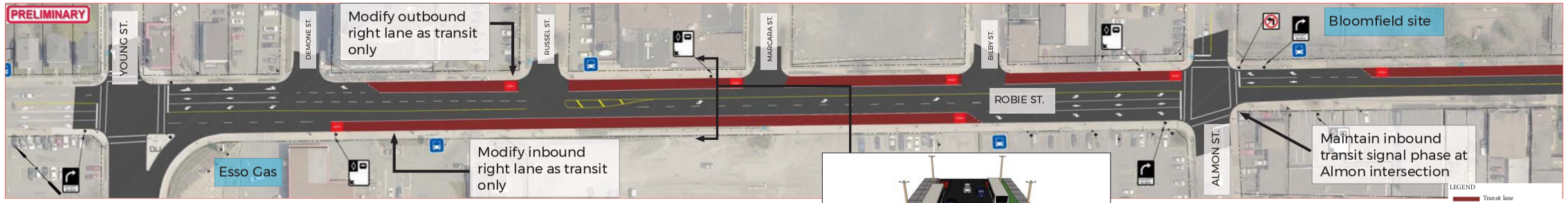
ROBIE STREET - YOUNG STREET TO ALMON STREET

Existing Cross Section

Key Map - Robie Street



CURBSIDE BUS LANES: BOTH DIRECTIONS (NORTH OF ALMON ST.)



IMPACTS

- Provides curbside transit lanes in both directions.
- No impact.
- Loss of parking south of Almon St.
- Minimal impact to traffic.
- No major impact.
- No impact.

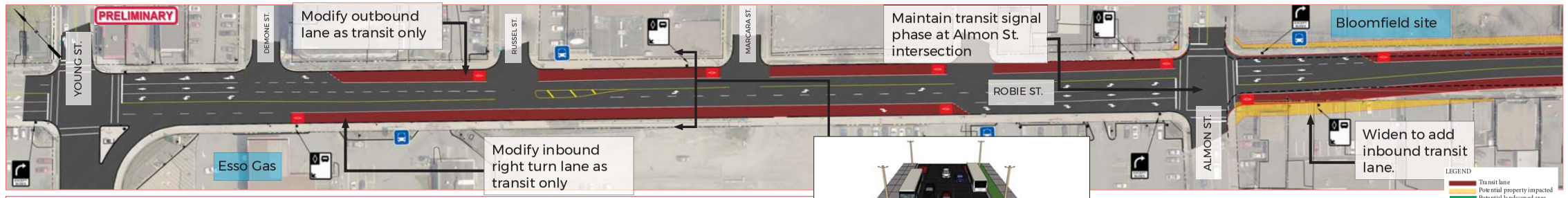
PROS

- Improves flow of transit vehicles in both directions (north of Almon Street).
- Provides continuous northbound transit lane (south of Demone Street).

CONS

- Fewer travel lanes for non-transit traffic will increase queuing on Robie Street.
- Require merging by northbound left-turning transit vehicles to Young Street.

CURBSIDE BUS LANES: BOTH DIRECTIONS



IMPACTS

- Provides curbside transit lanes in both directions.
- No impact.
- Loss of parking south of Almon St.
- Minimal impact to traffic.
- No impact north of Almon St. Some impact south of Almon St.
- No impact north of Almon St. See next board for impacts south of Almon St.

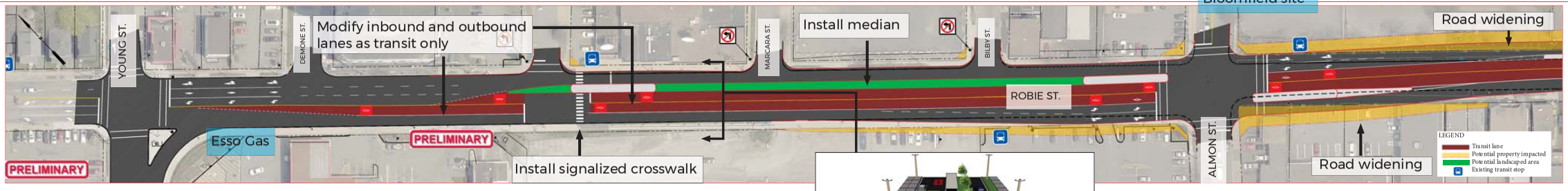
PROS

- Improves flow of transit vehicles in both directions.
- Northbound transit lane provided but ends before Young Street.

CONS

- Fewer travel lanes for non-transit traffic will increase queuing on Robie Street.
- Requires merging by northbound left-turning transit vehicles to Young Street.

CENTRE MEDIAN BUS LANES



IMPACTS

- Provides centre median transit lanes in both directions.
- Longer pedestrian crossings at Almon Street.
- Loss of parking south of Almon St.
- Longer and additional alternative routing for local traffic with elimination of many left turns
- Impacts to properties near Almon Street.
- No impact north of Almon St. See next board for impacts south of Almon St.

PROS

- Improves flow of transit vehicles in both directions.
- Better aligns northbound buses to turn left onto Young Street.

CONS

- Added delay at signalized intersections for all users.
- Fewer travel lanes for non-transit traffic on Robie Street.
- Restricts mid-block left turn movements. Turn restrictions could increase routing for local traffic.

HALIFAX

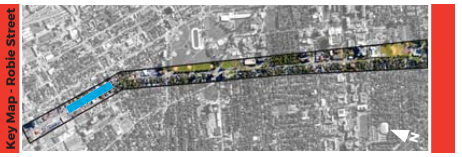
wsp

ATTACHMENT B

ROBIE STREET - ALMON STREET TO WILLOW STREET

Existing Cross Section

Key Map - Robie Street



CURBSIDE BUS LANES: NORTHBOUND ONLY

IMPACTS

- Provides curbside transit lanes in northbound direction.
- Longer pedestrian crossings at North Street.
- Loss of on-street parking.
- Restricted northbound left at Almon Street will divert additional traffic to Young Street
- Road widening may impact properties at North Street intersection.
- Road widening will impact one large tree.

PROS

- Improves flow of transit vehicles in northbound direction.

CONS

- No southbound transit priority.
- Restricts northbound left turns to Almon Street.
- Loss of on-street parking.
- Road widening will impact adjacent properties and tree at North Street.

CURBSIDE BUS LANES: BOTH DIRECTIONS

IMPACTS

- Provides curbside transit lanes in both directions.
- Longer pedestrian crossings.
- Loss of on-street parking.
- Added left turn lane at Almon Street going northbound.
- Road widening may impact several properties along the corridor.
- Road widening will impact 4 large trees, 3 medium trees

PROS

- Improves flow of transit vehicles in both directions.
- Provides left-turn traffic lane (northbound) on to Almon Street.

CONS

- Longer pedestrian crossings.
- Road widening will impact adjacent properties and street trees.
- Loss of on-street parking.

CENTRE MEDIAN BUS LANES

IMPACTS

- Provides centre median transit lanes in both directions.
- Longer pedestrian crossings at all crossings.
- Loss of on-street parking.
- Required traffic signal phasing for left turns will delay through- traffic. Longer routing for local traffic with elimination of many left turns
- Widening may impact several properties along the corridor.
- Road widening will impact 4 large trees, 3 medium trees.

PROS

- Improves flow of transit vehicles in both directions.
- Provides left-turn traffic lane (northbound) on to Almon Street.

CONS

- Added delay at signalized intersections for all users.
- Road widening will impact adjacent properties and street trees.
- Loss of on-street parking.
- Restricts mid-block left turn movements. Turn restrictions could increase routing for local traffic.

HALIFAX

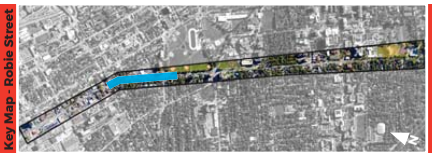
WSP

ATTACHMENT B

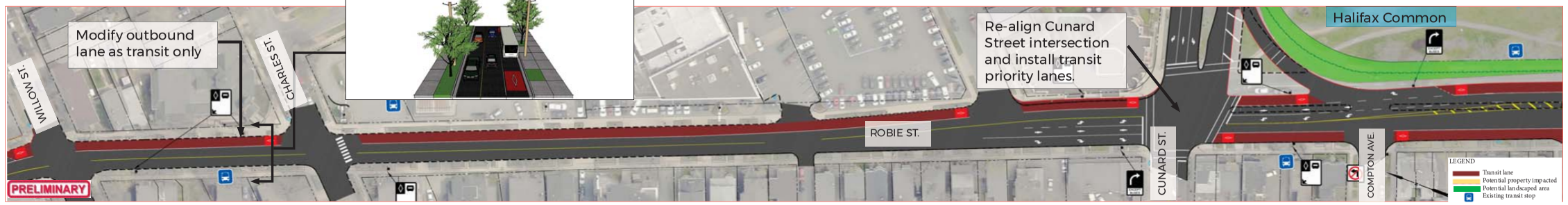
ROBIE STREET - WILLOW STREET TO COMPTON AVENUE

Existing Cross Section

Key Map - Robie Street



CURBSIDE BUS LANES: NORTHBOUND ONLY



IMPACTS

- Provides curbside transit lanes in northbound direction.
- Loss of median refuge at Cunard Street. Shorter crossing at Cunard Street.
- No impact.
- Loss of northbound traffic lane.
- No major impact.
- No impact

PROS

- Improves flow of transit vehicles in northbound direction.
- Significant improvements to alignment at Cunard / Robie intersection.

CONS

- No southbound transit priority.
- May impact flow of traffic (northbound) during peak periods.

CURBSIDE BUS LANES: BOTH DIRECTIONS

IMPACTS

- Provides curbside transit lanes in both directions.
- Longer pedestrian crossings. Shorter crossing at Cunard.
- No impact.
- Loss of right-turn lane. Loss of northbound traffic lane. Improved alignment at Cunard Street intersection
- Widening may impact properties along the corridor. Halifax Common green space gained.
- Road widening will impact 8 large trees, 1 medium tree.

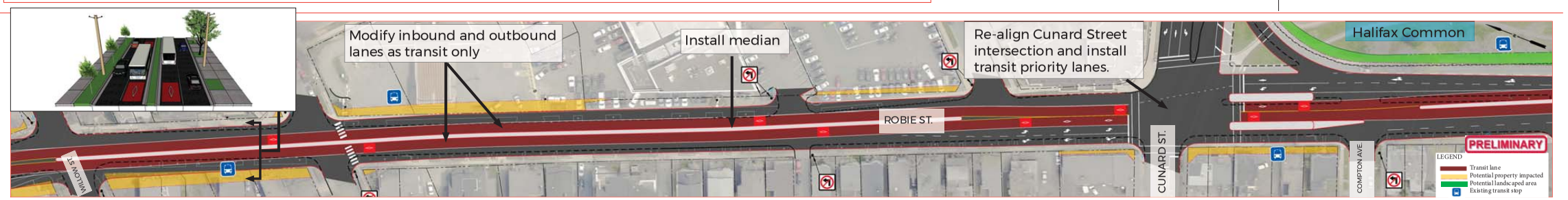
PROS

- Improves flow of transit vehicles in both directions.
- Significant improvements to alignment at Cunard / Robie intersection.
- Gains to Halifax Common land at southeast corner of Cunard Street intersection.

CONS

- Longer pedestrian crossings.
- Road widening will impact adjacent properties and trees.
- May impact flow of traffic (northbound) during peak periods.

CENTRE MEDIAN BUS LANES



IMPACTS

- Provides centre median transit lanes in both directions.
- Longer pedestrian crossings of Robie at Almon Street.
- No impact.
- Traffic signal phasing will increase intersection delay. Left turns to/from unsignalized side streets prohibited.
- Widening may impact several properties along the corridor.
- Road widening will impact 8 large trees, 1 medium tree.

PROS

- Improves flow of transit vehicles in both directions.
- Improvements to alignment at Cunard / Robie intersection.
- Gains to Halifax Common land at southeast corner of Cunard Street intersection.
- Aligns buses for left turns to Cunard Street.

CONS

- Added delay at signalized intersections for all users.
- Road widening will impact adjacent trees and properties
- May impact flow of traffic (northbound) during peak periods.
- Restricts mid-block left turn movements. Turn restrictions could increase routing for local traffic.

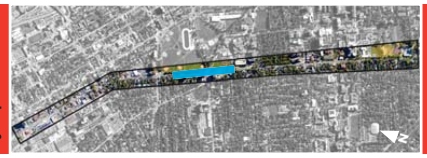
HALIFAX WSP

ATTACHMENT B

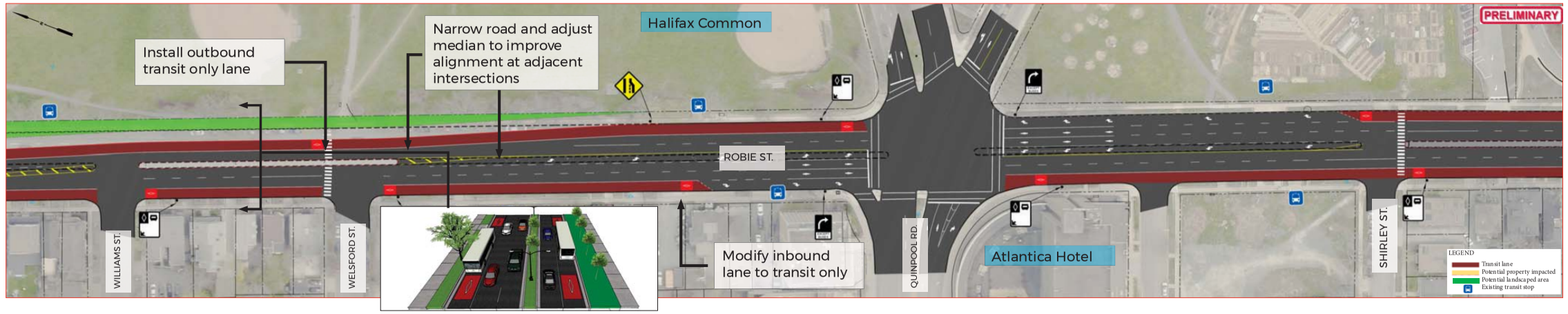
ROBIE STREET - WILLIAMS STREET TO SHIRLEY STREET

Existing Cross Section

Key Map - Robie Street



CURBSIDE BUS LANES



IMPACTS

- Provides curbside transit lanes in both directions.
- Shorter pedestrian crossings at Welsford Street. Elimination of median refuge at Quinpool intersection.
- Loss of on-street parking.
- Fewer through lanes in both directions.
- Halifax Common greenspace gained.
- Small trees will be lost with the removal of the median. Road narrowing will provide additional greenspace around the Common.

PROS

- Improves flow of transit vehicles in both directions.
- Road narrowing will provide additional greenspace at the Halifax Common.
- Shorter pedestrian crossing at Welsford Avenue.
- Improved northbound alignment at Quinpool Road intersection

CONS

- Loss of on-street parking along Robie Street.
- Loss of median refuge at Quinpool Rd. intersection.

CENTRE MEDIAN BUS LANES

IMPACTS

- Provides centre median transit lanes in both directions.
- Shorter pedestrian crossings at Welsford Avenue. Longer pedestrian crossings at Quinpool Road intersection.
- Loss of on-street parking.
- Traffic signal phasing will increase intersection delay. Left turns to/from unsignalized side streets prohibited.
- Halifax Common greenspace gained. Impact on Common property near Cogswell Street.
- Road widening will impact 10 large trees. Small trees will be relocated with changes to the median.

PROS

- Improves flow of transit vehicles in both directions.
- Road narrowing will provide additional greenspace at the Halifax Common.
- Shorter pedestrian crossing at Welsford.
- Improved alignment at Quinpool Road. intersection.

CONS

- Added delay at signalized intersections for all users.
- Loss of on-street parking along Robie Street.
- Road widening will impact adjacent Common property and trees.
- Restricts mid-block left turn movements. Turn restrictions could increase routing for local traffic.

HALIFAX

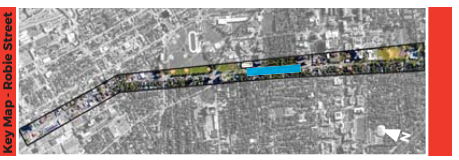
wsp

ATTACHMENT B

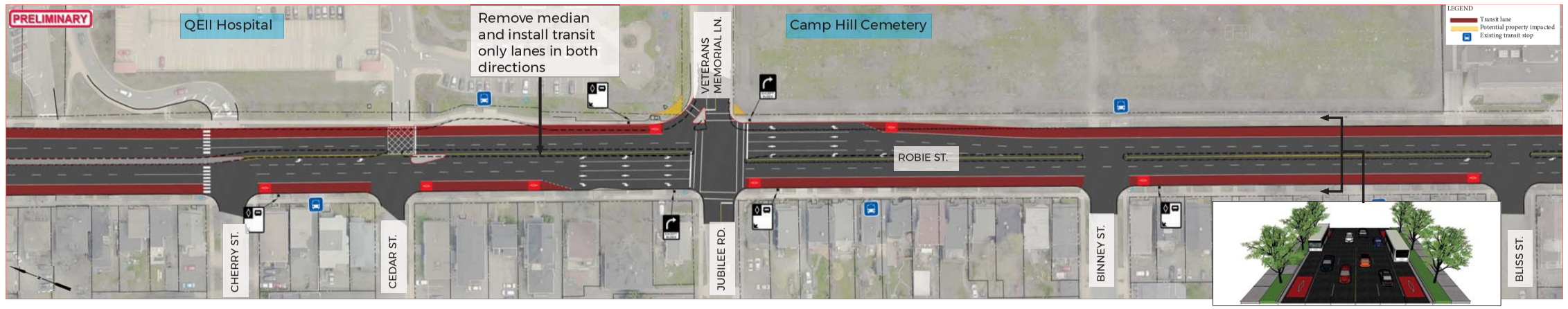
ROBIE STREET - CHERRY STREET TO BLISS STREET

Existing Cross Section

Key Map - Robie Street



CURBSIDE BUS LANES



IMPACTS

- Provides curbside transit lanes in both directions.
- Longer pedestrian crossings of Robie at Jubilee Road. Loss of median refuge at Jubilee Road.
- Loss of on-street parking.
- Minimal impact to traffic.
- Minor impact to properties at Jubilee intersection.
- Road widening at Veteran's Memorial Lane will impact 5 medium trees.

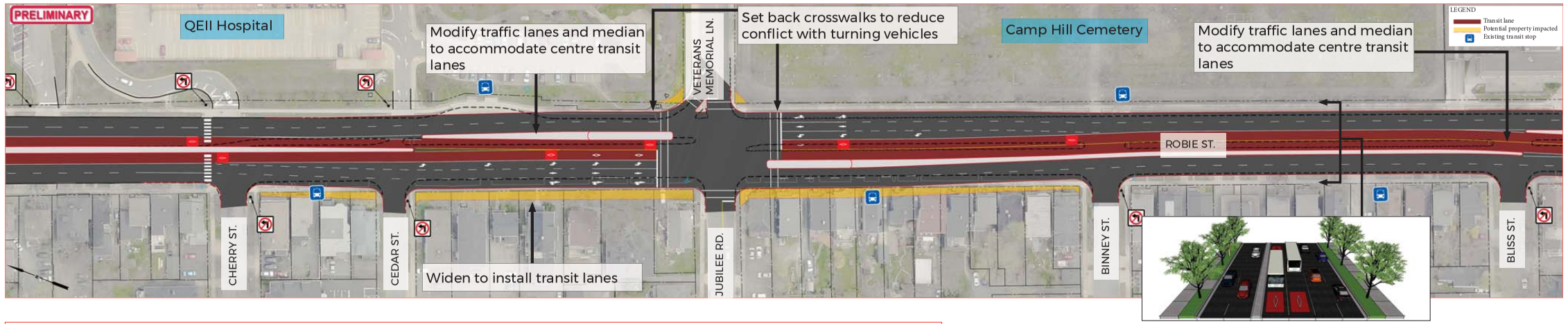
PROS

- Improves flow of transit vehicles in both directions.
- Minimal impact to traffic flow.

CONS

- Loss of parking along Robie Street.
- Loss of small trees with removal of the median.

CENTRE MEDIAN BUS LANES



IMPACTS

- Provides centre median transit lanes in both directions.
- Longer pedestrian crossings of Robie at Jubilee Road.
- Loss of on-street parking.
- Traffic signal phasing will increase intersection delay. Left turns to/from unsignalized side streets prohibited.
- Widening will impact several properties along the corridor. Restricts left turn movements into existing QEII Hospital driveway.
- Road widening will impact 18 large trees, 9 medium trees. Loss of small trees with the adjustment of the median.

PROS

- Improves flow of transit vehicles in both directions.

CONS

- Added delay at signalized intersections for all users.
- Loss of on-street parking along Robie Street.
- Road widening will impact adjacent properties and trees.
- Restricts mid-block left turn movements. Turn restrictions could increase routing for local traffic.

HALIFAX

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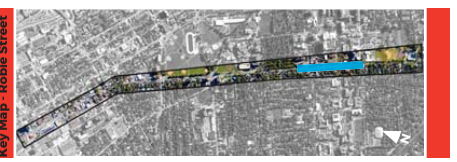
ATTACHMENT B

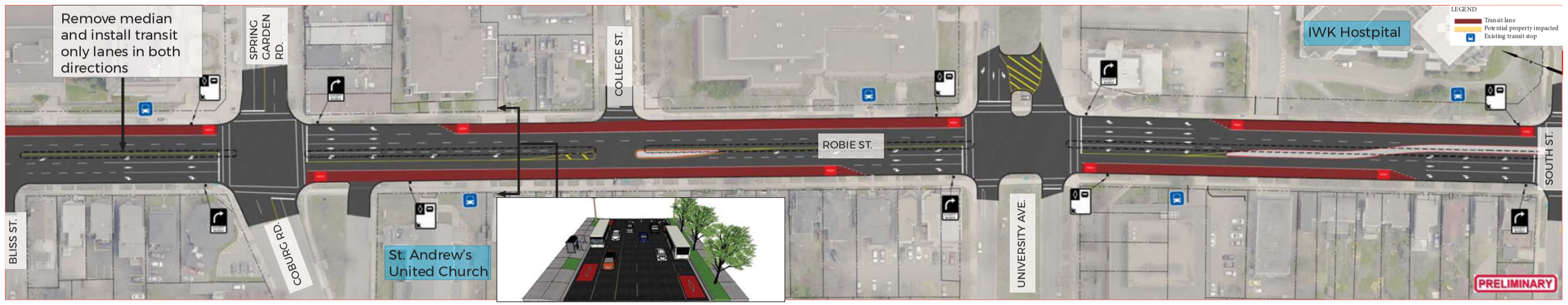
ROBIE STREET - BLISS STREET TO SOUTH STREET

Existing Cross Section

Key Map - Robie Street



CURBSIDE BUS LANES



IMPACTS

- Provides curbside transit lanes in both directions.
- Loss of median refuge at Spring Garden Road
- Loss of on-street parking
- Minimal impact to traffic.
- No major impact.
- Loss of small trees with the removal of the median.

PROS

- Improves flow of transit vehicles in both directions.
- Minimal impact to traffic flow.

CONS

- Loss of parking along Robie Street.
- Loss of small trees with removal of the median.

CENTRE MEDIAN BUS LANES

IMPACTS

- Provides centre median transit lanes in both directions.
- Longer and setback pedestrian crossings at Spring Garden Road and South Street. Eliminates boulevard buffer between sidewalk and street.
- Loss of on-street parking.
- Traffic signal phasing will increase intersection delay. Left turns to/from unsignalized side streets prohibited.
- Some impact near Coburg Road.
- Road widening will impact 5 large trees, 4 medium trees. Loss of small trees with the removal of the median.

PROS

- Improves flow of transit vehicles in both directions.

CONS

- Added delay at signalized intersections for all users.
- Loss of on-street parking along Robie Street.
- Road widening will impact adjacent trees.
- Restricts mid-block left turn movements. Turn restrictions could increase routing for local traffic.

HALIFAX

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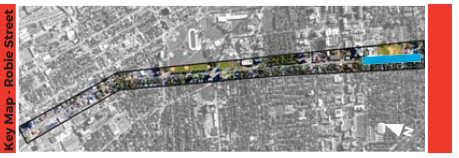
ATTACHMENT B

ROBIE STREET - SOUTH STREET TO INGLIS STREET

Existing Cross Section

Key Map - Robie Street



CURB SIDE TPM

IMPACTS

- Provides curbside transit lanes in both directions.
- No impact.
- Loss of on-street parking.
- Minimal impact to traffic.
- No major impact.
- Loss of two medium trees with the removal of the median section at South Street.

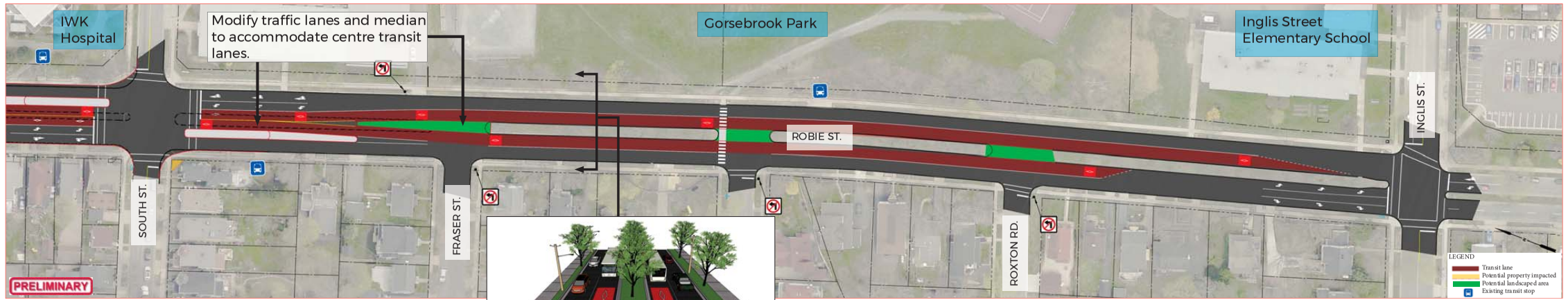
PROS

- Improves flow of transit vehicles in both directions.
- Minimal impact to traffic flow.

CONS

- Loss of parking along Robie Street.

CENTRE MEDIAN TPM



IMPACTS

- Provides centre median transit lanes in both directions.
- No impact.
- Loss of on-street parking.
- Traffic signal phasing will increase intersection delay.
  Left turns to/from unsignalized side streets prohibited.
- Impact to property at South Street.
- Loss of 4 medium trees with the removal of the median section at South Street.

PROS

- Improves flow of transit vehicles in both directions.

CONS

- Added delay at signalized intersections for all users.
- Loss of on-street parking along Robie Street.
- Restricts mid-block left turn movements. Turn restrictions could increase routing for local traffic.

ATTACHMENT C

Traffic Impact Analysis

Robie Street / Young Street
Transit Priority Corridor

Prepared by:

Strategic Transportation Planning
May 2019

HALIFAX

Table of Contents

Introduction

Background

Halifax Regional Municipality (HRM) are currently in the process of planning and design for proposed transit priority upgrades to Robie Street. Staff have recommended that the project be implemented in phases, the first of which would include installation of curbside bus lanes on the following segments of Robie Street (Figure 1):

- Young Street to Almon Street: Northbound / southbound bus lanes
- Almon Street to Cunard Street: Northbound bus lane
- Cunard Street to Quinpool Road: Northbound / southbound bus lanes

Proposed Phase 1 changes do not require widening, but do necessitate reconfiguration of existing curb-to-curb space that is currently used for traffic lanes and parking / loading. Accordingly, there are areas along Robie Street where it will be necessary to reduce traffic capacity at intersections and mid-block locations. Staff have completed an analysis of the traffic impacts associated with the proposed changes. These findings supplement the analyses that were completed by WSP for the various options considered for the Robie Street / Young Street Transit Priority Corridor.

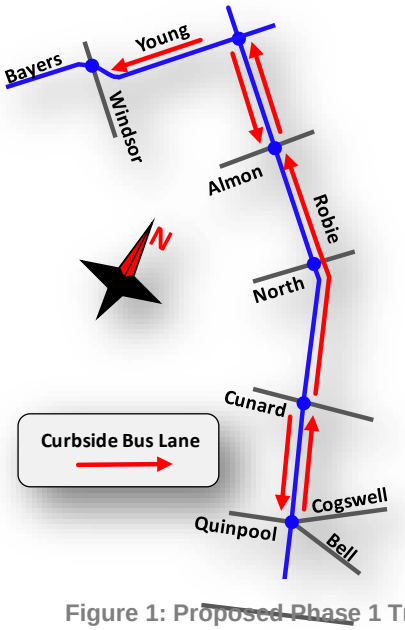


Figure 1: Proposed Phase 1 Transit Priority Upgrades

Objective

The objective of the traffic impact analysis is to review the impacts to traffic operation on Robie Street and Young Street that are anticipated to result from the implementation of Phase 1 transit priority upgrades.

Existing Conditions

Robie Street

Robie Street runs north-south centrally across the Halifax peninsula, connecting the north and south ends over approximately 4km. A key link in the regional roadway network, it accommodates between 15,000 and 25,000 vehicles per day (depending on location along the corridor). There is considerable variation in Robie Street's cross section, ranging from a constrained two-lane section (Cunard Street to Almon Street) to wider sections with up to five lanes and centre median (Figure 2).

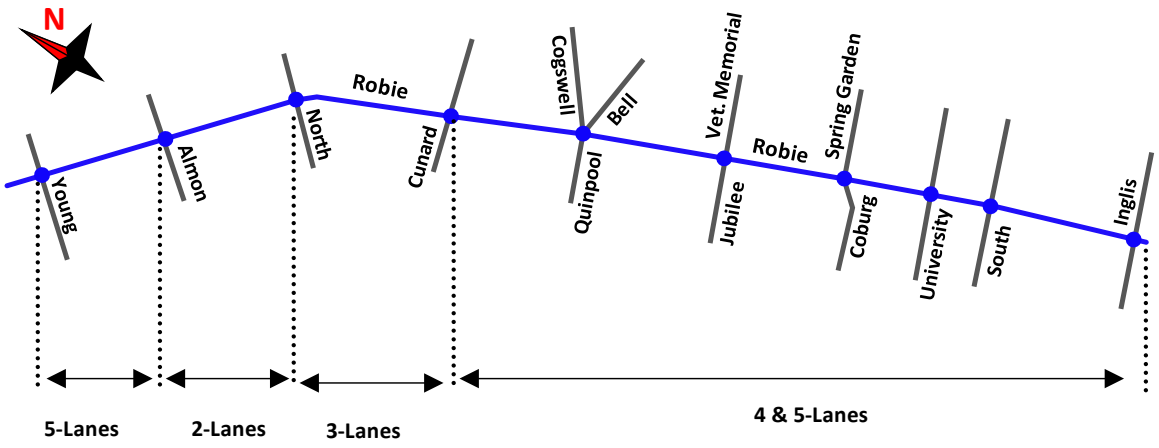


Figure 2: Through traffic lanes on Robie Street (Young Street to Inglis Street)

Hourly weekday distribution of traffic volumes for Robie Street (Almon Street to Young Street) on a typical weekday are illustrated in Figure 3. The daily peak hour volume (approximately 2,000 2-way vehicles) occurs during the afternoon commute period. Throughout the daytime hours, traffic volumes remain relatively balanced, and are less peak-oriented than is typically observed on many commuter-oriented streets.

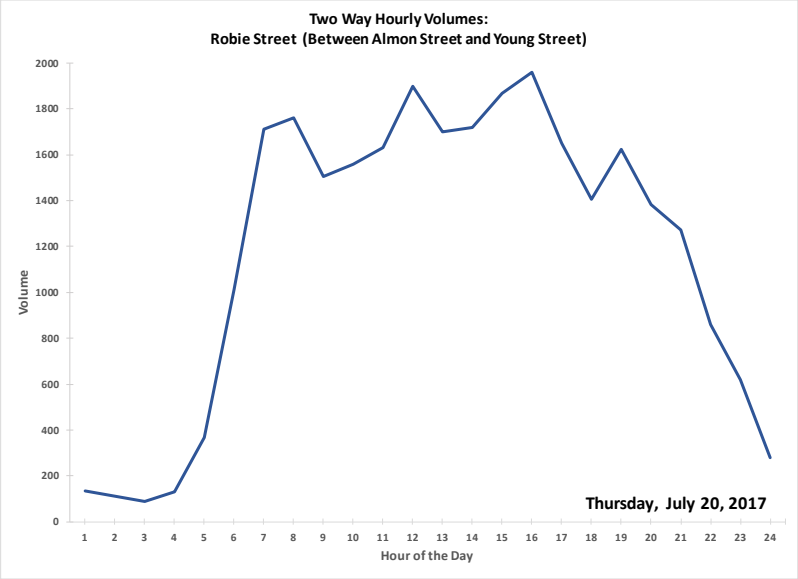


Figure 3: Hourly Traffic Distribution
Robie Street (Almon Street to Young Street)

Young Street

Young Street runs east-west between Windsor Street and Gottingen Street, effectively functioning as an extension to the Bayers Road / Highway 102 corridor. It has a 4-5 lane cross section, and accommodates approximately 15,000 vehicles per day.

Proposed Transit Priority Upgrades

Robie Street

Proposed Phase 1 transit priority upgrades on Robie Street include the addition of curbside bus lanes in one or both directions between Young Street and Quinpool Road. The proposed configuration, illustrated in Figure 4, includes repurposing sections of existing curb lanes on Robie Street between Young Street and Quinpool Road as transit only (right turning vehicles would continue to be accommodated at intersections and driveways).

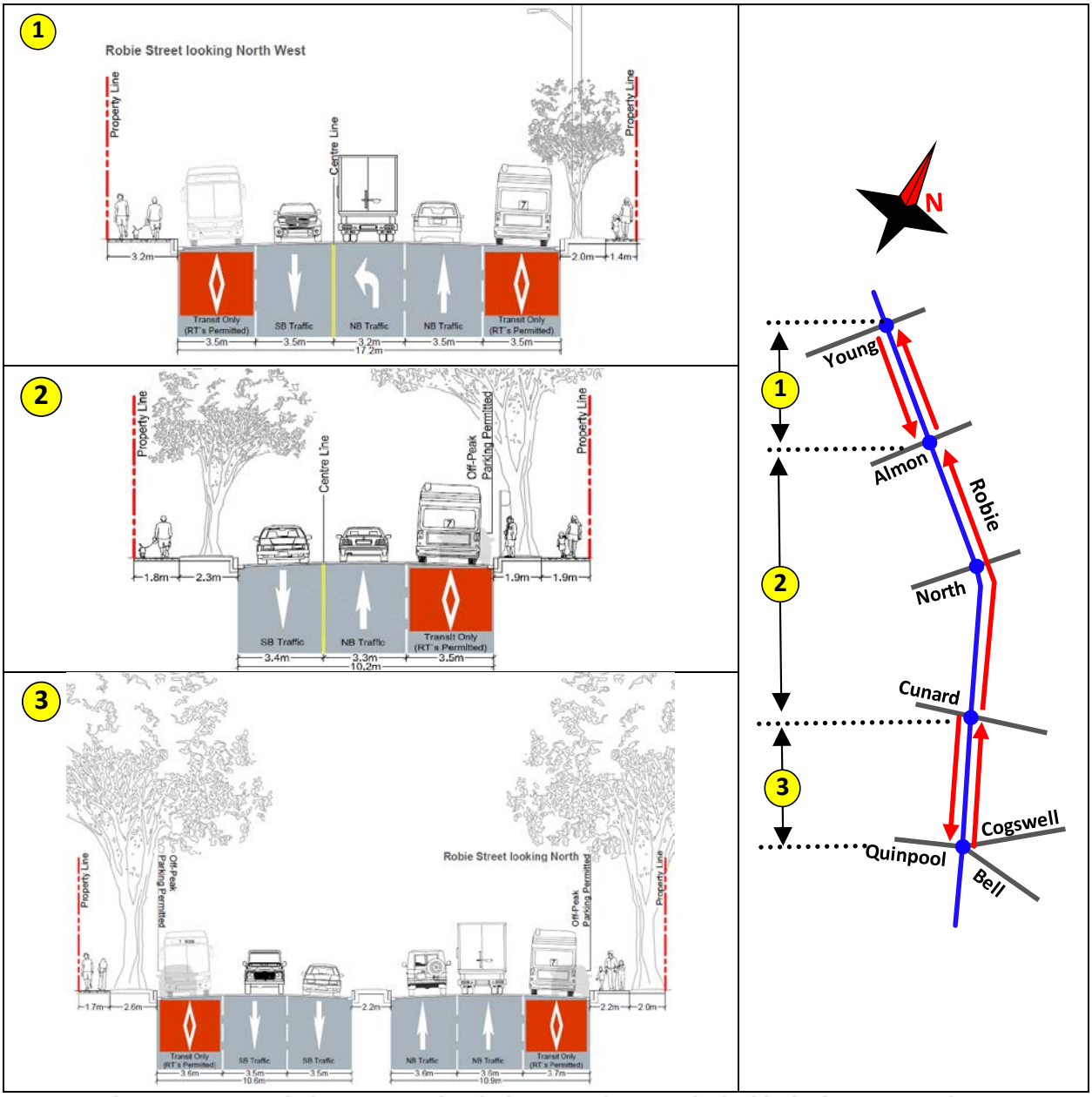


Figure 4: Proposed Phase 1 Transit Priority Upgrades – Typical Mid-Block Cross Sections

Intersection Configuration Changes

Intersection capacity analysis was completed using Synchro 10 software to evaluate the impact of proposed intersection configuration changes based on AM and PM peak periods. The following sections identify any proposed intersection changes and summarize the results of intersection capacity analysis for AM and PM peak periods for each intersection.

Robie Street – Almon Street Intersection

Proposed changes to the intersection include:

- On the Robie Street NB approach, modify the existing shared through-left / shared through-right configuration to through / right-turn only (except buses).
- Prohibit NB left turn movement to Almon Street. The need to prohibit this movement results from the reduction of the Robie Street northbound through movement to a single lane; maintaining the left turn movement would result in significant delays for through traffic.

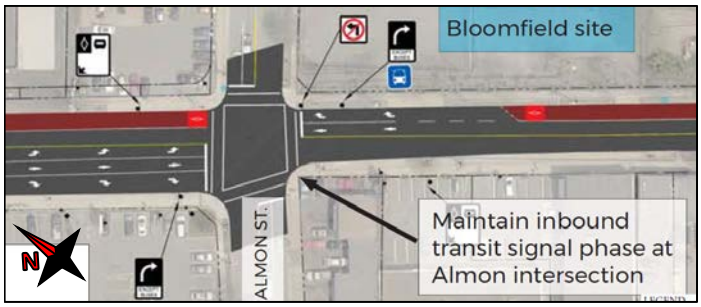


Figure 5: Proposed Intersection Configuration Robie Street @ Almon Street

Intersection performance analysis results are summarized below in Table 1. The Robie Street NB approach is most impacted by the proposed changes, given that the capacity of the through movement is significantly reduced. During the AM peak period, results indicate that despite significant increases in V/C ratio and 95th% queues, the intersection operates within acceptable limits. During the PM peak period, conditions worsen considerably, with V/C for the NB through movement increasing from 0.86 to 1.11 and 95th queues extending to over 270m. Prohibition of the NB left turn movement plays an important role in mitigating the impact of the proposed changes. Consideration of the network implications of prohibiting this left turn movement should be made. Additionally, it may be prudent to consider applying the turn restriction only during peak traffic periods.

Table 1: Intersection Performance Analysis Results: Robie Street @ Almon Street

			Almon Street						Robie Street					
			EB			WB			NB			SB		
			L	T	R	L	T	R	L	T	R	L	T	R
AM Peak		Hourly Volume	150	290	50	20	195	45	30	465	15	40	575	10
	Existing Conditions (Page A-1)	Delay	45.2	45.3		37.3		5.2	14			15.6	35.7	2.6
		V/C	0.68	0.80		0.63		0.13	0.46			0.14	0.86	0.31
		95th% Queue	57.8	112.8		66		6.1	45			11.5	173	10.5
		Int. Delay	28.3											
	Proposed Phase 1 Configuration (Page A-7)	Delay	48.3	47.8		39.8		5.7	20.4		1.4	15.4	33.7	2.5
		V/C	0.70	0.82		0.66		0.13	0.68		0.02	0.14	0.84	0.3
		95th% Queue	60.2	116.4		68.6		6.4	106.7		1.3	11.4	172	10.3
		Int. Delay	30.2											
PM Peak		Hourly Volume	190	195	60	15	470	125	30	760	10	20	370	10
	Existing Conditions (Page A-4)	Delay	43.3	18.4		63		9.4	34.2			26.4	37.1	4.5
		V/C	0.80	0.36		0.96		0.27	0.84			0.17	0.72	0.27
		95th% Queue	68.5	55.7		169.3		18.1	101.3			9.2	99.3	12
		Int. Delay	36.4											
	Proposed Phase 1 Configuration (Page A-10)	Delay	118	22.6		75.2		10	95.2		0	36	29.3	3.9
		V/C	1.10	0.41		1.00		0.28	1.11		0.02	0.32	0.60	0.24
		95th% Queue	77.2	59.9		174.9		18.9	272.8		0	11.1	95.7	11.2
		Int. Delay	64.2											

Robie Street – North Street Intersection

Proposed changes to the North Street intersection are minimal, and include the following:

- On the Robie Street NB approach, retain the existing lane configuration but permit buses to make a through movement from the right-turn only lane. It is recommended that vehicular traffic retain the ability to access the right-turn lane from Willow Street northward; although it reduces the amount of dedicated bus space, retaining capacity for the heavy right turn movement at North Street will also benefit buses by reducing congestion and queuing on the NB approach.
- Modify the north approach from the existing two lanes to include two NB receiving lanes, one for general traffic and one for buses only.

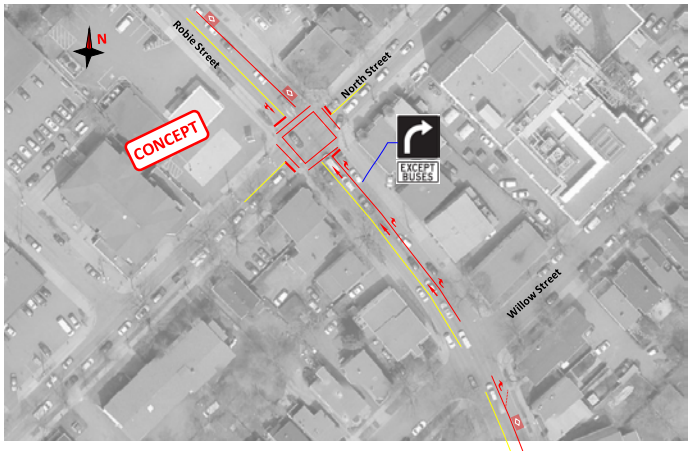


Figure 6: Proposed Intersection Configuration: Robie Street @ North Street

Intersection performance analysis results are summarized below in Table 2. Results indicate that the proposed changes will have minimal operational impact, which is primarily due to the fact that lane configurations (at the intersection) are effectively the same as existing conditions. In reality, the changes will reduce the storage length for right turns, which under existing conditions essentially extends back as far as the Cunard Street intersection (~450m). By designating the curb lane south of Willow Street as a bus-only lane, the effective right turn storage length will be reduced to approximately 75m.

Based on field observations, it is noted that during the afternoon peak period, operation on the NB approach varies considerably from day to day and is more dependent on queue spillback on North Street than on the operation of the Robie Street – North Street intersection. Approximately 2/3 of NB traffic are through movements at North Street, and observations indicate that a significant portion of this through traffic merges into the leftmost lane long before the North Street intersection, in many cases as far south as the North Common.

Table 2: Intersection Performance Analysis Results: Robie Street @ North Street

			North Street						Robie Street					
			EB			WB			NB			SB		
			L	T	R	L	T	R	L	T	R	L	T	R
AM Peak		Hourly Volume	0	375	25	0	420	10	0	470	110	0	565	10
	Existing Conditions (Page A-2)	Delay	47.8			42.8			20.9		2.9	26.5		
		V/C	0.89			0.86			0.71		0.18	0.77		
		95th% Queue	118			115.7			132		8.4	159.8		
		Int. Delay	31.7											
	Proposed Phase 1 Configuration (Page A-8)	Delay	47.8			42.6			23.8		7.3	26.5		
		V/C	0.89			0.86			0.71		0.18	0.77		
		95th% Queue	118			115			83.2		10.9	159.8		
		Int. Delay	32.6											
PM Peak		Hourly Volume	0	345	25	0	445	20	0	670	375	0	525	30
	Existing Conditions (Page A-5)	Delay	36.6			50.4			14		48.5	17.9		
		V/C	0.76			0.91			0.79		0.98	0.64		
		95th% Queue	95.6			139.6			179.2		125	110.6		
		Int. Delay	30.6											
	Proposed Phase 1 Configuration (Page A-11)	Delay	36.6			50.4			30.7		54.3	17.9		
		V/C	0.76			0.91			0.79		0.98	0.64		
		95th% Queue	95.6			139.6			127		81.1	110.6		
		Int. Delay	36.1											

Robie Street – Cunard Street Intersection

Proposed changes to the intersection, illustrated in Figure 7, include:

- Robie Street NB Approach: Convert curb lane to right-turn only (except buses), reducing the number of through lanes from two to one. Significantly reduce the size of the channelized right turn (size to be refined during detailed design).
- Cunard Street WB Approach: Modify the east intersection leg to realign the EB movement, as illustrated in the concept presented in Figure 7. Remove WB right turn lane.
- North of Cunard Street, designate the NB receiving curb lane as a dedicated bus lane.
- South of Cunard Street, designate the SB receiving curb lane as a dedicated bus lane.
- Removal of the NB protected only left turn phase may be possible with potential design improvements to address existing issues (sight lines, vehicle path overlap). This would provide more efficient signal operation.

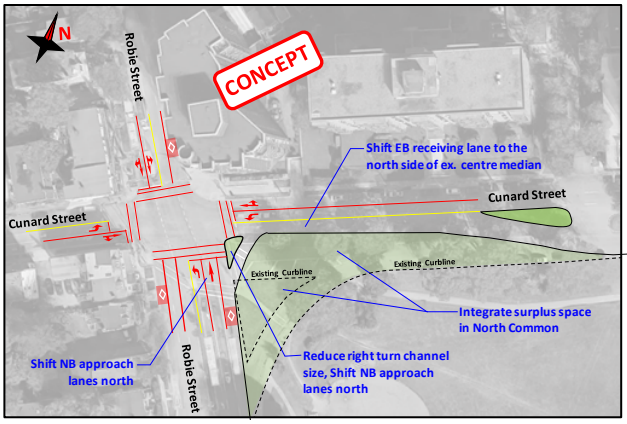


Figure 7: Proposed Intersection Configuration – Robie Street @ Cunard Street

Intersection performance analysis results are summarized below in Table 3. Results indicate the following:

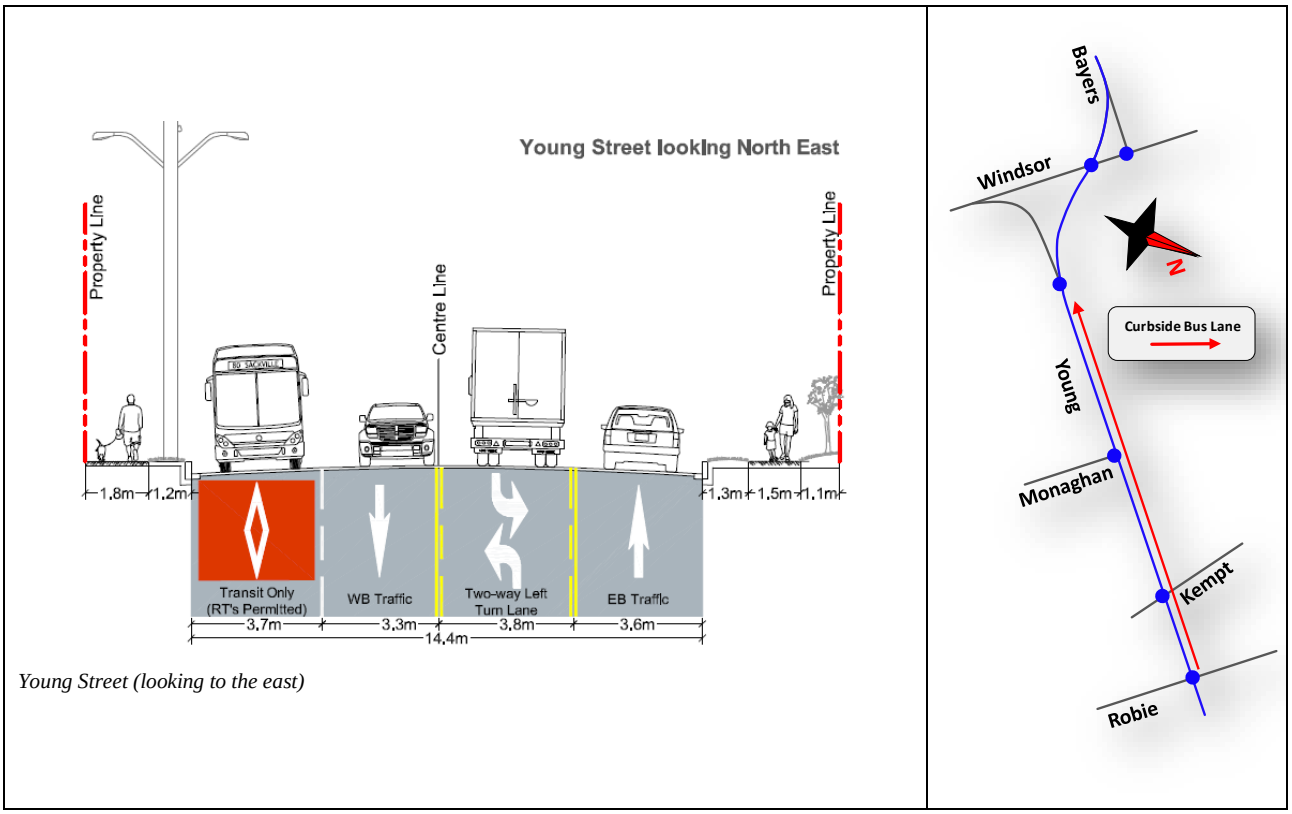
- During the AM peak period, operational changes are relatively insignificant. Operations on the Robie Street NB approach will degrade but remain within acceptable limits. The SB approach may have slight improvements over existing conditions.
- Operational changes are more pronounced during the PM peak period, particularly on the Robie Street NB approach and Cunard Street WB approach, where through movement V/C exceeds 1.0 and 95th% queue lengths extend considerably.
- Lane utilization on the northbound approach is currently imbalanced, with approximately 70% of through traffic using the leftmost through lane (anticipating a difficult downstream merge movement to continue north on Robie Street at North Street). Given this lane imbalance, it is expected that in reality loss of the rightmost through lane will be less critical than indicated in the results.

Table 3: Intersection Performance Analysis Results: Robie Street @ Cunard Street

			Cunard Street						Robie Street					
			EB			WB			NB			SB		
			L	T	R	L	T	R	L	T	R	L	T	R
		Hourly Volume	**10**	**410**	**90**	**40**	**160**	**40**	**50**	**470**	**20**	**75**	**655**	**10**
	Existing Conditions (Page A-3)	**Delay**	19	145		38	23	5.2	56	24.8		53		
		V/C	0.04	1.22		0.45	0.35	0.13	0.5	0.51		1.02		
		95th% Queue	4.7	183.6		18	40	6.1	24	56.2		122.1		
		Int. Delay	65.1											
	Proposed Phase 1 Configuration (Page A-9)	**Delay**	19.1	147.2		38	23.7		20	25	1.3	40.9		
		V/C	0.04	1.22		0.5	0.45		0.3	0.71	0.04	0.83		
		95th% Queue	4.7	183.6		19	47.9		15	109	1.4	102		
		Int. Delay	60.7											
		Hourly Volume	**20**	**300**	**60**	**65**	**475**	**75**	**50**	**760**	**60**	**55**	**545**	**50**
	Existing Conditions (Page A-6)	**Delay**	25.4	35.8		26	38	9.4	51	29.4		39.7		
		V/C	0.21	0.77		0.32	0.82	0.27	0.4	0.74		0.92		
		95th% Queue	9.1	103.6		21	135	5.7	21	98.9		108.6		
		Int. Delay	34.1											
	Proposed Phase 1 Configuration (Page A-12)	**Delay**	40.2	40.8		28	73.9		12	45	5.5	42.9		
		V/C	0.35	0.81		0.4	1.03		0.18	0.96	0.1	0.93		
		95th% Queue	11.3	110.2		22	179.8		10	219	7.9	100.8		
		Int. Delay	47.9											

Young Street

Proposed Phase 1 transit priority upgrades on Young Street include re-designation of the westbound curbside vehicle lane as a dedicated bus lane between Robie Street and Windsor Street (right turning vehicles would continue to be accommodated at intersections and driveways). A typical cross section of the proposed configuration is illustrated in Figure 8.



Young Street (looking to the east)

Figure 8: Proposed Street Configuration Options – Young Street (Windsor Street to Kempt Road)

Intersection Configuration Changes

Intersection capacity analysis was completed using Synchro 10 software to evaluate the impact of proposed intersection configuration changes based on AM and PM peak periods. The following sections identify any proposed intersection changes and summarize the results of intersection capacity analysis for AM and PM peak periods for each intersection.

Young Street: Robie Street to Kempt Road

The proposed configuration for the Young Street intersections at Robie Street and Kempt Road, illustrated below in Figure 9, includes the following modifications:

- Reconfigure the section of Young Street between Robie Street and Kempt Road to include:
  - A westbound bus lane in the receiving curb lane;
    - Right-turn only (except buses) on the approach to Kempt Road;
  - A westbound left turn lane at the Esso Driveway / Kempt Road intersection (by reassigning a portion of the existing EB left turn lane at Robie Street;
- Reconfigure the existing through-left lane on the Young Street WB approach to Robie Street to a left turn lane;
- Convert the Young Street WB receiving curb lane west of Kempt Road to a dedicated bus lane.
- Modify the Robie Street SB through-right lane to a right-turn lane, reducing the number of SB through lanes from two to one (to accommodate the bus lane that is introduced south of Young Street).

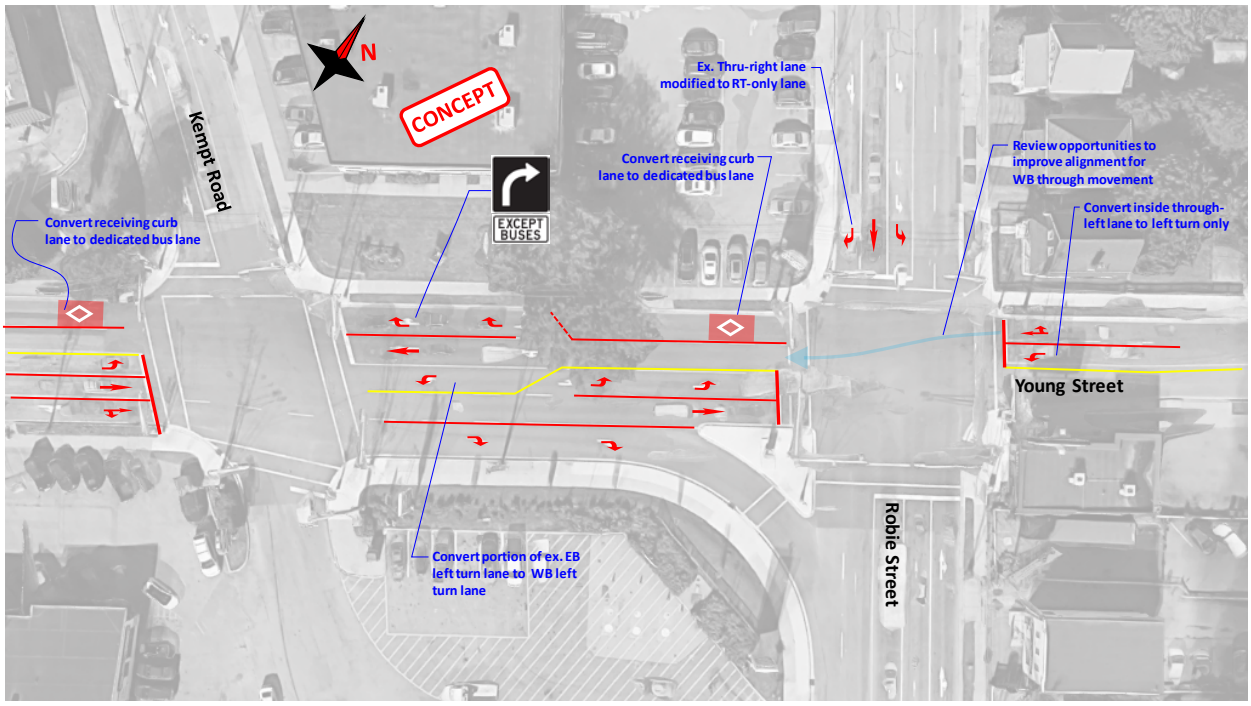


Figure 9: Proposed Configuration -- Young Street (Robie Street to Kempt Road)

Intersection performance analysis results for the Young Street – Robie Street and Young Street – Kempt Road intersections are summarized in Table 4 and Table 5, respectively. Key results include the following:

- At the Young Street – Robie Street intersection, reduction in through lane capacity on the Young Street WB approach and the Robie Street SB approach result in significant increases to key criteria including V/C ratio, delay, and queue length. Operational impacts are particularly pronounced for the Robie Street SB through movement, with V/C ratio during the AM peak hour increasing from 0.67 to above 1.0.

- The analysis indicates that impacts at the Young Street – Kempt Road intersection are relatively insignificant, though the results suggest that upstream metering at the Robie Street intersection may have an impact on WB traffic volumes flowing into the intersection.

Table 4: Intersection Performance Analysis Results: Young Street @ Robie Street

			Robie Street						Young Street					
			NB			SB			EB			WB		
			L	T	R	L	T	R	L	T	R	L	T	R
AM Peak		Hourly Volume	80	495	20	60	735	80	100	405	115	20	260	20
	Existing Conditions (Attachment E, Page F-3)	Delay	28.7	18		17.8	21		14.4	24.8	4.1	20.5	41.2	
		V/C	0.53	0.40		0.24	0.67		0.41	0.79	0.25	0.13	0.79	
		95th% Queue	19.5	37.3		16.3	85.5		11.6	109	3.9	5.6	95.5	
		Int. Delay	22.5											
	Proposed Phase 1 Configuration (Attachment E, Page F-15)	Delay	23.6	15		23.1	87.3	2.7	30.2	60.7	9.6	40.4	84.3	
		V/C	0.49	0.33		0.22	1.08	0.13	0.39	0.75	0.23	0.16	0.96	
		95th% Queue	20.4	47		19.8	275	6.4	29	138	5.6	11.6	121.9	
		Int. Delay	53.4											
PM Peak		Hourly Volume	165	850	15	35	420	75	160	325	200	15	340	60
	Existing Conditions (Attachment E, Page F-5)	Delay	25.6	14.2		32.6	20.4		26.6	17.3	4.1	24.6	63.1	
		V/C	0.77	0.81		0.40	0.49		0.67	0.51	0.34	0.07	0.95	
		95th% Queue	13.8	36.7		15	48.3		34.8	45.3	8.5	7.1	140.5	
		Int. Delay	24.1											
	Proposed Phase 1 Configuration (Attachment E, Page F-17)	Delay	25.9	22.7		30.7	60.2	3.4	29.5	19.9	5.1	25.2	56.2	
		V/C	0.66	0.65		0.28	0.94	0.17	0.64	0.48	0.25	0.06	0.9	
		95th% Queue	32.2	85.3		14.3	136	6.3	40.2	55.2	16.1	7.2	134.3	
		Int. Delay	32.2											

Table 5: Intersection Performance Analysis Results: Young Street @ Kempt Road

			Kempt Road						Young Street					
			NB			SB			EB			WB		
			L	T	R	L	T	R	L	T	R	L	T	R
AM Peak		Hourly Volume	60	55	45	125	70	60	35	450	55	45	305	70
	Existing Conditions (Attachment E, Page F-2)	Delay	14			17.2	9.3		16.7	23.5		30.9		
		V/C	0.29			0.29	0.2		0.15	0.55		0.78		
		95th% Queue	29.9			28.3	19.1		9.9	53.2		33.4		
		Int. Delay	22.6											
	Proposed Phase 1 Configuration (Attachment E, Page F-14)	Delay	59.1	40.3		30.8	32.7		20.8	22.2		14.3	19.6	5.9
		V/C	0.52	0.52		0.39	0.35		0.08	0.3		0.12	0.32	0.1
		95th% Queue	27	32.4		34	37.3		9.9	62.3		5.2	29.6	0.1
		Int. Delay	25.1											
PM Peak		Hourly Volume	105	65	25	210	60	90	160	450	200	20	445	115
	Existing Conditions (Attachment E, Page F-4)	Delay	22.6			29.3	8.6		26.8	17.8		39.5		
		V/C	0.47			0.62	0.27		0.65	0.57		0.81		
		95th% Queue	45.5			56.2	19.5		35.5	60.6		39.1		
		Int. Delay	26											
	Proposed Phase 1 Configuration (Attachment E, Page F-17)	Delay	48.6	27.6		24.6	23.4		26.3	13.2		7.1	12	1.5
		V/C	0.63	0.33		0.52	0.33		0.59	0.46		0.08	0.53	0.2
		95th% Queue	34.1	24.4		44.7	35		54.9	53.4		1.3	25.6	0
		Int. Delay	17.8											

Young Street: Monaghan Drive to Halifax Forum

The section of Young Street west of Monaghan Drive (extending approximately to the Halifax Forum – ~200m) is proposed to be reconfigured to include a WB dedicated bus lane, as well as two through lanes (one in each direction) and a center two-way left turn lane (TWLTL).

Young Street accommodates average annual weekday traffic (AADT) of approximately 15,000 vehicles per day (vpd). There is a range of guidance related to the suitability of applying a road diet approach to 4-lane, undivided roadways to add facilities for transit and active transportation. The US Federal Highway Administration (FHWA) advises that roadways with AADT less than 20,000 vpd may be candidates for road diets using TWLT configuration. Other research has suggested upper limits ranging from 15,000 to 24,000 vpd[1].

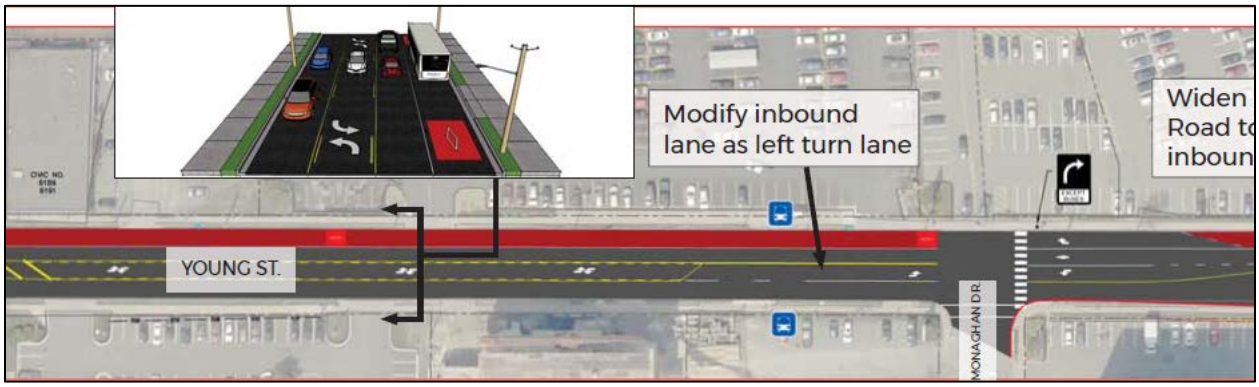


Figure 10: Proposed Configuration - Young Street (Monaghan Drive to Halifax Forum)

Concluding Thoughts

Staff have completed an analysis of the traffic impacts associated with the proposed Phase 1 transit priority upgrades on Robie Street and Young Street. These findings supplement the analyses that were completed by WSP for the various options considered for the Robie Street / Young Street Transit Priority Corridor

The proposed Phase 1 design for Robie Street and Young Street, which will reallocate existing traffic lanes on both streets to provide dedicated lanes for transit, will reduce traffic capacity and therefore impact operations for traffic during peak periods. The objective of this Traffic Impact Analysis has been to quantify these impacts at key intersections to enable a better understanding of the necessary trade-offs resulting from prioritization of transit on the corridor.

Overall, the proposed lane configuration changes, which reduce roadway traffic capacity both mid-block and at intersections, are expected to negatively impact traffic operations on the Robie Street corridor. Traffic analysis based on weekday morning and afternoon peak periods indicates that key metrics including vehicle delay and queue length will increase for some affected movements, in some cases significantly, relative to existing conditions. Analysis also indicates that based on current traffic demand during peak periods, traffic volumes will approach or exceed the amount of available capacity for some key movements. As a result, congestion on the corridor will be expected to worsen relative to existing conditions.

Resulting traffic congestion may encourage motorists to consider other options such as (i) shifting to other modes (i.e. transit, active transportation), (ii) changing commute times earlier or later in the day, (iii) diversion to other

[1] *Road Diet Informational Guide* (Federal Highway Administration, 2014)

routes. It is difficult to predict how motorists will react to the proposed changes; however, these are the types of behaviour shifts that are fundamental to the success of the IMP's transportation planning objectives.

ATTACHMENT D

On-Street Parking Review

Robie Street Transit Priority Corridor

Prepared by:

Strategic Transportation Planning
June 2019

HALIFAX

Table of Contents

Introduction

Background

Halifax Regional Municipality (HRM) is currently in the process of planning and designing for proposed transit priority upgrades to Robie Street. Staff have recommended that the project be implemented in phases, the first of which would include installation of curbside bus lanes on the following segments of Robie Street (Figure 1):

- Young Street to Almon Street: Northbound / southbound bus lanes
- Almon Street to Cunard Street: Northbound bus lane
- Cunard Street to Quinpool Road: Northbound / southbound bus lanes

Proposed Phase 1 changes do not require widening but do necessitate reconfiguration of existing curb-to-curb space that is currently used for traffic lanes and parking / loading. Accordingly, there are areas along Robie Street where it will be necessary to remove existing on-street parking spaces and prohibit curb access for loading activities. Recognizing the importance of both activities to businesses and residents in the area, staff completed an investigation of existing on-street parking on the affected sections of Robie Street that included an inventory of curbside uses, review of current parking utilization, and quantification of the impacts to these uses expected to result from the implementation of transit priority upgrades.

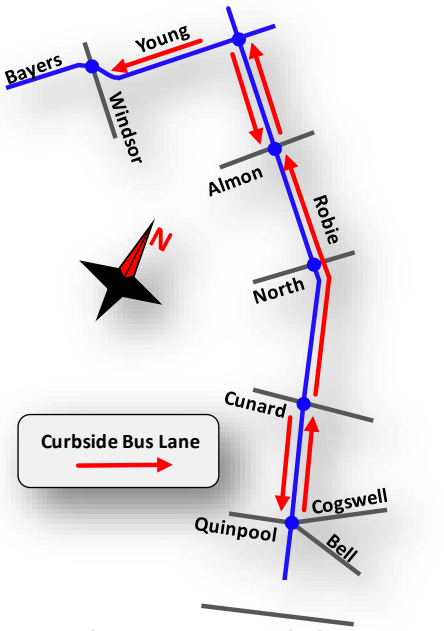


Figure 1: Proposed Phase 1 Transit Priority Upgrades

Objective

The objective of the on-street parking review is to develop a better understanding of the current parking and loading conditions on Robie Street and the impact of the proposed transit lanes on both activities.

Existing On-Street Parking

Existing Parking Supply

Curb access on Robie Street currently varies along the corridor, generally including on-street parking (time-restricted and unrestricted), accessible parking, and bus stops. There are also several locations where curb access is prohibited due to insufficient width or due to proximity to intersections, crosswalks, and bus stops. There are approximately 58 parking spaces on Robie Street between Quinpool Road and Almon Street, as summarized in Table 1 and Figure 2. There are no parking meters or taxi stands along this segment; parking time restrictions vary from 15-60 minutes. Figures 3 to 5 summarize curbside access along Robie Street and the surrounding streets, including the number, type and location of parking spaces.

ATTACHMENT D

Table 1: Existing On-Street Parking Supply

		Unrestricted Parking	Peak Restricted (7-9AM)	Peak Restricted (4-6PM)	Accessible Parking	Total
Almon Street to North Street	East	-	-	20	-	20
	West	-	-	-	-	0
North Street to Cunard Street	East	-	-	-	2	1
	West	-	-	-	-	0
Cunard Street to Quinpool Road	East	23	-	-	-	23
	West	-	13	-	-	13
Total	East	**23**	**-**	**20**	**2**	**45**
	West	**-**	**13**	**-**	**-**	**13**

Figure 2 – Existing On-Street Parking Supply

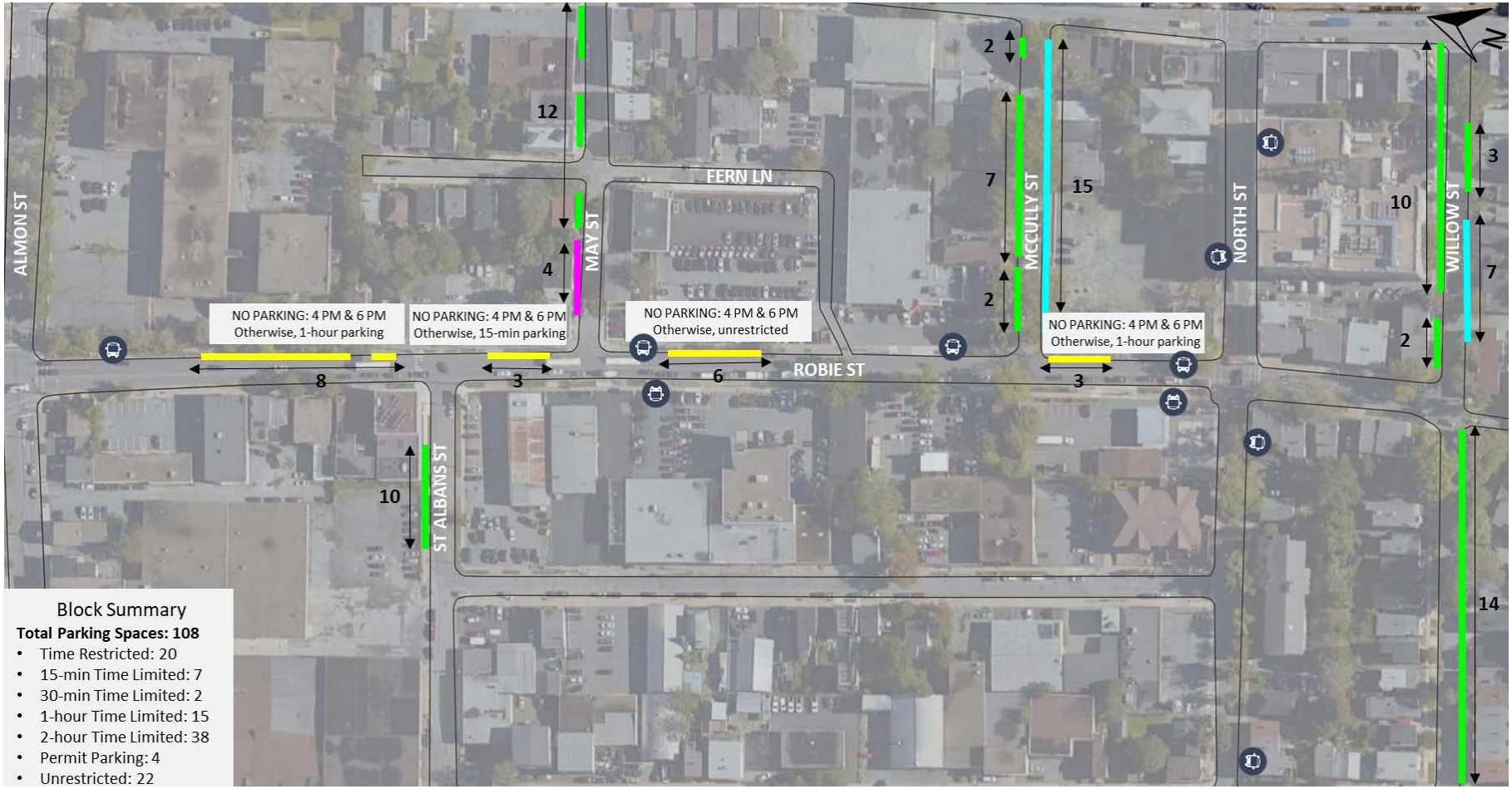


Figure 3 – Existing Parking Conditions – Robie Street from Almon Street to Willow Street

Time Limited Parking
Permit Parking
Time Restricted Parking
Loading Zone
Unrestricted Parking
Accessible Parking

ATTACHMENT D

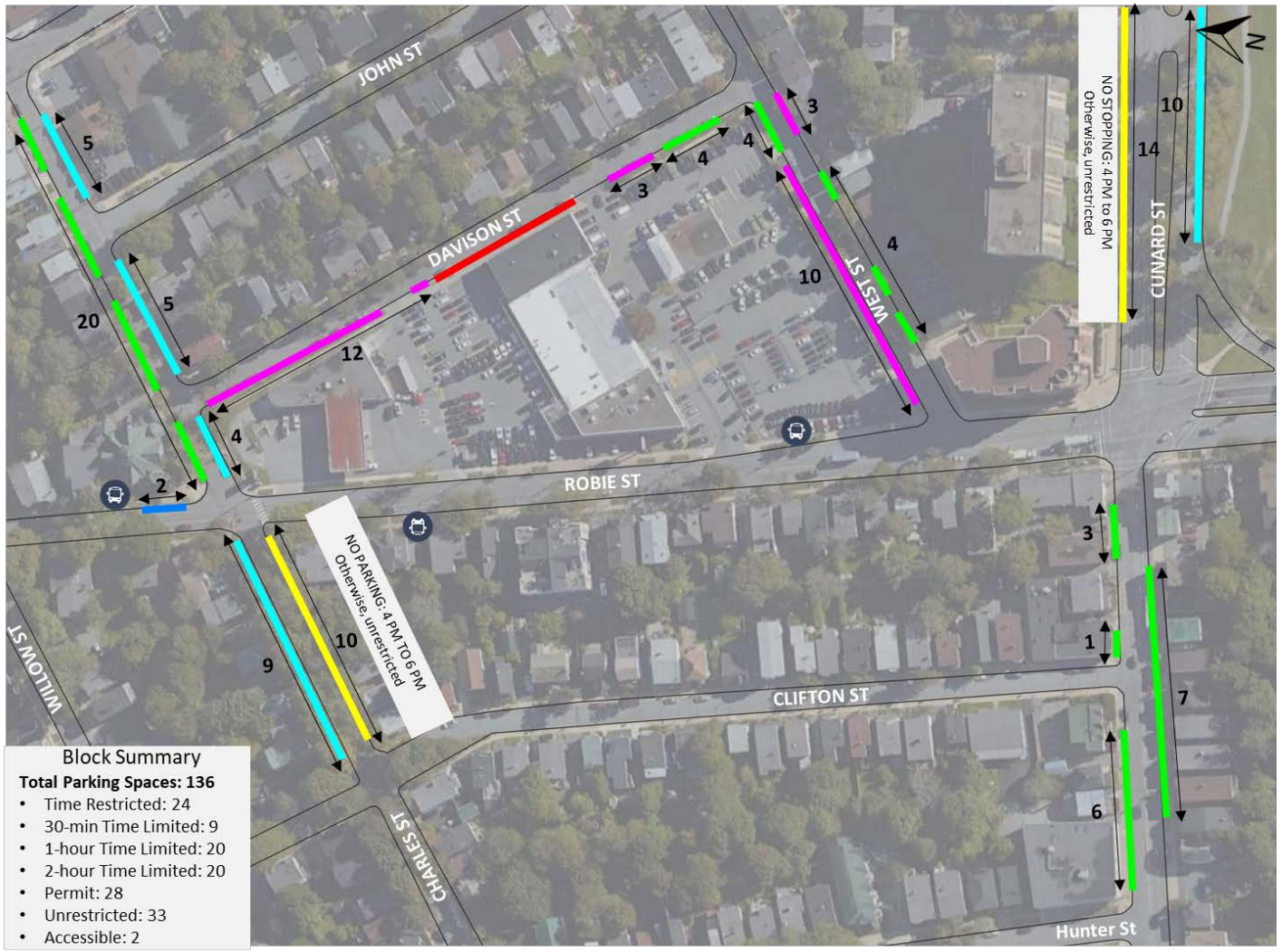


Figure 4 – Existing Parking Conditions – Robie Street from Willow Street to Cunard Street

Time Limited Parking
Time Restricted Parking
Unrestricted Parking
Permit Parking
Loading Zone
Accessible Parking

ATTACHMENT D

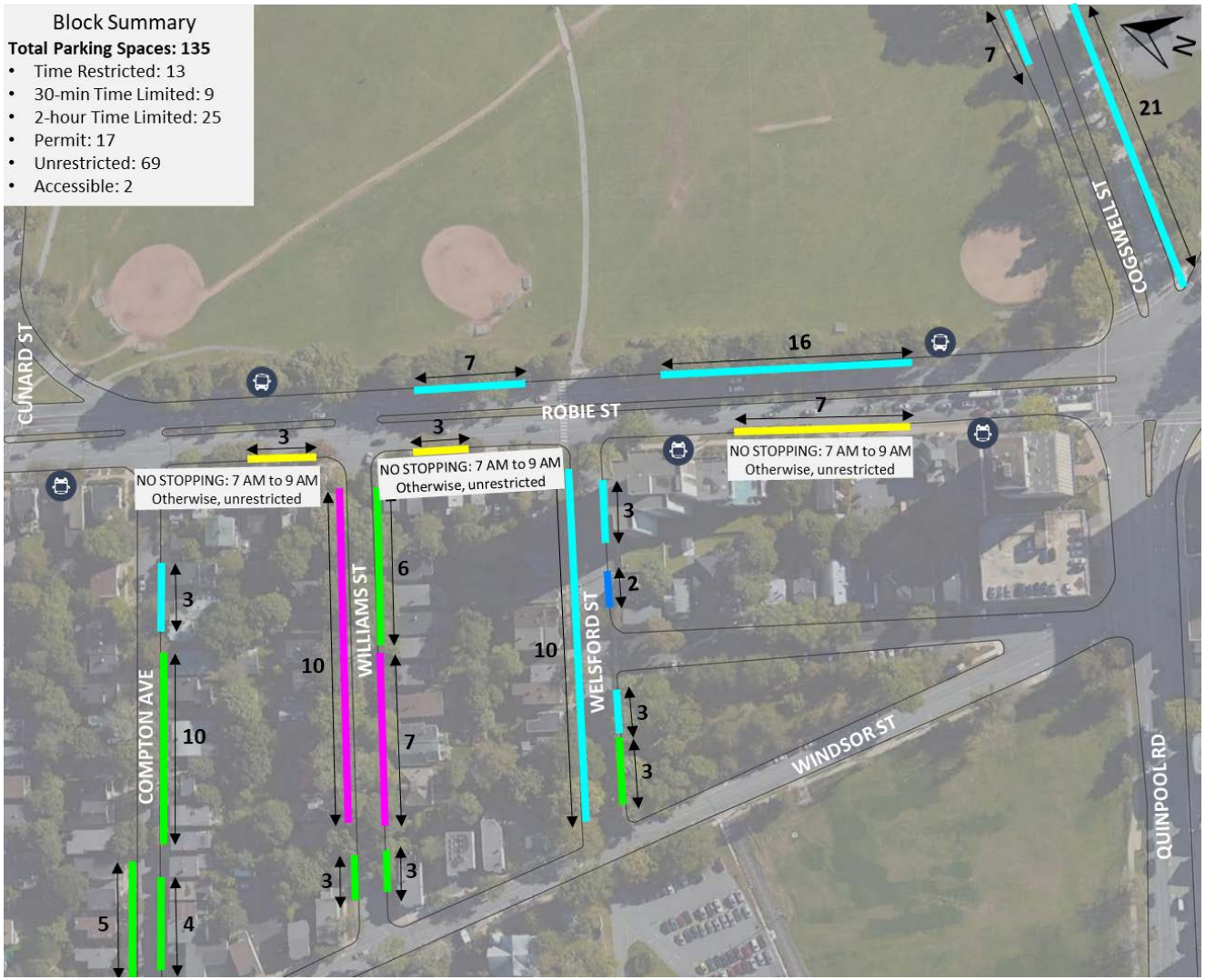


Figure 5 – Existing Parking Conditions – Robie Street from Cunard Street to Quinpool Road/Cogswell Street

Time Limited Parking
Time Restricted Parking
Unrestricted Parking
Permit Parking
Loading Zone
Accessible Parking

Existing Parking Utilization

Parking utilization observations were completed on Robie Street (Quinpool Road to Almon Street) and immediately adjacent streets over a 7-hour period on Wednesday, May 2nd and Thursday, May 3rd, 2018. Each parking space in the Study Area was observed every 30 minutes throughout the study period, enabling understanding of both parking utilization and turnover.

Results of the parking utilization observations, which are summarized below in Table 2 and Figure 6, indicate the following:

- Average parking occupancy on Robie Street was approximately 66% between 9am and 4pm. Spaces north of McCully Street and south of Cunard Street had very high utilization, exceeding 80% throughout the day.
- Average parking duration was 244 minutes (>4 hours), indicating very low turnover. The section of Robie Street with the highest turnover was on the west side between Cunard Street and Quinpool Road, with an average parking duration of 144 minutes. Turnover was lowest on the section of Robie Street between Cogswell Street and Welsford Street, where the average parking duration was 385 minutes (>6 hours).
- There are approximately 321 on-street parking spaces on the immediately adjacent streets. The aggregated average parking utilization for all side streets was 73% and the average duration was 223 minutes.

Table 2: Existing On-Street Parking Supply

		On-Street Parking Spaces	Average Utilization (7AM – 4PM)	Average Duration (7AM – 4PM)
Almon Street to North Street	East	20	54%	158 minutes
	West	0	-	-
North Street to Cunard Street	East	2	-	-
	West	0	-	-
Cunard Street to Quinpool Road	East	23	93%	380 minutes
	West	13	38%	144 minutes
Total		**58**	**66%**	**244 minutes**

ATTACHMENT D

Figure 6 – Summary of Parking Utilization on Robie Street and Adjacent Side Streets

Existing Loading Supply

There are no formally signed loading zones on Robie Street; 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.

The location and approximate amount (length in metres) of total "No Parking" areas on Robie Street is illustrated in Figure 7. In several locations, AM/PM peak period "No Stopping" restrictions reduce the amount of space available for loading activities.

Figure 7 – Summary of Existing "No Parking" areas (in meters) on Robie Street

Existing Loading Demand

Staff completed a survey of Robie Street businesses to better understand current loading operations. The survey included questions related to typical loading activities, including the time of day, frequency, location, and vehicle type. Key findings included:

- The majority of the 32 businesses surveyed (87%) indicated that they do not conduct loading activities on Robie Street (Figure 8). Most of these businesses conduct loading off-street (55%) or via side streets (29%). Two businesses (6%) reported not receiving any deliveries.
- Four of the businesses surveyed indicated that they currently conduct loading activities from Robie Street. Of these four, three indicated that they receive deliveries 1-3 days per week, with typical delivery duration of 15 minutes or less. One business reported receiving deliveries multiple times daily for a duration longer than one hour, with all deliveries occurring during the weekend, evenings or early morning.

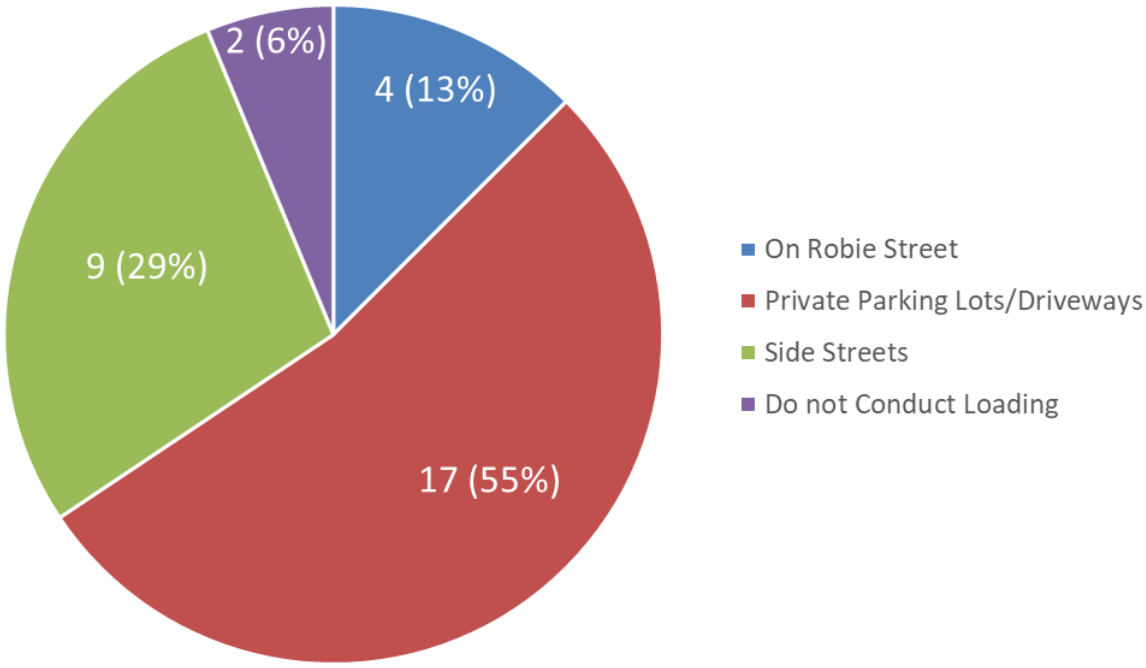


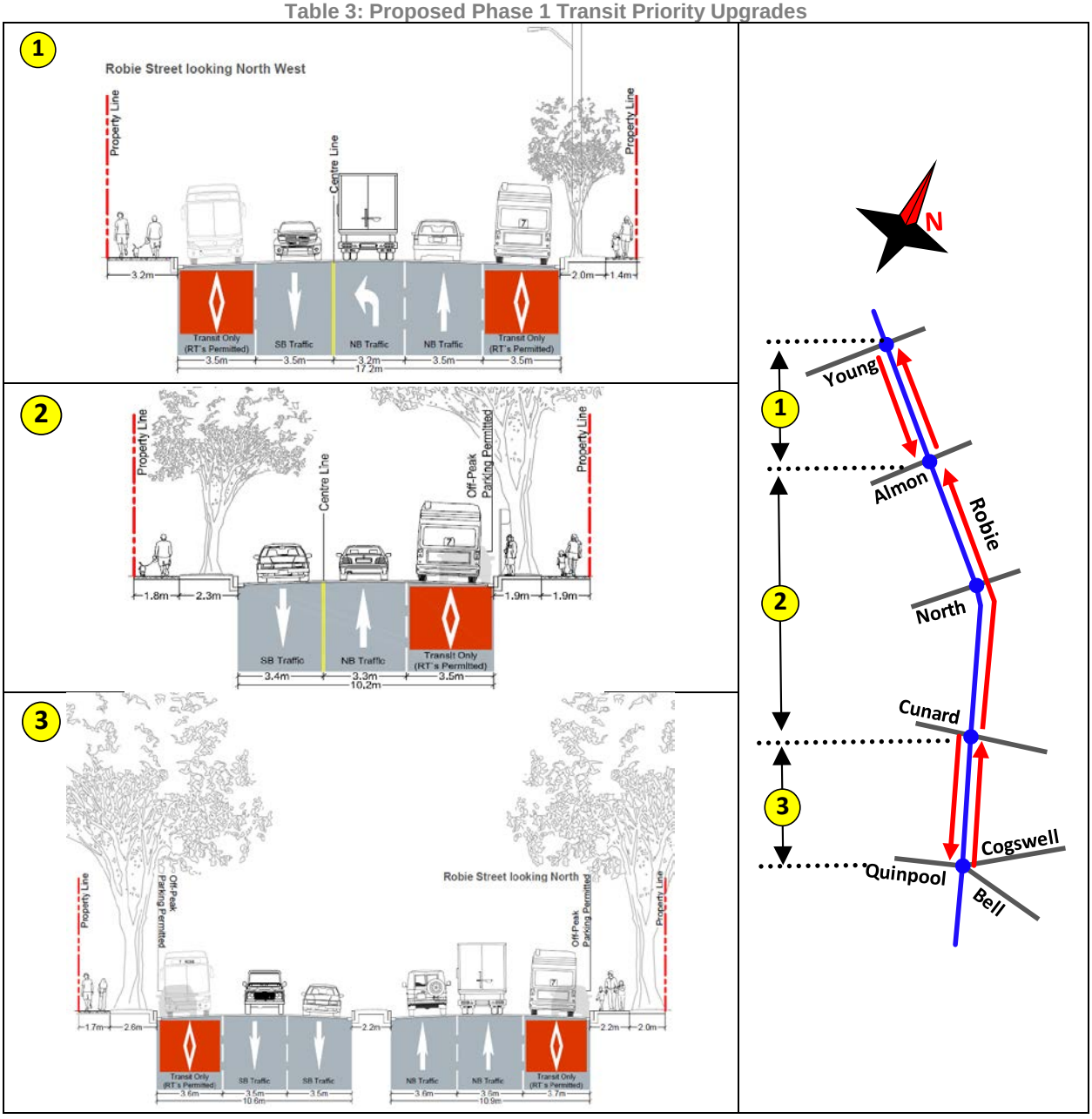
Figure 8 – Location of Loading Activities based on Survey Results

Proposed Changes to Parking and Loading

Proposed Phase 1 Transit Priority Upgrades

Proposed Phase 1 transit priority upgrades on Robie Street include the addition of curbside bus lanes in one or both directions between Young Street and Quinpool Road. The proposed configuration is summarized in Table 3.

Table 3: Proposed Phase 1 Transit Priority Upgrades



Parking and Loading Impacts

The number of parking spaces and "No Parking" (loading permitted) areas under existing and proposed conditions are summarized in Table 4.

- The proposed design will remove all 58 on-street parking spaces on Robie Street during periods when the transit lane is operational. The operational hours of the transit lane will dictate the full extent of how parking is impacted. Designating the bus lane as operational only during certain times (i.e. weekday peak periods) would eliminate all on-street parking during those peak periods but would provide the opportunity to retain on-street parking spaces (and loading areas) outside of these operational periods. This may be desirable given the relatively high demand for parking along some areas of the corridor.
- While there is potential that some of the lost parking on Robie Street could shift to adjacent side streets, it is noted that the amount of available parking on side streets may also be impacted within the next few years due to active transportation facilities that are being planned in the area.
- The two accessible parking spaces on Robie Street are available on Sundays only; therefore, they would not be impacted by the proposed weekday transit lane.

Table 4: Approximate Parking and Loading Inventory on Robie Street

		Parking Supply			Loading Permitted	
		Existing	Average Occupancy	Avg. Duration (Minutes)	Peak Periods	Off-Peak Periods
Almon Street to North Street	East	20	54%	158	125m	195m
	West	0	-	-	0	400m
North Street to Cunard Street	East	2	-	-	115m	380m
	West	0	-	-	0	405m
Cunard Street to Quinpool Road	East	23	93%	380	250m	250m
	West	13	38%	144	110m	390m
Total	East	**45**	**75%**	**275**	**490m**	**825m**
	West	**13**	**36%**	**109.5**	**110m**	**1195m**

Concluding Thoughts

Recognizing the importance of parking and loading activities on Robie Street, this on-street parking review has been prepared to develop a better understanding of parking / loading supply and demand along the corridor, and to review the impacts of the proposed design on both activities. In preparing the parking study, staff have completed an investigation of existing on-street parking and loading activities on Robie Street between Quinpool Road/Cogswell Street and Almon Street. The study includes a detailed parking / loading inventory, and parking utilization data.

The proposed design for the Robie Street transit lane will impact on-street parking and loading activities along the corridor. During the proposed operational hours of the transit lane, all on-street parking and loading on the east and west sides of the street will be prohibited. If there are periods when the transit lane is not operational (i.e. outside of peak periods), there is potential to retain parking and loading in its current configuration during those periods. Parking utilization observations on Robie Street suggest that parking occupancy is relatively high, with long average parking duration that exceeds current time restrictions.

Attachment E

Robie Street / Young Street Transit Priority Corridors

Public Feedback Survey Summary

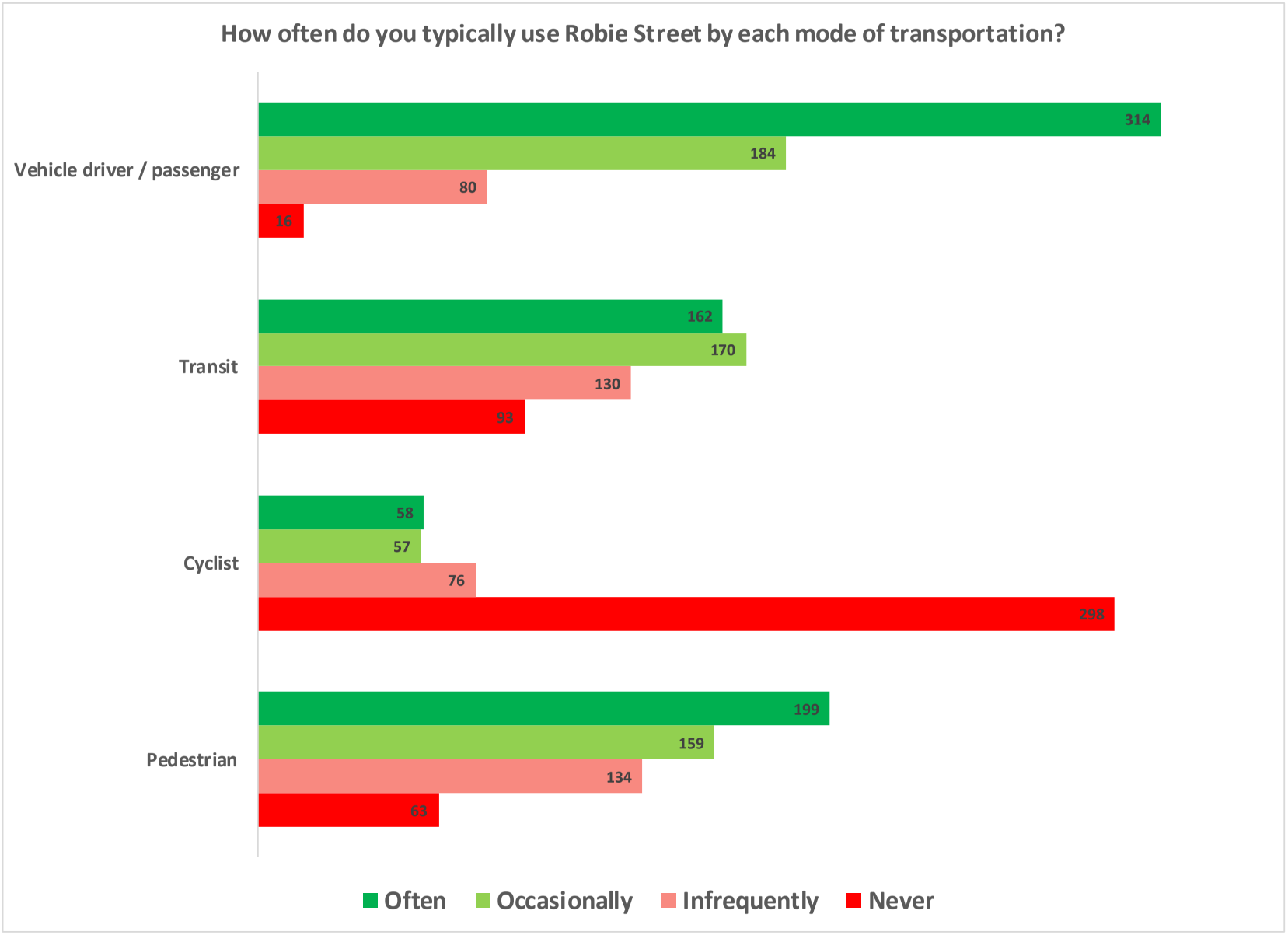
February-26-18

Robie Street

Total Participants: Shape Your City Online Survey	601

Attachment E

Robie Street



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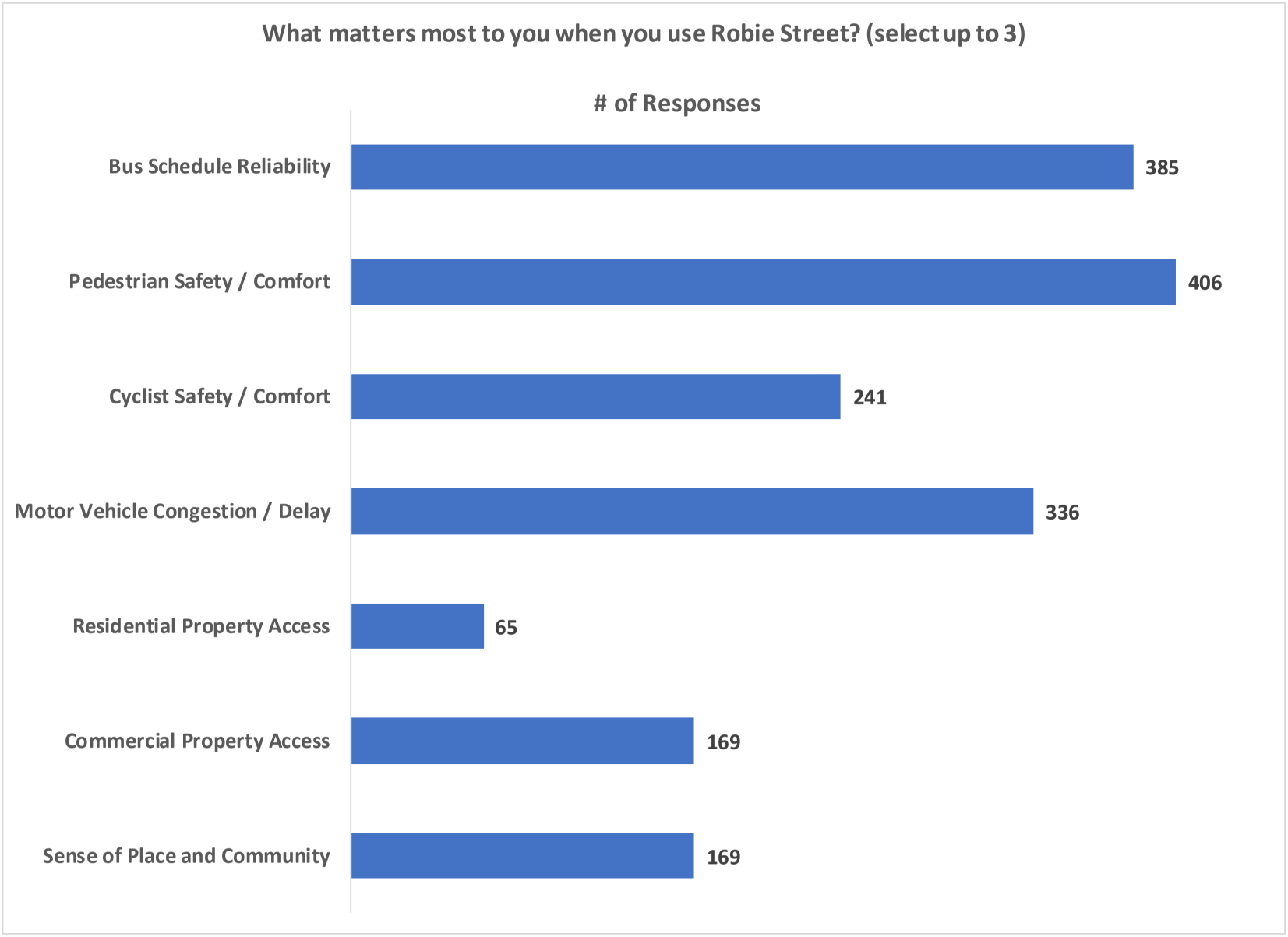
Attachment E

Robie Street



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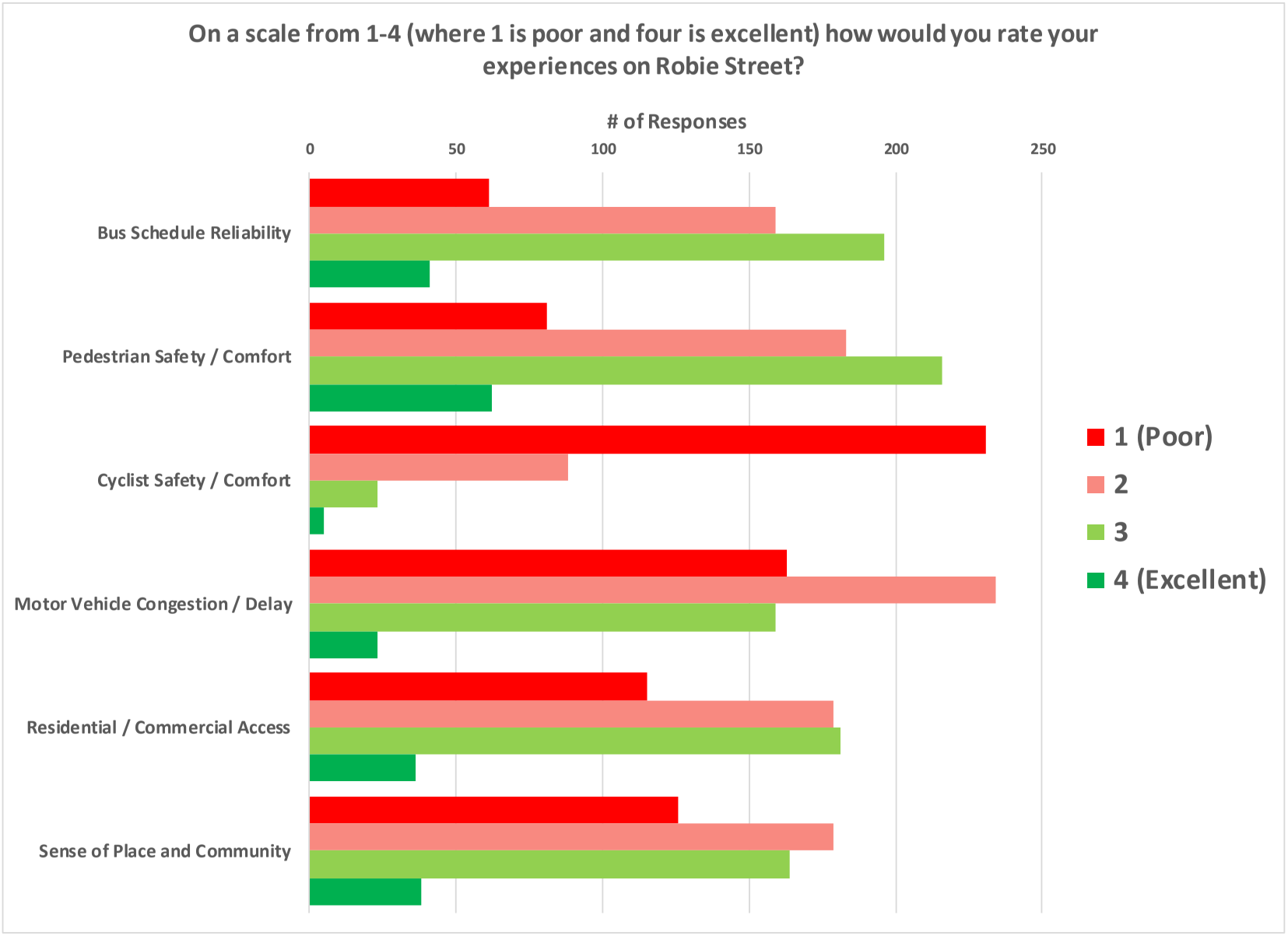
Attachment E

Robie Street



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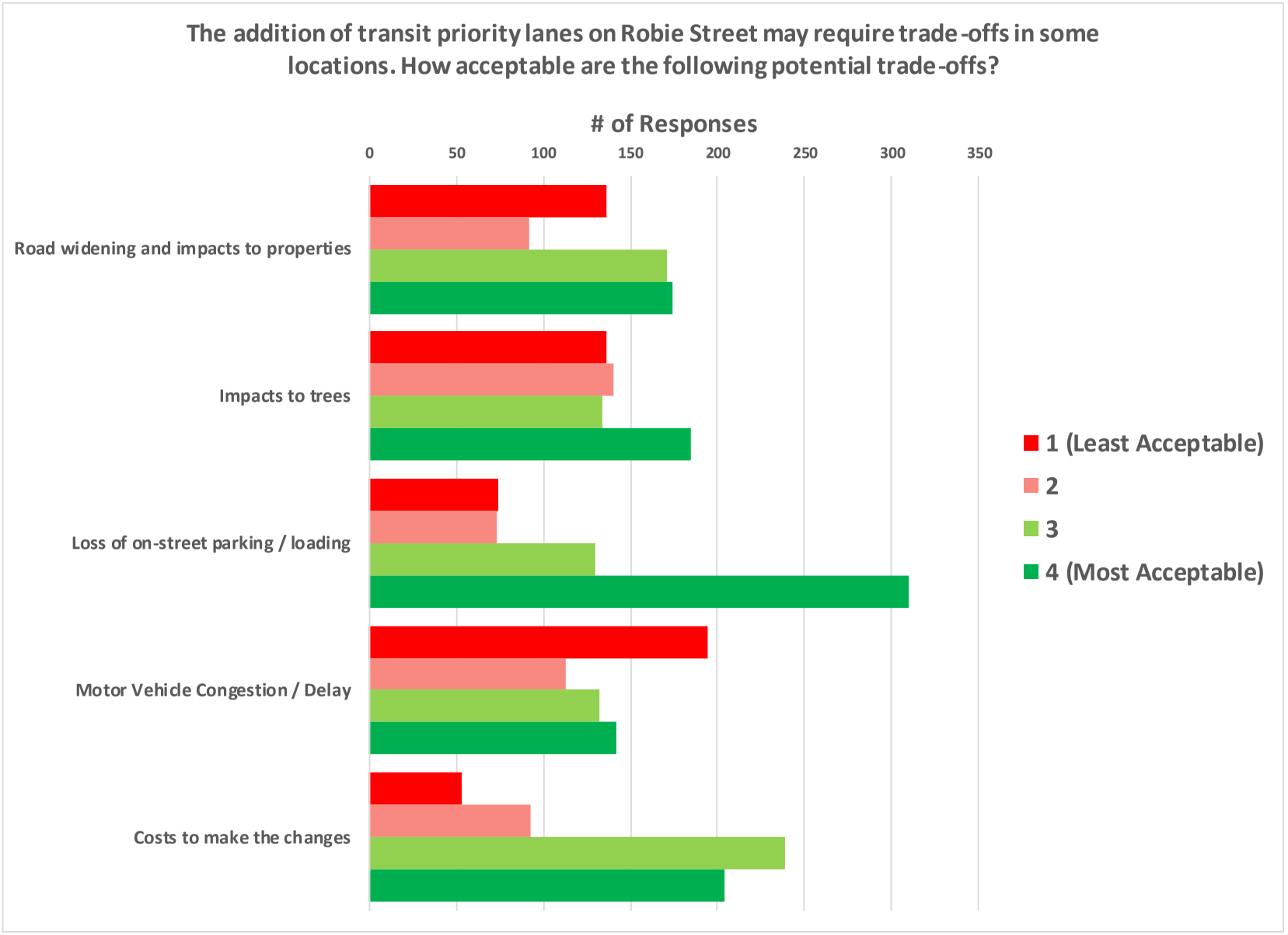
Attachment E

Robie Street



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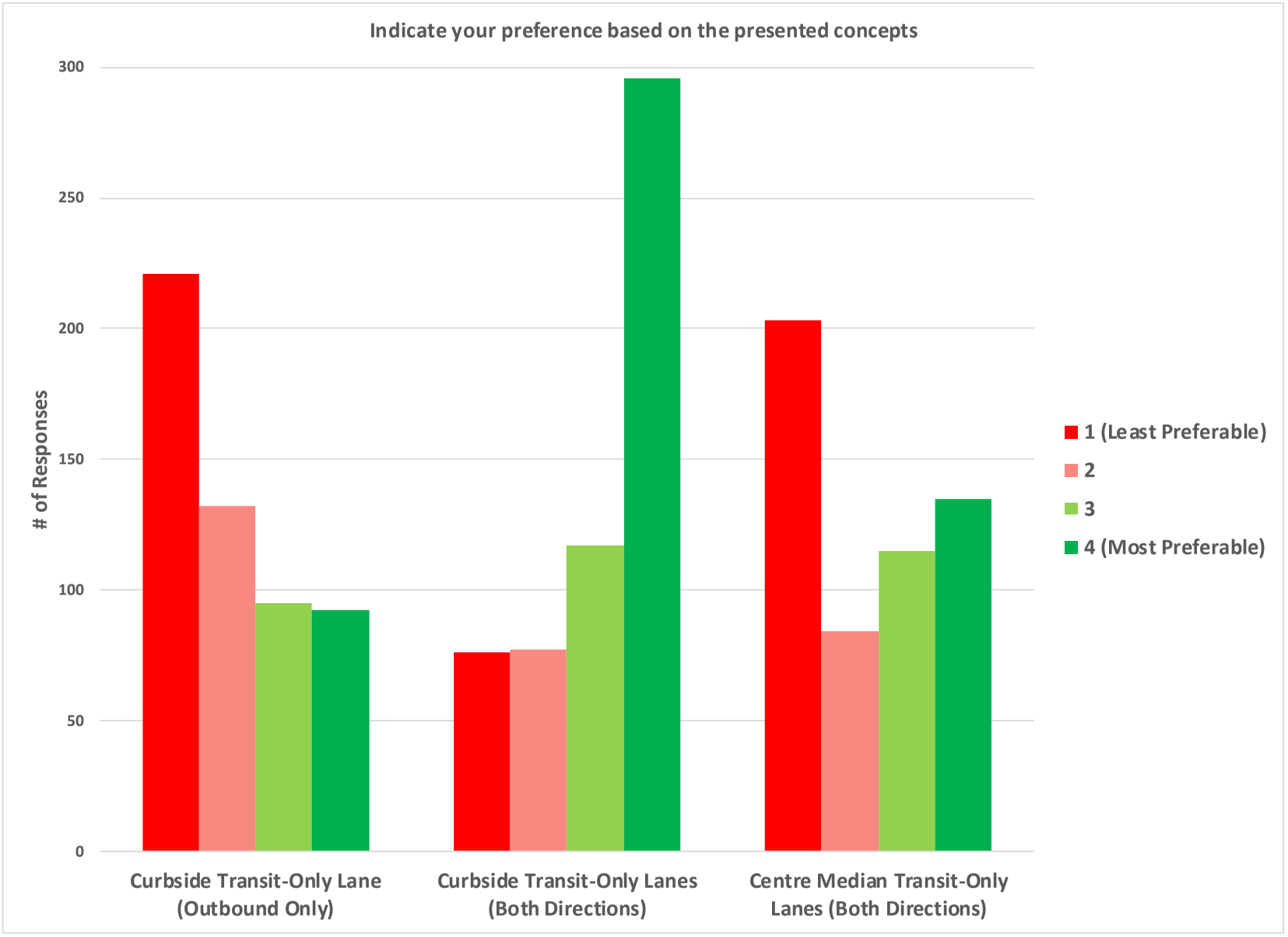
Attachment E

Robie Street



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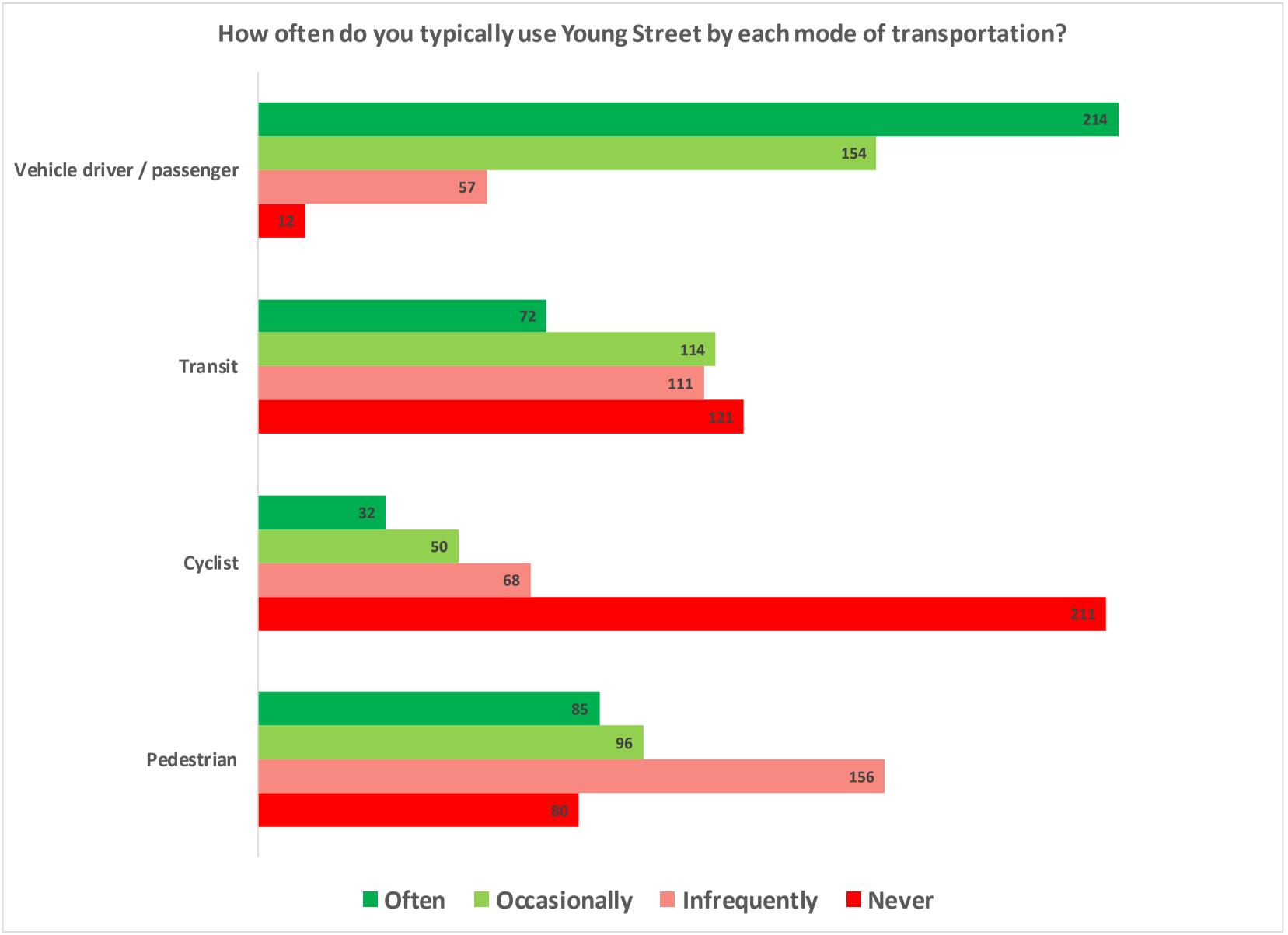
Young Street

Total Participants: Shape Your City Online Survey	442

Attachment E

Young Street



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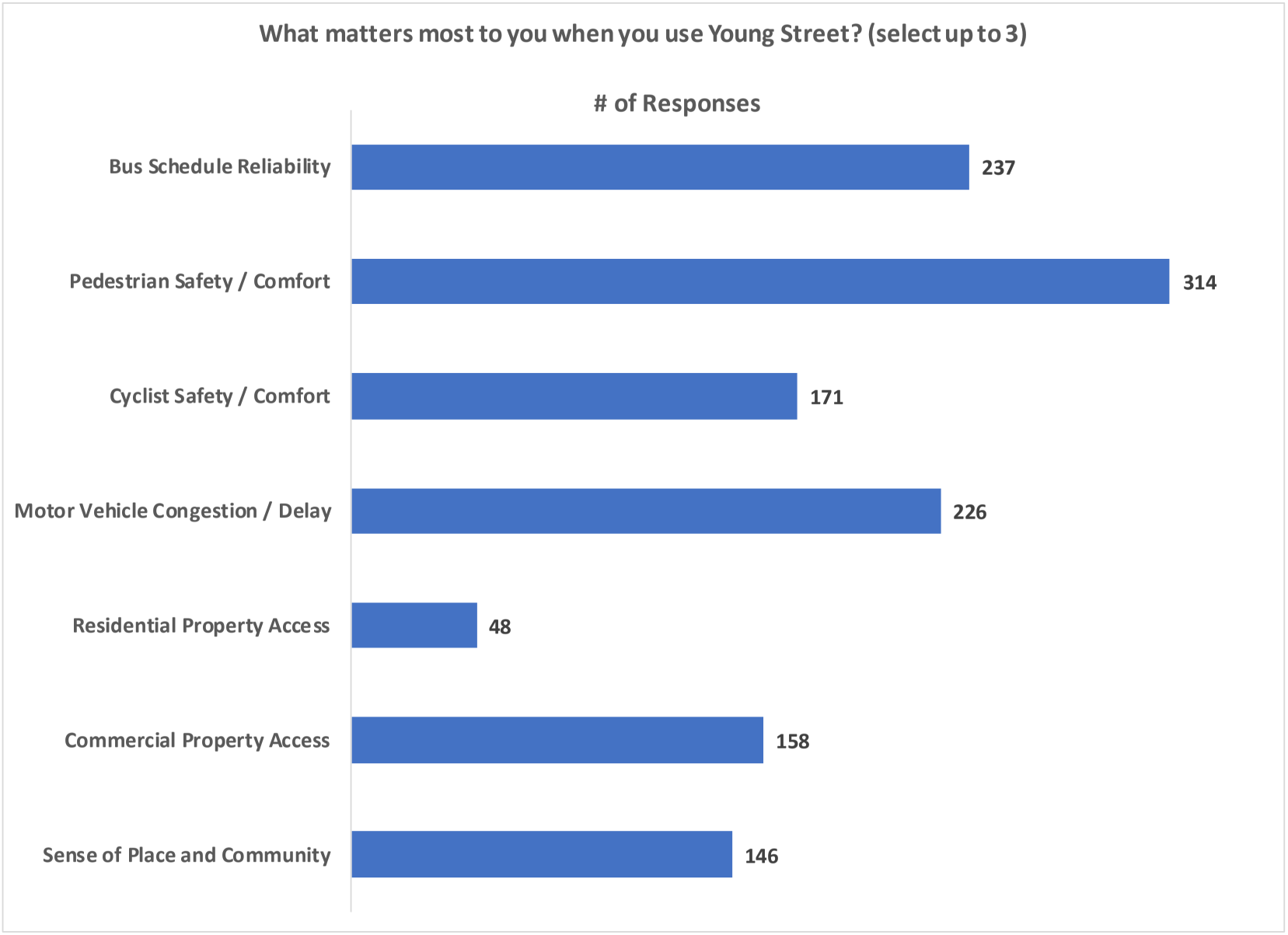
Attachment E

Young Street



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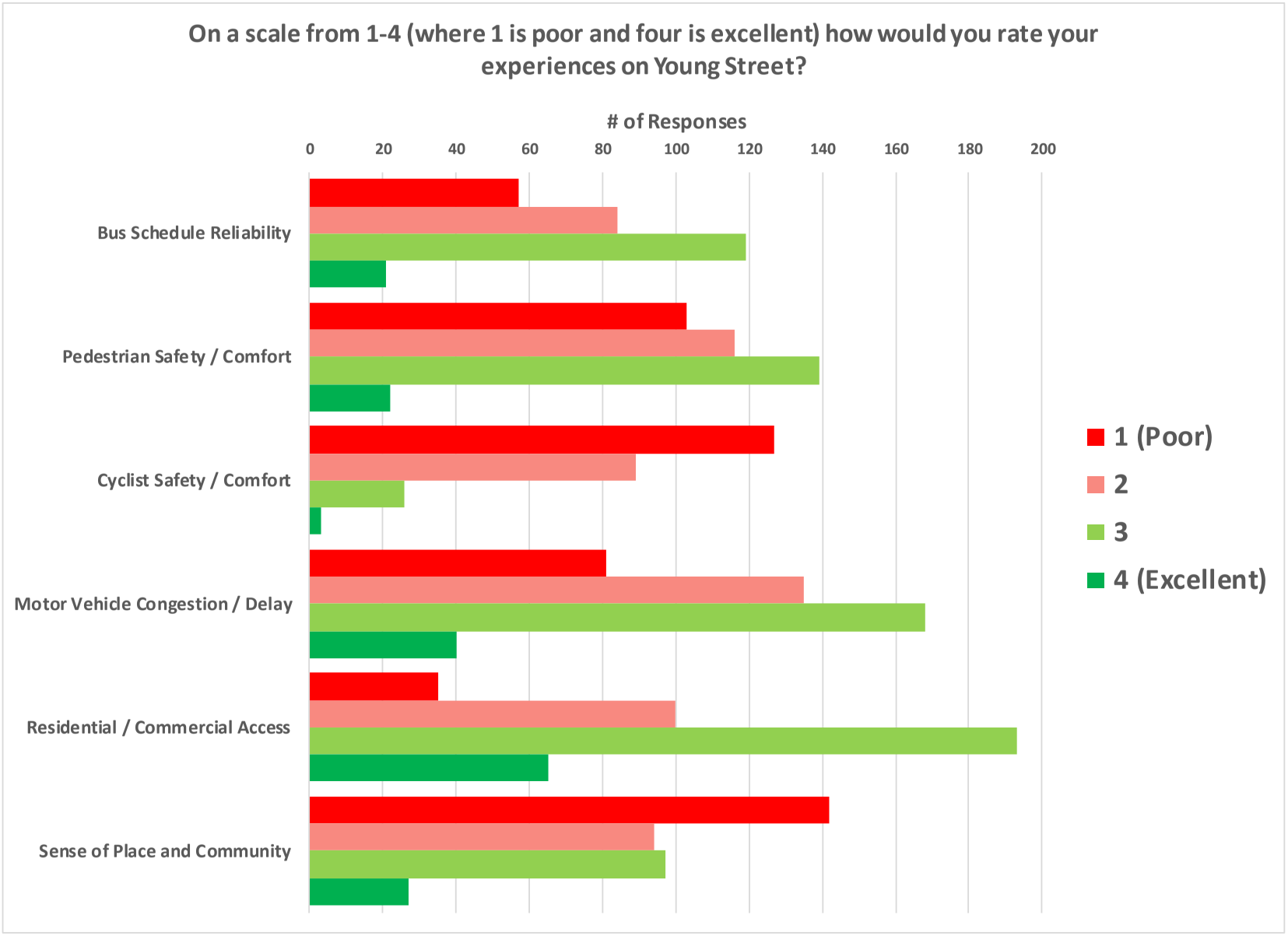
Attachment E

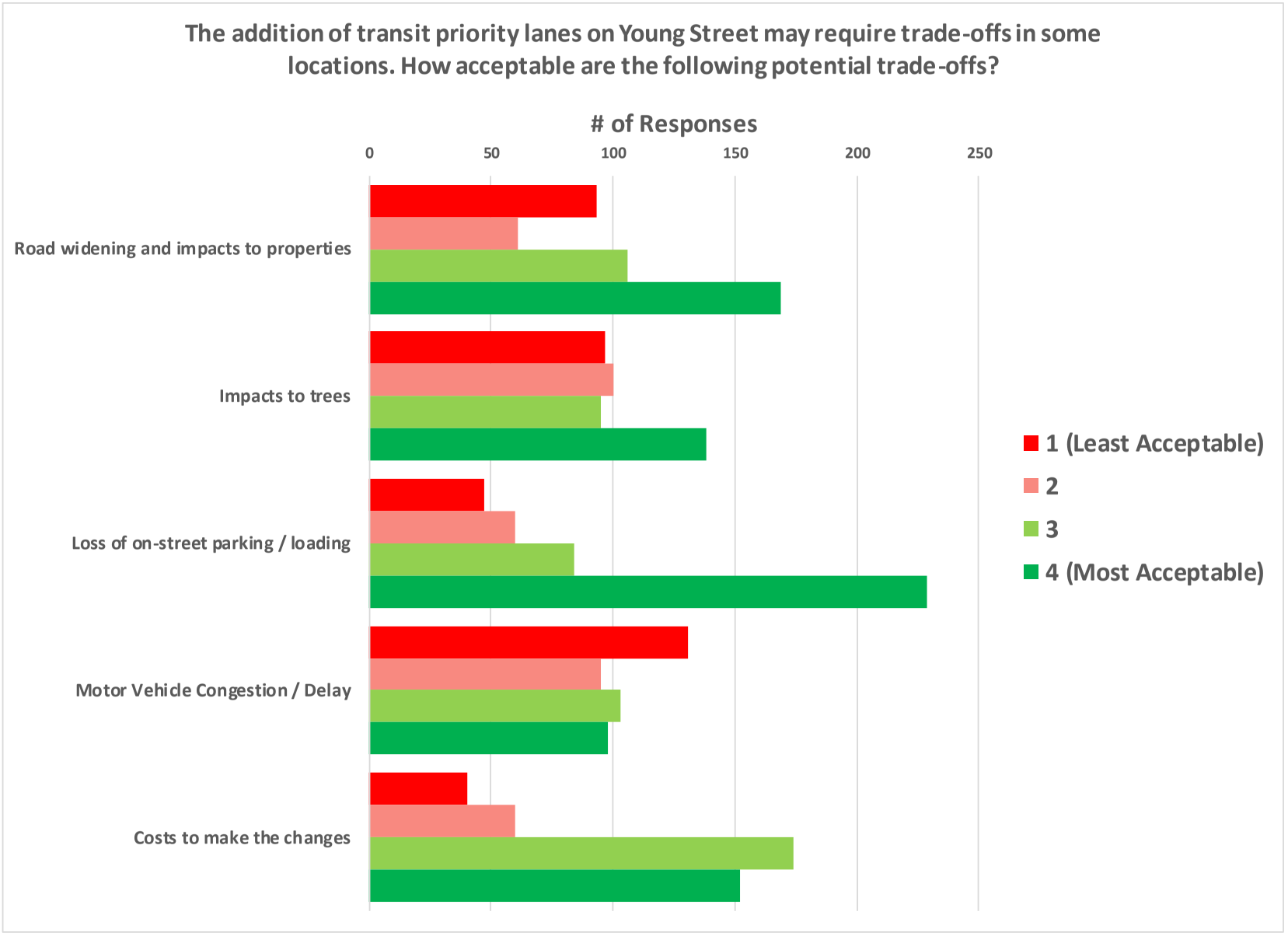
Young Street



HALIFAX

Attachment E

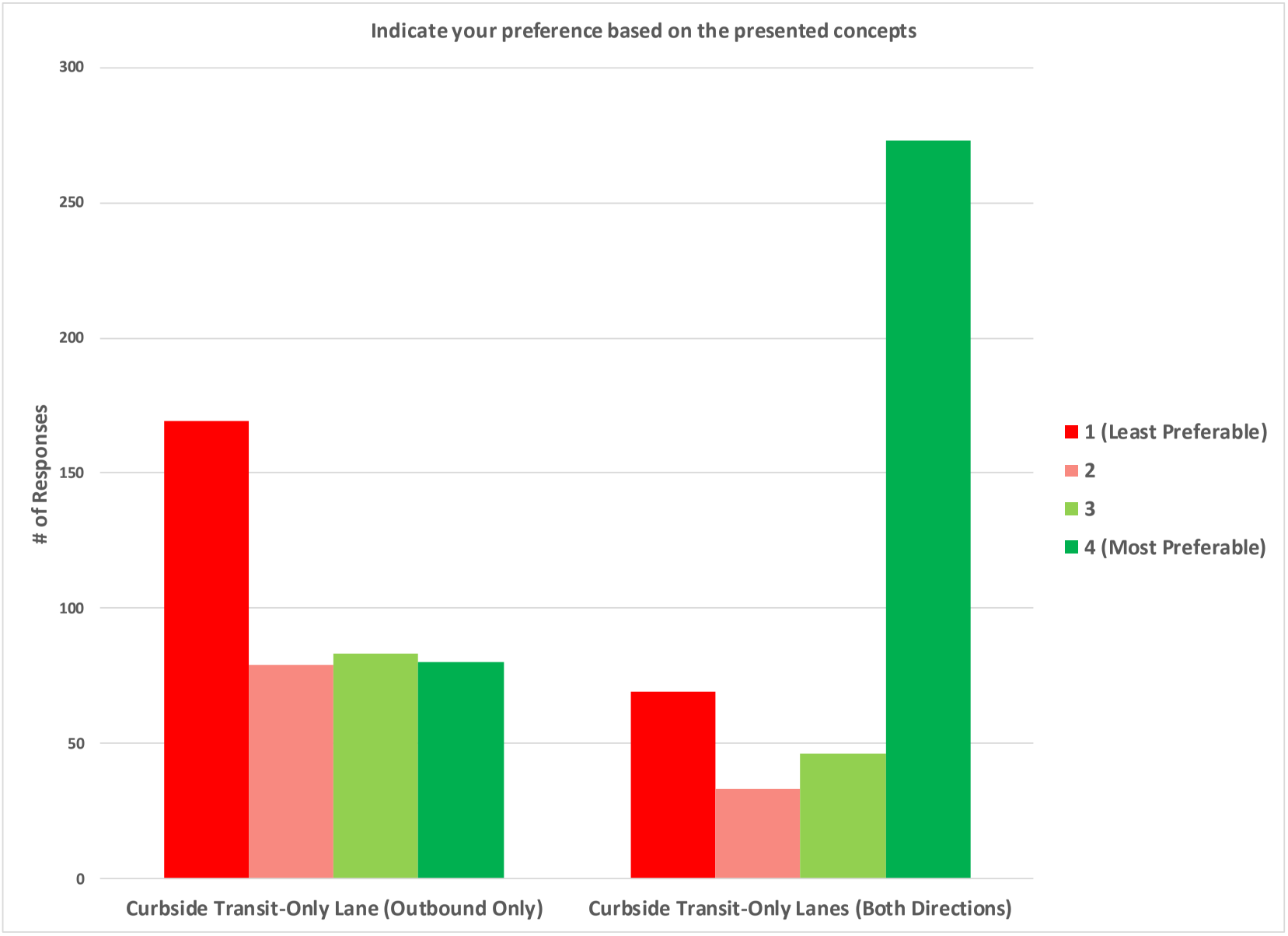
Young Street



HALIFAX

Attachment E

Young Street



HALIFAX