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PRIMARIS

HALIFAX SHOPPING CENTRE ANNEX
GROWTH AREA MOBILITY ANALYSIS

EXISTING CONDITIONS REPORT

EXECUTIVE SUMMARY

Plans are being prepared for a major multi-use development consisting of adding commercial and residential units (high-rise apartments and townhouses) to replace the existing commercial space on the site at the Halifax Shopping Centre Annex in Halifax, Nova Scotia. The Halifax Regional Municipality (HRM) has requested that a Growth Area Mobility Analysis (GAMA) be completed to review the existing, planned, and proposed transportation conditions around the site as well as how multimodal connections and accommodation can be provided within and near the site to further encourage trips by non-auto modes.

Buildout of the site is assumed by 2030. The proposed mixed-use development is expected to add 1,344 high-rise apartments and 42 townhomes to about 10,800 square feet of commercial floor area. The site concept for the combined sites and study intersections and streets are identified below.





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1 NEIGHBOURHOOD CONCEPT

1.1 INTRODUCTION

Plans are being prepared for a major multi-use development consisting of adding commercial and residential units (high-rise apartments and townhouses) to replace the existing commercial space on the site at the Halifax Shopping Centre Annex in Halifax, Nova Scotia. The location of the site is shown by the star in Figure 1 in the existing commercial area (Halifax Shopping Centre Annex) on the south side of Mumford Road. The Halifax Regional Municipality (HRM) has requested that a Growth Area Mobility Analysis (GAMA) be completed to review the existing, planned, and proposed transportation conditions around the site as well as how multimodal connections and accommodation can be provided within and near the site to further encourage trips by non-auto modes. The HRM provided general scope of a GAMA is included as Appendix A. The GAMA considers transportation mobility and identifies actions that will help connect the site to existing and planned transportation infrastructure including pedestrian facilities, bike connections, transit routes, and automobile routes. WSP Canada Inc. has been retained to complete this GAMA for the proposed Halifax Shopping Centre Annex development. Buildout of the site is assumed by 2030.

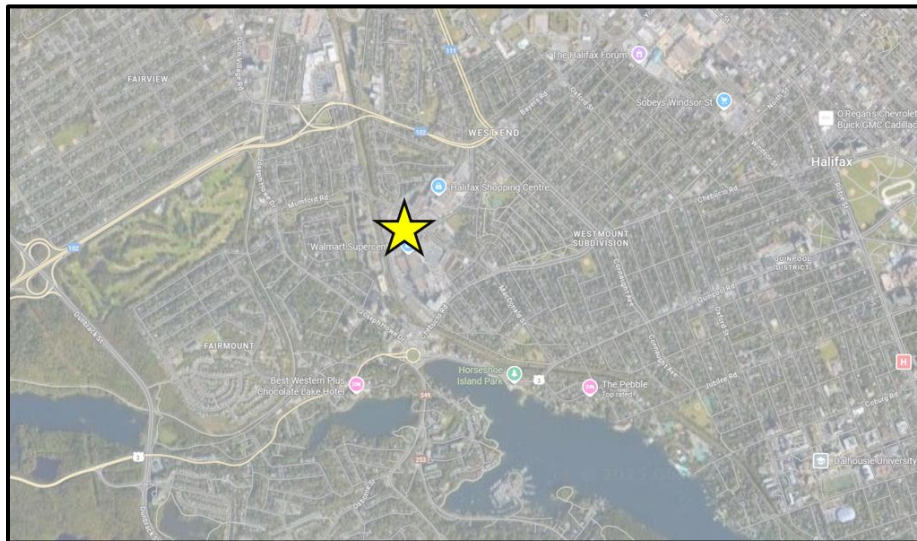


Figure 1 – 3D rendering of proposed development

1.2 VISION AND PRINCIPLES OF THE NEIGHBOURHOOD

Primaris intends to demolish the existing retail buildings on the site and develop two multiuse buildings with a total of 4 residential towers across the property. Grade-related dwelling units, and commercial and office uses are proposed within the building podia, with parking underground. The building and tower heights in the development are distributed to create a gradual transition up in height from the existing residential neighbourhood to the north. From north to south, the development first features a park space and a building podium of 4-5 storeys, then a 22-storey tower, then towers with 32 and 37 storeys, and finally the tallest 42-storey tower located at the southern corner farthest from the existing neighbourhood. Taken together, the differing tower heights create visual interest and a sense of rhythm and variety when viewed from the surrounding neighbourhoods.

The development includes significant public benefits with the integration and upgrade of the Mumford transit terminal as well as a large, high-quality, community space that could be used for several public uses. The proposal includes thoughtful placement of publicly accessible pedways and elevators to enhance convenience and safety for transit users connecting to Halifax Shopping Centre and other local destinations. The proposal also includes the development of a publicly accessible park at the northern end of the property.

1.3 UNIQUE CHARACTERISTICS OF THE AREA

This site includes an existing transit terminal and commercial space surrounded by nearby residential development and additional commercial space. These characteristics will be further expanded with mixed-use (commercial and residential units) replacing the existing commercial space on the site.

The existing site includes large areas of surface parking that have been used for existing commercial space. This parking has essentially provided a land bank for increasing density on the site by transforming the surface parking areas to a mixed-use node.

2 EXISTING CONDITIONS REVIEW

2.1 CONTEXT OF THE DEVELOPMENT

The subject site is in the West End of Halifax as identified in Figure 1 and is bordered by Mumford Road to the north which supports the current transit routes that service the onsite Mumford Road Terminal and arrive and depart the area from Mumford Road and the Halifax Shopping Centre driveway. The Armdale Roundabout and Highway 102 are located near the site providing good access to destinations outside of the Regional Centre.

Currently the site is occupied by the Halifax Shopping Centre Annex which includes an existing retail plaza, a Tim Horton's with a drive through window, and exterior surface parking.



Figure 2 – Development Context

2.2 DEFINING THE STUDY AREA

The Study Area (See Figure 3) for this GAMA includes the segment of Mumford Road between Romans Avenue and the HSC driveway, and six study intersections. Existing MMLOS has been prepared (See Appendix B) for Mumford Road between Romans Avenue and the HSC Driveway as well as the six study intersections.



Figure 3 - Study Area

2.3 OPPORTUNITIES & CHALLENGES

The proximity of the site to Highway 102 and Armdale Roundabout provides opportunities for vehicular mobility for regional access. The site location on the western border of the Halifax Peninsula presents the opportunity for a new “inland downtown” by intercepting regional travellers, employees, visitors, and shoppers in a complete community with services, shopping, jobs, and other amenities. Redevelopment of the site also provides the opportunity to integrate a modern transit terminal into the neighbourhood and to reimagine the function of Mumford Road by redeveloping the eastern side of the corridor to safely accommodate all road users. The addition of ground floor uses along the corridor and mid-block crossings would also create a more friendly pedestrian environment.

2.4 TOPOGRAPHY AND BARRIER MAPPING

In addition to the topography of the area (See Figure 4, star shows site location) there is a CN-owned rail line bordering the western side of the site. This barrier limits access to destinations west of the development and the existing bridge on Mumford Road over the CN-owned rail line has steep grades which may not be suitable for cycling. There are no additional nearby rail crossings limiting access to nearby residential development. Chebucto Road is also a barrier to the site with limited crossing opportunities for pedestrians and cyclists and significant grades. Significant grades along the entire site have resulted in large retaining walls and fences that separate commercial and residential areas limiting walking/rolling and cycling in the neighbourhood.



Figure 4 – Topographic Map (Source: <https://en-ca.topographic-map.com/>)

2.5 EXISTING & PLANNED TRANSPORTATION INFRASTRUCTURE

The existing transportation infrastructure is shown in Figure 5. There is concrete sidewalk along both sides of Arterial and Major Collector roads in the project area. There is a multi use path along the south side of Bayers Road. There is also a trail / multi use path along the west side of Joseph Howe Drive which is part of the Chain of Lakes Trail. There are dedicated eastbound and westbound transit lanes on Bayers Road between Romans Avenue and Connaught Avenue and there is a dedicated eastbound transit lane on Mumford Road between Romans Avenue and Chebucto Road. There are no onstreet bicycle lanes in the area though dedicated transit lanes can be used by cyclists.



Figure 5 – Existing Transportation Infrastructure in Study Area (Source: Explore HRM)

2.6 EXISTING & PLANNED TRANSIT

The existing transit routes within the study area are shown in Figure 6 with existing transit stops shown in Figure 5.

Within the study area lies the Mumford Terminal which is serviced by 12 different transit routes including four corridor routes (Route #1, Route #2, Route #3, and Route #9+). Frequency and ridership data for each corridor route that services the Mumford Terminal are summarized below.

Corridor Route #	Peak Headway	Daily Riders (2024)
1	10	8,167
2	15	5,162
3	15	7,594
9+	15	4,466

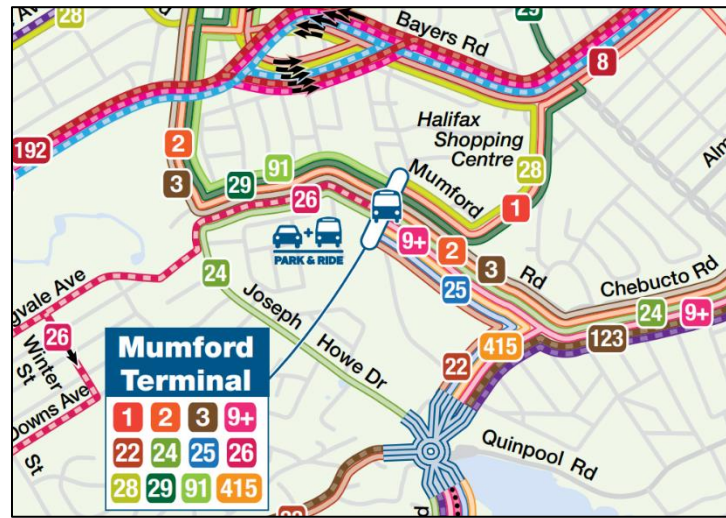


Figure 6 – Existing Transit Routes within the Study Area

The Mumford Transit Terminal is the third busiest transit terminal in HRM. The facility is at the end of its service life and is undersized for current demands. HRM's Rapid Transit Strategy has planned the yellow Bus Rapid Transit (BRT) line to access Mumford Terminal via Mumford Road and East Perimeter Road (HSC Driveway). This will provide all-day two-way high frequency transit service to residents. Transit priority corridors are in the process of being established along Bayers Road, Young Street, and Robie Street. These corridors are in the vicinity of the development.



Figure 7 – BRT Route Map (Extracted from Halifax Transit Rapid Transit Strategy)

2.7 EXISTING & PLANNED NEARBY LAND USES

The land use mix surrounding the existing site already includes significant retail / commercial uses and the addition of increased density residential development with this redevelopment generates significant opportunity to pair origins and destinations within short distances accessible by walking. The walkable distance within a 15-minute walk of the site is shown in Figure 8 and includes Westmount Elementary School and St. Agnes Junior High School, churches, and nearby recreational fields and parks. There is currently a Sobeys and a Walmart within a 15-minute walk of the site.

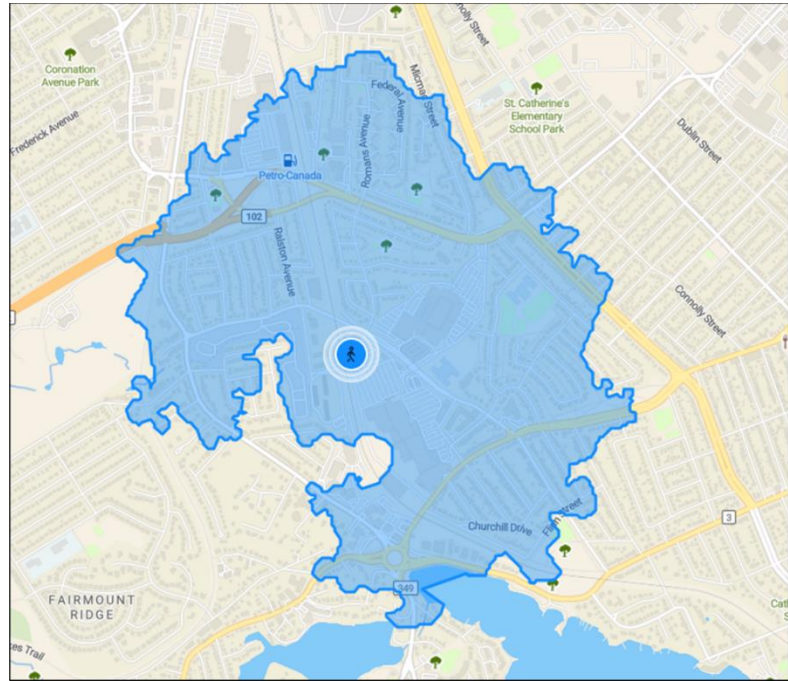


Figure 8 – 15-Minute Walking Distance

Within a 15-minute cycling distance (shown in Figure 9) much of Peninsular Halifax is accessible including Kings College, the Halifax Common, and the Halifax Forum. Within a few extra minutes of cycling time Dalhousie University, Mount Saint Vincent University, Saint Mary's University, the IWK and remaining sites of the Queen Elizabeth Health Sciences Centre.



Figure 9 – 15-Minute Cycling Distance

In addition to the current land uses within the remainder of the site itself (retail, office) the site is surrounded by supportive land uses (e.g., restaurants / general retail, parks, education, office, childcare) within the walkshed and bikeshed areas identified in Figure 8 and Figure 9. The supported land uses in the area, shown in Figure 10, display what is in the area and what are the important walking/rolling/cycling paths and connections to be considered to/from the development.

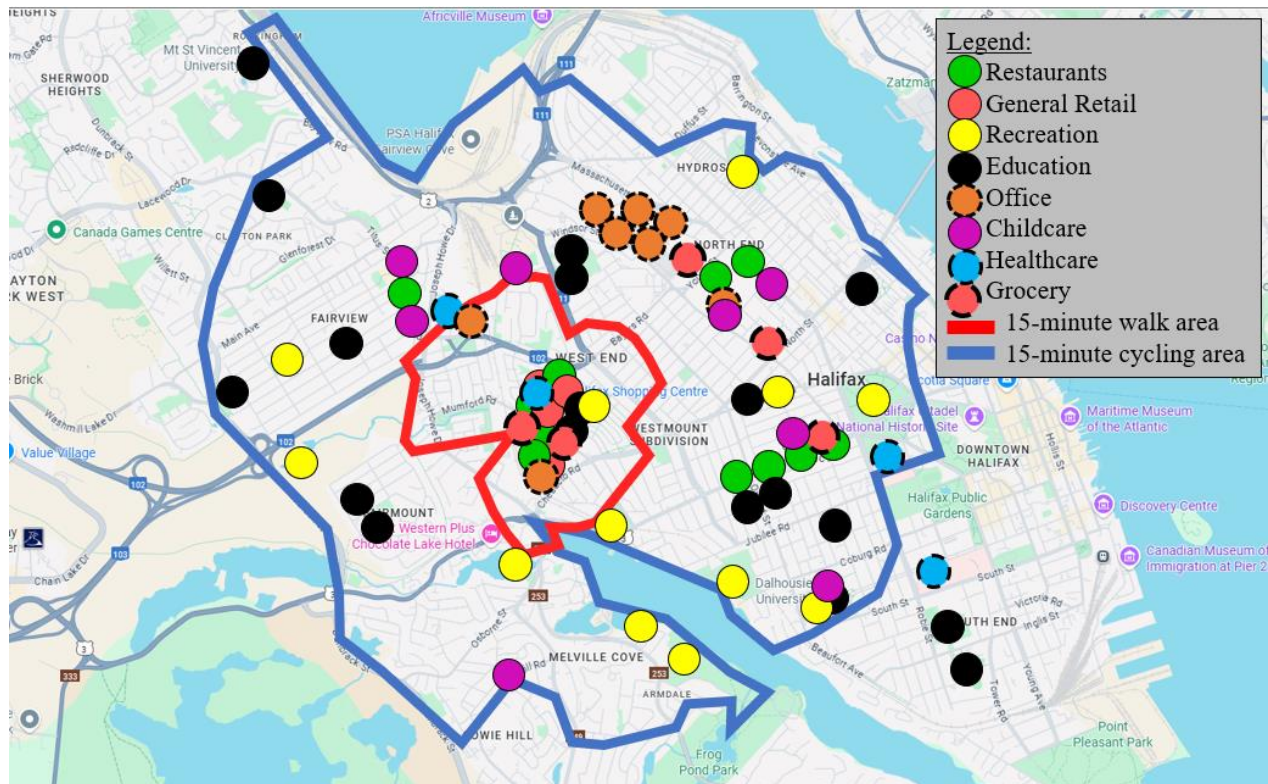


Figure 10 – Existing Land Uses and 15-minute distances with added AT connection to existing site

2.8 REVIEW OF PREVIOUS STUDIES

The HRM Rapid Transit Strategy includes the introduction of four BRT lines including the yellow line (See Figure 7) which would service the Mumford Terminal. Halifax Transit is currently undertaking a planning and design project that would implement changes at the Mumford Terminal to accommodate additional capacity at the terminal and better accommodate BRT at the station. This project is currently underway and it is understood that recommendations will be provided to the developer as that project continues to ensure that the terminal modifications can be incorporated into the development plan.

There were no other specific studies that were identified in the immediate area that were reviewed as part of the mobility analysis however there are a number of regional studies and reports that include the opportunities in the area including:

- Integrated Mobility Plan (IMP)
- Moving Forward Together Plan
- Centre Plan
- HalifACT 2050
- Active Transportation Priorities Plan

2.9 REVIEW OF HRM PLANS & POLICIES

During development of this Growth Area Mobility Analysis there have been meetings with HRM staff to discuss relevant plans and policies that are relevant to the growth node. The studies and reports listed in Section 2.8 include relevant sections to the Halifax Shopping Centre Annex Area as outlined below.

Unanimously approved by Regional Council in 2017, the Integrated Mobility Plan (IMP) provides guidance on augmenting the regional transportation systems in coordination with the eventual adoption of the Regional Center Plan. With focus on active modes and transit as well as transportation demand management in an effort to *manage congestion rather than eliminating it* the IMP examined all aspects of mobility within HRM. Emphasis was placed on

creating complete communities, moving people efficiently, and managing congestion by implementing integrated solutions. As indicated in *Figure 10* of the IMP and extracted and shown as *Figure 11* below, the subject site is located near the Mumford Road transit priority corridor (between the Halifax Shopping Centre driveway and Chebucto Road). Nearby Bayers Road and Chebucto Road are also identified as transit priority corridors. The site has also been identified as a prime candidate for a *Transit Oriented Community*. These areas are defined as sites where “there are opportunities for compact, mixed-use, complete communities within a ten-minute walking distance of proposed or existing transit terminals”. The objectives of the mobility plan had been analyzed and implemented in the design proposal from the beginning, focusing on creating a transit-oriented community in line with HRM’s vision for new developments along Transit Priority Corridors and adjacent to transit terminals.

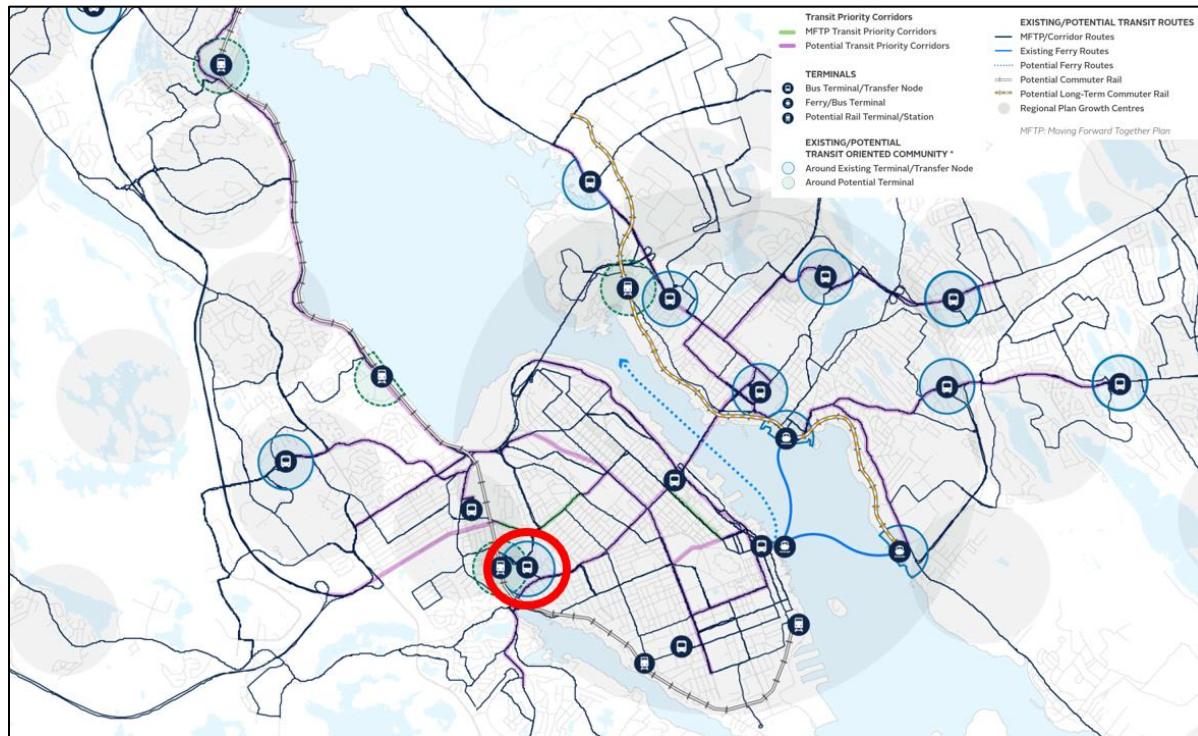


Figure 11 – Potential Transit Oriented Communities (Extracted from HRM Integrated Mobility Plan)

The HRM Regional Centre Secondary Municipal Planning Strategy establishes the West End Mall Lands as a future growth node with the following objectives:

1. Provide for diverse and inclusive opportunities for public engagement during the master neighbourhood planning process;
2. Identify and preserve significant environmental and cultural features;
3. Support the development of mixed-use neighbourhoods with a range of housing opportunities, places of employment, and services where daily needs of residents can be met;
4. Support a transportation network that prioritizes transit, pedestrians and cyclists, and is connected to surrounding communities;
5. Provide public parks, open spaces, and community facilities that meet the recreational needs of residents;
6. Integrate new developments with surrounding uses and neighbourhoods;
7. Support the creation of healthy and pedestrian-oriented places that consider human-scale design, food security, urban agriculture, and the conservation of energy;
8. Mitigate overland and coastal flooding, and manage stormwater on-site; and
9. Consider risks, impacts and opportunities associated with nearby railways, highways, and high-traffic arterial roadways.

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.

The Moving Forward Together Plan established 10 corridor routes throughout the municipality, and these routes were implemented with frequent service (5 to 15 minute peak headways) with 10 to 30 minute headways during off peak periods and daytime service 7-days per week. Route #1, Route #2, Route #3, and Route #9+ (formerly Route #9 Herring Cove) are four of these corridor routes that service the Mumford Transit Terminal with routing in the study area shown in Figure 6. Route #8 (also a corridor route) does not service the Mumford Transit Terminal but does run along Bayers Road.

Making Connections: 2014-2019 Halifax Active Transportation Priorities Plan recommended where and how the Municipality planned to build new active transportation greenways, sidewalks, and enhanced bicycle facilities. The plan for this area (See Figure 12) indicates a proposed local street bikeway on Romans Avenue.

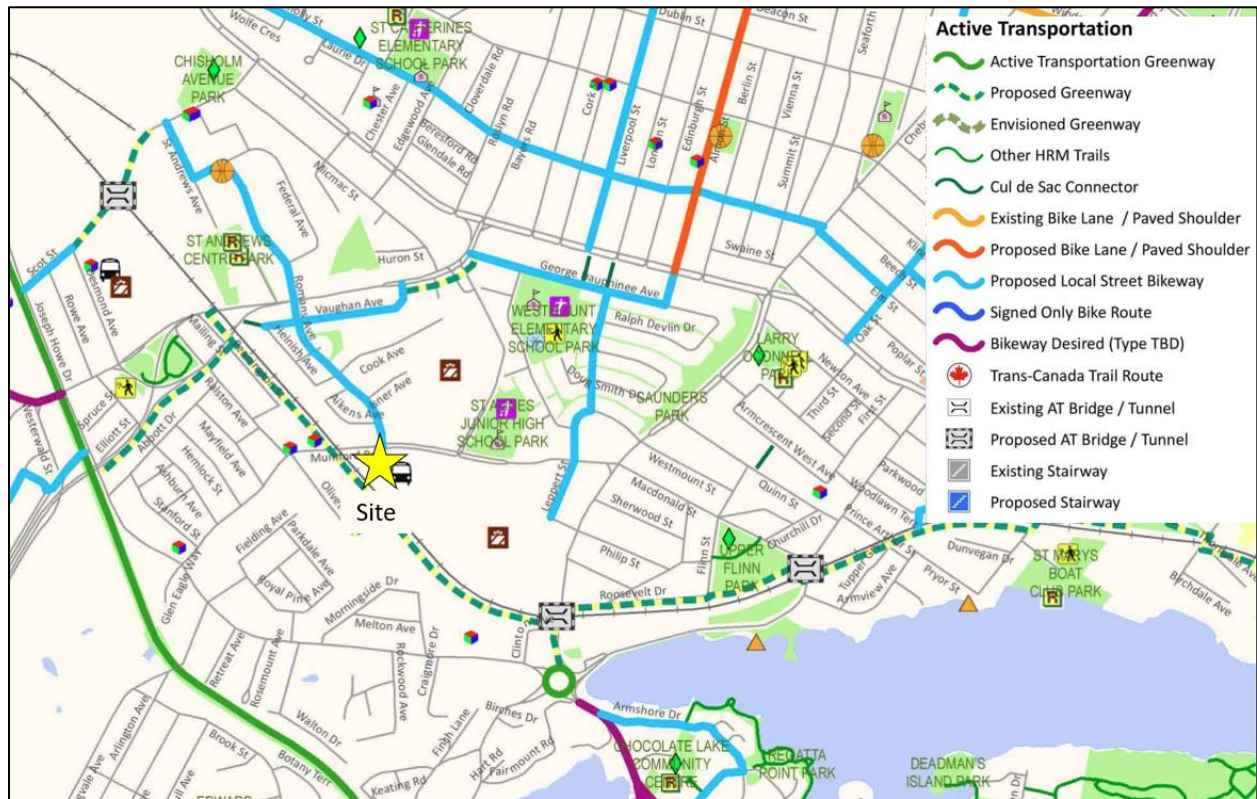


Figure 12 – AT Priorities within project area (Extracted from Map 2B, Making Connections)

2.10 REVIEW OF EXISTING TRANSPORTATION OPERATIONS

GAPS IN EXISTING INFRASTRUCTURE

A review of the streets surrounding the site identified that there are limited cycling connections as there is limited existing cycling infrastructure in the area. There is no cycling connection to the existing multi use pathway on Bayers Road or the multi use pathway on Joseph Howe Drive. There is good sidewalk connectivity on all public roads within the area. Figure 13 shows the study area existing active transportation infrastructure within the study area and identifies connectivity gaps.

2.10.1

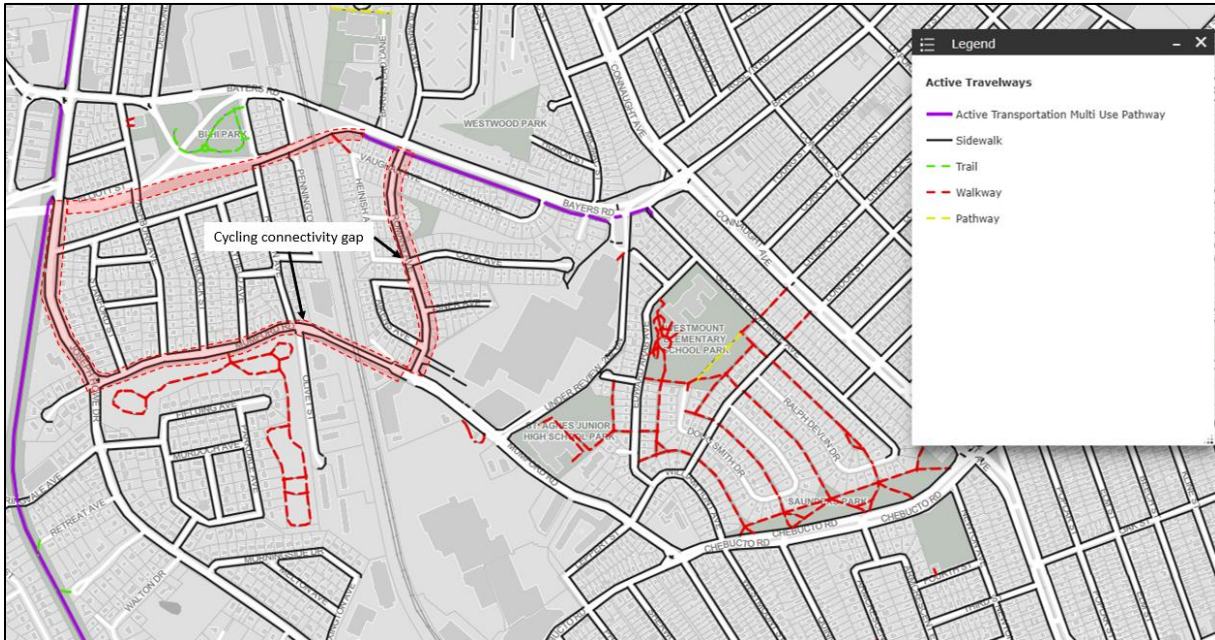


Figure 13 – Existing Active Transportation Infrastructure in Study Area (Source: Explore HRM)

2.10.2

REVIEW COLLISION DATA

In preparation for the project, WSP reviewed historical collision data available from HRM in the project area between January 2018 and May 2025. During the data period, reported data includes 335 total collisions with no fatal, 58 injury, and 277 property damage only collisions. Frequency of collisions in the study area are shown in Figure 14. Collisions where the location of the collision could not be determined (not at a study intersection, not within an existing parking lot, etc.) are not shown on the figure but are included in the review of collision data.

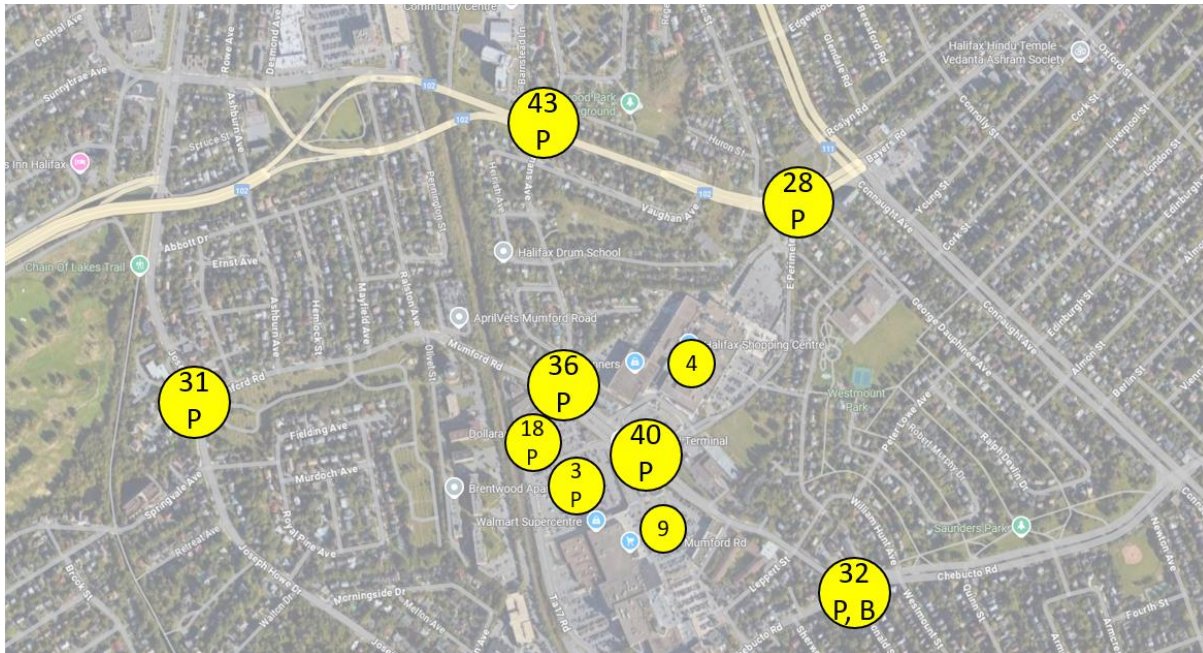


Figure 14 – Collision Frequency History (2018-2025)

The following collision configurations were found to be the most frequent for multiple vehicle collisions experienced within the HSC Annex project area:

- **Rear-End Collisions** were found to make up 30% of all collisions recorded within the available collision data from 2018-2025
- **Same Direction Side Swipe** were found to make up 26% of all collisions recorded within the available collision data between 2018-2025.
- **Pedestrian Collisions** were found to make up 11% of all collisions recorded within the available collision data between 2018-2025.

All intersections in the study area have at least one pedestrian collision within the time period. There is significant pedestrian collision history at the Mumford Road at Romans Avenue and Mumford Road at the HSC Driveway intersections. Several collisions in the area around these two intersections are pedestrian collisions (27 of 128 collisions). Of the pedestrian collisions, 6 occur at the Mumford Road at Romans Avenue intersection, 14 occur at the Mumford Road at HSC Driveway intersection, 5 occur within the HSC Annex / Walmart parking lot, and 2 are not related to the study intersections or the parking lot. These intersections and parking lots have high pedestrian activity because they are used to access the Mumford Transit Terminal. HRM is currently undertaking a review of the Mumford Transit Terminal to identify the long-term needs of the terminal.

2.10.3

There are also significant vehicle collisions within the HSC Annex parking lot. The removal of surface parking, the redesign of existing road cross sections within the site, and improvements to the Mumford Transit Terminal could improve movements within the area and reduce the collision frequency.

MULTI-MODAL OPERATIONAL ANALYSIS EXISTING CONDITIONS

HRM's Multi-Modal Level of Service (MMLOS) has been applied to the study area roadway segments and intersections identified in Figure 3. MMLOS analysis and results are included in Appendix B. A summary of the existing segment MMLOS for Mumford Road between Romans Avenue and the HSC driveway is included in Table 1 with the intersection MMLOS summarized in Table 2 through Table 7.

Table 1 - Existing Conditions Segment MMLOS – Mumford Road (Romans Avenue to HSC Driveway)

SCENARIO: Mumford Road Between Romans Avenue and HSC Driveway											Area Type: Regional Centre	
MODE												MODE
DIR	AM Peak Hour											DIR
WB ↓	Target	B	B	B	E	E	E	E	B	B	B	Target
	Actual	D	C	C	D	A	D	D	A	C	C	Actual
DIR	PM Peak Hour											DIR
WB ↓	Target	B	B	B	E	E	E	E	B	B	B	Target
	Actual	D	C	C	D	A	C	D	A	C	C	Actual
EB ↑												EB ↑

Table 2 - Existing Conditions Intersection MMLOS – Mumford Road at Romans Avenue

SCENARIO: Mumford Road at Romans Avenue					
Area Type: Regional Centre					
MODE					
AM Peak Hour					
Target	B	B	B	E	E
Actual	D	E	B	D	B
PM Peak Hour					
Target	B	B	B	E	E
Actual	D	E	B	C	B

Table 3 - Existing Conditions Intersection MMLOS – Mumford Road at HSC Driveway

SCENARIO: Mumford Road at HSC Driveway					
Area Type: Regional Centre					
MODE					
AM Peak Hour					
Target	B	B	A	E	E
Actual	D	E	D	C	A
PM Peak Hour					
Target	B	B	B	E	E
Actual	D	E	D	D	B

Table 4 - Existing Conditions Intersection MMLOS – Mumford Road at Chebucto Road

SCENARIO: Mumford Road at Chebucto Road					
Area Type: Regional Centre					
MODE					
AM Peak Hour					
Target	B	B	A	E	E
Actual	E	E	D	D	C
PM Peak Hour					
Target	B	B	A	E	E
Actual	E	E	D	D	C

Table 5 - Existing Conditions Intersection MMLOS – Joseph Howe Drive at Mumford Road

SCENARIO: Joseph Howe Drive at Mumford Road					
Area Type: Regional Centre					
MODE					
AM Peak Hour					
Target	B	B	B	E	E
Actual	E	E	B	B	B
PM Peak Hour					
Target	B	B	B	E	E
Actual	E	E	C	C	C

Table 6 - Existing Conditions Intersection MMLOS – Bayers Road at HSC Driveway

SCENARIO: Bayers Road at HSC Driveway					
Area Type: Regional Centre					
MODE					
AM Peak Hour					
Target	B	B	A	E	E
Actual	D	E	C	C	A
PM Peak Hour					
Target	B	B	A	E	E
Actual	E	E	C	C	B

Table 7 - Existing Conditions Intersection MMLOS – Bayers Road at Romans Avenue

SCENARIO: Bayers Road at Romans Ave					
Area Type: Regional Centre					
MODE					
AM Peak Hour					
Target	B	B	A	E	E
Actual	D	D	B	B	B
PM Peak Hour					
Target	B	B	A	E	E
Actual	D	D	C	C	C

With narrow sidewalk and pedestrian zones, no cycling lanes, and long block lengths, the PLOS and BLOS do not meet HRM targets along Mumford Road between Romans Avenue and the HSC Driveway. The TLOS along Mumford Road is met in the eastbound direction due to the dedicated transit facility along that segment. The TLOS is not met in the westbound direction.

TLOS at the Mumford Road at Romans Avenue intersection is met in the AM and PM peak hours. TLOS is met in the AM peak hour at the Joseph Howe Drive at Mumford Road intersection. PLOS and BLOS are not met at any of the study intersections.



GROWTH AREA MOBILITY ANALYSIS SCOPE (HRM)



GROWTH AREA MOBILITY ANALYSIS

Mobility Vision and Scope

Comprehensive planning presents a generational opportunity to create new neighbourhoods that showcase sustainable approaches to urban design, mobility, and land use planning. The real changes that development can bring to the area are significant opportunities to improve connectivity and shift from the car-focused design to a more sustainable, active, and transit-oriented network.

Mobility Vision

The development must be planned and designed as a **Complete and Transit-Oriented Community** – one that prioritizes sustainable transportation modes (walking/rolling, cycling, and transit) as the primary choices for residents, visitors, shoppers, and employees; one that connects to existing and future sustainable transportation networks; eliminates existing barriers to movement by sustainable modes, connects to surrounding neighbourhoods and the region; and one that provides the things needed for daily life.

The way people move to, from, and through the neighbourhood needs to be considered at three levels: *Internal, Adjacent, and Regional*.

Within the neighbourhood the **quality, continuity, connectivity, and scale for walking/rolling, cycling, and transit must be the prioritized**. The internal network should be designed with shorter block lengths for walking/rolling and cycling via plazas, parks, car-free streets, pathways, etc. The quality, connectivity, continuity, and scale of the network must make it *always available for all ages and abilities*. Efficient servicing of the neighbourhood is also an important consideration.



INTERNAL

The connections to and from the adjacent neighbourhoods should be improved to address existing barriers and **integrate the new neighbourhood in its surroundings** – recognizing the two-way relationship between the existing residents and supporting land uses (schools, shopping, jobs, etc.) that already exist and those in the new neighbourhood.



ADJACENT

As a regionally significant concentration of population, jobs, and land uses, **the regional connections for people moving to, from, and through the area need to be considered**. HRM is continuously planning, designing, and building regional networks that prioritize transit, walking, and cycling. The development must connect, complete, and augment these ongoing efforts.



REGIONAL

And moreover, the new neighbourhood must be planned, designed, and constructed as a complete community that **supports and furthers the goals, ideals, and actions of HRM's various plans and policies**, such as the Regional Plan, Centre Plan, HalifACT 2050, Integrated Mobility Plan, and Rapid Transit Strategy among others.

Scope

Given the above vision for mobility, the scope of the transportation analysis should include the following elements in a final report. HRM staff are available for regular check-in meetings to answer questions, discuss and agree on project direction and refine the neighbourhood's design throughout the process.

Neighbourhood Concept

A preliminary concept plan has likely already been provided to planning staff showing the proposed mix of land uses, residential densities, new internal mobility network, and connections to the existing street network. The goal of prioritizing sustainable transportation modes is supported through strategic land use planning and conceptual design in keeping with planning policies and HRM's environmental and mobility objectives.

1. Clearly articulate the vision and principles for design of the neighbourhood and how these align with HRM's social, environmental, and mobility priorities.
2. Identify unique characteristics of the existing area that will be capitalized upon, as well as new elements that the development will bring to the area.

Existing and Planned Conditions Review

The first task will be to review the land use and transportation conditions in the area to provide a picture of what the area looks like today. Additionally, there will be a need to review HRM's current plans and policies and any recent studies that concern the development and immediate vicinity to understand how HRM has already been planning for the future in the area. This will provide the foundational information to guide the project and analysis.

Document the current and planned conditions for mobility and land use within and surrounding the development including:

- Context of the development within the municipality
- Define the study area for detailed analysis
- Opportunities and challenges
- Mapping of topology, natural barriers, etc.
- Existing and planned transportation infrastructure for all modes
- Existing and planned transit service and stops
- Existing and planned land uses and densities
 - Identify key supporting land uses inside and within a 15-minute walk of the development
 - Retail, Commercial, Health Services, Education, Public Service Facilities, Parks and Greenspace, childcare, spiritual care, etc.
 - Identify land uses that are missing in the area and would be needed to create a complete community
- Review of previous studies completed in the area
- Review of pertinent HRM plans and policies for direction related to the development of the area. Discuss with HRM staff which plans and policies are pertinent to the development, but

these may include: Regional Plan, Centre Plan, Integrated Mobility Plan, HalifACT 2050, Rapid Transit Strategy, and Active Transportation Priorities Plan

Undertake baseline quantitative and qualitative review of existing transportation operations in the area. Discuss the appropriate study area for inclusion in this analysis with HRM staff. Technical work should:

- Identify gaps in connectivity, continuity, and quality of active transportation infrastructure
- Review historical collision data to identify road safety issues in the study area
- Include a multimodal operational analysis of adjacent streets using Vissim microsimulation (supported by Synchro / Vistro, as necessary)
- Include a [Multimodal Level of Service](#) (MMLOS) analysis for boundary streets and any internal streets that will remain in service after redevelopment

HRM will provide available existing conditions data and plans as necessary. HRM's [Open Data portal](#) is also an important source of information. The developer must examine existing data sources to identify any gaps and expect to fill gaps with data collection to support proper analysis of existing conditions.

Travel Demand Forecasting

Development of a new neighbourhood of this scale will naturally create significantly modified travel patterns for residents in the region, the existing local area, and in the new neighbourhood. The provision of new housing, jobs, shopping, parks, and mobility connections from, to, and through the area will redefine the character of the area and the needs related to transportation infrastructure.

Assess the future demands for travel at a regional scale to understand how this neighbourhood will fit into the region and connect to the future multimodal transportation network.

Work with HRM's Transportation Planning department to assess the future travel demand in the area via the municipality's regional travel demand forecasting model for an appropriate future build out horizon year. This analysis should focus on the number of *person trips* (not solely driving trips) moving to, from, and around the development to assess the scale of demand, given the proposed land use mix and density of population and jobs.

This assessment will give direction on the scale and type of transit service, transportation infrastructure, and transportation demand management initiatives that may be required to accommodate the development. It will also serve to characterize the changes in travel patterns that will result from the additional 'gravity' of the new development – how it affects people's daily movement in response to new jobs, homes, services, and amenities in the region.

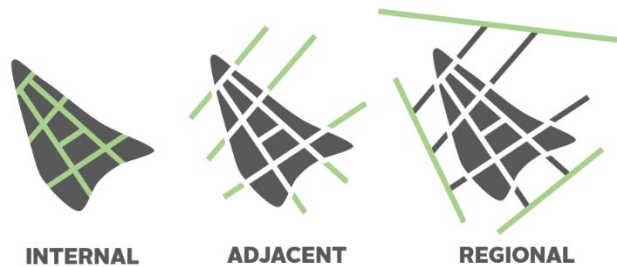
This work should provide the following:

- Quantification of the person-level travel demand to, from, and around the new development
 - Stratify into distance-based categories showing trips within a 15-minute walking distance, 15-minute cycling distance, and beyond to demonstrate the potential for walking, cycling, and vehicular modes

- Establish the existing, expected, and required mode share for sustainable modes based on the forecasted demands and understanding of local operations
- Identification of conceptual changes to the multimodal transportation network needed to achieve the desired mode share
- Initial list of Travel Demand Management (TDM) methods to change the time, route, mode, and/or need for travel

Transportation Analysis

The elements of the mobility design for the neighbourhood can be considered discretely to break down the analysis and focus on specific components, but there will naturally be feedback between these areas in reviewing and revising the design as the analysis proceeds.



The intent is for the developer/landowner to produce detailed analyses of the Internal and Adjacent areas to produce a workable multimodal network to accommodate the mobility needs of the development. The Regional analysis will produce high level information and recommendations for HRM related to system-level network improvements required to move people to and from the development.

The developer/landowner should document and discuss with HRM staff throughout the analysis, but particularly at the completion of each stage of the analysis.

For the Internal Transportation Analysis:

- Establish the internal network of streets, parks, plazas, sidewalks, cycling infrastructure, transit service and stops/stations to create an internal mobility network according to the vision and principles for the development
- Discuss approach to curbside activity, parking, and other servicing functions (waste management, loading, etc.)
- Perform [Multimodal Level of Service \(MMLOS\)](#) *segment* analysis for the internal street network according to HRM's guidelines (ignoring vehicle operations)
- Revise and review the design to meet MMLOS targets. Discuss challenges where the design does not meet the targets and work with HRM staff to overcome the challenges

For the Adjacent Transportation Analysis:

- Map the connections to existing neighbourhoods through existing and future multimodal infrastructure
- Identify and address barriers to movement by sustainable modes to/from adjacent neighbourhoods
- Multimodal operational analysis of adjacent streets using Vissim microsimulation (supported by Synchro / Vistro, as necessary)
- Perform [Multimodal Level of Service \(MMLOS\)](#) analysis for the adjacent street network according to HRM's guidelines for segments and intersections

- Revisit assumptions, mode share, land uses, densities, etc. as necessary to create a viable multimodal transportation network in the study area vicinity to serve the new development, existing demands, etc. and that meets the vision and principles for the development
- Document and discuss operational and MMLoS results, challenges, and solutions to connecting to the adjacent neighbourhoods
- Provide recommendations and cost estimates for infrastructure and transit service improvements

For the Regional Transportation Analysis:

- Quantify and map demand that will be arriving from outside / leaving the Internal/Adjacent study area following previous analysis steps
- Provide high level recommendations to planned walking/rolling, cycling, transit networks and service to accommodate future demand at a system level
- Identify opportunities / challenges related to accommodating additional regional movement given current plans and recommendations

Final Report

Compile the findings of the various analyses into a final report. This report should:

- Describe the vision, process, design considerations, opportunities, challenges, etc. and how the design of the neighbourhood has been undertaken to create a complete community.
- Document all data sources, analyses, and findings
- Provide recommendations on infrastructure, service, and other changes required to accommodate the development and improve mobility options in the area.
- Discuss phasing of the development and the recommended infrastructure
- Provide cost estimates, options for cost-sharing, and responsibilities between HRM and the developer for discussion
- Provide final digital working files, as appropriate, to allow for review by HRM staff – spreadsheets, transportation modelling files, GIS layers, etc.

West End Mall

Site-Specific Considerations

The context and scale of the development provide significant opportunities and challenges related to mobility in the neighbourhood and the region. Below is a brief initial summary of opportunities and challenges for consideration during the project. HRM staff may identify additional matters to consider at a detailed scope meeting with the developer and their consultants. The developer/landowner is also encouraged to expand on these through their work.

Location - As the neighbourhood is located on the western border of the Halifax Peninsula, the ability to intercept regional travellers, employees, visitors, and shoppers in a complete community with services, shopping, jobs, and other amenities in a new “inland downtown” is quite significant. The neighbourhood also sits close to Highway 102 and the Armdale Roundabout, which provide important regional access.

Mumford Transit Terminal – HRM’s third busiest transit terminal is located in the existing development. The facility is at the end of its service life and is undersized for current demands, let alone future growth in transit service and ridership. Integration of a modern terminal into the neighbourhood that incorporates modern amenities, additional capacity, and accessible design is critical to the neighbourhood and will vastly improve the comfort and convenience of residents, shoppers, and employees.

Bus Rapid Transit (BRT) – HRM’s Rapid Transit Strategy presents the municipality’s plan to provide higher order transit service throughout the municipality. In particular, the yellow BRT line is planned to access Mumford Terminal via Mumford Road and East Perimeter Road – providing all-day two-way high frequency transit service that connects residents to the region and directly into the new neighbourhood.

Bayers Road / Young Street / Robie Street Transit Priority Corridors – As part of the overall move to prioritization of transit vehicles along key commuting corridors and the Rapid Transit Strategy, transit priority corridors are in the process of being established along Bayers Road, Young Street, and Robie Street, which provide access to high reliability transit corridors in the vicinity of the development.

Mumford Road - Mumford Road itself presents an opportunity through the project to reimagine its function – particularly in the need to improve priority for transit and cyclists along its length as an important regional connection. Complete redevelopment of the eastern side of the corridor may provide opportunities to provide the necessary right-of-way to safely accommodate all road users via dedicated infrastructure. The street is currently overbuilt in some sections, providing multiple lanes for car traffic despite being capacity-restricted by the two-lane bridge over the rail line at one end and the intersection configuration and distribution of turning movements at the Chebucto Road end. Additionally, the creation of active ground floor uses along Mumford and additional mid-block crossings would create a much friendlier and more useful pedestrian environment, as the corridor is essentially blank at the moment.

Chebucto Road - Chebucto Road is a significant barrier to the new neighbourhood as well, with limited crossing opportunities for pedestrians and cyclists, in addition to significant grades along the corridor. Opportunities to improve this and connections from the new development to nearby amenities such as Flinn Park should be considered.

All Ages and Abilities Cycling Network - HRM is continuing to plan, design, and expand its All Ages and Abilities (AAA) cycling network. Connections to projects underway or complete include the Bayers Road Multi-Use Path, North End and West End Bikeways, the Halifax Urban Greenway, and others. These represent an opportunity to create new connections to and through the new neighbourhood for safe cycling in the region.

Existing traffic congestion – Traffic congestion is a significant consideration in redevelopment of the neighbourhood following decades of car-focused development and infrastructure. This places significant pressure on the developer and HRM to create regionally connected and locally useful routes for sustainable modes that provide more efficient, healthier, safer, and more environmentally responsible ways of moving around. Mitigation measures will need to be proposed that minimize the demand for peak hour car travel to allow the development to be recommended for approval.

Rail line – The CN-owned rail line that forms the western border of the site presents a significant challenge in connecting the new neighbourhood to the established residential and office/retail uses to the west. This redevelopment provides a golden opportunity to create new active transportation (walking/rolling, cycling) crossings to connect these areas to the shops, services, jobs, and amenities in the new neighbourhood. Three distinct crossing points are desirable to connect the disparate areas to the new neighbourhood to connect sections of public right-of-way:

- North – Connection to the tall residential towers on Olivet Street would provide a much needed connection to this dense and underserved small neighbourhood
- Central – Connection through to the collection of homes along Joseph Howe Drive would allow these residents and those to the west to access the area
- South – The collection of commercial buildings in the south is part of the same Future Growth Node as the West End Mall and may undergo a similar transformation and densification as the one envisioned here. Existing employees at these buildings will also benefit from the homes, shops, services, and other amenities in a redeveloped West End Mall.

Steep grades – There are significant grades along the entire site which provide challenges in connecting to the existing network and in the creation of a new network. Consider the grades in creating the new road network to improve accessibility for those walking/rolling and cycling in the area.

Retaining walls – The steep grades in the area have necessitated the use of large retaining walls and fences that separate the commercial and residential areas. These are significant accessibility/access barriers, which limit movement by walking/rolling and cycling in the neighbourhood. The development will need to consider both indoor and outdoor options for barrier free travel.

Existing land use mix – This element is both an opportunity and a challenge for the new neighbourhood, as the mix of retail, health, office, institutional, and other uses currently located in the area make it an important centre of activity. Retaining and expanding upon this important mix of

non-residential land uses in the redeveloped neighbourhood will be critical to creating a complete community – one that can provide everything that residents need to live a full life within the neighbourhood, attract visitors and shoppers, and provide an important ‘town centre’ function in the west end of the Halifax peninsula.

References

- Institute for Transportation and Development Policy: <https://www.itdp.org/library/standards-and-guides/tod3-o/what-is-tod/>
- TransLink Transit-Oriented Communities Framework: <https://www.translink.ca/plans-and-projects/strategies-plans-and-guidelines/transit-oriented-communities>
- Vancouver Olympic Village: <https://vancouver.ca/home-property-development/olympic-village.aspx>
- Transit Oriented Design Institute: <http://www.tod.org/>
- VTPI – TDM Encyclopedia: <https://www.vtpi.org/tdm/tdm12.htm>

The 6 Ds

There are six key attributes (the "6 Ds") that contribute to high levels of transit demand and productive transit service: destinations, distance, design, density, diversity, and demand management.

To be most effective, all "6 Ds" are planned and implemented together at multiple levels of geography, including the regional, corridor, neighbourhood and site scales.

Destinations: Coordinate land use and transportation

When land use and transportation are well coordinated, transit can provide fast, direct, and cost-effective access to more destinations for more people. At the neighbourhood scale, transit-oriented communities locate most new development along reasonably direct corridors so that most destinations are 'on the way' to other destinations. At the regional scale, they locate the highest densities of development and the most important destinations at the intersection of several frequent transit corridors.

Distance: Create a Well-Connected Street Network

A well-connected street network shortens travel distances, making it possible for people to quickly and conveniently walk or cycle to places they want to go, or to easily connect with transit on the way to their destination.

Design: Create Places for People

Transit-oriented communities are carefully designed with the needs of people in mind. People of all ages and abilities should be able to access and enjoy a comfortable, safe, delightful, and inviting public realm.

Diversity: Concentrate and Intensify Activities Near Frequent Transit

Transit-oriented communities concentrate most growth and development within a short walk of frequent transit stops and stations. A higher density of homes, jobs, and other activities creates a market for transit, allowing frequent service to operate more efficiently.

Diversity: Encourage a Mix of Uses

A vibrant mix of land uses helps create complete, walkable neighbourhoods around transit stations and stops, and supports a transit system that is well-utilized throughout the day.

Demand Management: Discourage Unnecessary Driving

Transit-oriented communities use demand management strategies to discourage unnecessary driving and promote walking, cycling, and transit. Demand management provides incentives for travelers to shift auto trips to other modes by increasing travel options, setting appropriate prices for parking or road usage, providing information and marketing, and allocating more road space to transit, cycling, or pedestrian uses.

WALK

DEVELOPING NEIGHBORHOODS THAT PROMOTE WALKING

- OBJECTIVE A.** The pedestrian realm is safe, complete, and accessible to all.
OBJECTIVE B. The pedestrian realm is active and vibrant.
OBJECTIVE C. The pedestrian realm is temperate and comfortable.

CYCLE

PRIORITIZE NONMOTORIZED TRANSPORT NETWORKS

- OBJECTIVE A.** The cycling network is safe and complete.
OBJECTIVE B. Cycle parking and storage is ample and secure.

CONNECT

CREATE DENSE NETWORKS OF STREETS AND PATHS

- OBJECTIVE A.** Walking and cycling routes are short, direct, and varied.
OBJECTIVE B. Walking and cycling routes are shorter than motor vehicle routes.

TRANSIT

LOCATE DEVELOPMENT NEAR HIGH-QUALITY PUBLIC TRANSPORT

- OBJECTIVE A.** High-quality transit is accessible by foot. (TOD Requirement)

MIX

PLAN FOR MIXED USES, INCOME, AND DEMOGRAPHICS

- OBJECTIVE A.** Opportunities and services are within a short walking distance of where people live and work, and the public space is activated over extended hours.
OBJECTIVE B. Diverse demographics and income ranges are included among local residents.

DENSIFY

OPTIMIZE DENSITY AND MATCH TRANSIT CAPACITY

- OBJECTIVE A.** High residential and job densities support high-quality transit, local services, and public space activity.

COMPACT

CREATE REGIONS WITH SHORT TRANSIT COMMUTES

- OBJECTIVE A.** The development is in, or next to, an existing urban area.
OBJECTIVE B. Traveling through the city is convenient.

SHIFT

INCREASE MOBILITY BY REGULATING PARKING AND ROAD USE

- OBJECTIVE A.** The land occupied by motor vehicle is minimized.



B

MULTIMODAL LEVEL OF SERVICE



INTERSECTION Mumford Road at Romans Avenue

SCENARIO Existing AM

PEDESTRIANS = LOS D

- 13 uncontrolled conflicts with pedestrians = LOS D
 - 4 permitted left turns
 - 3 right turn on red
 - 4 right turn on green
- Average Pedestrian Crossing = 20.9 m = LOS E
- Cycle Length = 90 seconds = LOS C

CYCLISTS = LOS E

- 12 uncontrolled conflicts with cyclists = LOS D
 - 4 permitted left turns
 - 3 exclusive right turn lanes
 - 5 lane changes to make a left turn
- No Bicycle Lanes
 - Score = -5% = LOS F
- Cycle Length = 90 seconds = LOS C

TRANSIT = LOS B

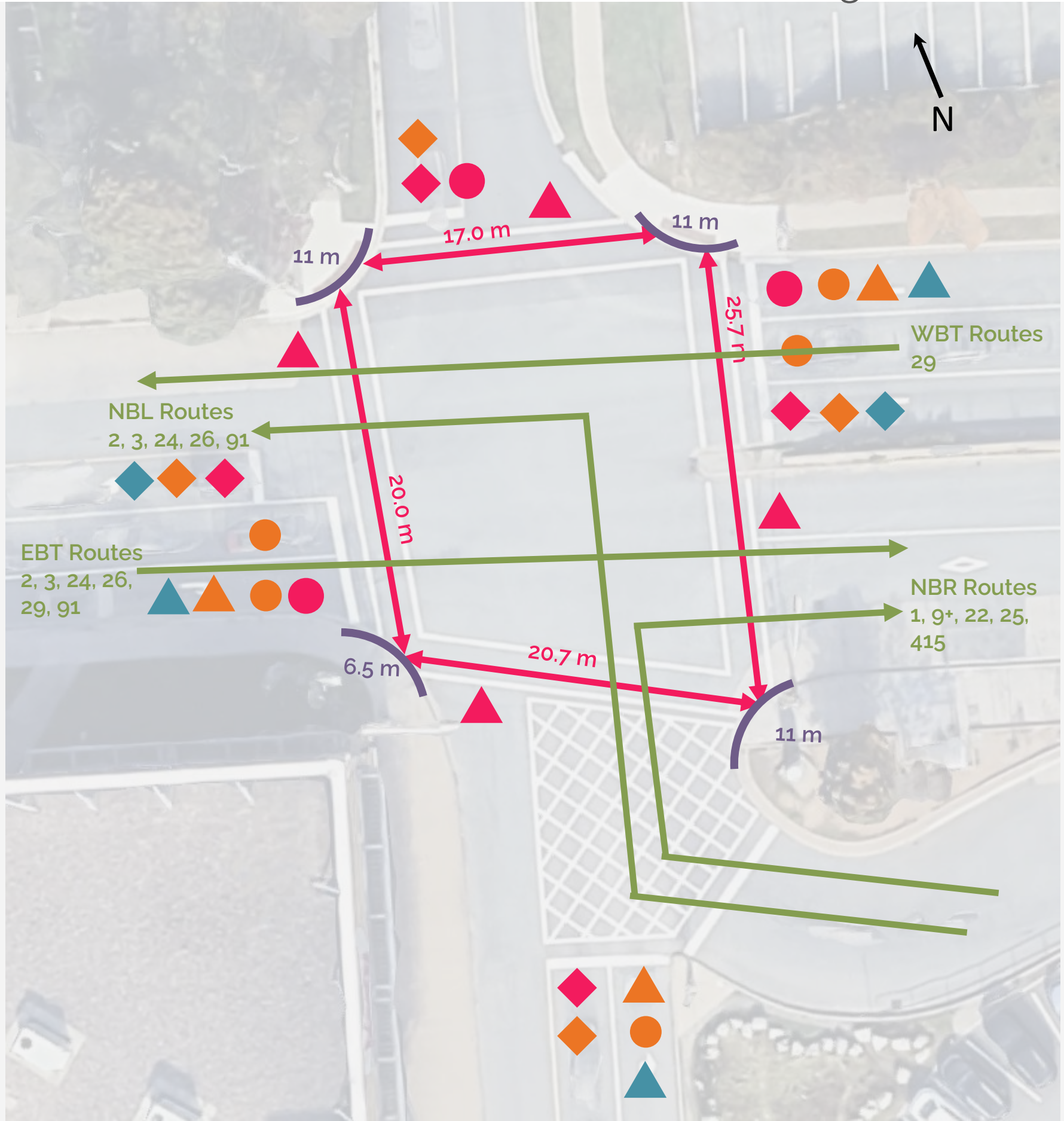
- No planned transit priority elements = LOS N/A
- $V/C = (0.13+0.16+0.17+0.59)/4 = 0.26 = \text{LOS A}$
- Delay = $(34.4+20.3+34.1+11.9)/4 = 25.2 \text{ sec} = \text{LOS C}$

GOODS MOVEMENT = LOS D

- Average Curb Lane Width = 3.76m = LOS C
- Average Effective Right Turning Radius = 9.9 m = LOS F
- Truck Intersection Delay = 27.8 sec = LOS C

AUTOMOBILES = LOS B

- 5 turning lanes for 8 movements = 62.5% = LOS B
 - 3 right turn lane
 - 2 left turn lanes
- NB Right turn prohibition= LOS B
- Intersection Delay = 27.8 sec = LOS C



INTERSECTION Mumford Road at Romans Avenue

SCENARIO Existing PM

PEDESTRIANS = LOS D

- 13 uncontrolled conflicts with pedestrians = LOS D
 - ◆ 4 permitted left turns
 - 3 right turn on red
 - ▲ 4 right turn on green
- Average Pedestrian Crossing = 20.9 m = LOS E
- Cycle Length = 100 seconds = LOS D

CYCLISTS = LOS E

- 12 uncontrolled conflicts with cyclists = LOS D
 - ◆ 4 permitted left turns
 - ▲ 3 exclusive right turn lanes
 - 5 lane changes to make a left turn
- No Bicycle Lanes
 - Score = -5% = LOS F
- Cycle Length = 100 seconds = LOS D

TRANSIT = LOS B

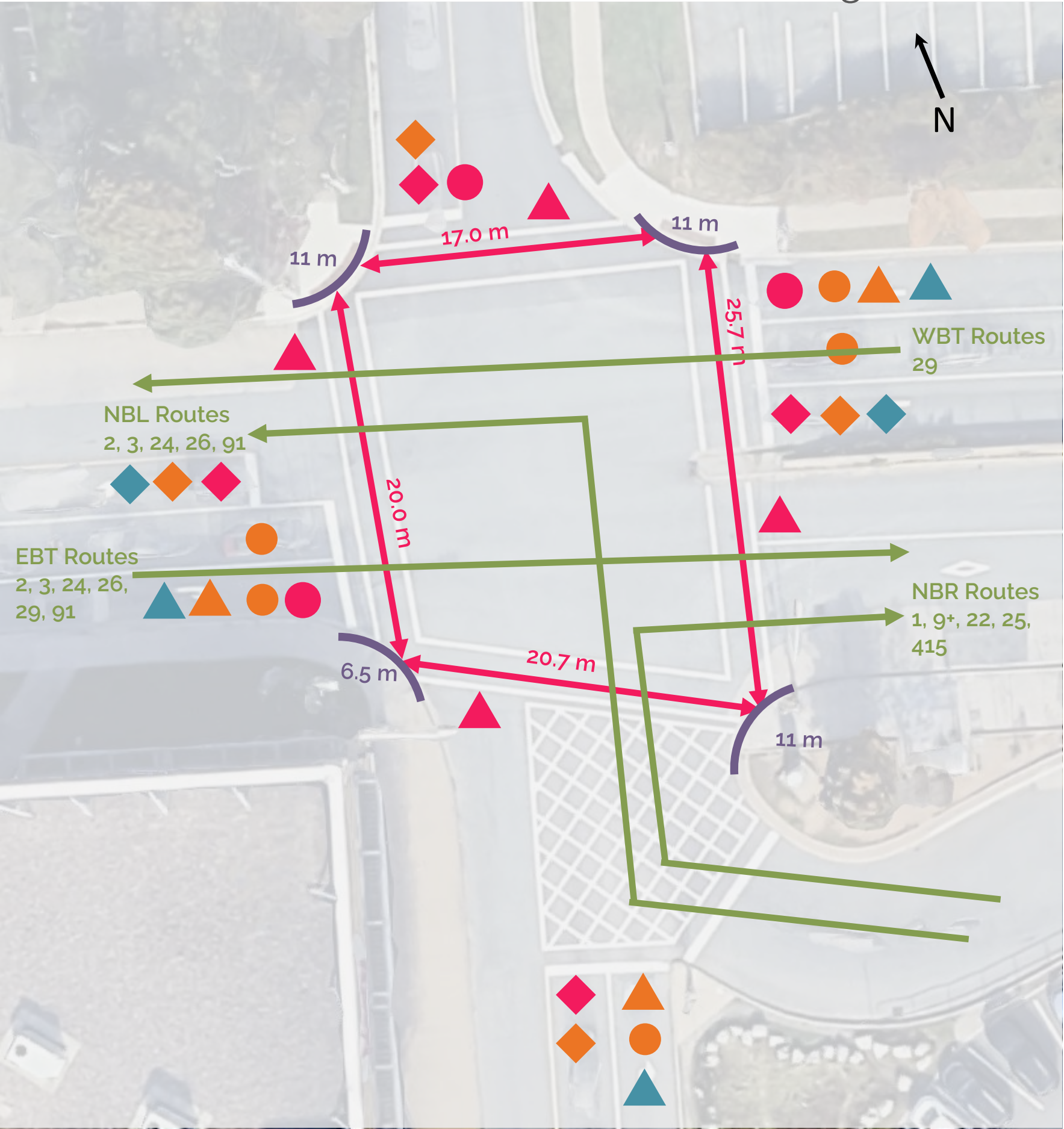
- No planned transit priority elements = LOS N/A
- $V/C = (0.15+0.18+0.46+0.54)/4 = 0.33 = \text{LOS A}$
- Delay = $(62.0+27.6+22.8+12.3)/4 = 31.2 \text{ sec} = \text{LOS C}$

GOODS MOVEMENT = LOS C

- Average Curb Lane Width = 3.76m = LOS C
- Average Effective Right Turning Radius = 9.9 m = LOS F
- Truck Intersection Delay = 19.8 sec = LOS B

AUTOMOBILES = LOS B

- 5 turning lanes for 8 movements = 62.5% = LOS B
 - ▲ 3 right turn lane
 - ◆ 2 left turn lanes
- NB Right turn prohibition = LOS B
- Intersection Delay = 19.8 sec = LOS B



INTERSECTION Mumford Road at HSC Driveway

SCENARIO Existing AM

PEDESTRIANS = LOS D

- 12 uncontrolled conflicts with pedestrians = LOS D
 - 4 permitted left turns
 - 4 right turn on red
 - 4 right turn on green
- Average Pedestrian Crossing = 25.4 m = LOS E
- Cycle Length = 90 seconds = LOS C

CYCLISTS = LOS E

- 14 uncontrolled conflicts with cyclists = LOS F
 - 4 permitted left turns
 - 2 exclusive right turn lanes
 - 8 lane changes to make a left turn
- No Bicycle Lanes
 - Score = -10% = LOS F
- Cycle Length = 90 seconds = LOS C

TRANSIT = LOS D

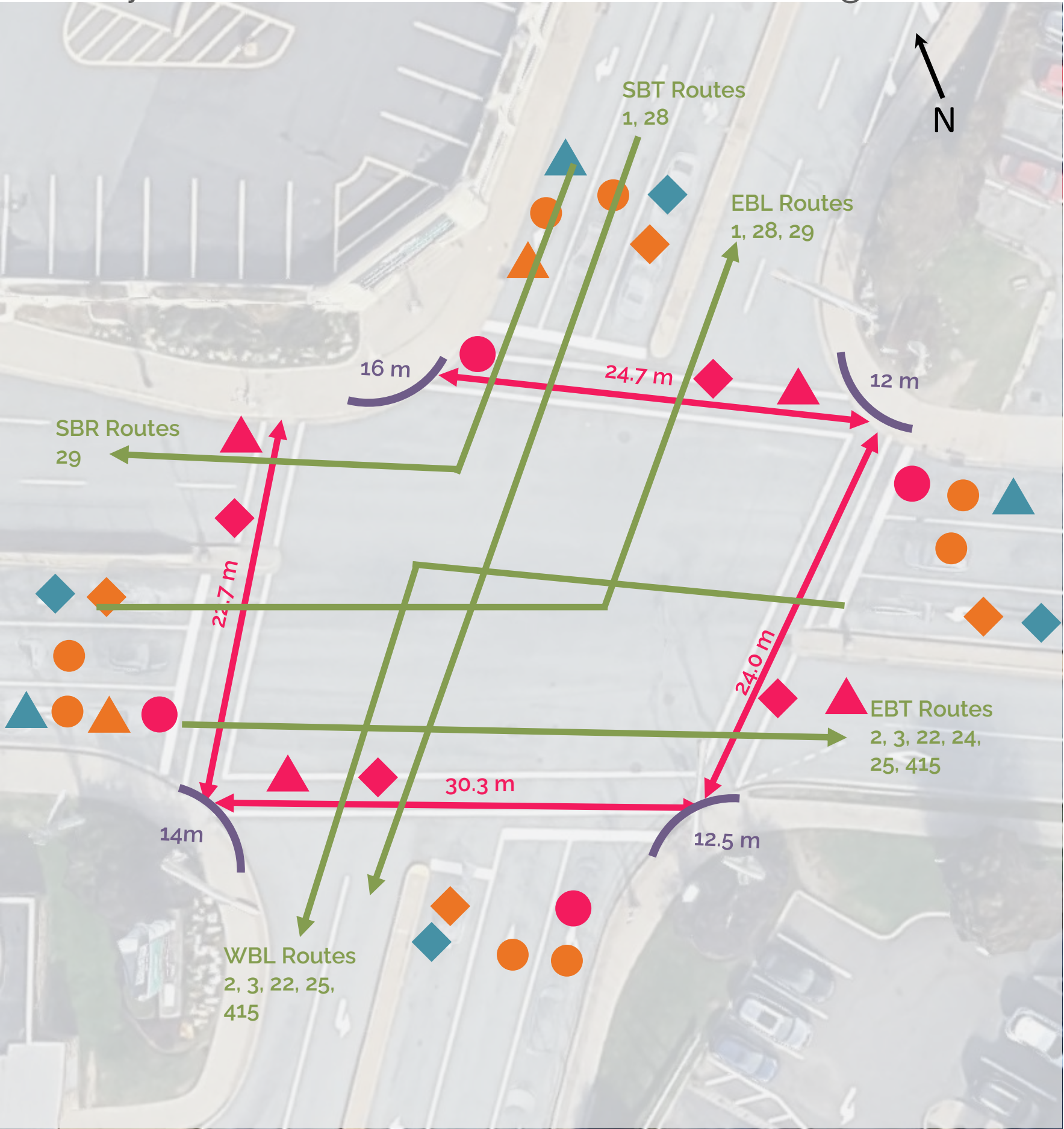
- Transit priority for EBT= 25% = LOS F
- $V/C = (0.14+0.49+0.17+0.15+0.06)/5 = 0.20 = \text{LOS A}$
- Delay = $(12.6+12.0+46.1+31.8+6.8)/5 = 21.9 \text{ sec} = \text{LOS C}$

GOODS MOVEMENT = LOS C

- Average Curb Lane Width = 3.4m = LOS D
- Average Effective Right Turning Radius = 13.6 m = LOS D
- Truck Intersection Delay = 17.5 sec = LOS B

AUTOMOBILES = LOS A

- 7 turning lanes for 8 movements = 87.5% = LOS A
 - 3 right turn lane
 - 4 left turn lanes
- No turn prohibitions = LOS A
- Intersection Delay = 17.5 sec = LOS B



INTERSECTION Mumford Road at HSC Driveway

SCENARIO Existing PM

PEDESTRIANS = LOS D

- 12 uncontrolled conflicts with pedestrians = LOS D
 - ◆ 4 permitted left turns
 - 4 right turn on red
 - ▲ 4 right turn on green
- Average Pedestrian Crossing = 25.4 m = LOS E
- Cycle Length = 100 seconds = LOS C

CYCLISTS = LOS E

- 14 uncontrolled conflicts with cyclists = LOS F
 - ◆ 4 permitted left turns
 - ▲ 2 exclusive right turn lanes
 - 8 lane changes to make a left turn
- No Bicycle Lanes
 - Score = -10% = LOS F
- Cycle Length = 100 seconds = LOS C

TRANSIT = LOS D

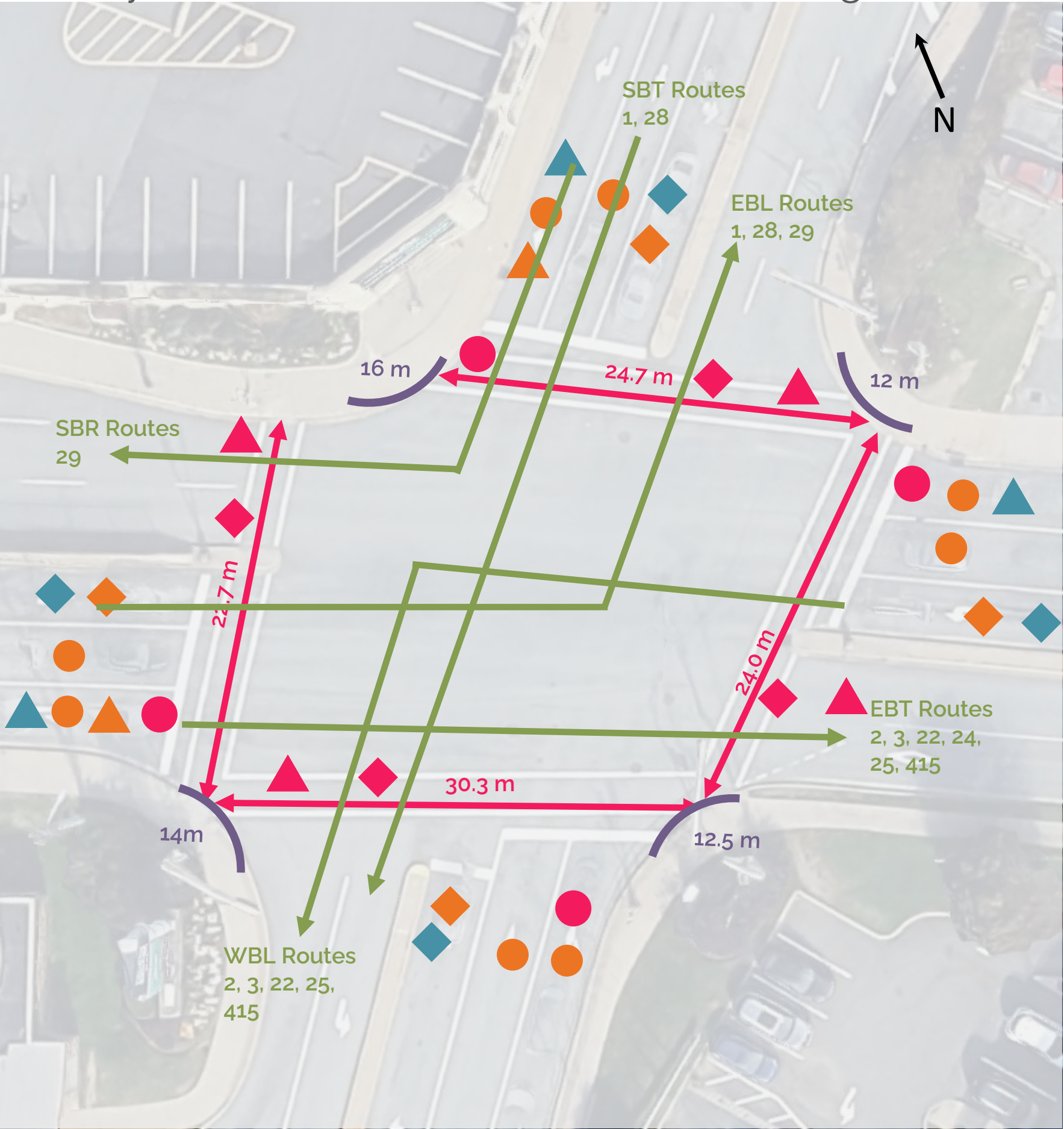
- Transit priority for EBT= 25% = LOS F
- $V/C = (0.36+0.39+0.22+0.52+0.29)/5 = 0.36 = \text{LOS A}$
- Delay = $(21.3+16.1+34.6+36.2+8.2)/5 = 23.3 \text{ sec} = \text{LOS C}$

GOODS MOVEMENT = LOS C

- Average Curb Lane Width = 3.4m = LOS D
- Average Effective Right Turning Radius = 13.6 m = LOS D
- Truck Intersection Delay = 22.4 sec = LOS C

AUTOMOBILES = LOS B

- 7 turning lanes for 8 movements = 87.5% = LOS A
 - ▲ 3 right turn lane
 - ◆ 4 left turn lanes
- No turn prohibitions = LOS A
- Intersection Delay = 22.4 sec = LOS C



INTERSECTION Mumford Road at Chebucto Road

SCENARIO Existing AM

PEDESTRIANS = LOS E

- 11 uncontrolled conflicts with pedestrians = LOS D
 - ◆ 2 permitted left turns
 - 4 right turn on red
 - ▲ 4 right turn on green
 - 1 right turn channel
- Average Pedestrian Crossing = 24.5m = LOS F
- Cycle Length = 110 seconds = LOS F

CYCLISTS = LOS E

- 7 uncontrolled conflicts with cyclists = LOS B
 - ◆ 2 permitted left turns
 - ▲ 1 exclusive right turn lanes
 - 3 lane changes to make a left turn
 - 1 RT channel
- No Bicycle Lanes
 - Score = -5% = LOS F
- Cycle Length = 110 seconds = LOS F

TRANSIT = LOS D

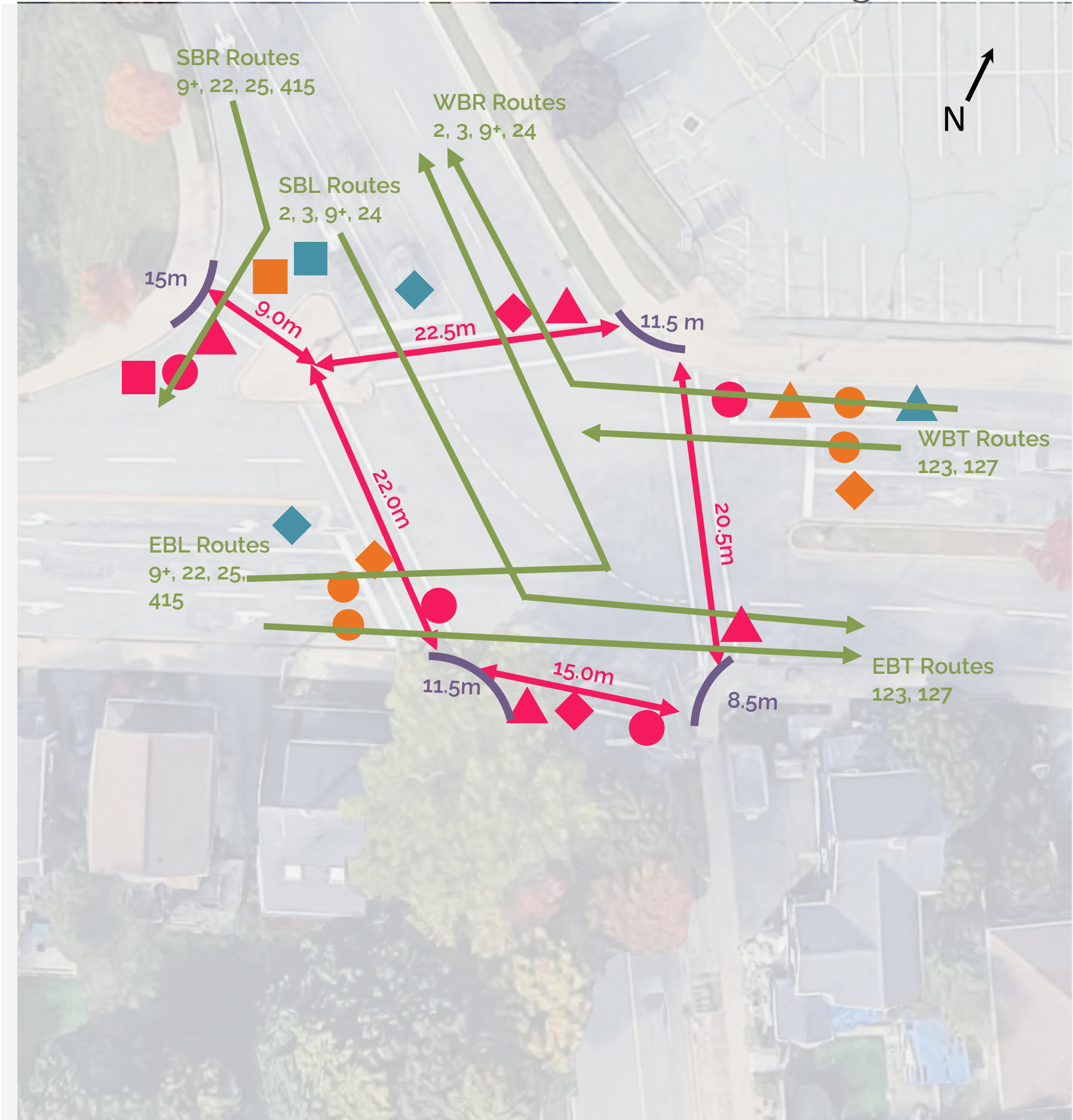
- No Transit Priority = LOS F
- $V/C = (0.14+0.94+0.48+0.26+0.66+0.06)/6 = 0.40 = \text{LOS A}$
- Delay = $(22.2+47.3+35.1+2.1+0.2+47.7)/6 = 25.8 \text{ sec} = \text{LOS C}$

GOODS MOVEMENT = LOS D

- Average Curb Lane Width = 3.79m = LOS C
- Average Effective Right Turning Radius = 11.6 m = LOS E
- Truck Intersection Delay = 39.2sec = LOS D

AUTOMOBILES = LOS C

- 4 turning lanes for 8 movements = 50% = LOS C
 - ▲ 1 right turn lane
 - ◆ 2 left turn lanes
 - 1 right turn channel
- No turn prohibitions = LOS A
- Intersection Delay = 39.2 sec = LOS D



INTERSECTION Mumford Road at Chebucto Road

SCENARIO Existing PM

PEDESTRIANS = LOS E

- 11 uncontrolled conflicts with pedestrians = LOS D
 - 2 permitted left turns
 - 4 right turn on red
 - 4 right turn on green
 - 1 right turn channel
- Average Pedestrian Crossing = 24.5m = LOS F
- Cycle Length = 130 seconds = LOS F

CYCLISTS = LOS E

- 7 uncontrolled conflicts with cyclists = LOS B
 - 2 permitted left turns
 - 1 exclusive right turn lanes
 - 3 lane changes to make a left turn
 - 1 RT channel
- No Bicycle Lanes
 - Score = -5% = LOS F
- Cycle Length = 130 seconds = LOS F

TRANSIT = LOS D

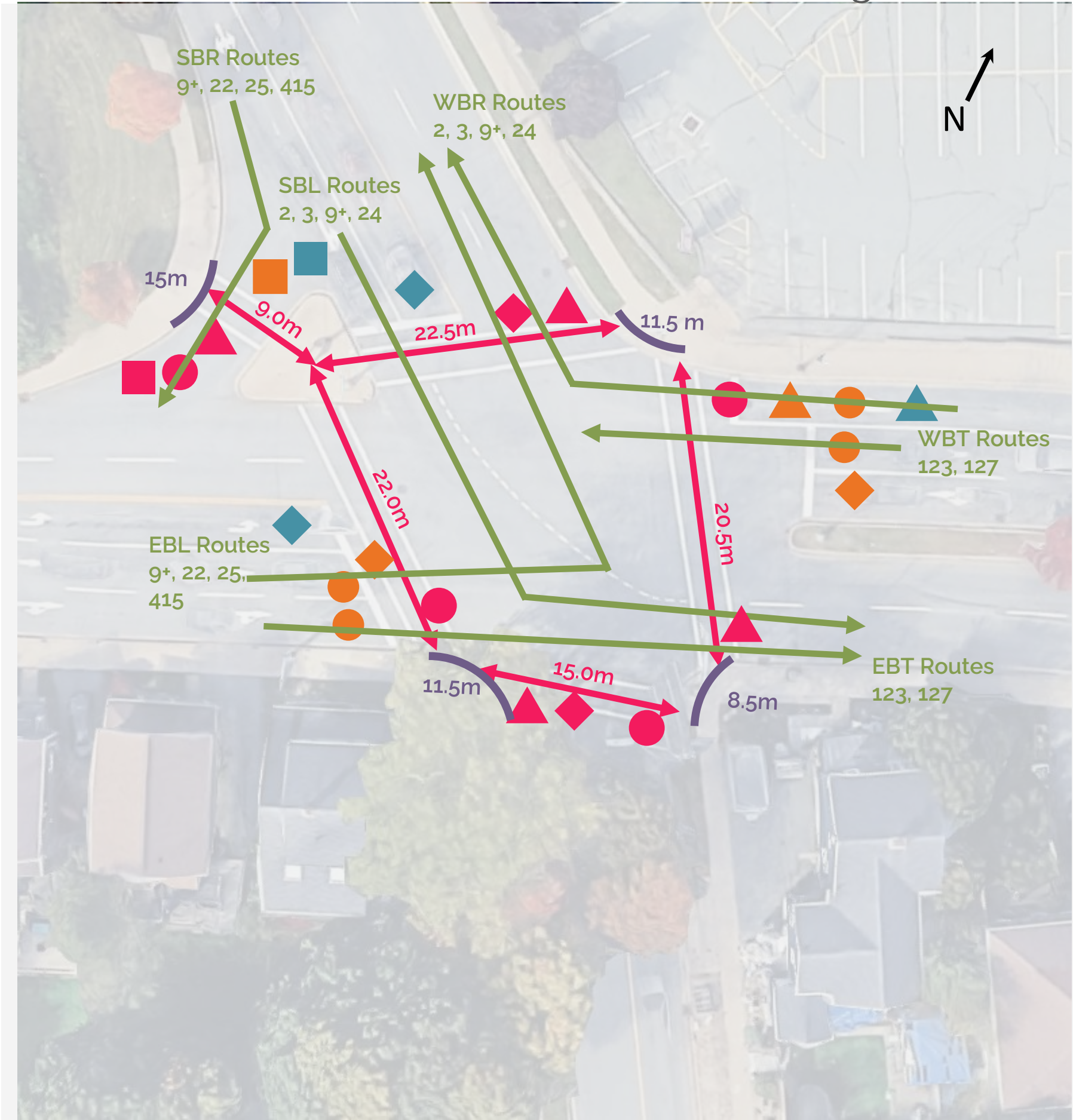
- No Transit Priority = LOS F
- $V/C = (0.46+0.28+0.65+0.81+0.72+0.21)/6 = 0.50 = \text{LOS A}$
- Delay = $(26.7+23.8+39.7+20.1+58.5+4.5)/6 = 28.9 \text{ sec} = \text{LOS C}$

GOODS MOVEMENT = LOS D

- Average Curb Lane Width = 3.79m = LOS C
- Average Effective Right Turning Radius = 11.6 m = LOS E
- Truck Intersection Delay = 35.9 sec = LOS D

AUTOMOBILES = LOS C

- 4 turning lanes for 8 movements = 50% = LOS C
 - 1 right turn lane
 - 2 left turn lanes
 - 1 right turn channel
- No turn prohibitions = LOS A
- Intersection Delay = 35.9 sec = LOS D



INTERSECTION Joseph Howe Drive at Mumford Road

SCENARIO Existing AM

PEDESTRIANS = LOS E

- 12 uncontrolled conflicts with pedestrians = LOS D
 - ◆ 4 permitted left turns
 - 4 right turn on red
 - ▲ 4 right turn on green
 - 1 right turn channel
- Average Pedestrian Crossing = 19.2m = LOS E
- Cycle Length = 110 seconds = LOS E

CYCLISTS = LOS E

- 8 uncontrolled conflicts with cyclists = LOS C
 - ◆ 4 permitted left turns
 - ▲ 1 exclusive right turn lanes
 - 2 lane changes to make a left turn
 - 1 RT channel
- No Bicycle Lanes
 - Score = -5% = LOS F
- Cycle Length = 110 seconds = LOS E

TRANSIT = LOS B

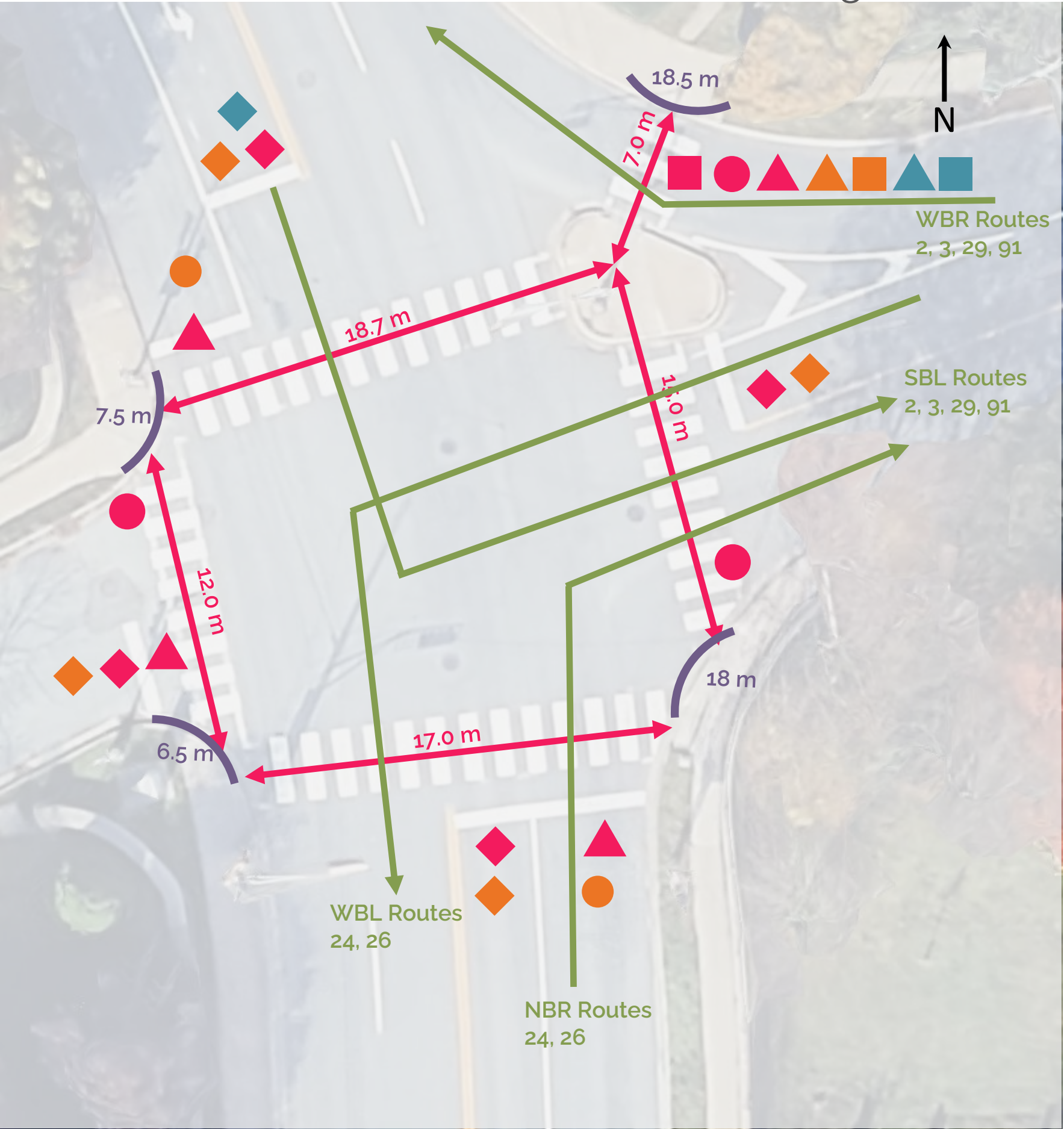
- No planned transit priority elements = LOS N/A
- $V/C = (0.43+0.54+0.19+0.65)/4 = 0.5 = \text{LOS A}$
- $\text{Delay} = (57.0+14.8+9.0+6.8)/4 = 21.9 \text{ sec} = \text{LOS C}$

GOODS MOVEMENT = LOS B

- Average Curb Lane Width = 4.5m = LOS A
- Average Effective Right Turning Radius = 12.8 = LOS E
- Truck Intersection Delay = 9.0sec = LOS A

AUTOMOBILES = LOS B

- 2 turning lanes for 8 movements = 25% = LOS D
 - ▲ 1 right turn lane
 - ◆ 2 left turn lanes
 - 1 right turn channel
- EBR turn prohibitions = LOS B
- Intersection Delay = 9.0sec = LOS A



INTERSECTION Joseph Howe Drive at Mumford Road

SCENARIO Existing PM

PEDESTRIANS = LOS E

- 12 uncontrolled conflicts with pedestrians = LOS D
 - ◆ 4 permitted left turns
 - 4 right turn on red
 - ▲ 4 right turn on green
 - 1 right turn channel
- Average Pedestrian Crossing = 19.2m = LOS E
- Cycle Length = 120 seconds = LOS E

CYCLISTS = LOS E

- 8 uncontrolled conflicts with cyclists = LOS C
 - ◆ 4 permitted left turns
 - ▲ 1 exclusive right turn lanes
 - 2 lane changes to make a left turn
 - 1 RT channel
- No Bicycle Lanes
 - Score = -5% = LOS F
- Cycle Length = 120 seconds = LOS E

TRANSIT = LOS C

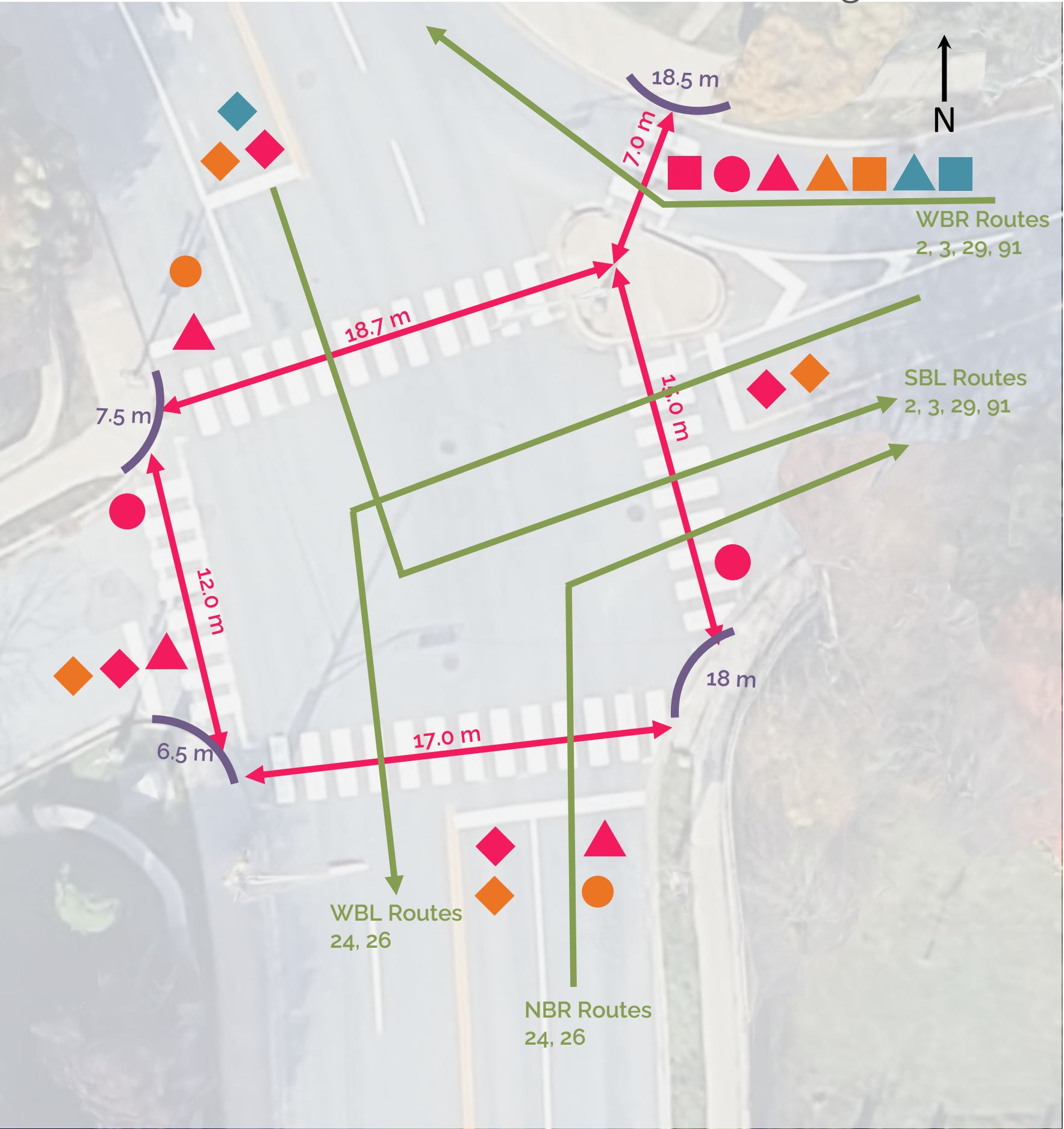
- No planned transit priority elements = LOS N/A
- $V/C = (0.68+0.76+0.64+0.68)/4 = 0.70 = \text{LOS C}$
- $\text{Delay} = (58.4+15.7+40.4+22.0)/4 = 34.1 \text{ sec} = \text{LOS C}$

GOODS MOVEMENT = LOS C

- Average Curb Lane Width = 4.5m = LOS A
- Average Effective Right Turning Radius = 12.8 = LOS E
- Truck Intersection Delay = 26.4 sec = LOS C

AUTOMOBILES = LOS C

- 2 turning lanes for 8 movements = 25% = LOS D
 - ▲ 1 right turn lane
 - ◆ 2 left turn lanes
 - 1 right turn channel
- EBR turn prohibitions = LOS B
- Intersection Delay = 26.4 sec = LOS C



INTERSECTION Bayers Road at HSC Driveway

SCENARIO Existing AM

PEDESTRIANS = LOS D

- 7 uncontrolled conflicts with pedestrians = LOS B
 - 4 right turn on red
 - ▲ 2 right turn on green
 - 1 right turn channel
- Average Pedestrian Crossing = 55.7m = LOS F
- Cycle Length = 120 seconds = LOS E

CYCLISTS = LOS E

- 7 uncontrolled conflicts with cyclists = LOS B
 - ▲ 4 exclusive right turn lanes
 - 2 lane changes to make a left turn
 - 1 RT channel
- EB Multi Use Path
 - Score = 27%= LOS F
- Cycle Length = 120 seconds = LOS E

TRANSIT = LOS C

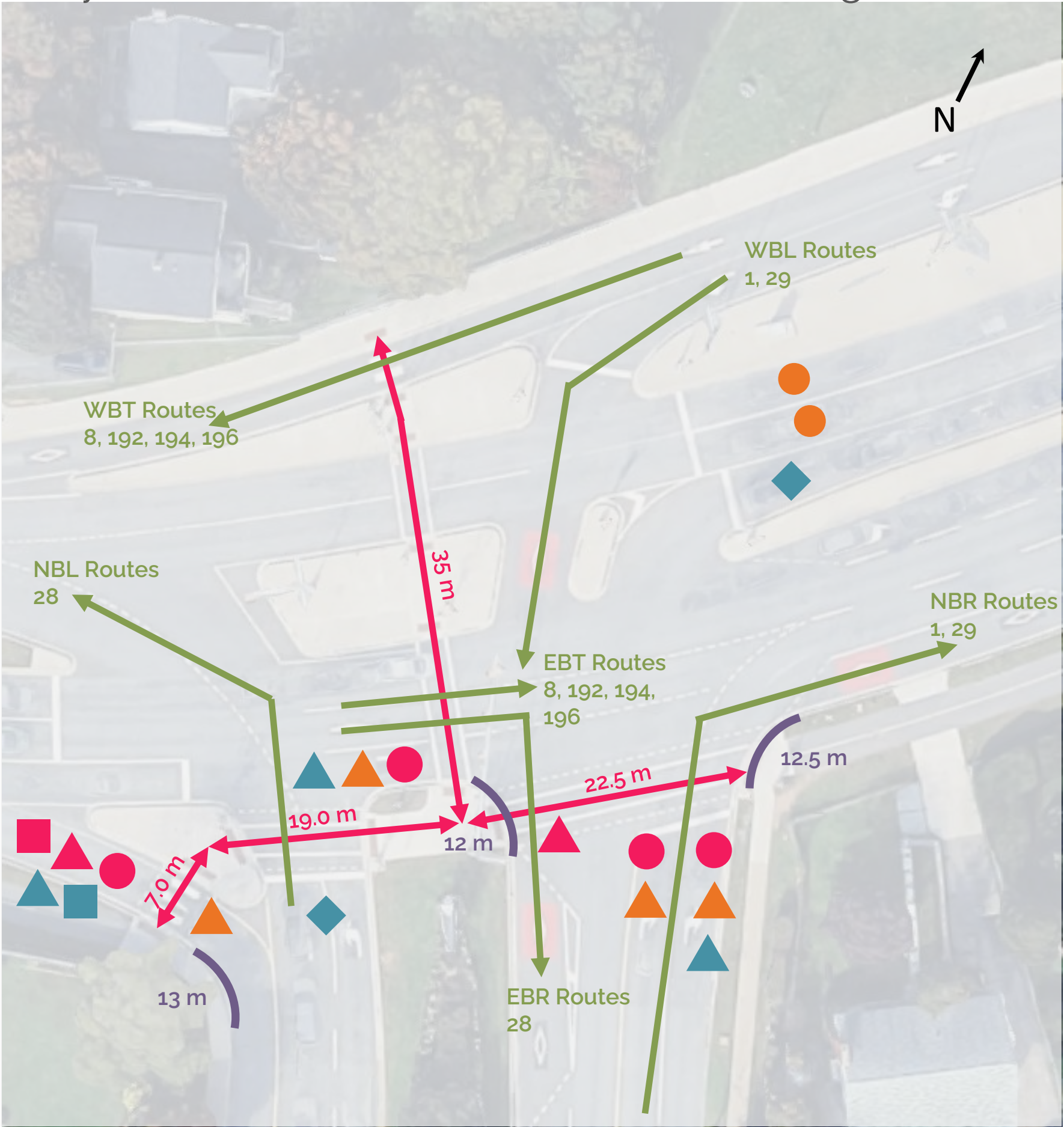
- Transit Priority for EBR, EBT, WBT, WBL = 67% = LOS D
- $V/C = (0.21+0.68+0.32+0.37+0.02+0.07)/6 = 0.28 = \text{LOS A}$
- Delay = $(3.3+0.5+41.5+7.1+46.5+63.6)/6 = 27.1 \text{ sec} = \text{LOS C}$

GOODS MOVEMENT = LOS C

- Average Curb Lane Width = 3.63m = LOS C
- Average Effective Right Turning Radius = 12.5 m = LOS E
- Truck Intersection Delay = 11.0 sec = LOS B

AUTOMOBILES = LOS A

- 6 turning lanes for 6 movements = 100% = LOS A
 - ▲ 3 right turn lane
 - ◆ 2 left turn lanes
 - 1 right turn channel
- No turn prohibitions = LOS A
- Intersection Delay = 11.0 sec = LOS B



INTERSECTION Bayers Road at HSC Driveway

SCENARIO Existing PM

PEDESTRIANS = LOS D

- 7 uncontrolled conflicts with pedestrians = LOS C
 - 4 right turn on red
 - 2 right turn on green
 - 1 right turn channel
- Average Pedestrian Crossing = 55.7m = LOS F
- Cycle Length = 130 seconds = LOS F

CYCLISTS = LOS E

- 7 uncontrolled conflicts with cyclists = LOS B
 - 4 exclusive right turn lanes
 - 2 lane changes to make a left turn
 - 1 RT channel
- EB Multi Use Path
 - Score = 27%= LOS F
- Cycle Length = 130 seconds = LOS F

TRANSIT = LOS C

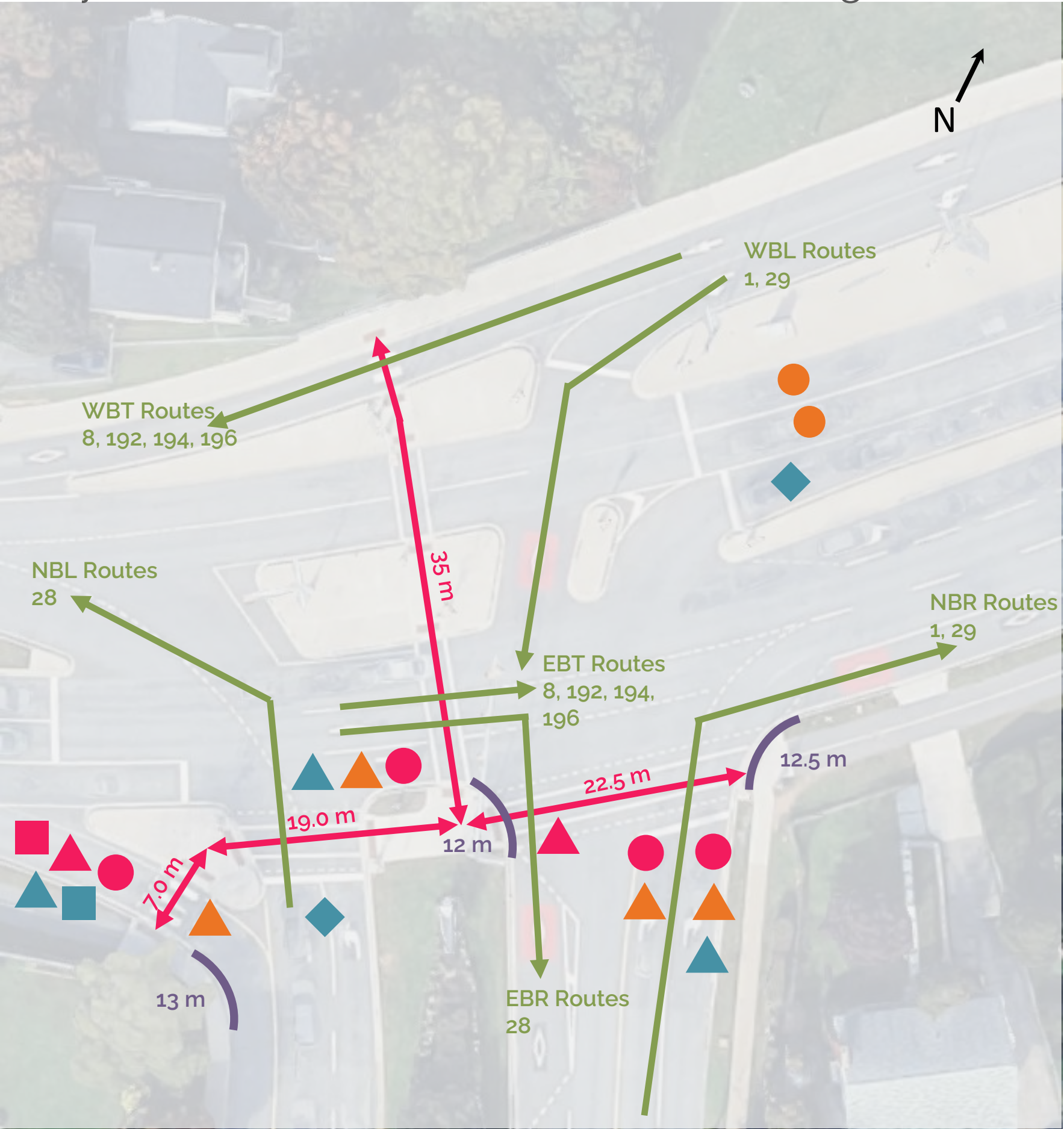
- Transit Priority for EBR, EBT, WBT, WBL = 67% = LOS D
 - $V/C = (0.71+0.41+0.21+0.33+0.14+0.51)/6 = 0.39$
 - = LOS A
- Delay = $(12.8+5.4+49.0+24.7+26.0+67.0)/6 = 30.8$ sec = LOS C

GOODS MOVEMENT = LOS C

- Average Curb Lane Width = 3.63m = LOS C
- Average Effective Right Turning Radius = 12.5 m = LOS E
- Truck Intersection Delay = 21.6 sec = LOS C

AUTOMOBILES = LOS B

- 6 turning lanes for 6 movements = 100% = LOS A
 - 3 right turn lane
 - 2 left turn lanes
 - 1 right turn channel
- No turn prohibitions = LOS A
- Intersection Delay = 21.6 sec = LOS C



INTERSECTION Bayers Road at Romans Ave

SCENARIO Existing AM

PEDESTRIANS = LOS D

- 10 uncontrolled conflicts with pedestrians = LOS D
 - ◆ 2 permitted left turns
 - 4 right turn on red
 - ▲ 4 right turn on green
- Average Pedestrian Crossing = 17.3m = LOS D
- Cycle Length = 120 seconds = LOS E

CYCLISTS = LOS D

- 5 uncontrolled conflicts with cyclists = LOS A
 - ◆ 2 permitted left turns
 - ▲ 2 exclusive right turn lanes
 - 3 lane changes to make a left turn
- No Bicycle Lanes
 - Score = 33% = LOS E
- Cycle Length = 120 seconds = LOS E

TRANSIT = LOS B

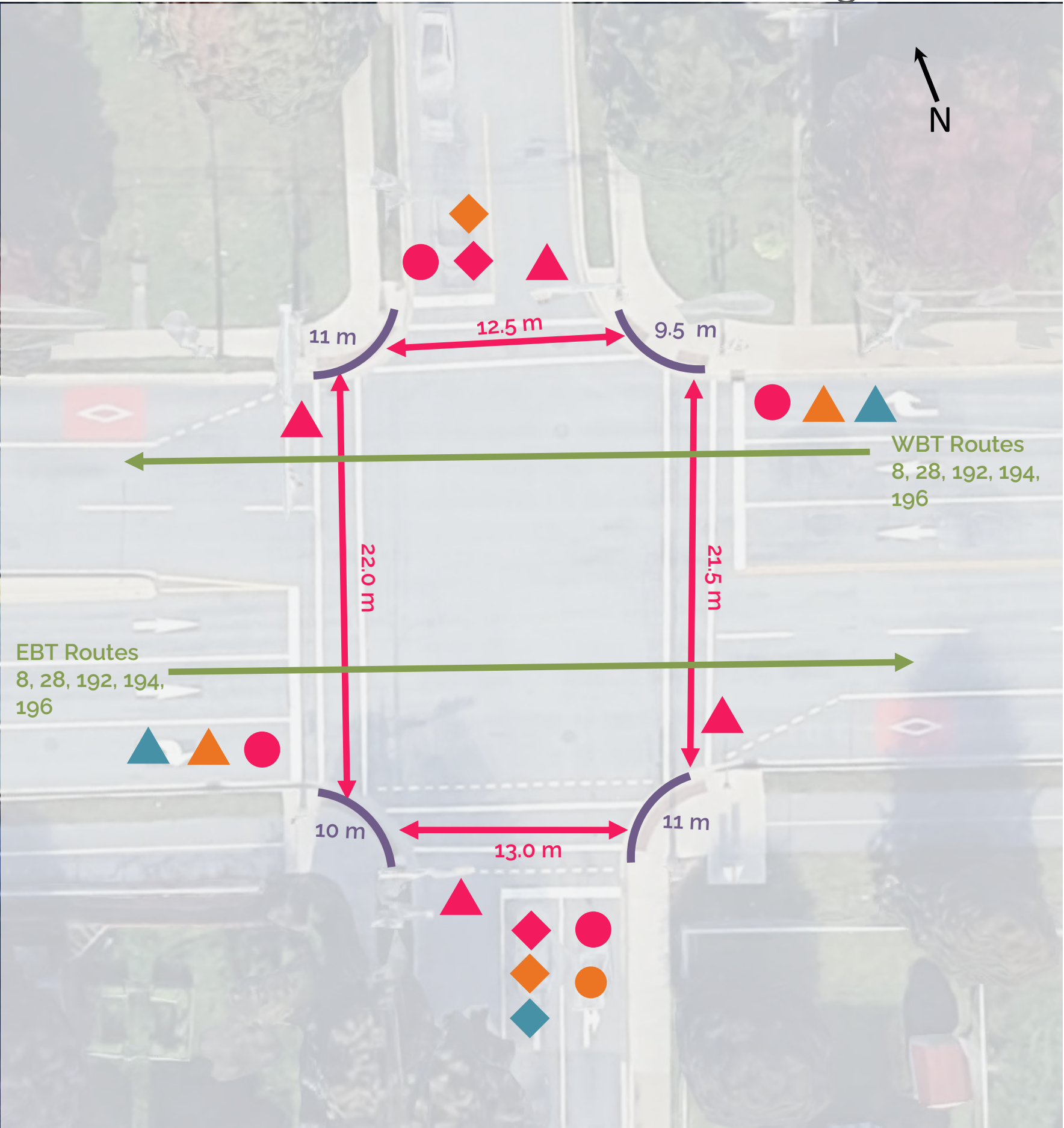
- Transit Priority for EBT, WBT = LOS C
- $V/C = (0.55+0.25)/2 = 0.40$ = LOS A
- Delay = $(4.7+2.7)/2 = 3.7$ sec = LOS A

GOODS MOVEMENT = LOS B

- Average Curb Lane Width = 3.85m = LOS B
- Average Effective Right Turning Radius = 10.4 m = LOS F
- Truck Intersection Delay = 7.2 sec = LOS A

AUTOMOBILES = LOS B

- 3 turning lanes for 6 movements = 50% = LOS C
 - ▲ 1 right turn lane
 - ◆ 2 left turn lanes
- WBL and EBL turn prohibitions = LOS C
- Intersection Delay = 7.2 sec = LOS A



INTERSECTION Bayers Road at Romans Ave

SCENARIO Existing PM

PEDESTRIANS = LOS D

- 10 uncontrolled conflicts with pedestrians = LOS D
 - ◆ 2 permitted left turns
 - 4 right turn on red
 - ▲ 4 right turn on green
- Average Pedestrian Crossing = 17.3m = LOS D
- Cycle Length = 130 seconds = LOS F

CYCLISTS = LOS D

- 5 uncontrolled conflicts with cyclists = LOS A
 - ◆ 2 permitted left turns
 - ▲ 2 exclusive right turn lanes
 - 3 lane changes to make a left turn
- No Bicycle Lanes
 - Score = 33% = LOS E
- Cycle Length = 130 seconds = LOS F

TRANSIT = LOS C

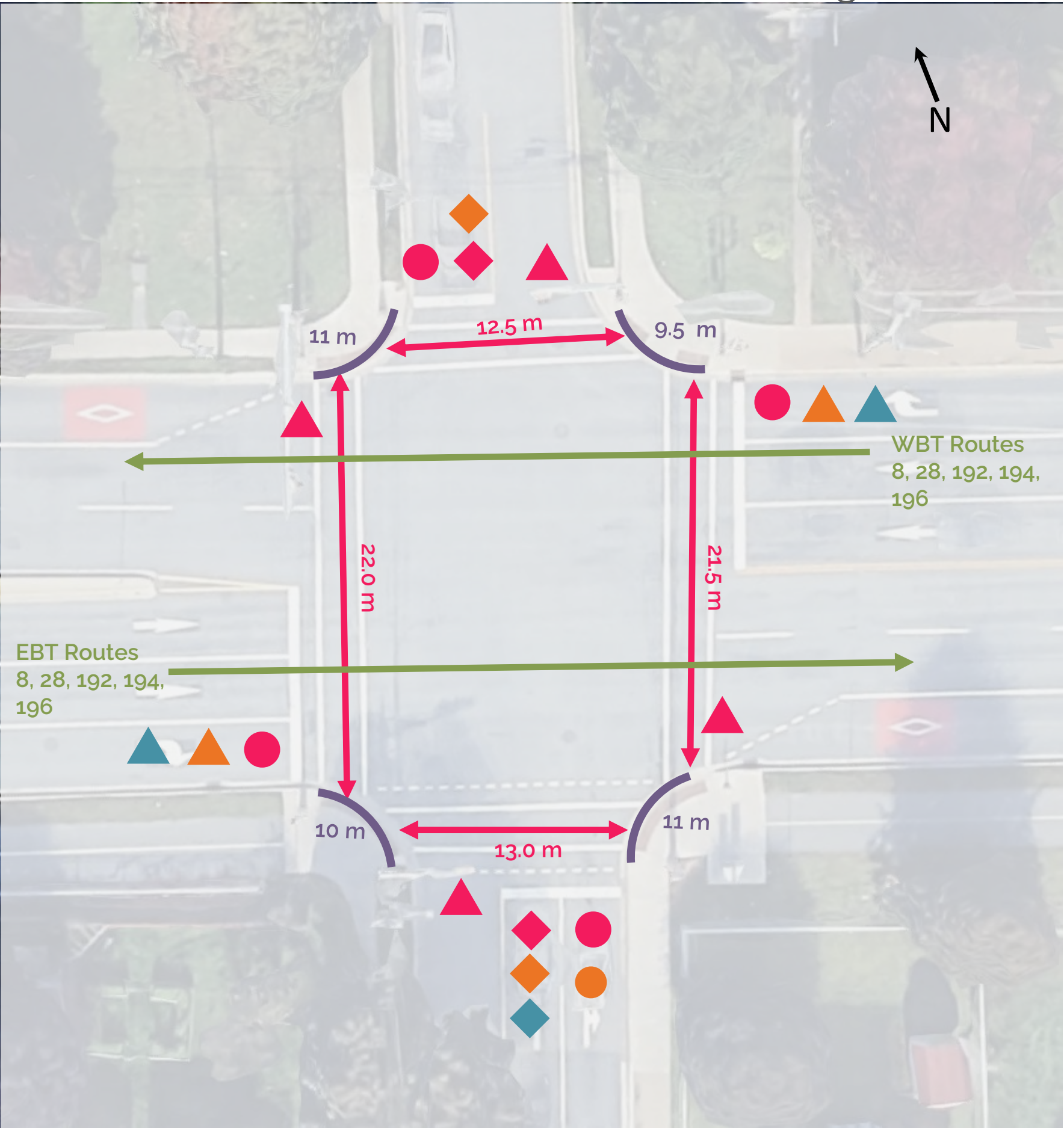
- Transit Priority for EBT, WBT = LOS C
- $V/C = (0.49+0.88)/2 = 0.70 = \text{LOS C}$
- Delay = $(7.8+10.4)/2 = 9.1 \text{ sec} = \text{LOS A}$

GOODS MOVEMENT = LOS C

- Average Curb Lane Width = 3.85m = LOS B
- Average Effective Right Turning Radius = 10.4 m = LOS F
- Truck Intersection Delay = 19.5 sec = LOS B

AUTOMOBILES = LOS C

- 3 turning lanes for 6 movements = 50% = LOS C
 - ▲ 1 right turn lane
 - ◆ 2 left turn lanes
- WBL and EBL turn prohibitions = LOS C
- Intersection Delay = 19.5 sec = LOS B



SEGMENT 1: Mumford Road(Romans Avenue to HSC Driveway) EB, WB

SCENARIO Existing AM

PEDESTRIANS = LOS C EB / LOS D WB

- Pedestrian Facility Width
 - EB = 2.5 m = LOS A
 - WB = 1.5 m = LOS D
- Pedestrian Zone Width
 - EB = 2.5 m = LOS D
 - WB = 2.7 m = LOS D
- Distance between marked crossings
 - EB = 168 m = LOS C
 - WB = 178 m = LOS C

CYCLISTS = LOS D EB / WB

- Driveway Density
 - EB = 0/km = LOS A
 - WB = 0/km = LOS A
- Speed x Volume
 - EB = 5.8 x 50 = 290.0 = LOS E
 - WB = 2.1 x 50 = 105.0 = LOS D
- Block Length
 - EB = 173 m = LOS C
 - WB = 192 m = LOS C

TRANSIT = LOS A EB / LOS C WB

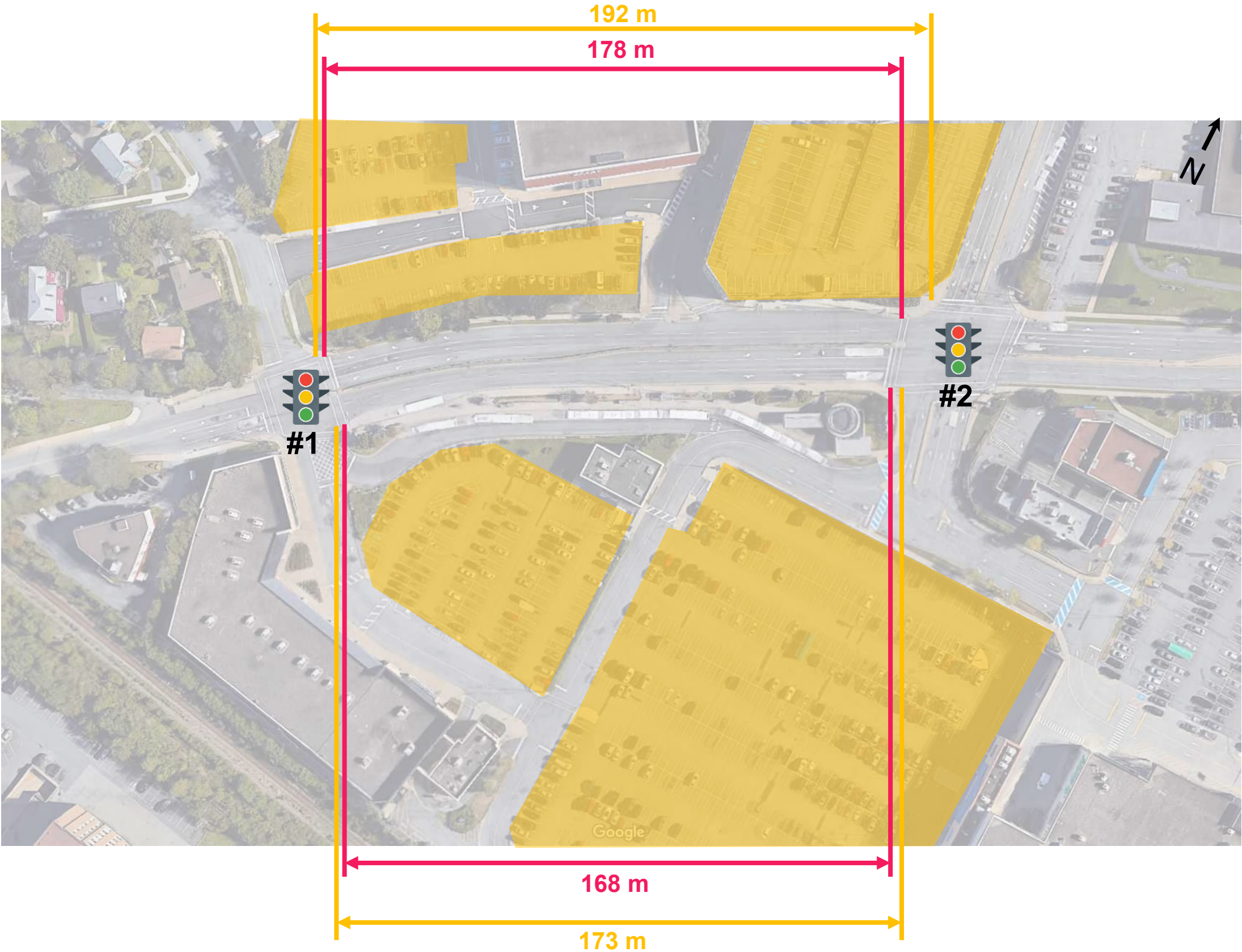
- Type of Facility
 - EB = 24 Hour Lanes / Dedicated Facility = LOS A
 - WB = Mixed traffic with >1 lane = LOS D
- Percent of stops with Bus Lay-By
 - EB = 0% = LOS A
 - WB = 0% = LOS A
- Travel Speed / Ideal Speed
 - Segment <700m = LOS N/A

GOODS MOVEMENT = LOS D EB / NB

- Average Curb Lane Width
 - EB = 3.5 m = LOS D
 - WB = 3.5 m = LOS D
- % No Stopping / No Loading
 - Loading bays available = LOS N/A
- Travel Speed / Ideal Speed
 - Segment <700m = LOS N/A

AUTOMOBILES = LOS D EB / LOS A WB

- Mid-block V/C
 - EB = 575 / 700 = 0.82 = LOS D
 - WB = 210 / 1400 = 0.15 = LOS A
- On-street parking availability
 - Large parking lots = LOS N/A
- Travel Speed / Ideal Speed
 - Segment <700m = LOS N/A



SEGMENT 1: Mumford Road(Romans Avenue to HSC Driveway) EB, WB

SCENARIO Existing PM

PEDESTRIANS = LOS C EB / LOS D WB

- Pedestrian Facility Width
 - EB = 2.5 m = LOS A
 - WB = 1.5 m = LOS D
- Pedestrian Zone Width
 - EB = 2.5 m = LOS D
 - WB = 2.7 m = LOS D
- Distance between marked crossings
 - EB = 168 m = LOS C
 - WB = 178 m = LOS C

CYCLISTS = LOS C EB / WB

- Driveway Density
 - EB = 0/km = LOS A
 - WB = 0/km = LOS A
- Speed x Volume
 - EB = 5.3 x 50 = 265.0 = LOS E
 - WB = 6.4 x 50 = 320.0 = LOS E
- Block Length
 - EB = 173 m = LOS C
 - WB = 192 m = LOS C

TRANSIT = LOS A EB / LOS C WB

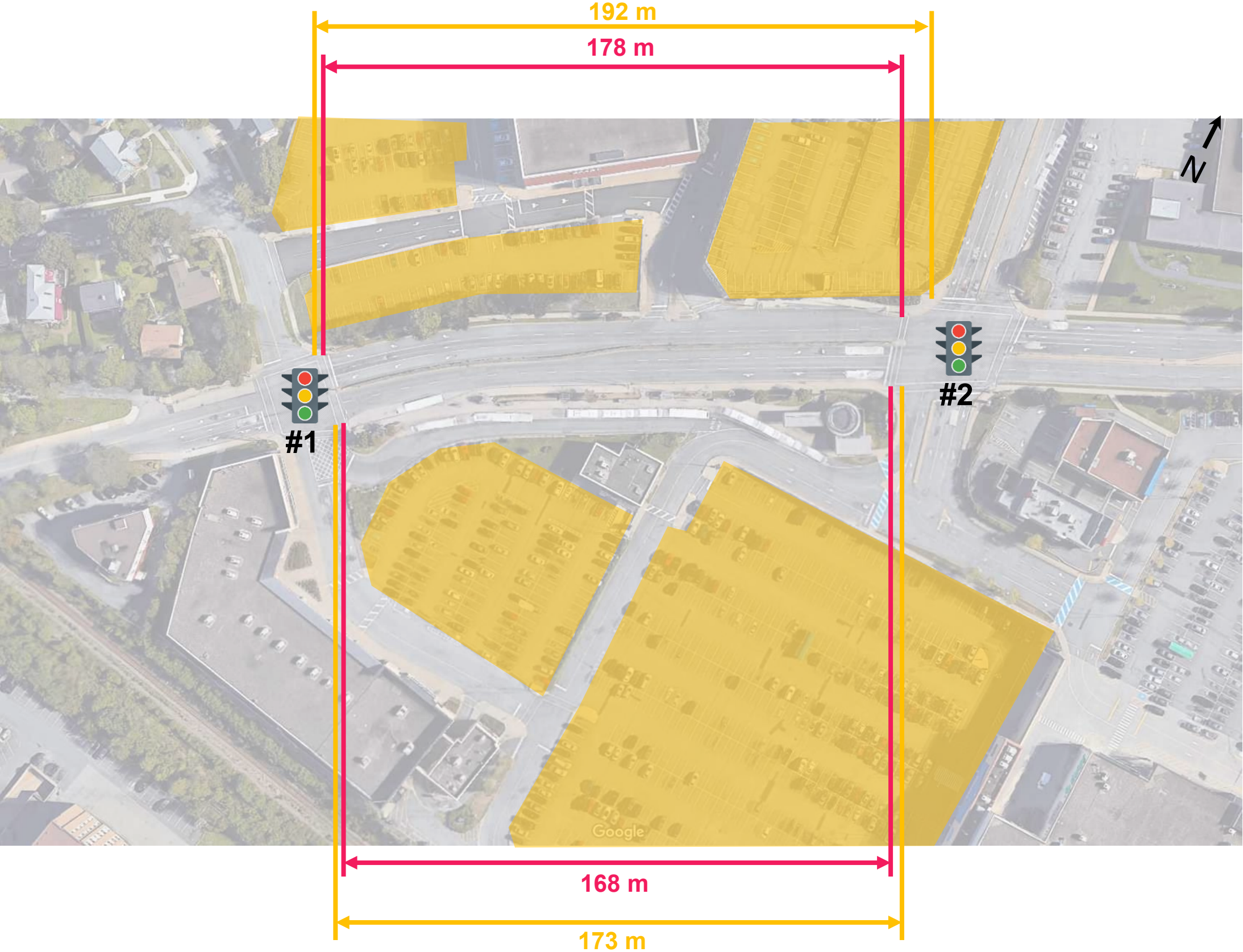
- Type of Facility
 - EB = 24 Hour Lanes / Dedicated Facility = LOS A
 - WB = Mixed traffic with >1 lane = LOS D
- Percent of stops with Bus Lay-By
 - EB = 0% = LOS A
 - WB = 0% = LOS A
- Travel Speed / Ideal Speed
 - Segment <700m = LOS N/A

GOODS MOVEMENT = LOS D EB / NB

- Average Curb Lane Width
 - EB = 3.5 m = LOS D
 - WB = 3.5 m = LOS D
- % No Stopping / No Loading
 - Loading bays available = LOS N/A
- Travel Speed / Ideal Speed
 - Segment <700m = LOS N/A

AUTOMOBILES = LOS C EB / LOS A WB

- Mid-block V/C
 - EB = 528 / 700 = 0.75 = LOS C
 - WB = 643 / 1400 = 0.46 = LOS A
- On-street parking availability
 - Large parking lots = LOS N/A
- Travel Speed / Ideal Speed
 - Segment <700m = LOS N/A





INTERSECTION CAPACITY ANALYSIS



Appendix C - Intersection Capacity Analysis
1: Romans Avenue & Mumford Road

Page C-1
AM Peak Existing

												
Lane Group	EBL	EBT	EBR	EBR2	WBL	WBT	WBR	NBL	NBT	NBR	SBL2	SBT
Lane Configurations												
Traffic Volume (vph)	60	510	0	140	10	145	55	60	70	35	50	50
Future Volume (vph)	60	510	0	140	10	145	55	60	70	35	50	50
Satd. Flow (prot)	1789	1883	1601	0	1789	1883	1601	0	1840	1601	0	1829
Flt Permitted	0.657				0.304				0.803			0.793
Satd. Flow (perm)	1237	1883	1601	0	573	1883	1601	0	1512	1601	0	1485
Satd. Flow (RTOR)			917				121					2
Lane Group Flow (vph)	65	554	152	0	11	158	60	0	141	38	0	113
Turn Type	Perm	NA	Perm		Perm	NA	Perm	Perm	NA	Perm	Perm	NA
Protected Phases		2				6			8			4
Permitted Phases	2		2		6		6	8		8	4	
Total Split (s)	45.0	45.0	45.0		45.0	45.0	45.0	35.0	35.0	35.0	35.0	35.0
Total Lost Time (s)	6.4	6.4	6.4		6.4	6.4	6.4		7.5	7.5		7.5
Act Effct Green (s)	47.6	47.6	47.6		47.6	47.6	47.6		27.5	27.5		27.5
Actuated g/C Ratio	0.50	0.50	0.50		0.50	0.50	0.50		0.29	0.29		0.29
v/c Ratio	0.11	0.59	0.12		0.04	0.17	0.07		0.32	0.08		0.26
Control Delay (s/veh)	14.8	21.1	0.2		14.9	14.7	0.2		29.0	25.3		27.5
Queue Delay	0.0	0.0	0.0		0.0	0.0	0.0		0.0	0.0		0.0
Total Delay (s/veh)	14.8	21.1	0.2		14.9	14.7	0.2		29.0	25.3		27.5
LOS	B	C	A		B	B	A		C	C		C
Approach Delay (s/veh)		16.4				10.9			28.2			27.5
Approach LOS		B				B			C			C
Queue Length 50th (m)	6.6	75.3	0.0		1.1	16.6	0.0		20.2	5.1		15.6
Queue Length 95th (m)	14.2	110.1	0.0		4.2	28.6	0.3		36.2	12.4		29.5
Internal Link Dist (m)		210.6				174.4			33.5			35.7
Turn Bay Length (m)	40.0		23.0		67.0							
Base Capacity (vph)	619	943	1259		286	943	862		437	463		431
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	0.11	0.59	0.12		0.04	0.17	0.07		0.32	0.08		0.26

Intersection Summary

Cycle Length: 95

Actuated Cycle Length: 95

Offset: 0 (0%), Referenced to phase 2:EBTL, Start of Green

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.59

Intersection Signal Delay (s/veh): 18.7

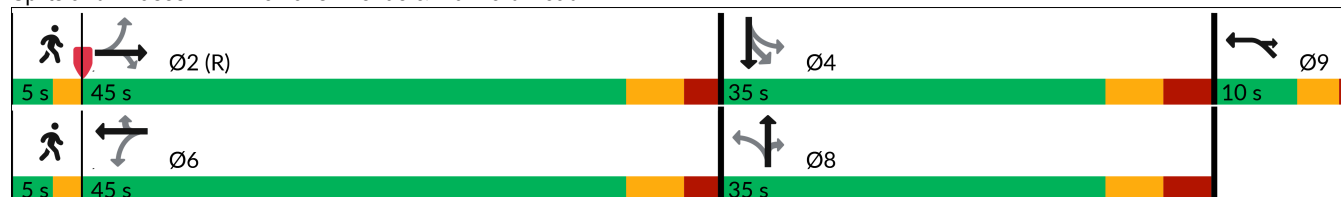
Intersection LOS: B

Intersection Capacity Utilization 70.3%

ICU Level of Service C

Analysis Period (min) 15

Splits and Phases: 1: Romans Avenue & Mumford Road





Lane Group	SBR	NWL	NWR2	Ø1	Ø5
Lane Configurations					
Traffic Volume (vph)	5	14	15		
Future Volume (vph)	5	14	15		
Satd. Flow (prot)	0	1789	1601		
Flt Permitted		0.950			
Satd. Flow (perm)	0	1789	1601		
Satd. Flow (RTOR)					
Lane Group Flow (vph)	0	15	16		
Turn Type		Prot	Prot		
Protected Phases		9	9	1	5
Permitted Phases					
Total Split (s)		10.0	10.0	5.0	5.0
Total Lost Time (s)		4.0	4.0		
Act Effect Green (s)		6.0	6.0		
Actuated g/C Ratio		0.06	0.06		
v/c Ratio		0.13	0.16		
Control Delay (s/veh)		44.9	45.9		
Queue Delay		0.0	0.0		
Total Delay (s/veh)		44.9	45.9		
LOS		D	D		
Approach Delay (s/veh)		45.4			
Approach LOS		D			
Queue Length 50th (m)		2.7	2.8		
Queue Length 95th (m)		8.8	9.2		
Internal Link Dist (m)		53.9			
Turn Bay Length (m)					
Base Capacity (vph)		112	101		
Starvation Cap Reductn		0	0		
Spillback Cap Reductn		0	0		
Storage Cap Reductn		0	0		
Reduced v/c Ratio		0.13	0.16		
Intersection Summary					

Appendix C - Intersection Capacity Analysis

2: HSC Driveway & Mumford Road

Page C-3
AM Peak Existing

												
Lane Group	EBL	EBT	EBR	EBR2	WBL	WBT	WBR	NBL	NBT	NBR	SBL2	SBT
Lane Configurations												
Traffic Volume (vph)	65	445	0	45	60	140	75	40	75	75	50	100
Future Volume (vph)	65	445	0	45	60	140	75	40	75	75	50	100
Satd. Flow (prot)	1789	1883	1601	0	1789	3389	0	1789	3310	0	1789	1883
Flt Permitted	0.528				0.440			0.557			0.648	
Satd. Flow (perm)	994	1883	1601	0	829	3389	0	1049	3310	0	1220	1883
Satd. Flow (RTOR)			778			82						
Lane Group Flow (vph)	71	484	49	0	65	234	0	43	164	0	54	109
Turn Type	Perm	NA	Perm		Perm	NA		Perm	NA		Perm	NA
Protected Phases		2				6			4			8
Permitted Phases	2		2		6			4			8	
Total Split (s)	54.0	54.0	54.0		54.0	54.0		36.0	36.0		36.0	36.0
Total Lost Time (s)	6.6	6.6	6.6		6.6	6.6		6.0	6.0		6.0	6.0
Act Effect Green (s)	54.4	54.4	54.4		47.4	47.4		37.0	37.0		30.0	30.0
Actuated g/C Ratio	0.52	0.52	0.52		0.46	0.46		0.36	0.36		0.29	0.29
v/c Ratio	0.14	0.49	0.04		0.17	0.15		0.12	0.14		0.15	0.20
Control Delay (s/veh)	13.7	18.1	0.1		18.3	10.8		23.7	23.1		29.1	29.2
Queue Delay	0.0	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0
Total Delay (s/veh)	13.7	18.1	0.1		18.3	10.8		23.7	23.1		29.1	29.2
LOS	B	B	A		B	B		C	C		C	C
Approach Delay (s/veh)		16.1				12.4			23.3			24.3
Approach LOS		B				B			C			C
Queue Length 50th (m)	7.1	60.0	0.0		7.6	8.9		5.8	11.6		8.1	16.6
Queue Length 95th (m)	14.8	86.5	0.0		16.3	16.0		13.5	19.0		17.9	30.2
Internal Link Dist (m)		174.4				79.5			22.6			66.6
Turn Bay Length (m)	81.0		45.0		50.0							
Base Capacity (vph)	519	984	1208		377	1589		373	1177		351	543
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	0.14	0.49	0.04		0.17	0.15		0.12	0.14		0.15	0.20

Intersection Summary

Cycle Length: 104

Actuated Cycle Length: 104

Offset: 0 (0%), Referenced to phase 2:EBTL and 6:WBTL, Start of Green

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.49

Intersection Signal Delay (s/veh): 17.6

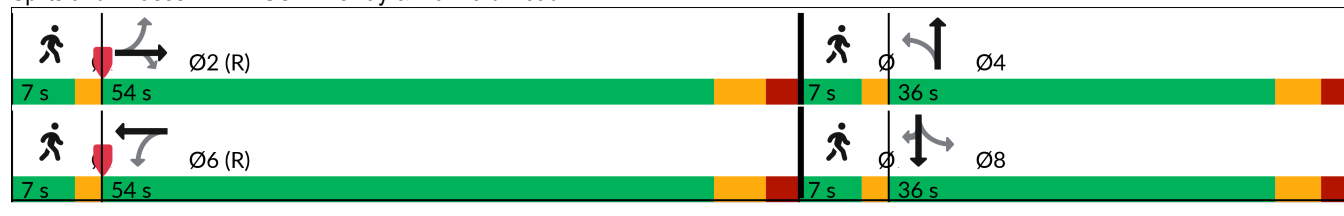
Intersection LOS: B

Intersection Capacity Utilization 61.9%

ICU Level of Service B

Analysis Period (min) 15

Splits and Phases: 2: HSC Driveway & Mumford Road



Lane Group	SBR	Ø1	Ø3	Ø5	Ø7
Lane Configurations	↗				
Traffic Volume (vph)	30				
Future Volume (vph)	30				
Satd. Flow (prot)	1601				
Flt Permitted					
Satd. Flow (perm)	1601				
Satd. Flow (RTOR)	80				
Lane Group Flow (vph)	33				
Turn Type	Perm				
Protected Phases		1	3	5	7
Permitted Phases	8				
Total Split (s)	36.0	7.0	7.0	7.0	7.0
Total Lost Time (s)	6.0				
Act Effct Green (s)	30.0				
Actuated g/C Ratio	0.29				
v/c Ratio	0.06				
Control Delay (s/veh)	0.2				
Queue Delay	0.0				
Total Delay (s/veh)	0.2				
LOS	A				
Approach Delay (s/veh)					
Approach LOS					
Queue Length 50th (m)	0.0				
Queue Length 95th (m)	0.0				
Internal Link Dist (m)					
Turn Bay Length (m)	55.0				
Base Capacity (vph)	518				
Starvation Cap Reductn	0				
Spillback Cap Reductn	0				
Storage Cap Reductn	0				
Reduced v/c Ratio	0.06				
Intersection Summary					

3: MacDonald Street/Mumford Road & Chebucto Road

AM Peak Existing

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	45	1170	10	5	400	250	15	55	30	435	25	25
Future Volume (vph)	45	1170	10	5	400	250	15	55	30	435	25	25
Satd. Flow (prot)	1789	3575	0	0	3575	1601	0	1794	0	1700	1712	1601
Flt Permitted	0.372				0.859			0.993		0.950	0.957	
Satd. Flow (perm)	701	3575	0	0	3074	1601	0	1794	0	1700	1712	1601
Satd. Flow (RTOR)		1				272		18				138
Lane Group Flow (vph)	49	1283	0	0	440	272	0	109	0	251	249	27
Turn Type	pm+pt	NA		Perm	NA	pm+ov	Split	NA		Split	NA	Perm
Protected Phases	5	2			6	4	8	8		4	4	
Permitted Phases	2			6		6						4
Total Split (s)	11.0	45.0		34.0	34.0	34.0	31.0	31.0		34.0	34.0	34.0
Total Lost Time (s)	4.0	6.4			6.4	6.5		6.5		6.5	6.5	6.5
Act Effect Green (s)	44.4	42.0			33.0	63.9		24.0		24.6	24.6	24.6
Actuated g/C Ratio	0.40	0.38			0.30	0.58		0.22		0.22	0.22	0.22
v/c Ratio	0.14	0.94			0.48	0.26		0.27		0.66	0.65	0.06
Control Delay (s/veh)	22.2	47.3			35.1	2.1		31.8		47.7	47.2	0.2
Queue Delay	0.0	0.0			0.0	0.0		0.0		0.0	0.0	0.0
Total Delay (s/veh)	22.2	47.3			35.1	2.1		31.8		47.7	47.2	0.2
LOS	C	D			D	A		C		D	D	A
Approach Delay (s/veh)		46.4			22.4			31.8			45.0	
Approach LOS		D			C			C			D	
Queue Length 50th (m)	6.3	136.2			41.4	0.0		16.2		52.4	51.8	0.0
Queue Length 95th (m)	14.6	#194.5			59.7	10.8		31.4		77.6	76.7	0.0
Internal Link Dist (m)		69.0			62.6			39.0			37.5	
Turn Bay Length (m)	20.0											8.0
Base Capacity (vph)	354	1366			921	1079		413		425	428	503
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	0.14	0.94			0.48	0.25		0.26		0.59	0.58	0.05

Intersection Summary

Cycle Length: 110

Actuated Cycle Length: 110

Offset: 0 (0%), Referenced to phase 2:EBTL and 6:WBTL, Start of Green

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.94

Intersection Signal Delay (s/veh): 39.2

Intersection LOS: D

Intersection Capacity Utilization 72.6%

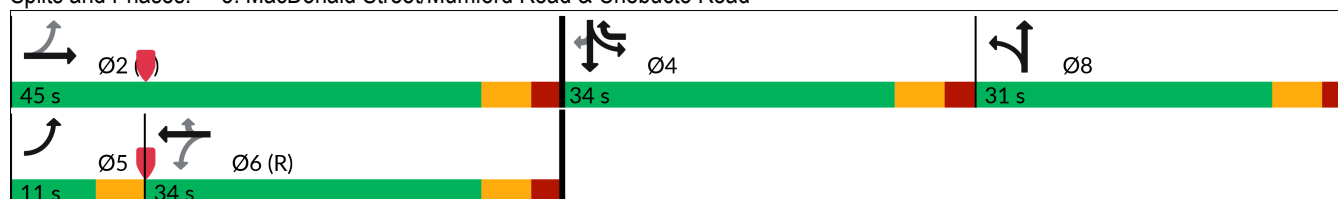
ICU Level of Service C

Analysis Period (min) 15

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

Queue shown is maximum after two cycles.

Splits and Phases: 3: MacDonald Street/Mumford Road & Chebucto Road



Appendix C - Intersection Capacity Analysis
4: Joseph Howe Drive & Glen Eagle Way/Mumford Road

Page C-6
AM Peak Existing

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔			↔	↔		↔		↔	↔	
Traffic Volume (vph)	5	0	0	50	0	140	0	265	110	520	805	0
Future Volume (vph)	5	0	0	50	0	140	0	265	110	520	805	0
Satd. Flow (prot)	0	1789	0	0	1789	1601	0	3421	0	1789	1883	0
Flt Permitted		0.722			0.754					0.484		
Satd. Flow (perm)	0	1360	0	0	1420	1601	0	3421	0	912	1883	0
Satd. Flow (RTOR)						152		58				
Lane Group Flow (vph)	0	5	0	0	54	152	0	408	0	565	875	0
Turn Type	Perm	NA		Perm	NA	Perm		NA		pm+pt	NA	
Protected Phases		8			4			6		5	2	
Permitted Phases	8			4		4	6			2		
Total Split (s)	28.0	28.0		28.0	28.0	28.0	37.0	37.0		45.0	82.0	
Total Lost Time (s)		6.3			6.3	6.3		5.8		4.0	5.8	
Act Effect Green (s)		9.8			9.8	9.8		68.3		89.9	88.1	
Actuated g/C Ratio		0.09			0.09	0.09		0.62		0.82	0.80	
v/c Ratio		0.04			0.43	0.54		0.19		0.65	0.58	
Control Delay (s/veh)		44.6			57.0	14.8		9.0		6.8	6.3	
Queue Delay		0.0			0.0	0.0		0.0		0.0	0.0	
Total Delay (s/veh)		44.6			57.0	14.8		9.0		6.8	6.3	
LOS		D			E	B		A		A	A	
Approach Delay (s/veh)		44.6			25.9			9.0			6.5	
Approach LOS		D			C			A			A	
Queue Length 50th (m)		1.0			11.2	0.0		14.7		24.2	54.0	
Queue Length 95th (m)		4.5			23.0	18.0		30.0		44.6	96.5	
Internal Link Dist (m)		62.3			40.6			94.9			76.8	
Turn Bay Length (m)						35.0						
Base Capacity (vph)		268			280	437		2144		1071	1507	
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		0.02			0.19	0.35		0.19		0.53	0.58	

Intersection Summary

Cycle Length: 110

Actuated Cycle Length: 110

Offset: 0 (0%), Referenced to phase 2:SBTL and 6:NBTL, Start of Green

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.65

Intersection Signal Delay (s/veh): 9.0

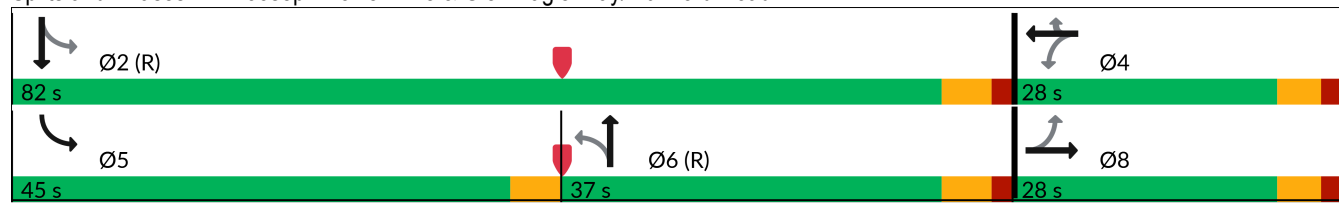
Intersection LOS: A

Intersection Capacity Utilization 74.0%

ICU Level of Service D

Analysis Period (min) 15

Splits and Phases: 4: Joseph Howe Drive & Glen Eagle Way/Mumford Road



Appendix C - Intersection Capacity Analysis
5: Romans Avenue & Bayers Road

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AM Peak Existing

	→	↗	↘	←	↖	↗	↘	↑	↖	↘	↓	↙
Lane Group	EBT	EBR	EBR2	WBT	WBR	WBR2	NBL2	NBT	NBR	SBL2	SBT	SBR
Lane Configurations	↑↑	↗		↑↑	↗		↖	↖			↙	
Traffic Volume (vph)	1535	0	55	690	0	5	40	40	15	5	15	25
Future Volume (vph)	1535	0	55	690	0	5	40	40	15	5	15	25
Satd. Flow (prot)	3579	1601	0	3579	1601	0	1789	1806	0	0	1732	0
Flt Permitted							0.726				0.954	
Satd. Flow (perm)	3579	1601	0	3579	1601	0	1367	1806	0	0	1660	0
Satd. Flow (RTOR)		1010			885							
Lane Group Flow (vph)	1668	60	0	750	5	0	43	59	0	0	48	0
Turn Type	NA	Perm		NA	Perm		Perm	NA		Perm	NA	
Protected Phases	2			6				8			4	
Permitted Phases		2			6		8			4		
Total Split (s)	82.0	82.0		82.0	82.0		38.0	38.0		38.0	38.0	
Total Lost Time (s)	6.6	6.6		6.6	6.6		6.6	6.6			6.6	
Act Effect Green (s)	101.2	101.2		101.2	101.2		9.6	9.6			9.6	
Actuated g/C Ratio	0.84	0.84		0.84	0.84		0.08	0.08			0.08	
v/c Ratio	0.55	0.04		0.25	0.00		0.39	0.41			0.36	
Control Delay (s/veh)	4.7	0.1		2.7	0.0		62.1	60.2			59.0	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0			0.0	
Total Delay (s/veh)	4.7	0.1		2.7	0.0		62.1	60.2			59.0	
LOS	A	A		A	A		E	E			E	
Approach Delay (s/veh)	4.5			2.7				61.0			59.0	
Approach LOS	A			A				E			E	
Queue Length 50th (m)	57.5	0.0		16.6	0.0		9.8	13.5			10.9	
Queue Length 95th (m)	85.2	0.0		25.9	m0.0		21.0	26.1			22.4	
Internal Link Dist (m)	56.2			360.9				29.8			35.4	
Turn Bay Length (m)		25.0			35.0							
Base Capacity (vph)	3018	1508		3018	1488		357	472			434	
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	0.55	0.04		0.25	0.00		0.12	0.13			0.11	

Intersection Summary

Cycle Length: 120

Actuated Cycle Length: 120

Offset: 109 (91%), Referenced to phase 2:EBT and 6:WBT, Start of Green

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.55

Intersection Signal Delay (s/veh): 7.2

Intersection LOS: A

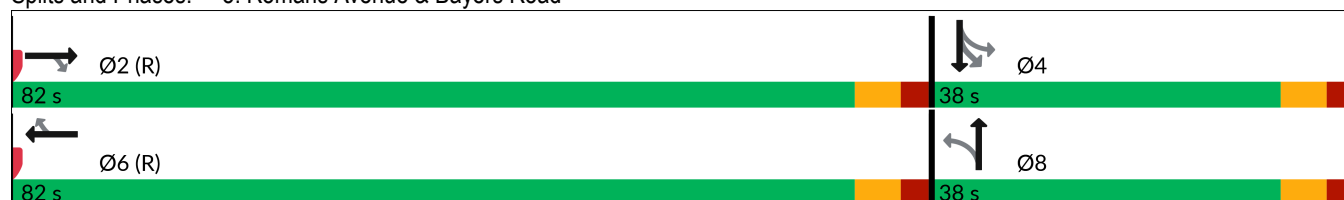
Intersection Capacity Utilization 62.3%

ICU Level of Service B

Analysis Period (min) 15

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

Splits and Phases: 5: Romans Avenue & Bayers Road



Synchro 12 Report
July 2025

	→	↘	↙	←	↖	↗		
Lane Group	EBT	EBR	WBL	WBT	NBL	NBR	Ø3	Ø9
Lane Configurations	↑↑↑	↗		↑↑	↖↗			
Traffic Volume (vph)	1275	20	0	780	30	0		
Future Volume (vph)	1275	20	0	780	30	0		
Satd. Flow (prot)	5142	1601	0	3579	3471	0		
Flt Permitted					0.950			
Satd. Flow (perm)	5142	1601	0	3579	3471	0		
Satd. Flow (RTOR)		21						
Lane Group Flow (vph)	1386	22	0	848	33	0		
Turn Type	NA	Perm		NA	Prot			
Protected Phases	4			8	2		3	9
Permitted Phases		4						
Total Split (s)	72.0	72.0		72.0	48.0		37.0	11.0
Total Lost Time (s)	8.5	8.5		8.5	6.0			
Act Effect Green (s)	88.0	88.0		88.0	17.5			
Actuated g/C Ratio	0.73	0.73		0.73	0.15			
v/c Ratio	0.37	0.02		0.32	0.07			
Control Delay (s/veh)	3.3	0.5		0.9	41.5			
Queue Delay	0.0	0.0		0.0	0.0			
Total Delay (s/veh)	3.3	0.5		0.9	41.5			
LOS	A	A		A	D			
Approach Delay (s/veh)	3.2			0.9	41.5			
Approach LOS	A			A	D			
Queue Length 50th (m)	10.8	0.0		2.0	3.5			
Queue Length 95th (m)	23.0	m0.2		2.4	7.4			
Internal Link Dist (m)	22.0			6.2	38.3			
Turn Bay Length (m)		50.0						
Base Capacity (vph)	3772	1180		2625	1214			
Starvation Cap Reductn	0	0		0	0			
Spillback Cap Reductn	85	0		0	0			
Storage Cap Reductn	0	0		0	0			
Reduced v/c Ratio	0.38	0.02		0.32	0.03			

Intersection Summary

Cycle Length: 120

Actuated Cycle Length: 120

Offset: 22 (18%), Referenced to phase 4:EBT and 8:WBT, Start of Green

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.68

Intersection Signal Delay (s/veh): 2.9

Intersection LOS: A

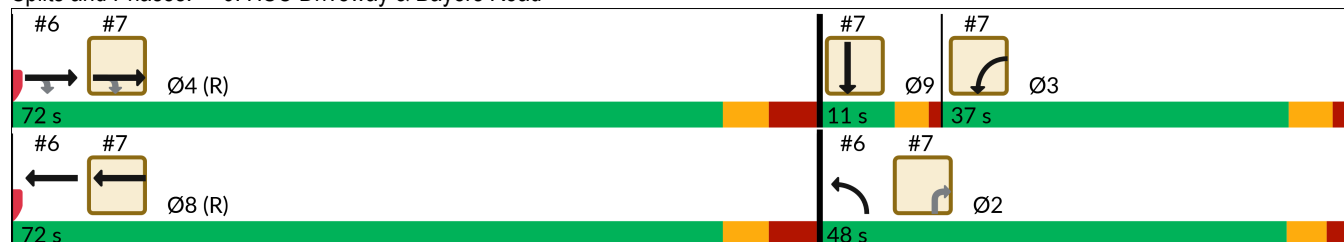
Intersection Capacity Utilization 42.6%

ICU Level of Service A

Analysis Period (min) 15

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

Splits and Phases: 6: HSC Driveway & Bayers Road



Appendix C - Intersection Capacity Analysis
7: HSC Driveway/Transit Priority Lane & Bayers Road

Page C-9
AM Peak Existing

	↖	→	↗	↖	←	↖	↖	↑	↗	↘	↓	↙
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↑	↗	↖	↑↑				↗↗		↑	
Traffic Volume (vph)	0	1275	0	85	780	0	0	0	285	0	10	0
Future Volume (vph)	0	1275	0	85	780	0	0	0	285	0	10	0
Satd. Flow (prot)	0	3579	1883	1789	3579	0	0	0	2818	0	961	0
Flt Permitted				0.950								
Satd. Flow (perm)	0	3579	1883	1789	3579	0	0	0	2818	0	961	0
Satd. Flow (RTOR)									56			
Lane Group Flow (vph)	0	1386	0	92	848	0	0	0	310	0	11	0
Turn Type		NA	Perm	Prot	NA				Perm		NA	
Protected Phases		4		3	8						9	
Permitted Phases			4						2			
Total Split (s)		72.0	72.0	37.0	72.0				48.0		11.0	
Total Lost Time (s)		8.5	8.5	5.9	8.5				6.0		4.0	
Act Effect Green (s)		88.0		15.4	88.0				17.5		6.6	
Actuated g/C Ratio		0.73		0.13	0.73				0.15		0.06	
v/c Ratio		0.53		0.40	0.32				0.68		0.21	
Control Delay (s/veh)		2.2		53.0	6.5				46.5		63.6	
Queue Delay		0.0		0.0	0.6				0.0		0.0	
Total Delay (s/veh)		2.2		53.0	7.1				46.5		63.6	
LOS		A		D	A				D		E	
Approach Delay (s/veh)		2.2			11.6			46.5			63.6	
Approach LOS		A			B			D			E	
Queue Length 50th (m)		3.3		20.0	30.9				32.9		2.5	
Queue Length 95th (m)		19.4		36.4	54.5				44.5		8.7	
Internal Link Dist (m)		6.2			107.7			39.7			18.2	
Turn Bay Length (m)				70.0								
Base Capacity (vph)		2625		463	2625				1022		56	
Starvation Cap Reductn		0		0	1276				0		0	
Spillback Cap Reductn		0		0	0				0		0	
Storage Cap Reductn		0		0	0				0		0	
Reduced v/c Ratio		0.53		0.20	0.63				0.30		0.20	

Intersection Summary

Cycle Length: 120

Actuated Cycle Length: 120

Offset: 22 (18%), Referenced to phase 4:EBT and 8:WBT, Start of Green

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.68

Intersection Signal Delay (s/veh): 11.0

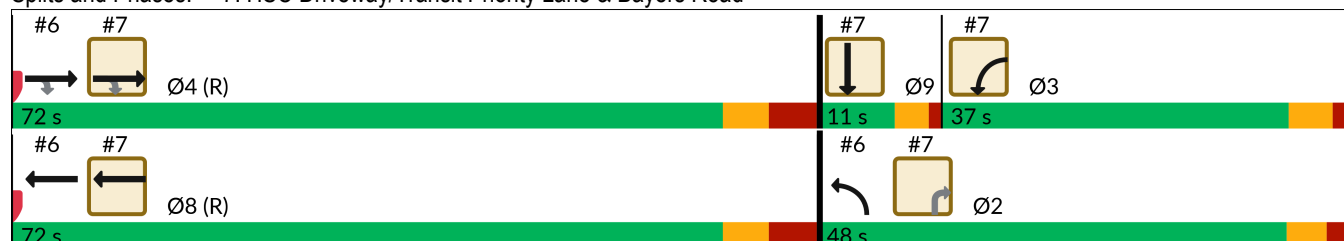
Intersection LOS: B

Intersection Capacity Utilization 60.3%

ICU Level of Service B

Analysis Period (min) 15

Splits and Phases: 7: HSC Driveway/Transit Priority Lane & Bayers Road



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Appendix C - Intersection Capacity Analysis
1: Romans Avenue & Mumford Road

Page C-10
PM Peak Existing

												
Lane Group	EBL	EBT	EBR	EBR2	WBL	WBT	WBR	NBL	NBT	NBR	SBL2	SBT
Lane Configurations												
Traffic Volume (vph)	100	440	0	105	30	510	105	150	75	25	80	60
Future Volume (vph)	100	440	0	105	30	510	105	150	75	25	80	60
Satd. Flow (prot)	1789	1883	1601	0	1789	1883	1601	0	1823	1601	0	1796
Flt Permitted	0.331				0.391				0.686			0.607
Satd. Flow (perm)	623	1883	1601	0	736	1883	1601	0	1292	1601	0	1116
Satd. Flow (RTOR)			868				114					10
Lane Group Flow (vph)	109	478	114	0	33	554	114	0	245	27	0	185
Turn Type	Perm	NA	Perm		Perm	NA	Perm	Perm	NA	Perm	Perm	NA
Protected Phases		2				6			8			4
Permitted Phases	2		2		6		6	8		8	4	
Total Split (s)	55.0	55.0	55.0		55.0	55.0	55.0	35.0	35.0	35.0	35.0	35.0
Total Lost Time (s)	6.4	6.4	6.4		6.4	6.4	6.4		7.5	7.5		7.5
Act Effct Green (s)	57.6	57.6	57.6		57.6	57.6	57.6		27.5	27.5		27.5
Actuated g/C Ratio	0.55	0.55	0.55		0.55	0.55	0.55		0.26	0.26		0.26
v/c Ratio	0.32	0.46	0.09		0.08	0.54	0.12		0.72	0.06		0.62
Control Delay (s/veh)	17.7	17.1	0.1		13.6	18.5	2.9		49.2	29.8		42.5
Queue Delay	0.0	0.0	0.0		0.0	0.4	0.0		0.0	0.0		0.0
Total Delay (s/veh)	17.7	17.1	0.1		13.6	18.9	2.9		49.2	29.8		42.5
LOS	B	B	A		B	B	A		D	C		D
Approach Delay (s/veh)		14.4				16.1			47.3			42.5
Approach LOS		B				B			D			D
Queue Length 50th (m)	12.7	61.4	0.0		3.3	75.3	0.0		45.6	4.2		31.5
Queue Length 95th (m)	26.0	88.7	0.0		8.5	107.7	8.2		#79.7	10.9		55.4
Internal Link Dist (m)		33.6				174.4			33.5			35.7
Turn Bay Length (m)	40.0		23.0		67.0							
Base Capacity (vph)	342	1033	1270		403	1033	929		338	419		299
Starvation Cap Reductn	0	0	0		0	139	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	0.32	0.46	0.09		0.08	0.62	0.12		0.72	0.06		0.62

Intersection Summary

Cycle Length: 105

Actuated Cycle Length: 105

Offset: 85 (81%), Referenced to phase 2:EBTL, Start of Green

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.72

Intersection Signal Delay (s/veh): 23.1

Intersection LOS: C

Intersection Capacity Utilization 76.0%

ICU Level of Service D

Analysis Period (min) 15

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

Queue shown is maximum after two cycles.

Splits and Phases: 1: Romans Avenue & Mumford Road





Lane Group	SBR	NWL	NWR2	Ø1	Ø5
Lane Configurations					
Traffic Volume (vph)	30	14	15		
Future Volume (vph)	30	14	15		
Satd. Flow (prot)	0	1789	1601		
Flt Permitted		0.950			
Satd. Flow (perm)	0	1789	1601		
Satd. Flow (RTOR)					
Lane Group Flow (vph)	0	15	16		
Turn Type		Prot	Prot		
Protected Phases		9	9	1	5
Permitted Phases					
Total Split (s)		10.0	10.0	5.0	5.0
Total Lost Time (s)		4.0	4.0		
Act Effect Green (s)		6.0	6.0		
Actuated g/C Ratio		0.06	0.06		
v/c Ratio		0.15	0.18		
Control Delay (s/veh)		50.5	51.8		
Queue Delay		0.0	0.0		
Total Delay (s/veh)		50.5	51.8		
LOS		D	D		
Approach Delay (s/veh)		51.2			
Approach LOS		D			
Queue Length 50th (m)		3.0	3.2		
Queue Length 95th (m)		9.5	10.1		
Internal Link Dist (m)		53.9			
Turn Bay Length (m)					
Base Capacity (vph)		102	91		
Starvation Cap Reductn		0	0		
Spillback Cap Reductn		0	0		
Storage Cap Reductn		0	0		
Reduced v/c Ratio		0.15	0.18		
Intersection Summary					

Appendix C - Intersection Capacity Analysis

2: HSC Driveway & Mumford Road

Page C-12
PM Peak Existing

												
Lane Group	EBL	EBT	EBR	EBR2	WBL	WBT	WBR	NBL	NBT	NBR	SBL2	SBT
Lane Configurations												
Traffic Volume (vph)	85	375	0	50	95	475	220	115	180	80	140	135
Future Volume (vph)	85	375	0	50	95	475	220	115	180	80	140	135
Satd. Flow (prot)	1789	1883	1601	0	1789	3410	0	1789	3414	0	1789	1883
Flt Permitted	0.244				0.523			0.514			0.578	
Satd. Flow (perm)	460	1883	1601	0	985	3410	0	968	3414	0	1089	1883
Satd. Flow (RTOR)			696			90						
Lane Group Flow (vph)	92	408	54	0	103	755	0	125	283	0	152	147
Turn Type	Perm	NA	Perm		Perm	NA		Perm	NA		Perm	NA
Protected Phases		2				6			4			8
Permitted Phases	2		2		6			4			8	
Total Split (s)	60.0	60.0	60.0		60.0	60.0		40.0	40.0		40.0	40.0
Total Lost Time (s)	6.6	6.6	6.6		6.6	6.6		6.0	6.0		6.0	6.0
Act Effect Green (s)	64.0	64.0	64.0		53.4	53.4		37.4	37.4		30.4	30.4
Actuated g/C Ratio	0.56	0.56	0.56		0.47	0.47		0.33	0.33		0.27	0.27
v/c Ratio	0.36	0.39	0.04		0.22	0.46		0.39	0.25		0.52	0.29
Control Delay (s/veh)	18.9	15.5	0.1		19.6	18.9		34.0	28.7		43.1	35.0
Queue Delay	0.0	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0
Total Delay (s/veh)	18.9	15.5	0.1		19.6	18.9		34.0	28.7		43.1	35.0
LOS	B	B	A		B	B		C	C		D	D
Approach Delay (s/veh)		14.5				19.0			30.3			33.9
Approach LOS		B				B			C			C
Queue Length 50th (m)	10.6	48.0	0.0		13.3	51.0		21.5	24.3		29.1	26.3
Queue Length 95th (m)	24.3	71.9	0.0		24.9	66.8		37.9	34.3		49.2	42.7
Internal Link Dist (m)		174.4				79.5			22.6			66.6
Turn Bay Length (m)	81.0		45.0		50.0							
Base Capacity (vph)	258	1057	1204		461	1645		317	1119		324	561
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	0.39	0.04		0.22	0.46		0.39	0.25		0.47	0.26

Intersection Summary

Cycle Length: 114

Actuated Cycle Length: 114

Offset: 9 (8%), Referenced to phase 2:EBTL and 6:WBTL, Start of Green

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.52

Intersection Signal Delay (s/veh): 22.4

Intersection LOS: C

Intersection Capacity Utilization 62.3%

ICU Level of Service B

Analysis Period (min) 15

Splits and Phases: 2: HSC Driveway & Mumford Road

		Ø2 (R)			Ø4
7 s	60 s		7 s	40 s	
		Ø6 (R)			Ø8
7 s	60 s		7 s	40 s	

Lane Group	SBR	Ø1	Ø3	Ø5	Ø7
Lane Configurations	↗				
Traffic Volume (vph)	50				
Future Volume (vph)	50				
Satd. Flow (prot)	1601				
Flt Permitted					
Satd. Flow (perm)	1601				
Satd. Flow (RTOR)	73				
Lane Group Flow (vph)	54				
Turn Type	Perm				
Protected Phases		1	3	5	7
Permitted Phases	8				
Total Split (s)	40.0	7.0	7.0	7.0	7.0
Total Lost Time (s)	6.0				
Act Effct Green (s)	30.4				
Actuated g/C Ratio	0.27				
v/c Ratio	0.11				
Control Delay (s/veh)	4.6				
Queue Delay	0.0				
Total Delay (s/veh)	4.6				
LOS	A				
Approach Delay (s/veh)					
Approach LOS					
Queue Length 50th (m)	0.0				
Queue Length 95th (m)	6.1				
Internal Link Dist (m)					
Turn Bay Length (m)	55.0				
Base Capacity (vph)	528				
Starvation Cap Reductn	0				
Spillback Cap Reductn	0				
Storage Cap Reductn	0				
Reduced v/c Ratio	0.10				
Intersection Summary					

3: MacDonald Street/Mumford Road & Chebucto Road

PM Peak Existing

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	115	395	10	10	690	810	30	205	10	450	50	85
Future Volume (vph)	115	395	10	10	690	810	30	205	10	450	50	85
Satd. Flow (prot)	1789	3564	0	0	3575	1601	0	1861	0	1700	1719	1601
Flt Permitted	0.201				0.945			0.994		0.950	0.961	
Satd. Flow (perm)	379	3564	0	0	3382	1601	0	1861	0	1700	1719	1601
Satd. Flow (RTOR)		2				268		1				117
Lane Group Flow (vph)	125	440	0	0	761	880	0	267	0	269	274	92
Turn Type	pm+pt	NA		Perm	NA	pm+ov	Split	NA		Split	NA	Perm
Protected Phases	5	2			6	4	8	8		4	4	
Permitted Phases	2			6		6						4
Total Split (s)	13.0	62.0		49.0	49.0	37.0	31.0	31.0		37.0	37.0	37.0
Total Lost Time (s)	4.0	6.4			6.4	6.5		6.5		6.5	6.5	6.5
Act Effct Green (s)	60.2	57.8			45.0	80.0		24.2		28.6	28.6	28.6
Actuated g/C Ratio	0.46	0.44			0.35	0.62		0.19		0.22	0.22	0.22
v/c Ratio	0.46	0.28			0.65	0.81		0.77		0.72	0.73	0.21
Control Delay (s/veh)	26.7	23.8			39.7	20.1		65.7		58.5	58.7	4.5
Queue Delay	0.0	0.0			0.0	0.0		0.0		0.0	0.0	0.0
Total Delay (s/veh)	26.7	23.8			39.7	20.1		65.7		58.5	58.7	4.5
LOS	C	C			D	C		E		E	E	A
Approach Delay (s/veh)		24.5			29.1			65.7			50.8	
Approach LOS		C			C			E			D	
Queue Length 50th (m)	18.6	37.7			88.8	120.3		65.5		66.4	67.7	0.0
Queue Length 95th (m)	31.4	50.3			110.9	187.3		#101.7		98.3	99.6	8.3
Internal Link Dist (m)		69.0			62.6			39.0			37.5	
Turn Bay Length (m)	20.0											8.0
Base Capacity (vph)	274	1586			1171	1108		351		398	403	465
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	0.46	0.28			0.65	0.79		0.76		0.68	0.68	0.20

Intersection Summary

Cycle Length: 130

Actuated Cycle Length: 130

Offset: 18 (14%), Referenced to phase 2:EBTL and 6:WBTL, Start of Green

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.81

Intersection Signal Delay (s/veh): 35.9

Intersection LOS: D

Intersection Capacity Utilization 90.6%

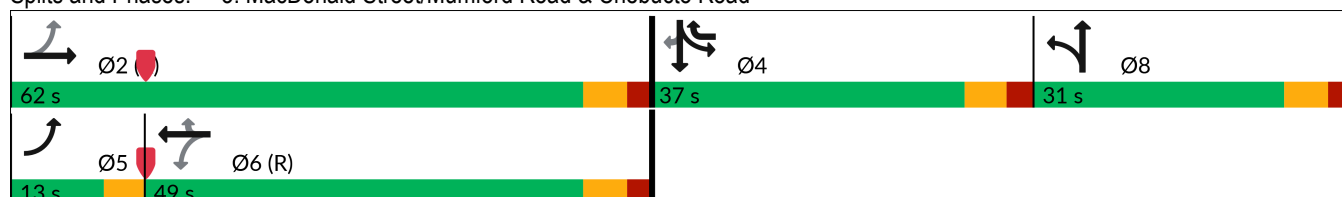
ICU Level of Service E

Analysis Period (min) 15

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

Queue shown is maximum after two cycles.

Splits and Phases: 3: MacDonald Street/Mumford Road & Chebucto Road



4: Joseph Howe Drive & Glen Eagle Way/Mumford Road

PM Peak Existing

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	5	5	0	160	0	440	0	540	185	465	495	0
Future Volume (vph)	5	5	0	160	0	440	0	540	185	465	495	0
Satd. Flow (prot)	0	1838	0	0	1789	1601	0	3443	0	1789	1883	0
Flt Permitted		0.869			0.751					0.186		
Satd. Flow (perm)	0	1637	0	0	1414	1601	0	3443	0	350	1883	0
Satd. Flow (RTOR)						411		42				
Lane Group Flow (vph)	0	10	0	0	174	478	0	788	0	505	538	0
Turn Type	Perm	NA		Perm	NA	Perm		NA		pm+pt	NA	
Protected Phases		8			4			6		5	2	
Permitted Phases	8			4		4	6			2		
Total Split (s)	52.0	52.0		52.0	52.0	52.0	46.0	46.0		22.0	68.0	
Total Lost Time (s)		6.3			6.3	6.3		5.8		4.0	5.8	
Act Effect Green (s)		21.7			21.7	21.7		41.7		88.0	86.2	
Actuated g/C Ratio		0.18			0.18	0.18		0.35		0.73	0.72	
v/c Ratio		0.03			0.68	0.76		0.64		0.68	0.40	
Control Delay (s/veh)		36.4			58.4	15.9		34.0		22.0	8.7	
Queue Delay		0.0			0.0	0.0		6.4		0.0	0.0	
Total Delay (s/veh)		36.4			58.4	15.9		40.4		22.0	8.7	
LOS		D			E	B		D		C	A	
Approach Delay (s/veh)		36.4			27.3			40.4			15.1	
Approach LOS		D			C			D			B	
Queue Length 50th (m)		2.0			38.5	13.6		75.2		61.9	44.8	
Queue Length 95th (m)		6.1			57.0	47.4		100.5		#124.7	81.5	
Internal Link Dist (m)		62.3			40.6			94.9			76.8	
Turn Bay Length (m)						35.0						
Base Capacity (vph)		623			538	864		1223		742	1352	
Starvation Cap Reductn		0			0	0		378		0	0	
Spillback Cap Reductn		0			0	0		0		0	0	
Storage Cap Reductn		0			0	0		0		0	0	
Reduced v/c Ratio		0.02			0.32	0.55		0.93		0.68	0.40	

Intersection Summary

Cycle Length: 120

Actuated Cycle Length: 120

Offset: 98 (82%), Referenced to phase 2:SBTL and 6:NBTL, Start of Green

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.76

Intersection Signal Delay (s/veh): 26.4

Intersection LOS: C

Intersection Capacity Utilization 77.3%

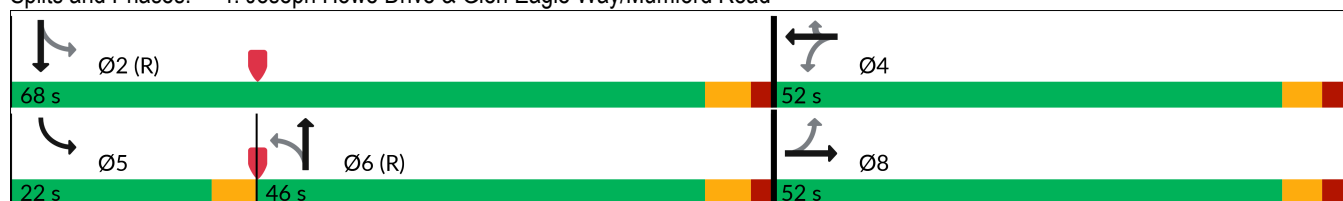
ICU Level of Service D

Analysis Period (min) 15

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

Queue shown is maximum after two cycles.

Splits and Phases: 4: Joseph Howe Drive & Glen Eagle Way/Mumford Road



Appendix C - Intersection Capacity Analysis
5: Romans Avenue & Bayers Road

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PM Peak Existing

												
Lane Group	EBT	EBR	EBR2	WBT	WBR	WBR2	NBL2	NBT	NBR	SBL2	SBT	SBR
Lane Configurations	↑↑	↔		↑↑	↔		↔	↔			↔	
Traffic Volume (vph)	1210	0	115	2170	0	15	145	70	5	5	50	5
Future Volume (vph)	1210	0	115	2170	0	15	145	70	5	5	50	5
Satd. Flow (prot)	3579	1601	0	3579	1601	0	1789	1866	0	0	1855	0
Flt Permitted							0.770				0.978	
Satd. Flow (perm)	3579	1601	0	3579	1601	0	1450	1866	0	0	1822	0
Satd. Flow (RTOR)		835			748							
Lane Group Flow (vph)	1315	125	0	2359	16	0	158	81	0	0	64	0
Turn Type	NA	Perm		NA	Perm		Perm	NA		Perm	NA	
Protected Phases	2			6				8			4	
Permitted Phases		2			6		8			4		
Total Split (s)	90.0	90.0		90.0	90.0		40.0	40.0		40.0	40.0	
Total Lost Time (s)	6.6	6.6		6.6	6.6		6.6	6.6			6.6	
Act Effect Green (s)	97.3	97.3		97.3	97.3		19.5	19.5			19.5	
Actuated g/C Ratio	0.75	0.75		0.75	0.75		0.15	0.15			0.15	
v/c Ratio	0.49	0.09		0.88	0.01		0.73	0.29			0.23	
Control Delay (s/veh)	7.8	0.1		20.1	0.0		70.9	49.9			48.6	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0			0.0	
Total Delay (s/veh)	7.8	0.1		20.1	0.0		70.9	49.9			48.6	
LOS	A	A		C	A		E	D			D	
Approach Delay (s/veh)	7.2			20.0				63.8			48.6	
Approach LOS	A			B				E			D	
Queue Length 50th (m)	61.5	0.0		297.4	0.0		39.1	18.7			14.6	
Queue Length 95th (m)	94.7	0.0		#344.5	m0.0		58.9	31.7			26.3	
Internal Link Dist (m)	56.2			358.7				29.8			35.4	
Turn Bay Length (m)		25.0			35.0							
Base Capacity (vph)	2678	1408		2678	1386		372	479			468	
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	0.49	0.09		0.88	0.01		0.42	0.17			0.14	

Intersection Summary

Cycle Length: 130

Actuated Cycle Length: 130

Offset: 8 (6%), Referenced to phase 2:EBT and 6:WBT, Start of Green

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.88

Intersection Signal Delay (s/veh): 18.5

Intersection LOS: B

Intersection Capacity Utilization 85.7%

ICU Level of Service E

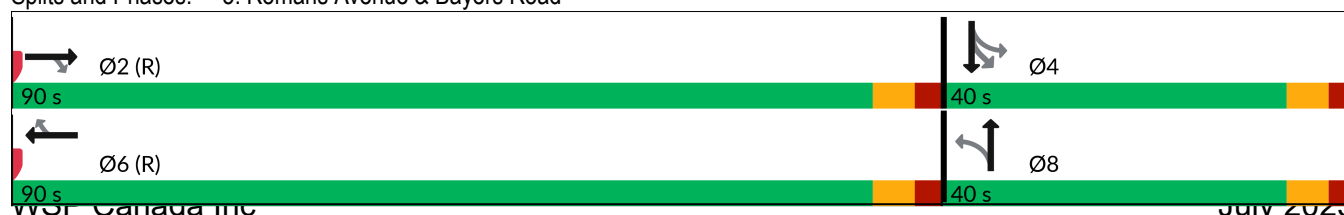
Analysis Period (min) 15

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

Queue shown is maximum after two cycles.

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

Splits and Phases: 5: Romans Avenue & Bayers Road



Appendix C - Intersection Capacity Analysis 6: HSC Driveway & Bayers Road

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PM Peak Existing

	→	↘	↙	←	↖	↗		
Lane Group	EBT	EBR	WBL	WBT	NBL	NBR	Ø1	Ø9
Lane Configurations	↑↑↑	↗		↑↑	↖↗			
Traffic Volume (vph)	1110	145	0	1645	305	0		
Future Volume (vph)	1110	145	0	1645	305	0		
Satd. Flow (prot)	5142	1601	0	3579	3471	0		
Flt Permitted					0.950			
Satd. Flow (perm)	5142	1601	0	3579	3471	0		
Satd. Flow (RTOR)		158						
Lane Group Flow (vph)	1207	158	0	1788	332	0		
Turn Type	NA	Perm		NA	Perm			
Protected Phases	2			6			1	9
Permitted Phases		2			8			
Total Split (s)	82.0	82.0		82.0	48.0		37.0	11.0
Total Lost Time (s)	8.5	8.5		8.5	6.0			
Act Effect Green (s)	91.2	91.2		91.2	24.3			
Actuated g/C Ratio	0.70	0.70		0.70	0.19			
v/c Ratio	0.33	0.14		0.71	0.51			
Control Delay (s/veh)	12.8	5.4		2.1	49.0			
Queue Delay	0.0	0.0		0.0	0.0			
Total Delay (s/veh)	12.8	5.4		2.1	49.0			
LOS	B	A		A	D			
Approach Delay (s/veh)	11.9			2.1	49.0			
Approach LOS	B			A	D			
Queue Length 50th (m)	36.9	0.0		1.9	40.8			
Queue Length 95th (m)	104.5	21.6		8.3	45.1			
Internal Link Dist (m)	23.9			6.2	38.3			
Turn Bay Length (m)		50.0						
Base Capacity (vph)	3607	1170		2510	1121			
Starvation Cap Reductn	0	0		0	0			
Spillback Cap Reductn	149	0		0	0			
Storage Cap Reductn	0	0		0	0			
Reduced v/c Ratio	0.35	0.14		0.71	0.30			

Intersection Summary

Cycle Length: 130

Actuated Cycle Length: 130

Offset: 102 (78%), Referenced to phase 2:EBT and 6:WBT, Start of Green

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.76

Intersection Signal Delay (s/veh): 10.4

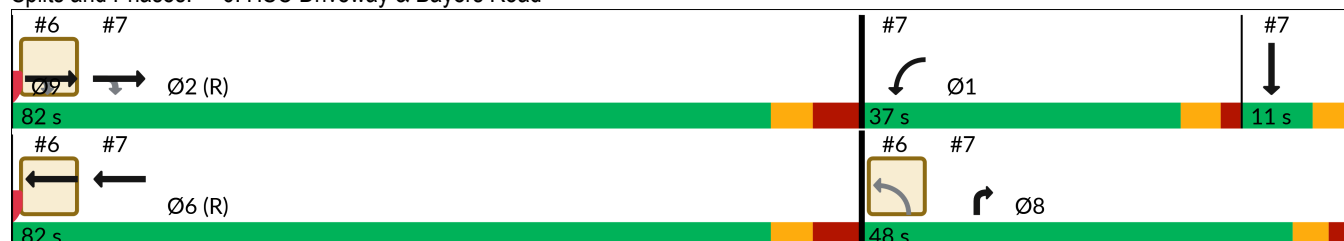
Intersection LOS: B

Intersection Capacity Utilization 66.3%

ICU Level of Service C

Analysis Period (min) 15

Splits and Phases: 6: HSC Driveway & Bayers Road



Synchro 12 Report
July 2025

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↑	↑	↑	↑↑				↑↑		↑	
Traffic Volume (vph)	0	1110	0	210	1645	0	0	0	235	0	10	0
Future Volume (vph)	0	1110	0	210	1645	0	0	0	235	0	10	0
Satd. Flow (prot)	0	3579	1883	1789	3579	0	0	0	2818	0	961	0
Flt Permitted				0.950								
Satd. Flow (perm)	0	3579	1883	1789	3579	0	0	0	2818	0	961	0
Satd. Flow (RTOR)									111			
Lane Group Flow (vph)	0	1207	0	228	1788	0	0	0	255	0	11	0
Turn Type		NA	Perm	Prot	NA				Prot		NA	
Protected Phases		2		1	6				8		9	
Permitted Phases			2						8			
Total Split (s)		82.0	82.0	37.0	82.0				48.0		11.0	
Total Lost Time (s)		8.5	8.5	5.9	8.5				6.0		4.0	
Act Effect Green (s)		91.2		21.8	91.2				24.3		7.2	
Actuated g/C Ratio		0.70		0.17	0.70				0.19		0.06	
v/c Ratio		0.48		0.76	0.71				0.41		0.21	
Control Delay (s/veh)		3.9		83.9	14.2				26.0		67.0	
Queue Delay		0.0		0.0	10.5				0.0		0.0	
Total Delay (s/veh)		3.9		83.9	24.7				26.0		67.0	
LOS		A		F	C				C		E	
Approach Delay (s/veh)		3.9			31.4			26.0			67.0	
Approach LOS		A			C			C			E	
Queue Length 50th (m)		15.9		60.1	217.5				18.6		2.8	
Queue Length 95th (m)		39.7		m71.6	270.0				26.4		9.1	
Internal Link Dist (m)		6.2			107.7			39.7			18.2	
Turn Bay Length (m)				70.0								
Base Capacity (vph)		2510		427	2510				985		56	
Starvation Cap Reductn		0		0	717				0		0	
Spillback Cap Reductn		96		0	1				29		0	
Storage Cap Reductn		0		0	0				0		0	
Reduced v/c Ratio		0.50		0.53	1.00				0.27		0.20	

Intersection Summary

Cycle Length: 130

Actuated Cycle Length: 130

Offset: 102 (78%), Referenced to phase 2:EBT and 6:WBT, Start of Green

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.76

Intersection Signal Delay (s/veh): 21.6

Intersection LOS: C

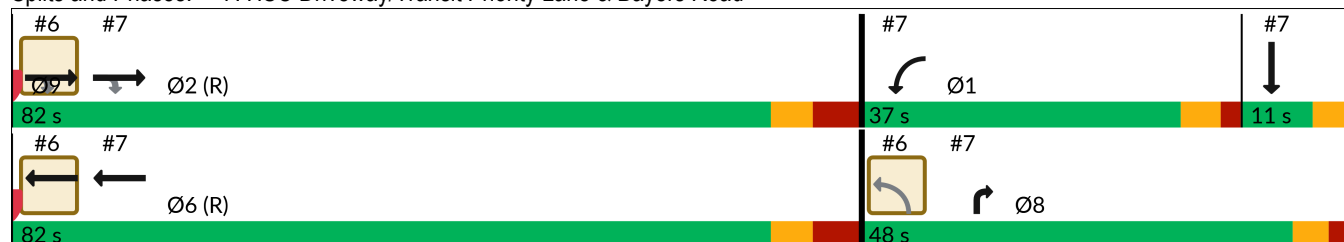
Intersection Capacity Utilization 62.7%

ICU Level of Service B

Analysis Period (min) 15

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

Splits and Phases: 7: HSC Driveway/Transit Priority Lane & Bayers Road



Appendix C - Intersection Capacity Analysis 21: Connaught Avenue & Bayers Road

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PM Peak Existing

											
Lane Group	EBL	EBT	EBR	EBR2	WBT	WBR	NBL	NBT	NBR	SBT	SBR
Lane Configurations											
Traffic Volume (vph)	195	455	0	695	535	10	500	200	15	245	350
Future Volume (vph)	195	455	0	695	535	10	500	200	15	245	350
Satd. Flow (prot)	1789	1883	961	1601	3568	0	3471	1865	0	1883	1601
Flt Permitted	0.134						0.950				
Satd. Flow (perm)	252	1883	961	1601	3568	0	3471	1865	0	1883	1601
Satd. Flow (RTOR)				601	1						380
Lane Group Flow (vph)	212	495	0	755	593	0	543	233	0	266	380
Turn Type	pm+pt	NA	Prot	Perm	NA		Prot	NA		NA	Perm
Protected Phases	7	4	4		8		5	2		6	
Permitted Phases	4			4							6
Total Split (s)	33.0	65.0	65.0	65.0	32.0		29.0	65.0		36.0	36.0
Total Lost Time (s)	5.0	6.0	6.0	6.0	6.0		7.0	6.0		6.0	6.0
Act Effect Green (s)	65.8	64.8		64.8	24.9		22.0	53.2		24.2	24.2
Actuated g/C Ratio	0.51	0.50		0.50	0.19		0.17	0.41		0.19	0.19
v/c Ratio	0.39	0.53		0.69	0.87		0.93	0.31		0.76	0.63
Control Delay (s/veh)	30.9	35.4		20.1	64.7		76.0	26.3		63.9	9.0
Queue Delay	0.0	4.2		1.2	50.8		47.9	0.0		0.0	0.4
Total Delay (s/veh)	30.9	39.5		21.3	115.5		123.9	26.3		63.9	9.4
LOS	C	D		C	F		F	C		E	A
Approach Delay (s/veh)		28.9			115.5			94.6		31.8	
Approach LOS		C			F			F		C	
Queue Length 50th (m)	29.9	104.1		53.0	77.2		71.4	39.3		64.6	0.0
Queue Length 95th (m)	62.1	161.5		166.5	#100.5		#103.5	54.8		90.2	25.8
Internal Link Dist (m)		107.7			33.5			32.3		20.8	
Turn Bay Length (m)											
Base Capacity (vph)	540	939		1099	714		590	846		434	661
Starvation Cap Reductn	0	355		160	0		0	0		0	0
Spillback Cap Reductn	0	0		0	187		175	0		0	54
Storage Cap Reductn	0	0		0	0		0	0		0	0
Reduced v/c Ratio	0.39	0.85		0.80	1.13		1.31	0.28		0.61	0.63

Intersection Summary

Cycle Length: 130

Actuated Cycle Length: 130

Offset: 36 (28%), Referenced to phase 4:EBTL and 7:EBL, Start of Green

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.93

Intersection Signal Delay (s/veh): 58.9

Intersection LOS: E

Intersection Capacity Utilization 72.2%

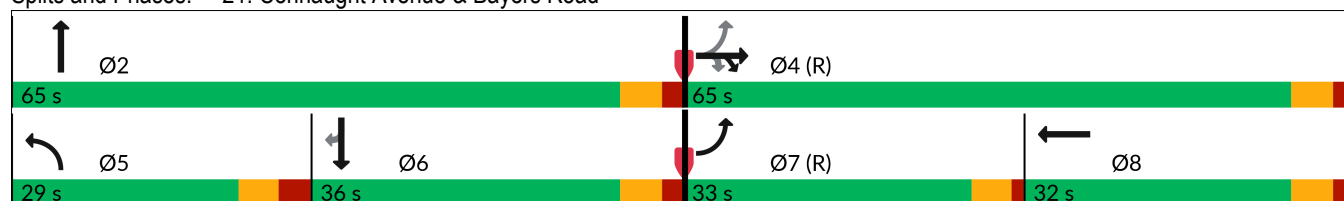
ICU Level of Service C

Analysis Period (min) 15

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

Queue shown is maximum after two cycles.

Splits and Phases: 21: Connaught Avenue & Bayers Road

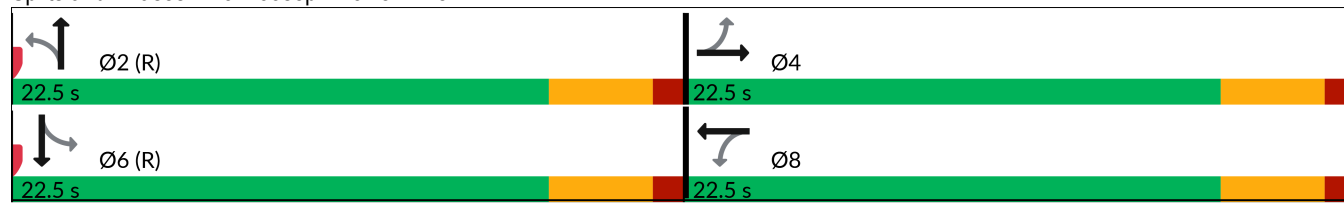


31: Joseph Howe Drive

PM Peak Existing

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Future Volume (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Satd. Flow (prot)	0	1883	0	0	1883	0	0	3579	0	0	3579	0
Flt Permitted												
Satd. Flow (perm)	0	1883	0	0	1883	0	0	3579	0	0	3579	0
Satd. Flow (RTOR)												
Lane Group Flow (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Turn Type												
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Total Split (s)	22.5	22.5		22.5	22.5		22.5	22.5		22.5	22.5	
Total Lost Time (s)		4.5			4.5			4.5			4.5	
Act Effct Green (s)												
Actuated g/C Ratio												
v/c Ratio												
Control Delay (s/veh)												
Queue Delay												
Total Delay (s/veh)												
LOS												
Approach Delay (s/veh)												
Approach LOS												
Queue Length 50th (m)												
Queue Length 95th (m)												
Internal Link Dist (m)		24.6			46.7			35.6			94.9	
Turn Bay Length (m)												
Base Capacity (vph)												
Starvation Cap Reductn												
Spillback Cap Reductn												
Storage Cap Reductn												
Reduced v/c Ratio												
Intersection Summary												
Cycle Length: 45												
Actuated Cycle Length: 45												
Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green												
Control Type: Pretimed												
Maximum v/c Ratio: 0.00												
Intersection Signal Delay (s/veh): 0.0						Intersection LOS: A						
Intersection Capacity Utilization 0.0%						ICU Level of Service A						
Analysis Period (min) 15												

Splits and Phases: 31: Joseph Howe Drive





PTV VISSIM RESULTS



APPENDIX D

Table D1 – PTV VISSIM Results – Mumford Road at Romans Avenue

LOS Criteria	Delay (sec/veh), Level of Service (LOS), Average Queue, and Maximum Queue by Intersection Movement														Overall Intersection		
	Transit Terminal		Mumford Road						Romans Avenue								
	NB-L	NB-R	EB-L	EB-T	EB-R	WB-L	WB-T	WB-R	NB-L	NB-T	NB-R	SB-L	SB-T	SB-R	Delay	LOS	Control
AM Peak Existing Volumes																	
Delay	34.4	20.3	36.5	34.1	25.2	27.6	11.9	4.2	25.9	26.9	26.9	28.3	28.5	15.3	27.8	C	
LOS	C	C	D	C	C	C	A	A	C	C	C	C	C	B			
Avg Queue	4.4	6.2	97.1	97.1	97.1	3.7	3.7	4.2	6.0	6.0	6.0	4.6	4.6	5.1			
Max Queue	78.7	89.3	316.4	316.4	316.4	43.3	43.3	44.9	43.1	43.1	43.1	36.8	36.8	38.0			
LOS Criteria	Delay (sec/veh), Level of Service (LOS), Average Queue, and Maximum Queue by Intersection Movement														Overall Intersection		
	Transit Terminal		Mumford Road						Romans Avenue								
	NB-L	NB-R	EB-L	EB-T	EB-R	WB-L	WB-T	WB-R	NB-L	NB-T	NB-R	SB-L	SB-T	SB-R	Delay	LOS	Control
PM Peak Existing Volumes																	
Delay	62.0	27.6	48.6	22.8	13.5	18.2	12.3	4.4	14.9	14.9	14.4	37.6	38.3	28.6	19.8	B	
LOS	E	C	D	C	B	B	B	A	B	B	B	D	D	C			
Avg Queue	5.9	8.0	22.0	22.0	22.0	3.7	11.4	4.2	6.4	5.5	5.9	8.9	8.9	9.6			
Max Queue	76.0	86.1	191.9	191.9	191.9	99.8	99.8	101.4	77.9	78.0	77.4	56.8	56.8	58.0			

Table D2 – PTV VISSIM Results – Mumford Road at HSC Driveway

LOS Criteria	Delay (sec/veh), Level of Service (LOS), Average Queue, and Maximum Queue by Intersection Movement												Overall Intersection		
	Mumford Road						HSC Driveway						Delay	LOS	Control
	EB-L	EB-T	EB-R	WB-L	WB-T	WB-R	NB-L	NB-T	NB-R	SB-L	SB-T	SB-R			
AM Peak Existing Volumes															
Delay	12.6	12.0	9.5	46.1	8.2	16.1	36.8	29.5	14.9	30.3	31.8	6.8	17.5	B	
LOS	B	B	A	B	A	B	D	C	B	C	C	A			
Avg Queue	13.7	13.7	14.4	7.8	7.6	5.2	2.4	2.4	2.4	6.9	6.9	6.9			
Max Queue	103.5	103.5	105.0	48.6	47.4	45.7	40.5	40.5	40.5	53.0	53.0	53.0			
LOS Criteria	Delay (sec/veh), Level of Service (LOS), Average Queue, and Maximum Queue by Intersection Movement												Overall Intersection		
	Mumford Road						HSC Driveway						Delay	LOS	Control
	EB-L	EB-T	EB-R	WB-L	WB-T	WB-R	NB-L	NB-T	NB-R	SB-L	SB-T	SB-R			
PM Peak Existing Volumes															
Delay	21.3	16.1	23.1	34.6	16.1	23.1	69.4	45.9	28.4	61.9	36.2	8.2	28.1	C	
LOS	D	C	C	C	A	A	C	C	C	C	C	B			
Avg Queue	7.6	7.6	7.8	12.7	13.6	12.6	22.5	22.5	22.5	20.7	20.7	20.7			
Max Queue	70.1	70.1	71.6	83.1	81.9	81.1	98.2	98.2	98.2	76.9	76.9	76.9			

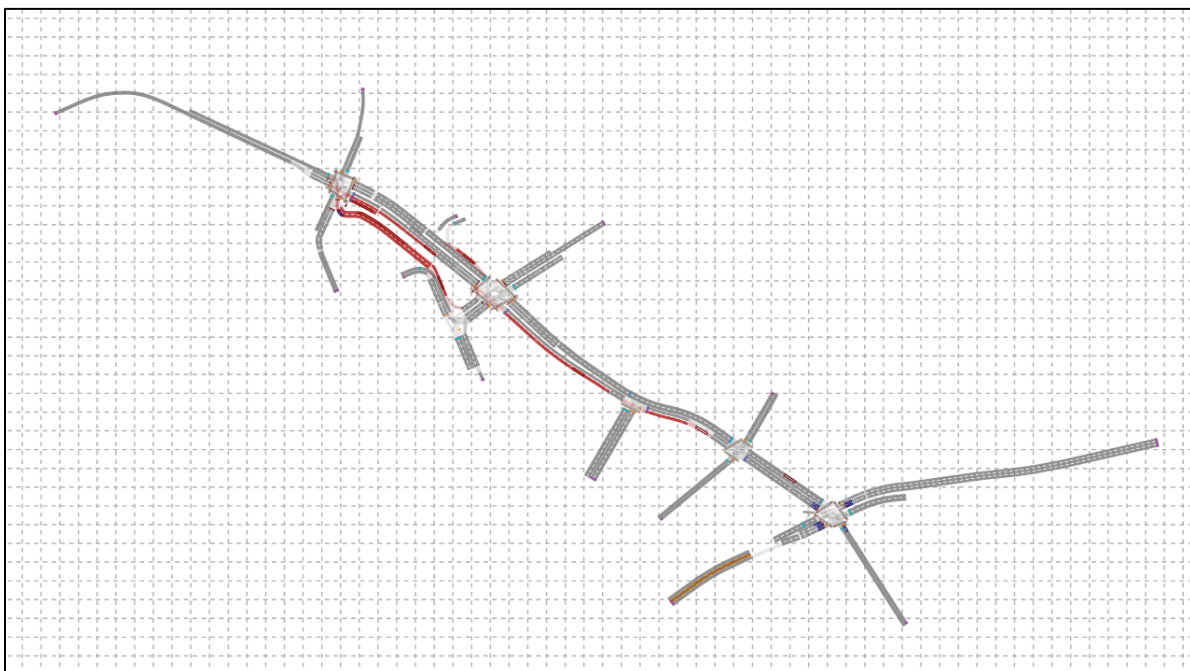


Figure D1 – PTV VISSIM Model Extents (Model provided by HRM).