TECHNICAL REPORT F

MULTI-MODAL LEVEL OF SERVICE

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1.0 INTRODUCTION

As a rapidly growing municipality, Brampton is transitioning from a suburban to an urban context. Guiding this growth is the Brampton 2040 Vision, Brampton Plan (the Official Plan) and Brampton Mobility Plan (the Transportation Master Plan). These plans focus on a future for Brampton that is supported by a well-designed multi-modal transportation network that prioritizes an equitable people-first approach. Traditional approaches to transportation planning are often car-centric and focus on throughput of the private vehicle with minimal consideration for the other modes, creating a need for updated planning tools that support Brampton's growth.

Supporting the plans mentioned above, the City of Brampton's Complete Streets Guide provides tailored actions that the City of Brampton (the "City") can undertake to promote street design that safely and comfortably accommodates all users. One of the actions recommended in the Complete Streets Guide is to develop a Brampton-specific Multi-Modal Level of Service (MMLOS) framework and tool as part of the Brampton Mobility Plan and apply it in the planning, design, and evaluation of street design.

The MMLOS framework is designed to evaluate the trade-offs between different transportation modes, contributing to informed decision-making on transportation improvements in the city. This is the first iteration of a MMLOS tool for the City of Brampton and updates are recommended on a 5-year cycle in conjunction with future Transportation Master Plan updates to ensure the framework reflects the City's latest policy direction.

While the tool and framework provide guidance on the MMLOS evaluation, practitioners are encouraged to interpret the guidelines for non-standard roadways based on their professional judgement as long as the fundamental principles of the methodology are maintained. This approach ensures that the framework remains adaptable and responsive to the unique needs of Brampton's evolving transportation needs.

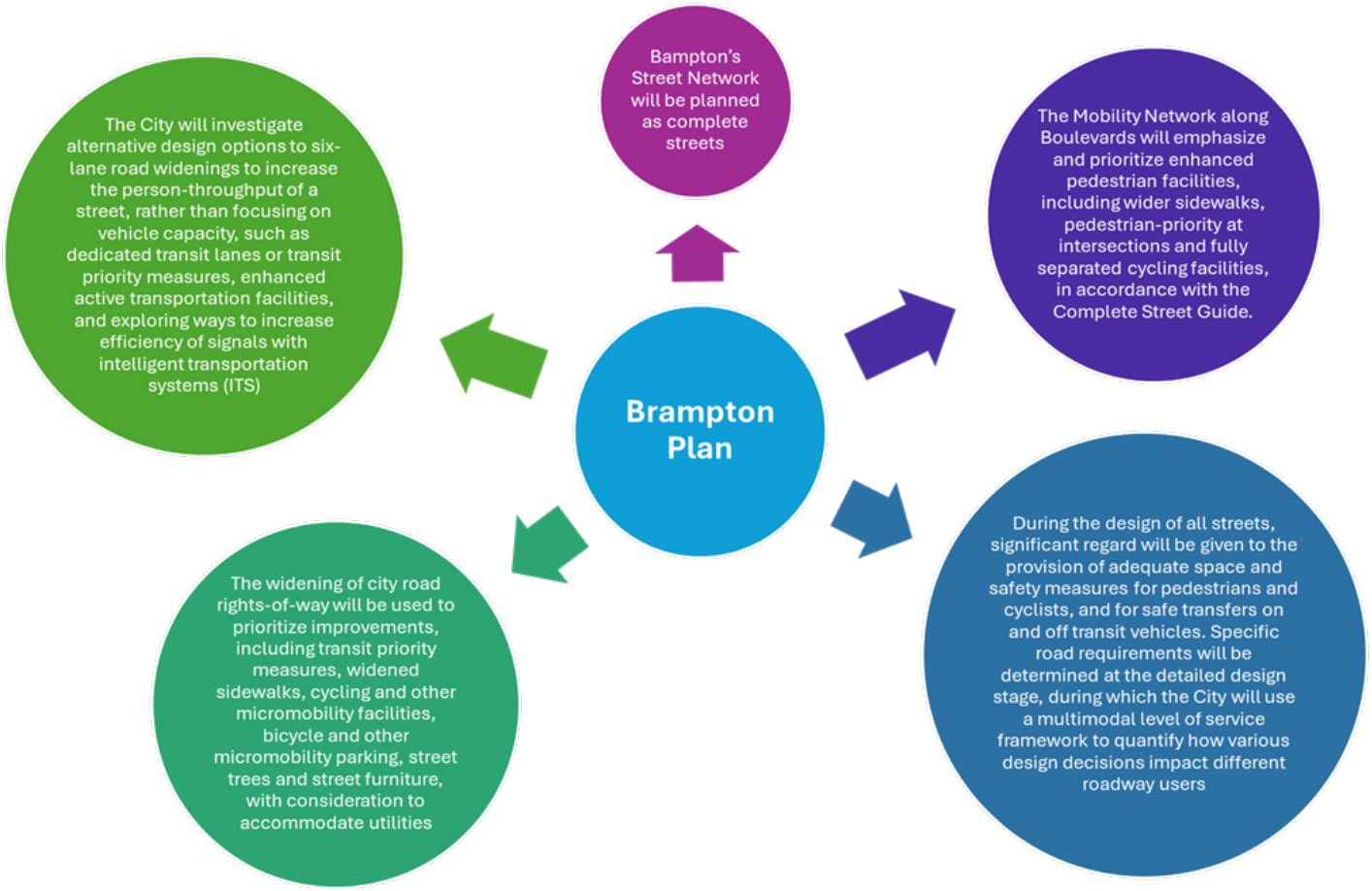
SUPPORTING POLICIES

BRAMPTON VISION 2040

The Brampton 2040 Vision imagines that in 2040, Brampton will be a mosaic of safe, integrated transportation choices and new modes, contributing to civic sustainability, and emphasizing walking, cycling, and transit. To achieve this vision, it provides bold and people-centric actions to shape Brampton's future. Specifically, Action #4-2, introduces the Complete Streets strategy, which envisions streets that balance the needs of all users, from pedestrians and cyclists to public transit riders and drivers. This action emphasizes the physical redesign of roads to include expanded sidewalks, protected bike lanes, and improved crossings and also highlights policy changes that encourage walkability and reduce car dependency.

BRAMPTON PLAN

The Brampton Plan, which is the City's Official Plan, carries forward and implements the Brampton 2040 Vision. It envisions that streets will transition from their current automobile-oriented nature to complete streets that will be easy to cross and pleasant to walk and cycle along. The Brampton Plan includes robust policies to achieve this vision and guide the future of Brampton's transportation system, some of which include:



Brampton Complete Streets Guide

Brampton has adopted a complete streets approach, guided by the City's Complete Streets Guide, that informs the planning and design of all road infrastructure. Enhancing street design to better serve pedestrians, cyclists, transit, and vehicles will increase the network's overall capacity to move people. Over time, all roads in Brampton will become complete streets.

To support a more sustainable transportation system, the City of Brampton aims to limit the addition of new general-purpose vehicle lanes, especially on existing four-lane roads. Instead, the focus is on building a resilient Complete Streets Network that supports transit, serves growth areas, improves connectivity, and accommodates all modes of travel.

With significant growth planned in strategic growth areas (e.g. Urban Centres), Brampton requires investment in transportation infrastructure that will increase the person carrying capacity of the network, including dedicated transit lanes and comfortable facilities for walking and cycling.

The MMLOS framework is a tool that can be used to assess the overall suitability of a street to meet the mobility needs of all users, not just vehicles. The MMLOS framework will guide the deciaion points in the planning and design of infrastructre and support the implementation of a complete streets approach in Brampton.

Brampton Mobility Plan (BMP)

The Brampton Mobility Plan (BMP) serves as the long-term blueprint for the City's future transportation system and identifies infrastructure, program, and policy recommendations to support future growth to the 2051 horizon. The BMP rethinks traditional transportation planning approaches and prioritizes the sustainable modes to accommodate growth. The BMP recommends limited 4 lane road widenings, complete street reconstruction projects, and the implementation of a higher order transit along key corridors. A fundamental recommendation of the BMP is that all future transportation improvements will be designed and built using complete street principles and evaluated using an MMLOS framework.

The MMLOS framework plays a pivotal role in BMP by providing a structured method for evaluating how well the City's transportation network supports different modes of travel. It ensures that infrastructure decisions align with sustainability, accessibility, and equity goals, shifting the focus from vehicle-centric planning to a more inclusive approach that prioritizes pedestrians, cyclists, and transit users alongside drivers.

2.0 MMLOS IN BRAMPTON

Traditionally, LOS analysis is vehicle-centric and focuses on the experience of drivers by only taking vehicular capacity into consideration. The Brampton MMLOS framework relies on several performance metrics to evaluate five modes of transportation, expanding on traditional LOS practices. **Pedestrian Level of Service (PLOS)** measures sidewalk width, crossing safety, and accessibility, evaluating pedestrian comfort and connectivity along a corridor. **Bicycle Level of Service (BLOS)** assesses bike lane safety, connectivity, and overall comfort to encourage cycling as a practical alternative to driving for shorter trips. **Transit Level of Service (TLOS)** measures key factors like travel time, reliability, and stop accessibility, evaluating the attractiveness and convenience of public transit. Additionally, **Vehicular Level of Service (VLOS)** shifts the focus from traditional congestion metrics to person-moving capacity and equitable road space allocation, ensuring that streets serve all users effectively rather than prioritizing cars alone. Finally, **Truck Level of Service (TkLOS)** complements the Vehicle Level of Service to ensure that trucks are accommodated appropriately, facilitating goods movement in Brampton. By evaluating a road segment or intersection from all perspectives, the City can plan for the comfort and safety of all road users.

IMPLEMENTATION

The MMLOS framework should be included as early as possible in the Planning Process in order to establish priorities for each mode of transportation and physical needs for the project. Where feasible, the MMLOS analysis should be used to establish the design criteria during the preliminary design of transportation facilities within the city.

One of MMLOS framework's key applications is in Environmental Assessments (EAs)/Functional Designs, MMLOS can play a critical role in evaluating the environmental impacts of transportation projects. The tool can identify changes in road characteristics that support sustainable mode shifts by analyzing pedestrian safety, bicycle comfort, transit service efficiency, and vehicular travel times to identify gaps and prioritize multi-modal infrastructure improvements. The integration of the MMLOS framework in the evaluation of alternatives can help in the development of a design that promotes reductions in car dependency, ensure that new projects support the City's long-term transportation goals.

In Corridor Studies, the MMLOS framework can be used to assess the functionality of streets in relation to land use and context. Through analyzing the various transportation modes, the framework can identify gaps in infrastructure and recommend approaches to improve mobility, enhance connectivity and accommodate future growth in the corridor. By evaluating streets holistically, MMLOS helps guide context sensitive infrastructure improvements that create safer, more accessible, and more efficient transportation corridors.

In addition to its application in the planning process, the framework can also be applied to evaluate existing infrastructure to identify areas in need of improvement through Operational Projects.

A key application of operational projects includes Transportation/Traffic Impact Studies (TIS), where MMLOS can be used to analyze development proposals. It ensures that new developments prioritize active transportation and transit access while mitigating traffic impacts. By embedding MMLOS principles into the development review process, Brampton can promote land use patterns that reduce congestion and enhance mobility options for all residents.

In addition to TIS studies, the framework can also be used for Operational Reviews, Corridor Optimization Studies and Safety Improvement Studies to align existing streets with municipal goals and network priorities.

Further to the studies listed above, staff are developing a MMLOS framework that can be applied at a Transportation Master Plan or Secondary Plan stage to assess recommended networks.

By incorporating MMLOS into every stage of the transportation planning and evaluation process in addition to the studies listed in this section, the City can foster a more balanced and sustainable mobility network. The framework ensures that infrastructure investments and policy decisions create a city where walking, cycling, and transit are not just alternatives to driving but preferred, accessible, and efficient choices for all.

The Multimodal Analysis Framework document provides the methodology for analysis of the level of service experienced by different modes in Brampton. The document provides insight on the criteria used in the analysis and provides guidance on how to use the tool to provide consistency in the evaluation of the multi-modal user experience.

COMPLETE STREET TYPOLOGIES

Building on functional roadway classification, the Complete Streets Guide classifies streets in Brampton into 11 different complete street typologies based on livability and mobility characteristics and assigns them unique design objectives. This classification ensures that realistic goals that centre all road users are in place for roads with different contexts and uses in both current and planned scenarios. Whether it is a busy urban main street or a quiet residential road, this approach ensures that every street, no matter its role, is designed to prioritize the well-being of all users—pedestrians, cyclists, drivers, and beyond. Figure 2-1 and Figure 2-2 provide more insight on the classification and locations of the street typologies from Brampton.

Urban Main Streets are vibrant mixed-use 'destination streets' located in the Uptown and Downtown and along the corridors where higher density transit-supportive development is intended to occur.

Neighbourhood Connectors are through streets that serve as major links between residential neighbourhoods.

Commercial Connectors are through streets that serve as major links between Employment Areas in the City.

Mixed-Use Neighbourhood Streets will serve a focus within the emerging Town Centres and nodes beyond the Downtown and provide a high quality pedestrian realm with active street frontage and multi modal travel options.

Neighbourhood Residential Streets provide access to residential areas of the city and often mark the entrances to Brampton's Neighbourhoods.

Employment Collectors Streets provide access to and from the Brampton's employment and industrial areas and often mark the entrances to Brampton's employment districts.

Downtown Streets are smaller streets concentrated within Brampton's historic downtown and serve important commercial, office and institutional uses as well as a growing mixture of residential and retail uses.

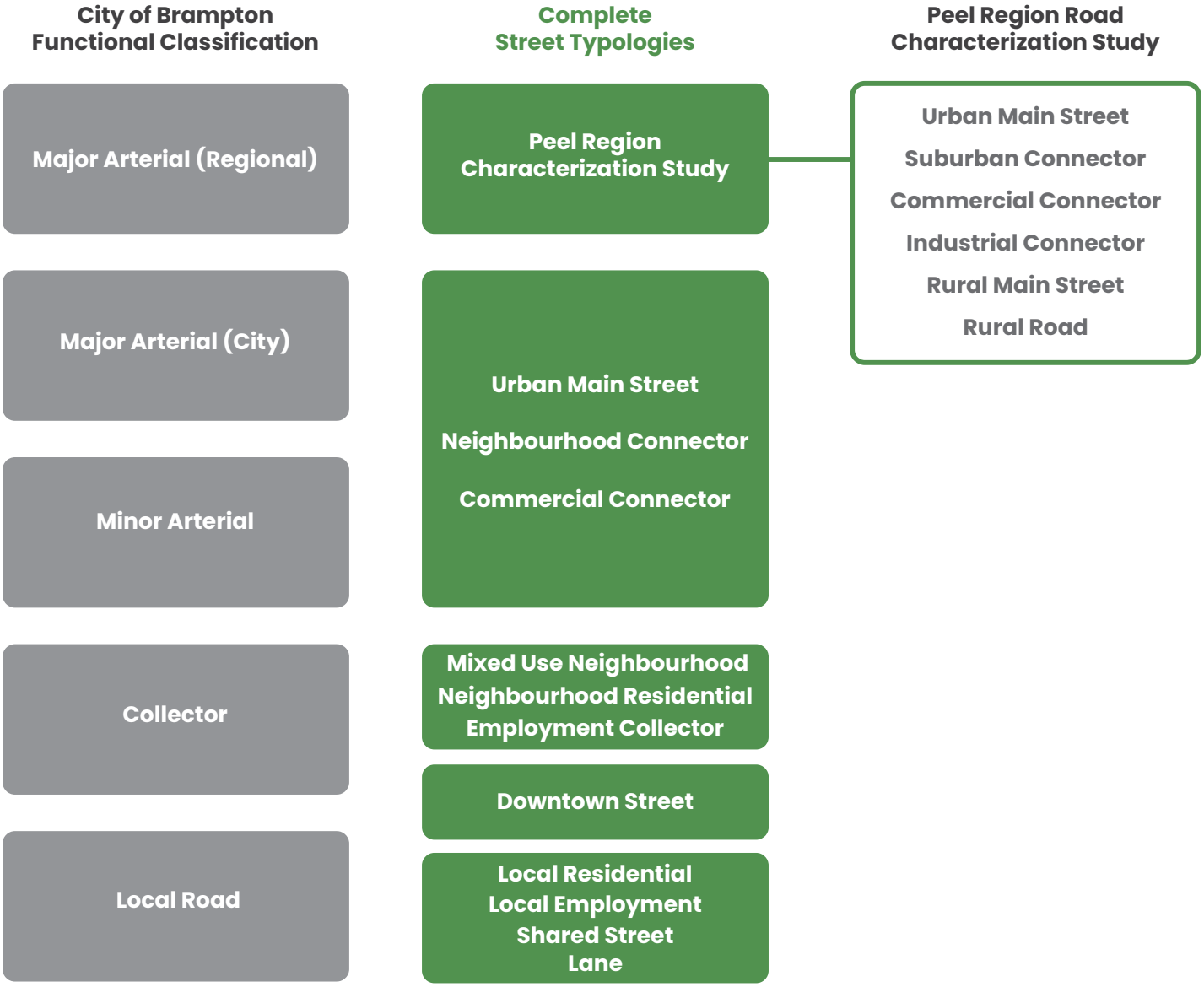
Local Residential Streets have relatively low traffic volumes and lower speeds and prioritize active neighbourhood life.

Local Employment Streets are typically found outside of the Downtown and Centres and provide access to industrial or commercial businesses.

Shared Streets are a new street typology for Brampton's Downtown and those areas supported by high levels of pedestrian activity.

Lanes are currently found in the Downtown and support servicing access. Lanes can also be used as shortcuts or mid-block connections to neighbourhood destinations by pedestrians and bicyclists.

Figure 2-1: Street Classification



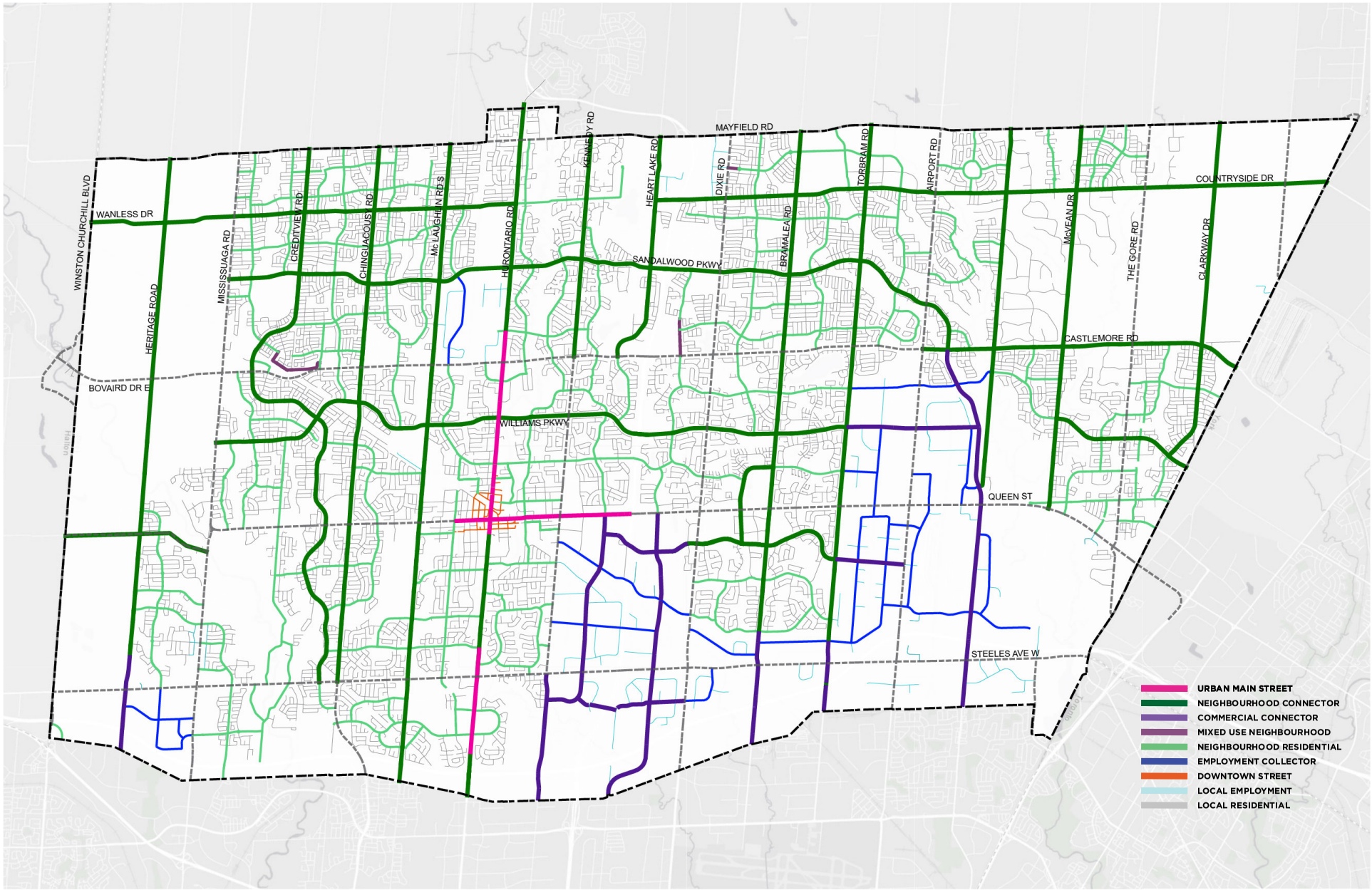


Figure 2-2: Complete Streets Network Map

3.0 TARGETS

FINAL TARGETS

The MMLOS framework supports the Complete Streets Guide by setting mode-specific targets for each Brampton Street Type. Final targets were created for all 11 Street Types, with interim targets set for five Street Types (Neighbourhood Connector, Commercial Connector, Neighbourhood Residential, Employment Collector, and Local Employment Streets). Table 3-1 summarizes the targets based on street typology.

Table 3-1: Final Targets

Street Type	Pedestrian	Bicycle	Transit	Vehicle	Truck
Downtown Streets	A	A	N/A	E	N/A
Urban Main Street*	B	B	A	E	E
Neighbourhood Connector	B	B	B	D	D
Commercial Connector	B	B	B	D	B
Mixed Use Neighbourhood	B	B	C	D	D
Neighbourhood Residential	B	B	D	D	N/A
Employment Collector	B	B	C	D	B
Local Residential Streets	B	B	C	D	N/A
Local Employment Streets	B	B	B	D	B
Shared Streets	A	B	N/A	E	N/A
Lanes	A	B	N/A	N/A	N/A

*If higher order transit is not present, the target for pedestrian and bicycle on an urban main street will be LOS A.

INTERIM TARGETS

Interim targets are intended for use where designs are already past the Environmental Assessment phase or on roads with lower intended use (for example, in areas with less dense built form and less diversity in land use). As more complete street projects are implemented the need for interim targets will reduce and they will eventually be phased out. Table 3-2 summarizes the interim targets based on street typology.

Table 3-2: Interim Targets

Street Type	Pedestrian	Bicycle	Transit	Vehicle	Truck
Downtown Streets	A	A	N/A	E	N/A
Urban Main Street	B	B	A	E	E
Neighbourhood Connector	C	C	C	D	D
Commercial Connector	C	C	C	D	C
Mixed Use Neighbourhood	B	B	C	D	D
Neighbourhood Residential	B	B	D	D	N/A
Employment Collector	C	C	C	D	B
Local Residential Streets	C	C	C	D	N/A
Local Employment Streets	C	C	C	D	B
Shared Streets	A	B	N/A	E	N/A
Lanes	A	B	N/A	N/A	N/A

The targets aim to promote the development of complete streets, however there may be other constraints that make achieving these targets difficult or impossible. If a MMLOS evaluation is conducted along a corridor and the targets are not met, justification can be provided in the analysis as to why the corridor did not meet the targets and what can be improved to reach the target LOS.

4.0 EVALUATION FRAMEWORK

For each of the five modes included in the tool, the level of service is measured along segments and intersections (signalized and unsignalized). One exception is the Transit LOS, which is also evaluated at Transit Stops along the route. The intent of the tool is to evaluate each mode at the selected segment, transit stop (transit only), signalized intersections and unsignalized intersections.

Segments are defined as links that are accompanied by similar adjacent land use and consistent street function. Points along a segment where the land uses changes should be considered separately and split into two (or more) segments. In some cases, it may be necessary to evaluate each direction of travel separately along a segment.

The analysis will focus on the characteristics and performance of the roadway by evaluating factors like traffic flow, road design, and facilities available for different modes of transportation (e.g., cycling lanes, sidewalks).

In cases where multiple transit routes operate along a given segment, the route that serves the majority of the corridor should be selected for analysis. If there are multiple routes servicing majority of the corridor, they should be analyzed separately and averaged at the end to obtain a final transit segment score. The user should exercise professional judgment in selecting the relevant routes for analysis and each analysis should be documented separately to track the criteria for each route, facilitating the identification of potential areas for improvement.

Transit Stops will be individually evaluated along the corridor. An average of the resulting LOS scores will be taken as the final transit stop score.

Signalized Intersections are locations where traffic control signals are used to regulate the flow of vehicles, pedestrians and cyclists. The performance of these intersections is evaluated based on the efficiency of signal timing, waiting times, and how well the intersection accommodates various modes of transport. In the MMLOS analysis, signalized intersections are assessed for how effectively they manage the balance between different travel modes while maintaining safety and minimizing delays. Each signalized intersection will be evaluated individually and an average of the scores will be assigned as the final intersection score along the segment.

Unsignalized Intersections are intersections where traffic is not controlled by traffic control signals and rely on other methods such as stop signs, yield signs or uncontrolled merging. MMLOS for unsignalized intersections examines how well the intersection facilitates the safe and efficient flow of all modes of transportation. When analyzing an intersection between a major and minor road where there is no control in place along the major road, the intersection only considers the minor road in analysis. Similar to the signalized intersections, each unsignalized intersection will be evaluated individually and an average of the scores along the selected segment will be assigned as the final unsignalized intersection score.

For the purposes of the evaluation in Brampton the peak AM period will be used to ensure that the MMLOS methodology reflects the transportation system under the most demanding conditions.

PEDESTRIAN LEVEL OF SERVICE

The Pedestrian Level of Service (PLOS) evaluates the experience of pedestrians using criteria that measure relative safety, convenience and comfort for those walking or using assisted mobility. Selected criteria consider the quality, location and road conditions surrounding pedestrian facilities. **Table 4-1**, **Table 4-2**, and **Table 4-3** outline PLOS criteria.

Table 4-1: Pedestrian Segment Criteria

Criteria Title	Description	Measurement Details	Units	Source
Facility Width	Width of the pedestrian facility only (exclusive of kill strips, curbs, buffers, etc.). Different ranges and scores are assigned based on the type of facility (sidewalk or multi-use path).	Smallest facility width should be used.	Metres	Field or design measurement
Buffer Width	Width of the area between the closest vehicle travel lane and the edge of the pedestrian facility, inclusive of any bike lanes, on-road buffers or kill strips.	Predominant buffer width should be used.	Metres	Field or design measurement
Posted Speed	Posted speed for vehicles. Different scores for posted speed are assigned based on the type of facility and cumulative width of the facility and buffer.	Highest posted speed should be used.	km/h	Field assessment
Distance between Controlled Crossings	Length between pedestrian crossings with some form of vehicle control (Ex: Pedestrian crossover (PXO) with a push-button triggered signal).	Largest distance should be used.	Metres	Field or design measurement
Placemaking	Frequency and quantity of amenities that contribute to placemaking (e.g. Street furniture, pedestrian-scale lighting, waste receptacles, wayfinding and public art).	Entire segment should be qualitatively assessed from a pedestrian perspective.	N/A	Field or design assessment
Street Trees	Spacing and position of trees in relation to the pedestrian facility. Different ranges and scores are assigned based on the type of facility (sidewalk on one or two sides of the road).	Predominant state should be used. Trees on both private and City-owned property should be included.	N/A	Field or design measurement

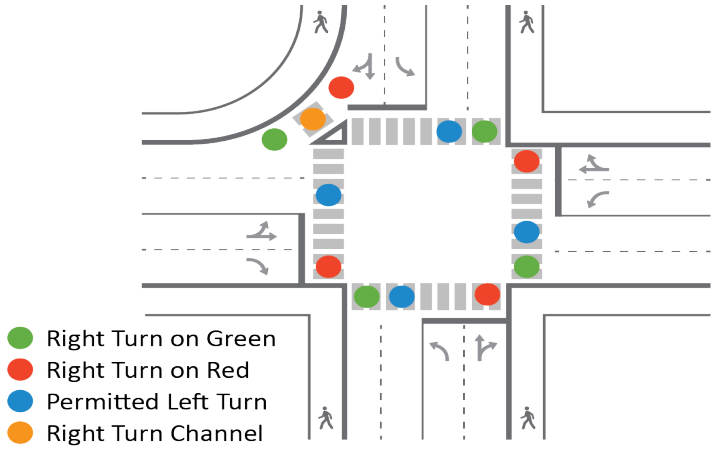
Criteria Title	Description	Measurement Details	Units	Source
Vertical Buffer (light poles, street trees, on-street parking)	Presence of closely spaced vertical elements that create a buffer between vehicle travel lanes and the pedestrian facility (Ex: light poles, trees, on-street parking, bike lane flexi posts/ bollards, etc.).	Predominant state should be used.	N/A	Field or design assessment

Table 4-2: Pedestrian Signalized Intersection Criteria

Criteria Title	Description	Measurement Details	Units	Source
Number of Lanes	Number of lanes crossed by pedestrians at the signalized intersection. This measure is inclusive of all turning lanes, transit lanes or bays, queue jump lanes and parking lanes.	Intersection leg with the largest crossing distance should be used.	N/A	Field or design measurement
Corner Radius	Radius of the corner from which pedestrians will start or end their crossing.	Corner with the largest radius should be used.	Metres	Field or design measurement
Right Turn Channel	Presence of right turn channel by type. See the OTC Protected Intersection Guide for a description of “smart channel”.	N/A	N/A	Field or design assessment
Signal Cycle Length (s)	Total length of the intersection signal cycle.	Peak AM cycle length should be used if phasing varies with time of day.	Seconds	Signal Timing Plan
Crosswalk Treatment	Type of crossing facility present at the intersection. See OTM Book 15 for types.	Intersection leg with the lowest quality treatment should be used.	N/A	Field or design assessment

Criteria Title	Description	Measurement Details	Units	Source
Number of Uncontrolled Conflicts	Count of uncontrolled conflicts divided by the number of approaches at the intersection. Uncontrolled conflicts include right turn on green, right turn on red and permitted left turn (See Figure 4-1).	N/A	N/A	Field or design assessment
Leading Pedestrian Interval (Bonus)	Presence of a leading pedestrian phase in the intersection signal cycle.	N/A	N/A	Field or design assessment

As shown in **Figure 4-1**, there are 3 conflicts (right turn on green, right turn on red and permitted left turn) on each intersection leg. The number of uncontrolled conflicts are added up to be a total of 12 and then divided by the number of intersection legs, in this case 4, to provide a value measure of 3. As per Section 6.6 Grade Tables, the grade for an intersection with a conflict calculation of 3 will score a LOS E.



# of uncontrolled conflicts: 12
# of intersection legs: 4
Value of measure: 12/4= 3

LOS E

Figure 4-1: Uncontrolled Conflict Calculation Example[1]

1 OTC MMLOS Guidelines, Uncontrolled Conflicts at an Intersection, February 2022.

Table 4-3: Pedestrian Unsignalized Intersection Criteria

Criteria Title	Description	Measurement Details	Units	Source
Pavement Marking at Controlled Crossings	Percentage of pedestrian movements with painted crossings.	N/A	Percent	Field or design assessment
Crossing Distance	Total distance crossed by pedestrians at the unsignalized intersection. This measure is inclusive of all turning lanes, transit lanes or bays, queue jump lanes and parking lanes.	Intersection leg with the largest crossing distance should be used. The distance will be calculated from the centre of the curb radius.	Metres	Field or design assessment
Corner Radius	Radius of the corner from which pedestrians will start or end their crossing. If a roundabout is present at the intersection, this is instead an identification of the number of lanes approaching the roundabout.	Corner with the largest radius should be used.	Metres	Field or design assessment

BICYCLE LEVEL OF SERVICE

The Bicycle Level of Service (BLOS) evaluates the experience of cyclists using criteria that measure relative safety, stress and facility attractiveness for those travelling by bicycle or micromobility. Selected criteria consider the components of the bicycling facility and surrounding road conditions.

For mixed AT facilities where pedestrians and cyclists share the operating space (e.g. multi-use paths, etc.) the facility should be scored based on the pedestrian and cyclist metrics independently and the resulting scores discounted by one grade (ex: B -> C). This reflects the negative impact to the pedestrian and cycling experience that results from sharing the same operating space. It should be noted that in areas of high pedestrian and bicycle activity that mixed facilities should be avoided when possible.

The Cycling network can consist of various types of facilities. **Designated Facilities** include on-road bike lanes that provide designated space for cyclists on the road but no physical separation. **Separated Cycling Facilities** can include physically separated bikeways with grade-separation, curbs, planters or bollards to provide physical separation between people riding bikes and motor vehicle traffic. Shared cycling facilities or cyclists in **Mixed Traffic** conditions do not have distinct operating space on the roadway but can have supporting amenities such as pavement markings or signage to indicate their presence on the roadway. **Table 4-4**, **Table 4-5**, **Table 4-6**, and **Table 4-7** outline BLOS criteria.

Table 4-4: Bicycle Segment Criteria (Designated or Separated Cycling Facility)

Criteria Title	Description	Measurement Details	Units	Source
Facility Type	Type of cycling facility that is present on the road segment, used to understand if cyclists share the right-of-way with other modes or have their own designated operating space.	Predominant condition should be used.	N/A	Field or design assessment
Physical Separation	Type of separation between the cycling facility and the closest vehicle travel lane. See OTM Book 18 for physical separation types.	Predominant separation type should be used.	N/A	Field or design assessment
Number of Travel Lanes	Count of the number of vehicle travel lanes (through lanes and centre left-turn lanes) on the road segment, including dedicated transit lanes.	Maximum lane count should be used.	N/A	Field or design assessment
Buffer Width	Width of the buffer provided between the cycling facility and the closest vehicle travel lane. Different ranges and scores are assigned based on the type of facility (on-road or boulevard). Buffer and facility width's greater than 2.8m with no type of physical separation can allow for undesirable vehicle usage in the bike lane.	Predominant buffer width should be used.	Metres	Field or design measurement
Cycling Facility Width per Direction	Width of the cycling facility. If the facility is shared between pedestrians and cyclists (MUP), divide the total width by two.	Predominant facility width should be used.	Metres	Field or design assessment
Continuous Facility	Presence of interruptions to the cycling facility, such as a redirection of the facility to the other side of the road or the transition of the facility from predominantly dedicated infrastructure to mixed traffic.	Entire segment should be qualitatively assessed from a cyclist perspective.	N/A	Field or design measurement
Posted Speed	Posted speed for vehicles.	Highest posted speed should be used.	km/h	Field assessment

Criteria Title	Description	Measurement Details	Units	Source
Cycling Facility Conflicts	Frequency of conditions that create conflicts within the cycling facility (e.g. driveways, on-street parking, servicing or delivery destinations, etc.).	Entire segment should be qualitatively assessed from a cyclist perspective.	N/A	Field or design assessment
Cycling Facility on Both Sides of the Road	Presence of a cycling facility on both sides of the road, with consideration for one-sided cycling facilities that may cross from one side of the road to the other.	Least complete section of facility should be used.	N/A	Field or design assessment
Parking Lane	Presence of a buffer between on-street parking lane and cycling facility. This will only be applicable if there is a parking lane present.	Predominant condition should be used.	N/A	Field or design assessment

Table 4-5: Bicycle Segment Criteria (Mixed Traffic Cycling Facility)

Criteria Title	Description	Measurement Details	Units	Source
Number of Travel Lanes and Posted Speed	Count of the number of vehicle travel lanes on the road segment combined with posted speed and presence of centrelines.	Predominant condition should be used.	N/A + km/h	Field or design assessment
Pavement Markings and regulatory signage	Presence of pavement markings (e.g. sharrows, shoulder markings, etc.) indicating that road is to be shared by motor vehicles and cyclists. See OTM Book 18 for examples.	Predominant condition should be used.	N/A	Field or design assessment
Presence of Heavy Vehicles (trucks and Buses)	Presence of trucks or transit vehicles on the road segment.	More than 30 trucks/transit vehicles per hour in curb lane.	N/A	Traffic counts
Signage	Presence of traffic or wayfinding signage.	Predominant condition should be used.	N/A	Field or design assessment

Table 4-6: Bicycle Signalized Intersection Criteria

Criteria Title	Description	Measurement Details	Units	Source
Left-turn Crossing and Posted Speed	Type of left-turn crossing condition based on the presence of designated left-turn pavement markings, lanes crossed and posted speed on the side street (the street receiving the turning cyclist).	Intersection leg with the lowest score should be used. Only intersection legs with cycling facilities should be considered.	N/A + km/h	Field or design assessment
Enhanced Cycling Measures	Presence of measures that improve the safety and/or comfort of cyclists crossing an intersection, including bicycle signal phasing, signal detection type, and pavement markings, expressed as a percentage for intersections that are not protected for cyclists.	Intersection leg with the lowest score should be used.	N/A	Field or design assessment
Corner Radius	Radius of the signalized intersection corner.	Corner with the largest radius should be used.	Metres	Field or design assessment
Signal Cycle Length	Measure of the length of the intersection signal cycle.	Peak AM cycle length should be used if phasing changes throughout the day.	Seconds	Signal Timings Plan
Number of Uncontrolled Conflicts	Measure of the number of uncontrolled conflicts divided by the number of approaches at the intersection. Uncontrolled conflicts include right turn on green, right turn on red and permitted left turn (See Figure 3).	N/A	N/A	Field or design assessment

Table 4-7: Bicycle Unsignalized Intersection Criteria

Criteria Title	Description	Measurement Details	Units	Source
Number of Travel Lanes and Posted Speed of Side Streets	Count of the number of vehicle travel lanes at the unsignalized intersection along the segment being analysed combined with posted speed on the side/ intersecting street	Predominant condition should be used.	N/A + km/h	Field or design assessment

TRANSIT LEVEL OF SERVICE

The Transit Level of Service (TLOS) evaluates the experience of transit users using criteria that measure the relative attractiveness of public transportation. Selected criteria consider the components, performance, and location of the transit service. TLOS is only applicable on streets where transit is operating. **Table 4-8**, **Table 4-9**, **Table 4-10**, and **Table 4-11** outline TLOS criteria.

Table 4-8: Transit Segment Criteria

Criteria Title	Description	Measurement Details	Units	Source
Facility Type	Type of transit facility based on separation from traffic. Dedicated transit facilities will score higher than transit operating in mixed traffic.	Predominant condition should be used.	N/A	Field or design assessment
Average Transit Travel Speed/ Average Vehicle Travel Speed	Ratio calculated by dividing the average transit travel speed on the segment by the average vehicle travel speed on the segment.	Average transit speed is calculated using the Brampton Transit schedule arrival times at the initial and final stops and the distance between them. Vehicle travel speed is obtained from corridor speed studies, preferably during AM peak hours.	km/h	Transit Speed data determined through Brampton Transit schedule. Vehicle data can be obtained through speed study
Peak Period Transit Headway	Amount of time between the arrival of transit vehicles at a stop.	Average peak AM headway should be used.	Minutes	Brampton Transit Route Frequency Guide
Average Transit On-time Performance	Percentage of transit vehicles that meet the schedule and adherence goals of the Brampton Transit Service Guidelines.	Average peak AM performance should be used.	Percent	Data collected by Brampton Transit
Pedestrian Segment Level of Service	Pedestrian LOS score for the segment.	N/A	N/A	See Pedestrian Level of Service section
Bicycle Segment Level of Service	Bicycle LOS score for the segment.	N/A	N/A	See Bicycle Level of Service section

Table 4-9: Transit Stop Criteria

Criteria Title	Description	Measurement Details	Units	Source
Walkshed Reachability	Percentage of the 500-metre area around a stop that can be reached in a 10 minute walk.	A 10 minute walkshed should be visually compared against an estimated 500-metre buffer of the stop.	Percent	Spatial analysis software. An example for an open source software is CommuteTimeMap
Nearest Marked Crossing	Distance to nearest marked pedestrian crossing.	N/A	Metres	Field or design assessment
Transit Passenger Amenities	Quantity of amenities that improve the transit rider experience (e.g. shelter from elements, seating, waste receptacles, pedestrian lighting, posted maps/schedules, wifi, charging stations, emergency call buttons, etc.)	N/A	N/A	Field or design assessment
User Experience Services	Presence of real-time arrival communication options such as electronic displays at a stop or live route tracking through mobile/web-based applications.	N/A	N/A	Field or design assessment
AT facilities (Bonus)	Presence of active transportation facilities such as bicycle parking or storage at the transit stop.	N/A	N/A	Field or design assessment

Table 4-10: Transit Signalized Intersection Criteria

Criteria Title	Description	Measurement Details	Units	Source
Transit Priority Measures	Presence of transit priority measures (e.g. dedicated transit lanes, transit signal priority, etc.) based on the number of approaches that have a measure in place.	N/A	N/A	Field or design assessment
Transit Movement Delay	Amount of intersection delay experienced specifically by transit vehicles at the signalized intersection. The delay should be measured for each transit movement regardless of whether transit operates in mixed traffic or dedicated facilities and averaged.	Average delay for all movements should be used.	Seconds	Data can be obtained from an applicable traffic-related software or typical intersection analysis methods.
Pedestrian Signalized Intersection LOS	Pedestrian LOS score for the signalized intersection.	N/A	N/A	See Pedestrian Level of Service section
Bicycle Signalized Intersection LOS	Bicycle LOS score for the signalized intersection.	N/A	N/A	See Bicycle Level of Service section

Table 4-11: Transit Unsignalized Intersection Criteria

Criteria Title	Description	Measurement Details	Units	Source
Transit Movement Delay (s)	Amount of intersection delay experienced specifically by transit vehicles at the unsignalized intersection. The delay should be measured for each transit movement regardless of whether transit operates in mixed traffic or dedicated facilities and averaged.	N/A	Seconds	Data can be obtained from an applicable traffic-related software or typical intersection analysis methods
Pedestrian Unsignalized Intersection LOS	Pedestrian LOS score for the unsignalized intersection.	N/A	N/A	See Pedestrian Level of Service section
Bicycle Unsignalized Intersection LOS	Bicycle LOS score for the unsignalized intersection.	N/A	N/A	See Pedestrian Level of Service section

VEHICLE LEVEL OF SERVICE

The Vehicle Level of Service (VLOS) measures traffic flow and operational performance of a roadway segment or intersection. As per traditional traffic engineering practices, the volume capacity (V/C) ratio quantifies congestion along a segment or intersection by comparing traffic volumes against designed capacity. **Table 4-12**, **Table 4-13** and **Table 4-14** outline VLOS criteria.

Table 4-12: Vehicle Segment Criteria

Criteria Title	Description	Measurement Details	Units	Source
Midblock V/C Ratio (North/East)	Ratio of traffic volume versus the maximum capacity of the segment.	Average condition should be used.	N/A	Output from an applicable traffic related software.
Midblock V/C Ratio (South/West)	Ratio of traffic volume versus the maximum capacity of the segment.	Average condition should be used.	N/A	Output from an applicable traffic related software.

Table 4-13: Vehicle Signalized Intersection Criteria

Criteria Title	Description	Measurement Details	Units	Source
Intersection Volume Capacity Ratio	Ratio of traffic volume versus the maximum capacity of the signalized intersection.	Average condition should be used.	N/A	Output from an applicable traffic related software.

Table 4-14: Vehicle Unsignalized Intersection Criteria

Criteria Title	Description	Measurement Details	Units	Source
Intersection Volume Capacity Ratio	Ratio of traffic volume versus the maximum capacity of the signalized intersection.	Average condition should be used.	N/A	Output from an applicable traffic related software.

TRUCK LEVEL OF SERVICE

Vehicle LOS typically considers all motor vehicles, inclusive of trucks. However, some elements of the roadway segment and intersection can impact truck movements. Truck LOS (**TkLOS**) supplements Vehicle LOS by evaluating the physical space needed for truck operations in addition to the congestion measured through Vehicle LOS. Unlike other modes, trucks in the City of Brampton only operate on key goods movement corridors and arterial roads. Therefore, TkLOS is only applied on routes with no heavy vehicle restrictions as per By-Law 93-93. **Table 4-15**, **Table 4-16** and **Table 4-17** outline TkLOS criteria.

Table 4-15: Truck Segment Criteria

Criteria Title	Description	Measurement Details	Units	Source
Curb Lane Width	The average mid-block curb lane width along a segment.	Predominant condition should be used.	Metres	Field or design assessment
Vehicle Level of Service	Vehicle LOS score for the segment.	N/A	N/A	See Vehicle Level of Service

Table 4-16: Truck Signalized Intersection Criteria

Criteria Title	Description	Measurement Details	Units	Source
Corner Radius	Radius of the signalized intersection corner. Different scores are assigned based on the number of receiving lanes.	Corner with the lowest scoring condition should be used.	Metres	Field or design assessment
Vehicle Level of Service	Vehicle LOS score for the signalized intersection.	N/A	N/A	See Vehicle Level of Service

Table 4-17: Truck Unsignalized Intersection Criteria

Criteria Title	Description	Measurement Details	Units	Source
Corner Radius	Radius of the signalized intersection corner. Different scores are assigned based on the number of receiving lanes.	Corner with the lowest scoring condition should be used.	Metres	Field or design assessment
Vehicle Level of Service	Vehicle LOS score for the signalized intersection.	N/A	N/A	See Vehicle Level of Service

5.0 METHODOLOGY

GRADE TABLES

The grade tables organize the full range of inputs and differentiate between the LOS scores for each criteria. The tables in **Attachment A** break the performance of each metric into intervals and assign an appropriate grade accordingly to provide differentiation between the inputs for the purpose of comparison and analysis.

SPREADSHEET ANALYSIS TOOL AND METHODOLOGY

To simplify and standardize the process of calculating the LOS for each mode, a Brampton-specific Microsoft Excel tool was developed. The tool enables the user performing an MMLOS evaluation to record inputs for each evaluation criteria, restricted to values included in the grade tables shown in Section 6.6. Each letter grade associated with a criteria input has a corresponding numerical value that the tool uses to generate an LOS score. **Table 5-1** summarizes the grades and the associated numerical values.

Table 5-1: Letter Grades and Associated Numerical Values

Letter Grade	Numerical Value
A+	6.5
A	6
B+	5.5
B	5
C	4
D	3
E	2
F	1
N/A	0

Criteria Weighting

Each criterion is assigned a weight based on its relative importance in the LOS calculation. The weighted average is used to aggregate the performance of all relevant criteria into the LOS score for a singular mode. Weight assigned to each criterion can be seen in the grade tables in Attachment A.

Bonus Point Criteria

Bonus criteria are included in the tool to reflect the additional value provided by non-essential features. Bonus point criteria contribute extra points to an overall score. As a result, the sum of the weights for all criteria, including bonus points, may exceed 100 per cent (or a weight sum of 1.0). This ensures that the MMLOS calculation accurately reflects the added value of these added-value features, providing a more comprehensive assessment of the overall level of service.

Final LOS Calculation

To determine the final LOS score for each mode, the LOS scores for the segments, transit stops, signalized intersections and unsignalized intersections are averaged.

Up to 10 transit routes per segment and 50 transit stops, signalized intersections and unsignalized intersections can be evaluated using the tool.

ATTACHMENT A: GRADE TABLES

PEDESTRIAN LEVEL OF SERVICE

Table A-1: Pedestrian Segment Grade Table

Data Required		LOS A	LOS B	LOS C	LOS D	LOS E	LOS F	Weight
Facility Width	Sidewalk Width	≥3.0m	2.1 - 2.9m	1.5 - 2.0m	N/A	<1.5m	No sidewalk	25%
	MUP Width	N/A	≥ 4.0m	3.9 - 3.0m	2.5 - 3.0m	≤2.4m	E No facility	
	MUP on One Side and Sidewalk on the Other	N/A	N/A	≥4m MUP on one side of the road with ≥2.1m sidewalk on the other side of the road	≥3m MUP on one side of the road with ≥1.5m sidewalk on the other side of the road	Any other configuration of MUP on one side of the road with sidewalk on the other	N/A	
Buffer Width		2.5m or greater	2.5 - 1.5m	N/A	1.0 - 1.5m	<1.0m	No buffer	15%
Posted Speed	Sidewalk width + buffer 4.6 m or greater	≤50 km/h	51 - 60km/h	>60 km/h	N/A	N/A	N/A	15%
	Sidewalk width + buffer between 4.5-3.6 m	N/A	≤50 km/h	51 - 60km/h	>60 km/h	N/A	N/A	
	Sidewalk width + buffer between 3.5-2.6 m	N/A	N/A	≤50 km/h	51 - 60km/h	>60 km/h	N/A	
	Sidewalk width + buffer between 2.6-1.6 m	N/A	N/A	N/A	≤50 km/h	51 - 60km/h	>60 km/h	
	Sidewalk width + buffer <1.6 m	N/A	N/A	N/A	N/A	≤50 km/h	>50 km/h	
	MUP width + buffer 6.5 m or greater	≤50 km/h	51 - 60km/h	>60 km/h	N/A	N/A	N/A	
	MUP width + buffer between 6.4-5.5 m	N/A	≤50 km/h	51 - 60km/h	>60 km/h	N/A	N/A	
	MUP width + buffer between 5.4-4.5 m	N/A	N/A	≤50 km/h	51 - 60km/h	>60 km/h	N/A	
	MUP width + buffer between 4.4-3.5 m	N/A	N/A	N/A	≤50 km/h	51 - 60km/h	>60 km/h	
	MUP width + buffer 3 m or less	N/A	N/A	N/A	N/A	≤50 km/h	>50 km/h	
Distance between Controlled Crossings		<80m - 150m	151 - 250m	251 - 400m	401 - 550m	551 - 700m	>700m	15%
Placemaking		Abundance of placemaking amenities	Moderate amount of placemaking amenities	N/A	Low amount of placemaking amenities	N/A	No placemaking amenities	10%

Data Required		LOS A	LOS B	LOS C	LOS D	LOS E	LOS F	Weight
Street Trees	Pedestrian Facility on Both Sides of the Road	Double row of trees (provided on both sides of the boulevard) on both sides of the street spaced at intervals averaging 8m or less Lanes	Single row of trees on both sides of streets spaced at intervals averaging 8m or less	Single row of trees on one side of the street spaced at intervals averaging 8m or less	Single row of trees on one side of the street spaced at intervals averaging more than 9m-12m	Single row of trees on one or both side of the street spaced at intervals averaging 12m or more	No trees	15%
				Double row of trees (any configuration) on one side of the street. Single row (any configuration) of trees present on the other side.	Double row of trees on one side of the street. No trees present on other side.			
			Double row of trees (provided on both sides of the boulevard on both sides of the street) spaced at intervals averaging between 9-12m	Single row of trees on both sides of streets spaced at intervals averaging between 9m-12m	Other configurations of trees (both sides or one side)			
	Pedestrian Facility on One Side of the Road	Double row of trees (provided on both sides of the boulevard) spaced at intervals averaging 8m or less	Double row of trees (provided on both sides of the boulevard) spaced at intervals averaging between 9m-12m	Double row of trees (provided on both sides of the boulevard) spaced at intervals averaging 12 m or more	Single row of trees spaced at intervals averaging between 9-12 metres	Single row of trees spaced at intervals averaging 12m or more		
				Single row of trees spaced at intervals averaging 8m or less				
Vertical Buffer (light poles, street trees, on-street parking)		Presence of vertical elements at average intervals of 12m or less	N/A	N/A	N/A	N/A	N/A	5%

Table A-2: Pedestrian Signalized Intersection Grade Table

Data Required	LOS A	LOS B	LOS C	LOS D	LOS E	LOS F	Weight
Number of Lanes	3 lanes of traffic or less	4 lanes of traffic	5 lanes of traffic	6 lanes of traffic	7 lanes of traffic	8 lanes or more	20%
Corner Radius	<9.0m	9.0 - 10.9m	11.0-12.9m	13.0-14.9m	15.0-17.9m	≥18m	20%
Right Turn Channel	No Channelized Right Turn	N/A	N/A	N/A	Smart Channel	Right Turn Channel	15%
Signal Cycle Length (s)	<90s	91-110s	106-120s	121-140s	141-160s	>160s	15%
Crosswalk Treatment	Raised Crosswalk, Textured/ Coloured Pavement	Standard Ladder Bar Markings	N/A	Standard Markings	N/A	No markings at the intersection	25%
Number of Uncontrolled Conflicts	>1	1.1-1.5	1.6-2	2.1-2.5	2.6-3	>3	5%
Leading Pedestrian Interval* (Bonus)	Leading Pedestrian Interval Present	N/A	N/A	N/A	N/A	N/A	5%

Table A-3: Pedestrian Unsignalized Intersection Grade Table

Data Required		LOS A	LOS B	LOS C	LOS D	LOS E	LOS F	Weight
Pavement Markings at Controlled Crossings		100% of movements	N/A	N/A	N/A	At least 50% of movements	<50% of movements	33%
Crossing Distance		<9m	9-11.5m	11.6-13m	13-15m	N/A	≥15m	33%
Corner Radius	Right Turn Channel	<9m	9.0 - 10.9m	11.0-12.9m	13.0-14.9m	15.0-17.9m	≥18m	33%
	Roundabout	N/A	Single Lane	N/A	Multi Lane	N/A	N/A	

PEDESTRIAN LEVEL OF SERVICE

Table A-4: Bicycle Segment Grade Table

Data Required		LOS A	LOS B	LOS C	LOS D	LOS E	LOS F	Weight
Designated and Separated Bike Lanes								
Physical Separation / Buffers		In-boulevard grade separated infrastructure/ On-road physical separation present	Painted buffer with flexi posts/ bollards only	Painted Buffer	No Buffer	N/A	N/A	20%
No. of Travel Lanes		1 travel lane in each direction	N/A	2 travel lanes in each direction	3 or more travel lanes in each direction	N/A	N/A	20%
Buffer Width	**Boulevard Facilities**	2.5m or greater	1.5-2.5m	0.49-0.3m	1.5 - 1.0m	1.0-0.5m	<0.5m	15%
	On-road Facilities with Physical Separation	≥ 1.0m	0.9-0.5m	0.49-0.3m	Buffer width and facility width is greater than 2.8m	<0.3m	No Buffer	
	On-road Facilities with no Physical Separation	1.0m						
Cycling Facility Width per Direction	**Boulevard Facilities**	≥ 2.4m	2.3-1.8m	1.7-1.5m	1.4-1.2m	N/A	<1.2m	15%
	On-road Facilities	≥1.8m	1.5m - 1.7m	N/A				
Continuous Facility		Uninterrupted Facility	N/A	N/A	Interrupted Facility	N/A	N/A	5%
Posted Speed		≤40 km/h	41-50 km/h	51-60 km/h	N/A	≥60 km/h	N/A	10%
Cycling Facility Conflicts		Rare	N/A	Frequent	N/A	N/A	N/A	5%
Cycling Facility on Both Sides of the Road		Dedicated bike facility on both sides on the road	N/A	Dedicated, alternating side bike facility on one side of the road	Dedicated bike facility on one side on the road	N/A	N/A	5%
Parking Lane		Buffer provided between bike lane and parking lane	N/A	No buffer provided between bike lane and parking lane	N/A	N/A	N/A	5%

BICYCLE LEVEL OF SERVICE

Table A-4: Bicycle Segment Grade Table

Data Required	LOS A	LOS B	LOS C	LOS D	LOS E	LOS F	Weight
Mixed Traffic							
No. of Travel Lanes and Posted Speed	2 vehicle lanes, ≤ 40 km/h, no marked centre lane in residential area	2 vehicle lanes, ≤50 km/h, no marked centerline or classified as residential	3 vehicle lanes, ≤50 km/h, no marked centerline or classified as residential	4 to 5 vehicle lanes, ≤ 40 km/h	4 to 5 vehicle lanes, ≥ 50 km/h	6 or more vehicle lanes, ≤ 40 km/h	30%
Pavement Markings and Regulatory Signage	Mixed traffic pavement markings (sharrow/ shoulder markings and or signage.	N/A	N/A	No pavement markings (sharrow/ shoulder markings and or signage.	N/A	N/A	25%
Presence of Heavy Vehicles (Trucks and Buses)	No	N/A	N/A	N/A	N/A	Yes	30%
Signage	Presence of conformational and directional signage.	N/A	Presence of either conformational or directional signage.	N/A	N/A	No signage present.	15%

Table A-5: Bicycle Signalized Intersection Grade Table

Data Required	LOS A	LOS B	LOS C	LOS D	LOS E	LOS F	Weight
Left-turn Crossing and Posted Speed	Two Stage Crossing with Crossride; Left Turn Bike Box	1 lane of traffic being crossed at ≤40km/h	2 lanes of traffic being crossed at ≤40km/h; 1 lane being crossed at <50km/h; cyclists required to dismount for two stage crossing	1 or more lanes being crossed at ≥50 km/h	N/A	1 or more lanes lane being crossed at ≥ 60 km/h	20%
Enhanced Bicycle Measures	Protected intersection with bicycle signal phasing and passive bicycle detection or fixed signal timings on appraoches with dedicated cycling infrastructure	Protected intersection with bicycle signals without passive bicycle detection or fixed signal timing on appraoches with dedicated cycling infrastructure	Bicycle signals with cross rides/ guidelines/ bike box or other enhanced facilities on all approaches	Bicycle signals with cross rides/ guidelines/bike box or other enhanced facilities on 50% of appraoches with dedicated cycling infrastructure	Bicycle signals with cross rides/ guidelines/ bike box or other enhanced facilities on less than 50% of appraoches with dedicated cycling infrastructure	No dedicated infrastructure at intersection on appraoches with dedicated cycling infrastructure	35%
Corner Radius	<9.0m	9.0 - 10.9m	11.0-12.9m	13.0-14.9m	15.0-17.9m	≥18m	25%

Data Required	LOS A	LOS B	LOS C	LOS D	LOS E	LOS F	Weight
Signal Cycle Length	<60s	61-75s	76-90s	91-105s	106-120s	>120s	15%
Number of Uncontrolled Conflicts	1	1.1-1.5	1.6-2	2.1-2.5	2.6-3	>3.1	5%

Table A-6: Bicycle Unsignalized Intersection Grade Table

Data Required	LOS A	LOS B	LOS C	LOS D	LOS E	LOS F	Weight
Number of Travel Lanes and Posted Speed of Side Streets	3 or less lanes being crossed at ≤ 40 km/h	4 to 5 lanes being crossed at ≤ 40 km/h; 3 or less lanes being crossed at 50 km/h	4 to 5 lanes being crossed at 50 km/h ; 3 or less lanes being crossed at 60 km/h	4 to 5 lanes being crossed at 60 km/h	6 or more lanes being crossed at ≤ 40 km/h; 3 or less lanes being crossed at ≥ 65 km/h	6 or more lanes being crossed at ≥ 50 km/h; 4 to 5 lanes being crossed at ≥ 65 km/h	100%

TRANSIT LEVEL OF SERVICE

Table A-7: Transit Segment Grade Table

Data Required	LOS A	LOS B	LOS C	LOS D	LOS E	LOS F	Weight
Facility Type	Segregated Light Rail Transit (A+) Segregated Bus Rapid Transit (A)	Bus Rapid Transit in Dedicated Lanes (HOV) (B+) Mixed traffic with transit priority measures (Zum) (B)	Mixed Traffic with >1 lane per direction	Mixed Traffic with 1 lane	N/A	N/A	25%
Average Transit Travel Speed/ Average Vehicle Travel Speed	≥1 (A+) 1-0.8 (A)	0.8-0.7	0.69-0.6	0.59-0.4	0.39-0.2	<0.2	15%
Peak Period Transit Headway	<10min	11-15 min	16-30 min	31-59 min	60-89 min	≥90 min	20%
Average Transit On-time Performance	95-100%	90-94%	80-89%	70-79%	<70%	N/A	15%
Pedestrian Segment Level of Service	A	B	C	D	E	F	15%
Bicycle Segment Level of Service	A	B	C	D	E	F	10%

Table A-8: Transit Stop Grade Table

Data Required	LOS A	LOS B	LOS C	LOS D	LOS E	LOS F	Weight
Walkshed Reachability	Segregated Light Rail Transit (A+) Segregated Bus Rapid Transit (A)	Bus Rapid Transit in Dedicated Lanes (HOV) (B+) Mixed traffic with transit priority measures (Zum) (B)	Mixed Traffic with >1 lane per direction	Mixed Traffic with 1 lane	N/A	N/A	30%
Nearest Marked Crossing	≥1 (A+) 1-0.8 (A)	0.8-0.7	0.69-0.6	0.59-0.4	0.39-0.2	<0.2	25%
Transit Passenger Amenities	8+ passenger amenities	6-8 passenger amenities	4-5 passenger amenities	2-3 passenger amenities	<2 passenger amenities	No presence of passenger amenities	25%
User Experience Services	Arrival communication provided	N/A	N/A	N/A	No arrival communication provided	N/A	20%
AT Facilities* (Bonus)	Provision of secure bicycle parking /storage at transit stops and stations	N/A	N/A	N/A	N/A	N/A	10%

Table A-9: Transit Signalized Intersection Grade Table

Data Required	LOS A	LOS B	LOS C	LOS D	LOS E	LOS F	Weight
Transit Priority Measures	Implementation of transit priority measures at all approaches for transit	N/A	Implementation of transit priority measures on 50% of approaches for transit	No transit priority measures on any approach	N/A	N/A	30%
Transit Movement Delay	0 - 10s	11 - 20s	21 - 35s	36 - 55s	56 - 80s	>80s	25%
Pedestrian Signalized Intersection LOS	A	B	C	D	E	F	25%
Bicycle Signalized Intersection LOS	A	B	C	D	E	F	20%

Table A-10: Transit Unsignalized Intersection Grade Table

Data Required	LOS A	LOS B	LOS C	LOS D	LOS E	LOS F	Weight
Transit Movement Delay	0 - 10s	11 - 20s	21 - 35s	36 - 55s	56 - 80s	>80s	25%
Pedestrian Signalized Intersection LOS	A	B	C	D	E	F	25%
Bicycle Signalized Intersection LOS	A	B	C	D	E	F	20%

Table A-11: Vehicle Segment Grade Table

Data Required	LOS A	LOS B	LOS C	LOS D	LOS E	LOS F	Weight
Midblock V/C Ratio (North/East)	0-0.6	0.61-0.7	0.71-0.8	0.81-0.9	0.91-1	>1	50%
Midblock V/C Ratio (South/West)	0-0.6	0.61-0.7	0.71-0.8	0.81-0.9	0.91-1	>1	50%

Table A-12: Vehicle Signalized Intersection Grade Table

Data Required	LOS A	LOS B	LOS C	LOS D	LOS E	LOS F	Weight
Intersection V/C	0-0.6	0.61-0.7	0.71-0.8	0.81-0.9	0.91-1	>1	100%

Table A-13: Vehicle Unsignalized Intersection Grade Table

Data Required	LOS A	LOS B	LOS C	LOS D	LOS E	LOS F	Weight
Intersection V/C	0-0.6	0.61-0.7	0.71-0.8	0.81-0.9	0.91-1	>1	100%

Table A-14: Vehicle Segment Grade Table

Data Required	LOS A	LOS B	LOS C	LOS D	LOS E	LOS F	Weight
Curb Lane Width	≥3.5m	3.49-3.3m	3.29-3.2m	3.19-3.1m	3.09-3m	≤3m	50%
Vehicle Level of Service	A	B	C	D	E	F	50%

Table A-15: Vehicle Signalized Intersection Grade Table

Data Required	LOS A	LOS B	LOS C	LOS D	LOS E	LOS F	Weight
Corner Radius	> 15m and more than one receiving lane	10 to 15m and more than one receiving lane	< 15m and one receiving lane	<10m and more than one receiving lane	10 to 15m and one receiving lane	<10m and one receiving lane	50%
Vehicle Level of Service	A	B	C	D	E	F	50%

Table A-16: Vehicle Unsignalized Intersection Grade Table

Data Required	LOS A	LOS B	LOS C	LOS D	LOS E	LOS F	Weight
Corner Radius	> 15m and more than one receiving lane	10 to 15m and more than one receiving lane	< 15m and one receiving lane	<10m and more than one receiving lane	10 to 15m and one receiving lane	<10m and one receiving lane	100%
Vehicle Level of Service	A	B	C	D	E	F	50%

Attachment B: Example

Attachment B: Example

The examples in this section demonstrate the application of the MMLOS framework on different street typologies. The examples were selected to demonstrate a range of situations.

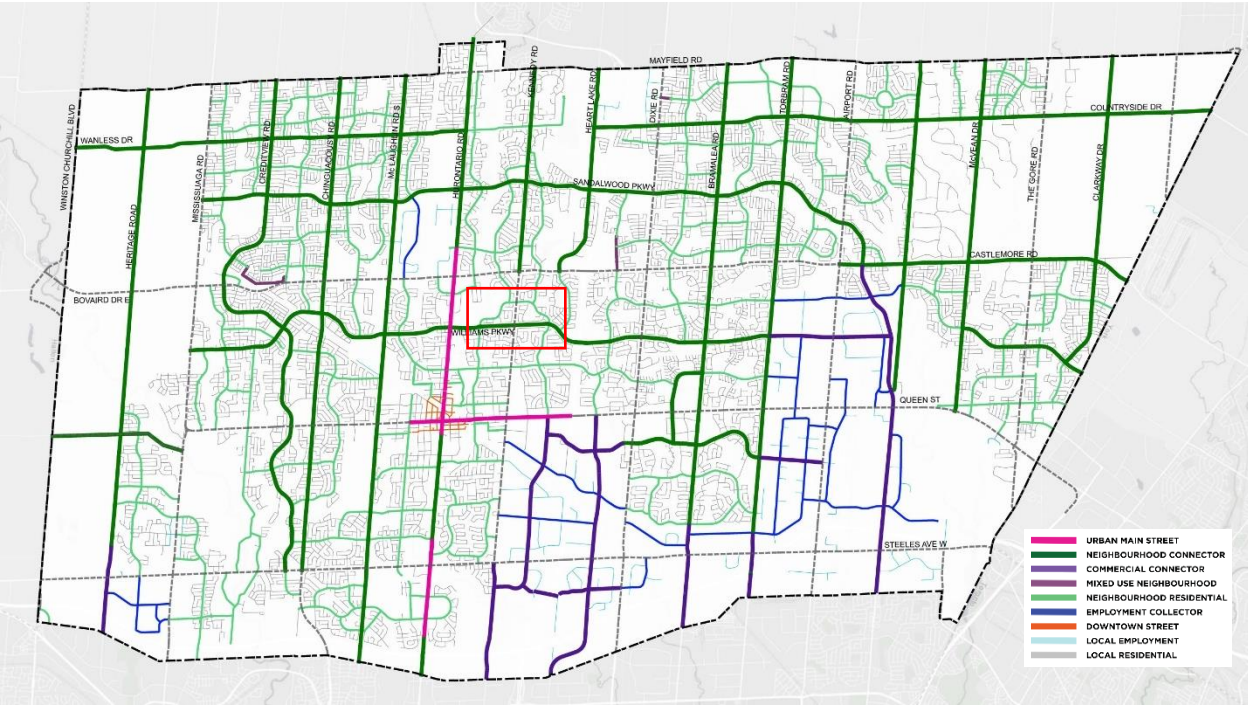
The following locations were selected:

- Williams Parkway between Centre Street and Rutherford Road
- Mill Street between Queen Street and Wellington Street

Williams Parkway between Centre Street and Rutherford Road

Step 1: Establishing Context – Street Classification and Land Use

In Brampton's Complete Streets Guide street typologies map, Williams Parkway is classified as a Neighbourhood Connector. The surrounding land use is low density residential.



Step 2: Corridor Details

Corridor details include:

- Segment Length: 1.5 km
- Two travel lanes per direction
- Proposed posted speed at 60 km/h
- Proposed MUP on both sides
- 3 signalized intersections
- Brampton Transit Route 29

- 8 transit stops
- Low density residential land use

The following graphic summarizes some of the details along the study corridor.

Step 2: Spreadsheet Analysis Tool

Enter details into the Summary Sheet in the tool.

Project	Williams Parkway Reconstruction 100% Design Drawings
Segment	Williams Parkway between Centre Street and Rutherford Road

Street Typology	Neighbourhood Connector
Target	Interim
Transit Route	Yes
Presence of Higher Order Transit	No
Truck Route	No

Step 3: Data Collection

The following data has been collected to perform the analysis:

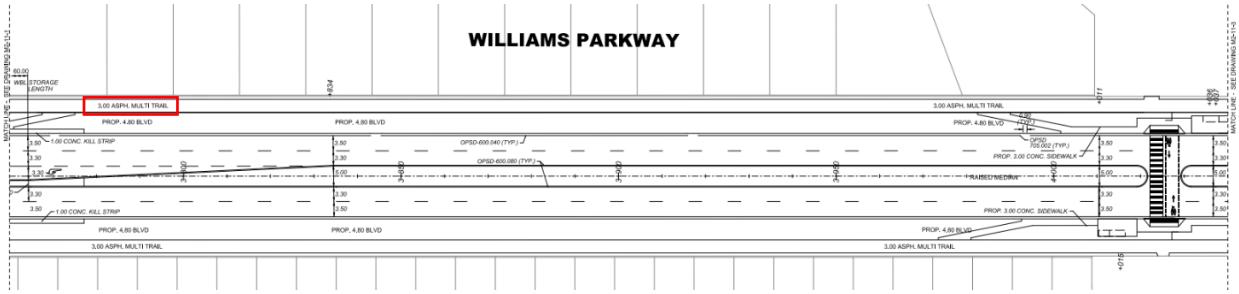
- Peak hour midblock and turning movement traffic counts (traffic analysis software input)
- Signal timings for all intersections (traffic analysis software input)
- Design drawings
- Transit schedule
- Transit on-time performance

Step 4: Segment Analysis

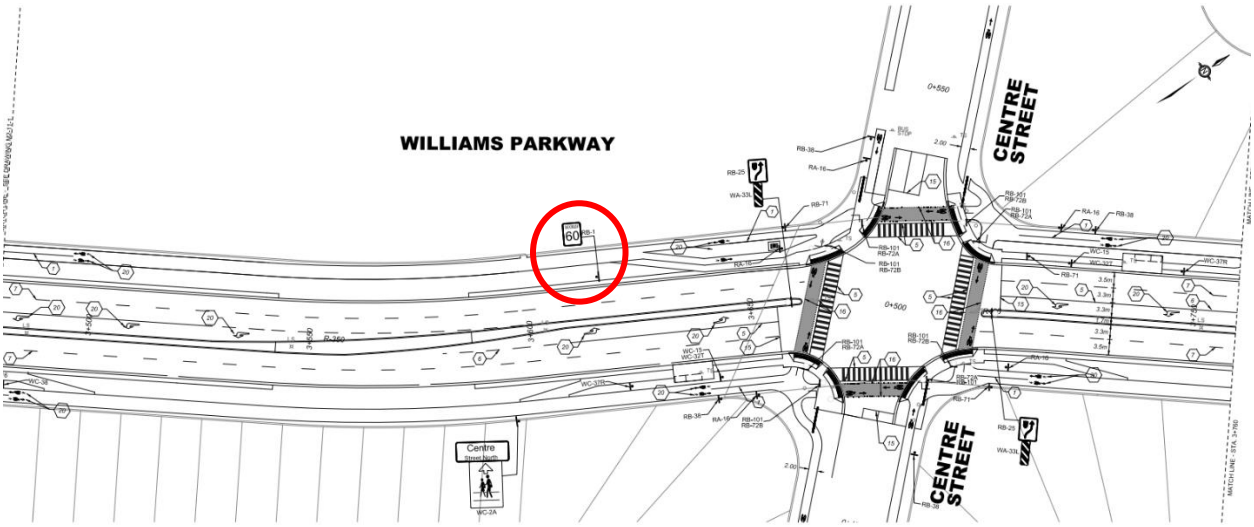
Since the road characteristics and land use are not significantly different along the chosen section, there would be no benefit in splitting the corridor into multiple segments.

Pedestrians:

- There is a proposed **3m multi-use path (MUP)** on both sides of the corridor. (LOS C)
- The predominant buffer width between the MUP and the curb lane is **4.8m**. (LOS A)



- The posted speed limit is **60 km/h**. The sum of the facility and buffer width is **7.8m.** (LOS B)

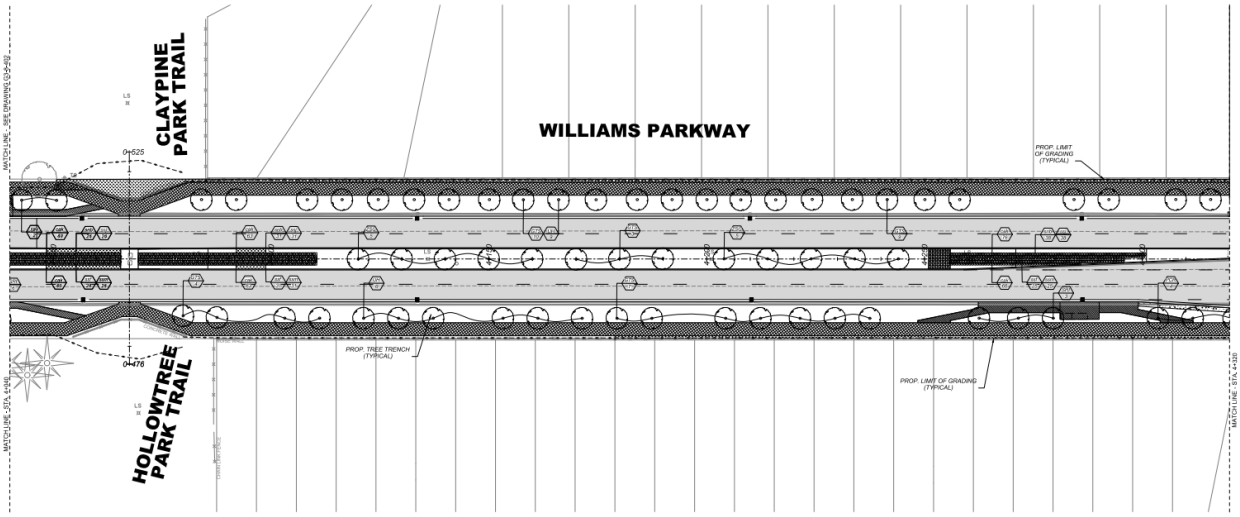


- The distance between Centre Street and the proposed midblock crossing at Clay Pine Park is 375m. The distance between the proposed midblock crossing at Clay Pine Park and Kennedy Road is 330m. The distance between Kennedy Road and proposed midblock crossing at Weybridge Trail is 350m. The distance between the proposed midblock crossing at Weybridge Trail and Rutherford Road is 400m. The following table summarizes the crossing distances along the segment.

To	From	Distance
Centre Street	Proposed Midblock Crossing at Clay Pine Park	375m
Proposed Midblock Crossing at Clay Pine Park	Kennedy Road	330m
Kennedy Road	Proposed Midblock Crossing at Weybridge Trail	350m
Proposed Midblock Crossing at Weybridge Trail	Rutherford Road	**400m**

The largest crossing distance along this segment is between the proposed midblock crossing at Weybridge Trail and Rutherford Road. (LOS C)

- Placemaking amenities include **street trees and pedestrian lighting**. There is a **low presence** of placemaking amenities along this segment. (LOS D)
- Street trees are placed as a single row of trees on **both sides of streets** spaced at intervals averaging **8 metres or less**. (LOS B)
- The **street trees** act as vertical buffers. (LOS A)



The final Pedestrian Segment LOS is B.

Bicycle:

- The design is proposing **3m multi-use paths** (MUP) on both sides of the road. This is a dedicated shared facility.
- There are **two vehicle travel lanes** in each direction. (LOS B)
- The MUP is **in the boulevard and is grade separated**. (LOS A)
- The buffer width between the MUP and the travel lane is **4.8m**. (LOS A)
- The cycling facility width is being halved to **1.5m** from 3m since it is a shared facility with pedestrians. (LOS C)
- The posted speed is **60 km/h**.
- Cycling facility blockage is rare (low presence of driveways. (LOS A)
- There is a cycling facility on both sides of the road. (LOS A)

- There is no parking lane. (N/A)

The final Bicycle Segment LOS is B.

Vehicle LOS:

- The eastbound midblock V/C ratio is 0.63 (LOS B) and the westbound midblock V/C ratio is 0.26 (LOS A) (taken from EMME Model)

The final Vehicle Segment LOS is A.

Truck LOS:

- The curb lane width along Williams Parkway is 3.5m. (LOS A)
- The Vehicle level of service is LOS A. (LOS A)

The final Truck Segment LOS is A.

Transit Route:

Route 29 is the only route servicing this section of Williams Parkway.

Details about Route 29:

- Route 29 operates in **mixed traffic with more than one lane in each direction**. (LOS C)
- Average transit travel speed can be calculated through the posted schedule along this segment.

Sample Peak Hour Arrival time at Initial Stop along Segment: Williams Pky E btwn Centre St N & Kennedy Rd N	**Sample Peak Hour Arrival Time at Final Stop along Segment:** Williams Pky w/of Rutherford Rd	**Distance**	**Time**	**Speed**
4:52 PM	4:55 PM	1.1 km	3 minutes	22 km/h

An average travel speed of 22km/h was determined by dividing the distance between the initial stop in the segment and final stop in the segment with the time of arrival.

The posted speed limit along the segment is 60 km/h.

$\frac{Average\ Transit\ Travel\ Speed}{Average\ Vehicle\ Travel\ Speed} = \frac{22\ km/h}{60\ km/h} = \mathbf{0.37}$ (LOS E)

- Based on the Brampton Transit schedule, the Peak Period Headway is **15 minutes**. (LOS B)
- Based on data shared by Brampton Transit, the average on-time performance is **74.4%**. (LOS D)

The final Transit Segment LOS is C.

Segment

Project	**Williams Parkway Reconstruction 100% Design Drawings**
Segment	**Villiams Parkway between Centre Street and Rutherford Roa**

Mode	**Pedestrian**	**Bicycle**	**Transit**	**Vehicle**	**Truck**
Target	C	C	C	D	D
Actual	C	B	C	A	A

	Facility on Both Sides of the Street	**Facility Width on Both Sides**	**Buffer Width from Travel Lane**	**Posted Speed and Buffer Width**	**Distance between Controlled Crossings**	**Placemaking**	**Street Trees**	**Vertical Buffer**
Pedestrian	Yes	MUP Width 3.0m - 3.9m	2.5m or greater	MUP width + buffer 6.5 m or greater; 51 - 60km/h	251 - 400m	Low amount of placemaking amenities	Single row of trees on both sides of streets spaced at intervals averaging 8 metres or less	Select
LOS		C	A	B	C	D	B	N/A
WEIGHTED SCORE	C							

	Facility Type	**Number of Travel Lanes**	**Physical Separation/Buffer**	**Buffer Width (In-Boulevard)**	**Facility Width (In-Boulevard)**	**Posted Speed**	**Cycling Facility Blockage**	**Cycling Facility on Both Sides on the Road**	**Parking Lane**
Bicycle	Dedicated/Separated Cycling Infrastructure	2 travel lanes in each direction	In-boulevard grade separated infrastructure	2.5m or greater	1.7 - 1.5m	51-60 km/h	Rare	Dedicated cycling facility on both sides on the road	N/A
LOS		B	A	A	C	C	A	A	N/A
WEIGHTED SCORE		B							

	Midblock V/C Ratio (North/East)	**Midblock V/C Ratio (South/West)**		**Curb Lane Width**	**Vehicle Level of Service**
Vehicle	0.61-0.7	0-0.6	**Truck**	3.7-3.5m	A
LOS	B	A	**LOS**	A	A
WEIGHTED SCORE	A		**WEIGHTED SCORE**	A	

Transit Routes

Number of Transit Routes to be Analysed	1
Transit Route	29

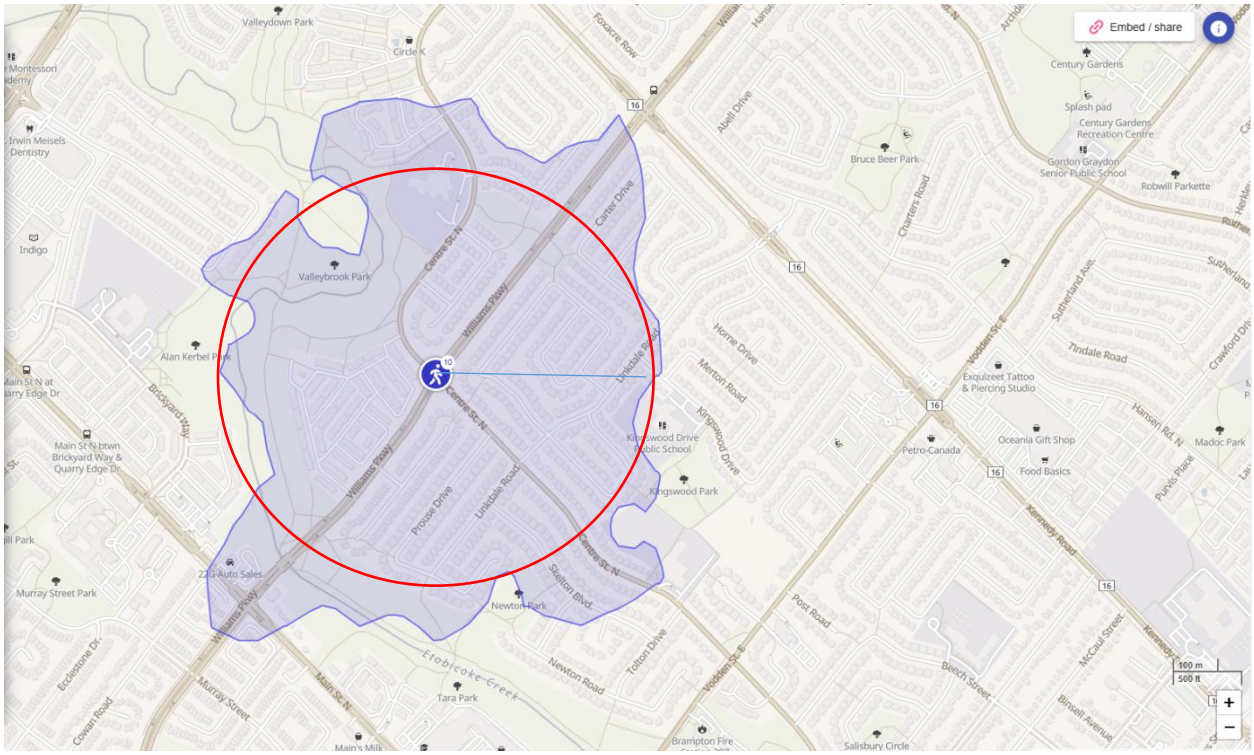
	Facility Type	**Average Transit Travel Speed/ Average Vehicle Travel Speed**	**Peak Period Transit Headway**	**Average Transit On-time Performance**	**Pedestrian Segment Level of Service**	**Bicycle Segment Level of Service**
Transit	Mixed Traffic with >1 lane per direction	0.39-0.2	11-15 min	70-79%	C	B
LOS	C	E	B	D	C	B
WEIGHTED SCORE	C					

Step 5: Transit Stop Analysis

There are 8 transit stops along the segment that need to be evaluated.

Transit Stop #1: Williams Pky E e/of Centre St N

- The following walkshed analysis is done using an open source walkshed analysis software:



81-100% of the walkshed area can be reached via a 10 minute walk. (LOS A)

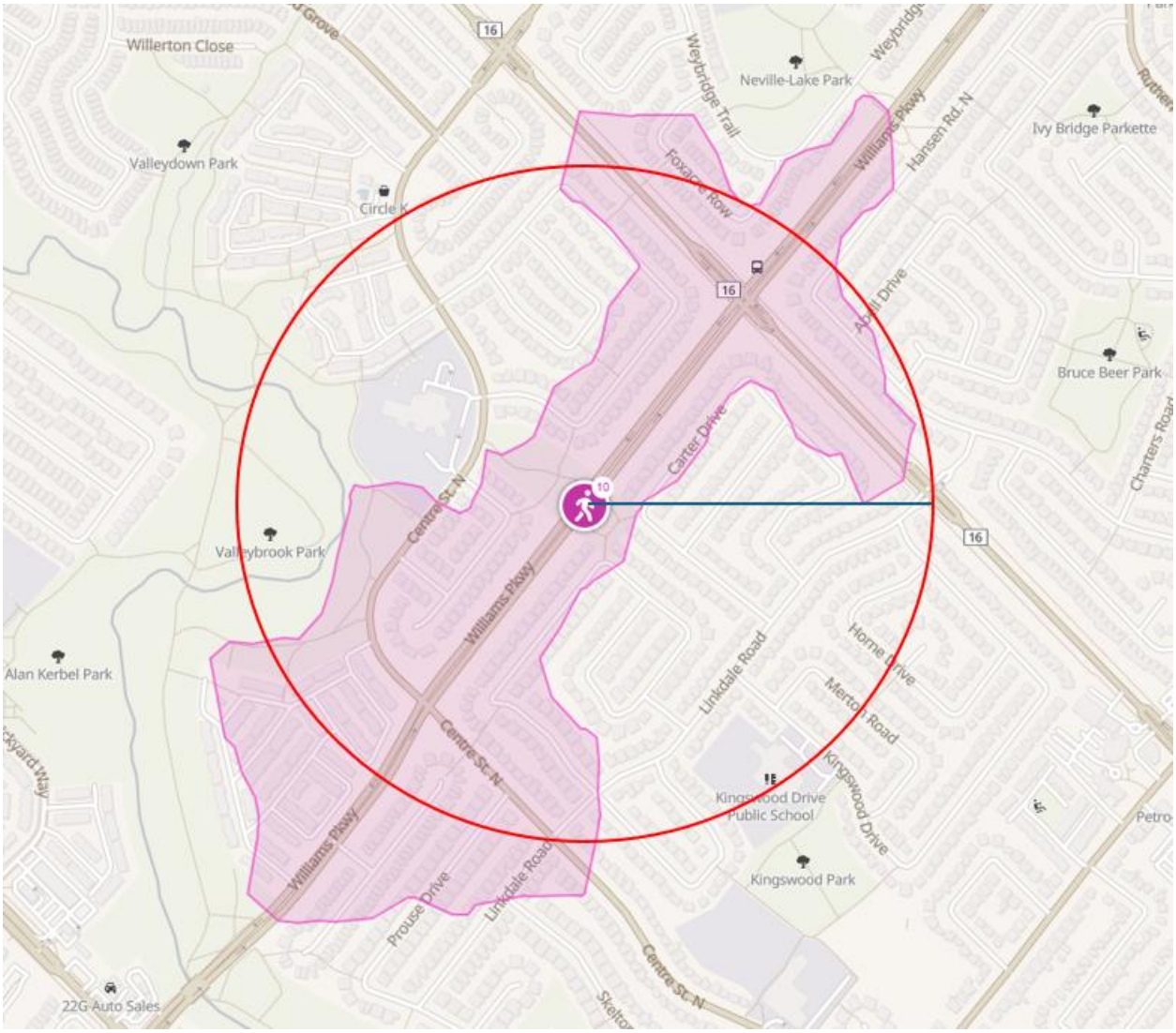
- The distance to the nearest crossing at Centre Street is less than 35m. (LOS C)

- There is a shelter proposed at the transit stop with seating/benches. There are 2-3 passenger amenities present at this transit stop. (LOS D)
- There is no real time communication service present at this stop. (LOS E)
- There are no bike racks present. (N/A)

Final LOS: C

Transit Stop #2: Williams Pkwy btwn Kennedy Rd & Centre St

- The following walkshed analysis is done using an open source walkshed analysis software:



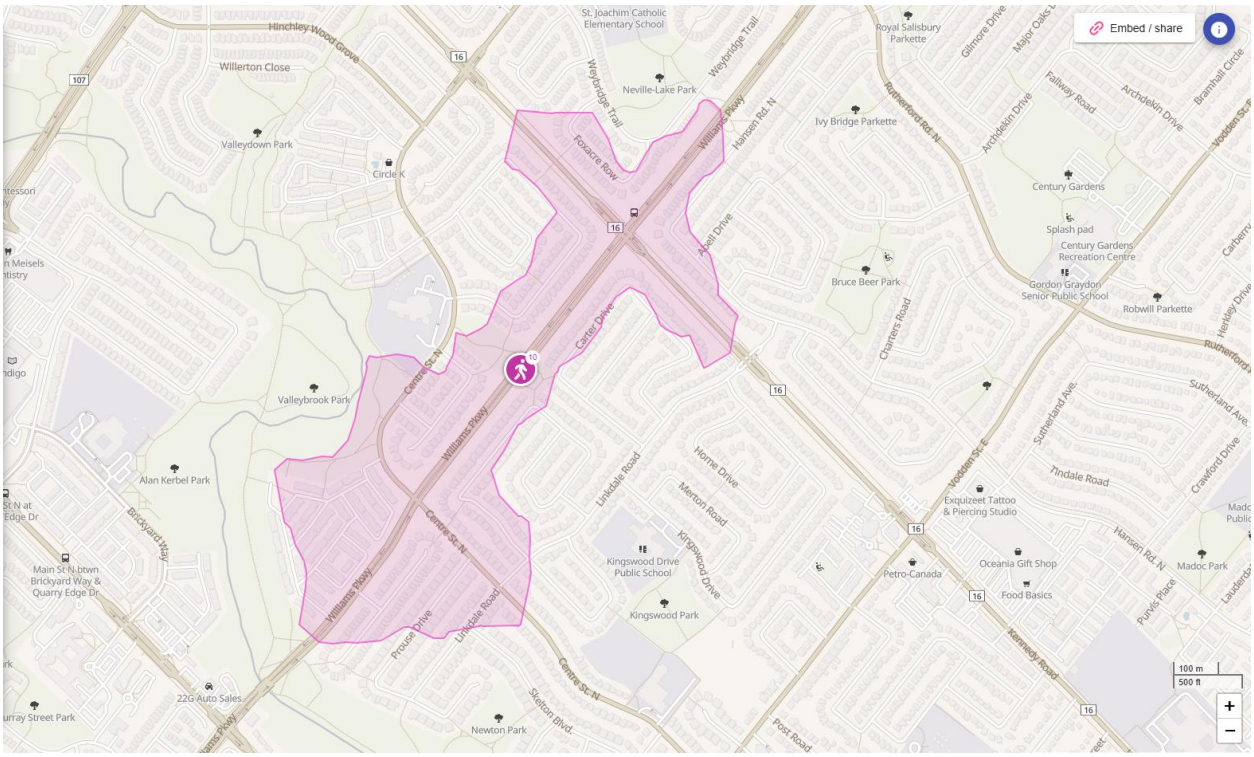
61-70% of the walkshed area can be reached via a 10 minute walk. (LOS C)

- With the proposed midblock crossing at Claypine Park, the distance to the nearest crossing is less than 10m. (LOS A)
- There is a shelter proposed at the transit stop with seating/benches. There are 2-3 passenger amenities present at this transit stop. (LOS D)
- There is no real time communication service present at this stop. (LOS E)
- There are no bike racks present. (N/A)

Final LOS: C

Transit Stop #3: Williams Pky E btwn Centre St N & Kennedy Rd N

- The following walkshed analysis is done using an open source walkshed analysis software:



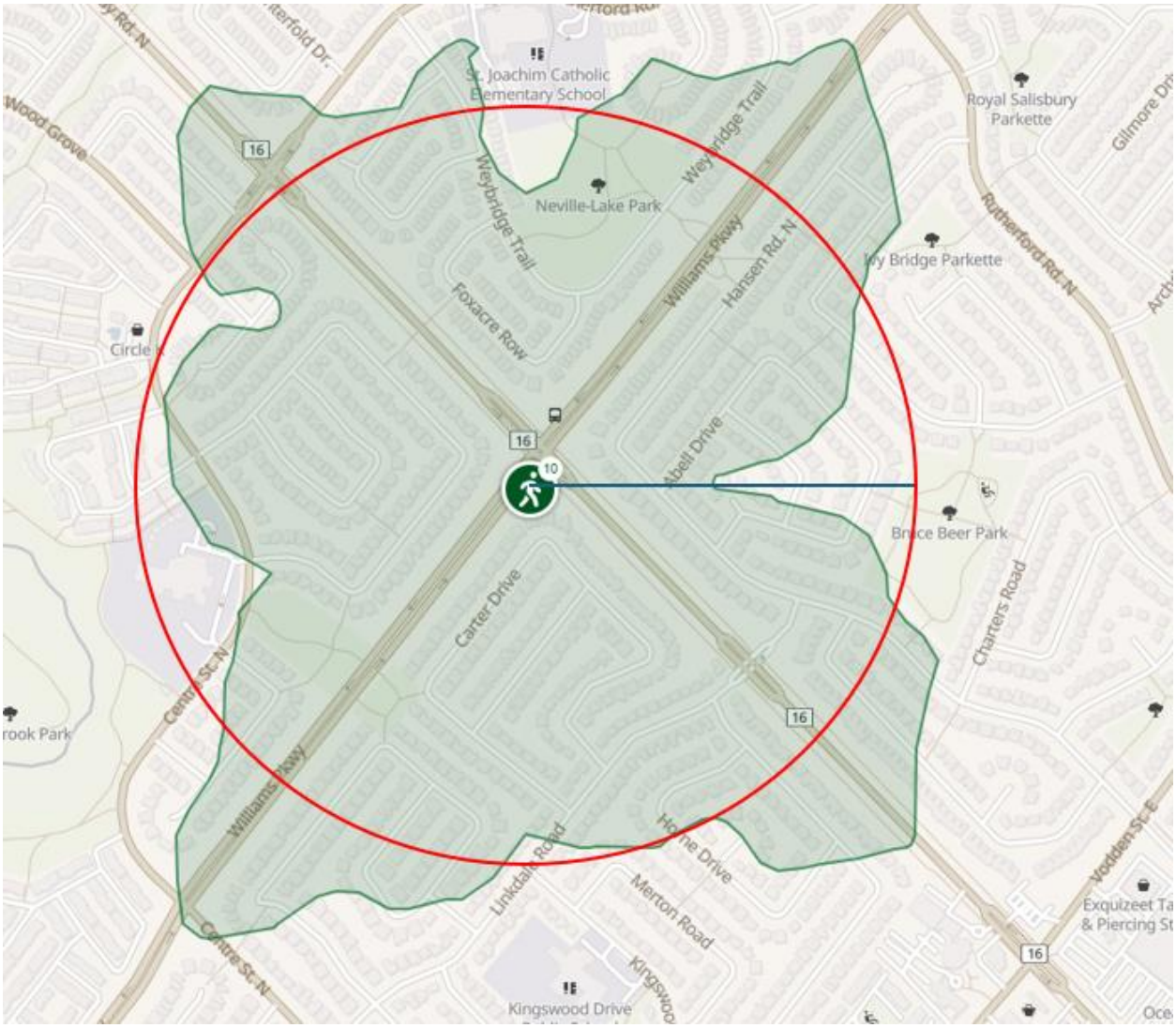
61-70% of the walkshed area can be reached via a 10 minute walk. (LOS C)

- With the proposed midblock crossing at Claypine Park, the distance to the nearest crossing is less than 10m. (LOS A)
- There is a shelter proposed at the transit stop with seating/benches. There are 2-3 passenger amenities present at this transit stop. (LOS D)
- There is no real time communication service present at this stop. (LOS E)
- There are no bike racks present. (N/A)

Final LOS: C

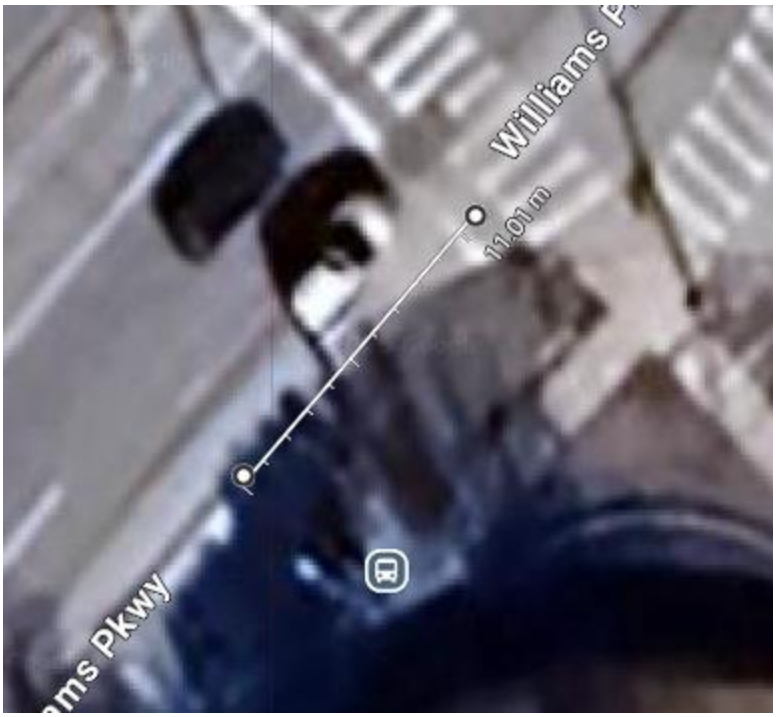
Transit Stop #4: Williams Pky w/of Kennedy Rd

- The following walkshed analysis is done using an open source walkshed analysis software:



81-100% of the walkshed area can be reached via a 10 minute walk. (LOS A)

- The distance to the nearest crossing at Kennedy Road is between 10-30m. (LOS C)

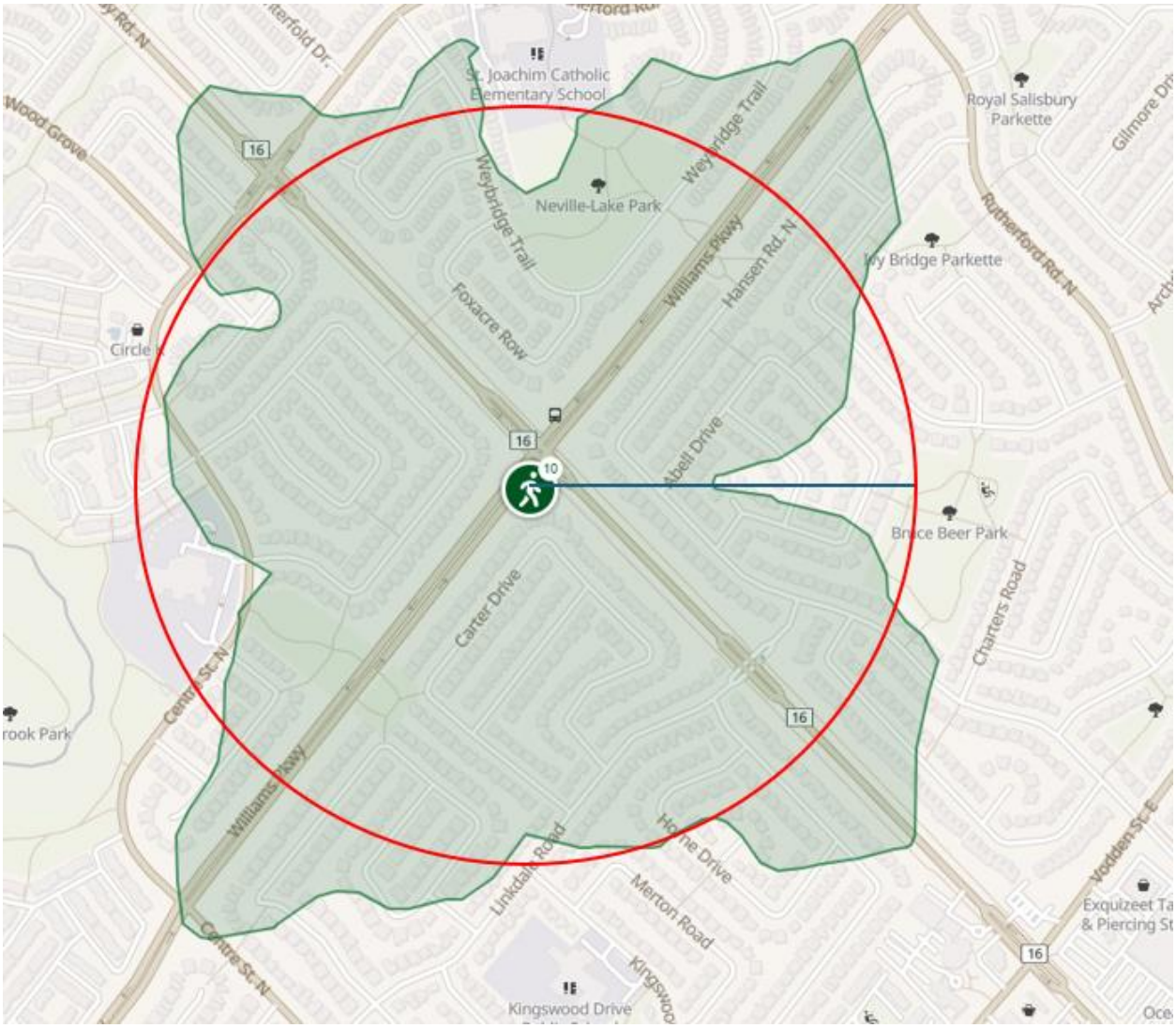


- There is a shelter proposed at the transit stop with seating/benches. There are 2-3 passenger amenities present at this transit stop. (LOS D)
- There is no real time communication service present at this stop. (LOS E)
- There are no bike racks present. (N/A)

Final LOS: C

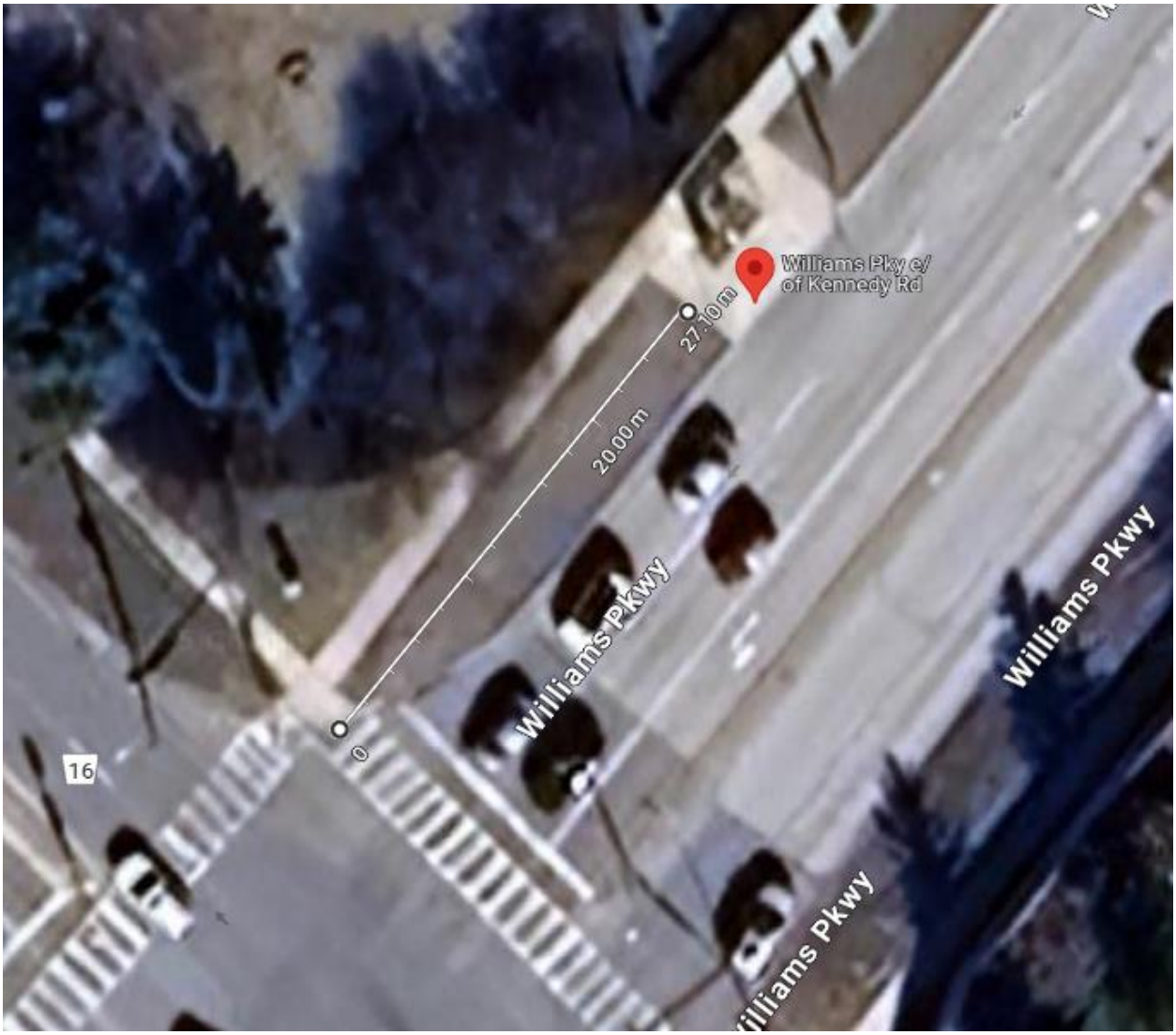
Transit Stop #5: Williams Pky e/of Kennedy Rd

- The following walkshed analysis is done using an open source walkshed analysis software:



81-100% of the walkshed area can be reached via a 10 minute walk. (LOS A)

- The distance to the nearest crossing at Kennedy Road is between 10-30m. (LOS C)

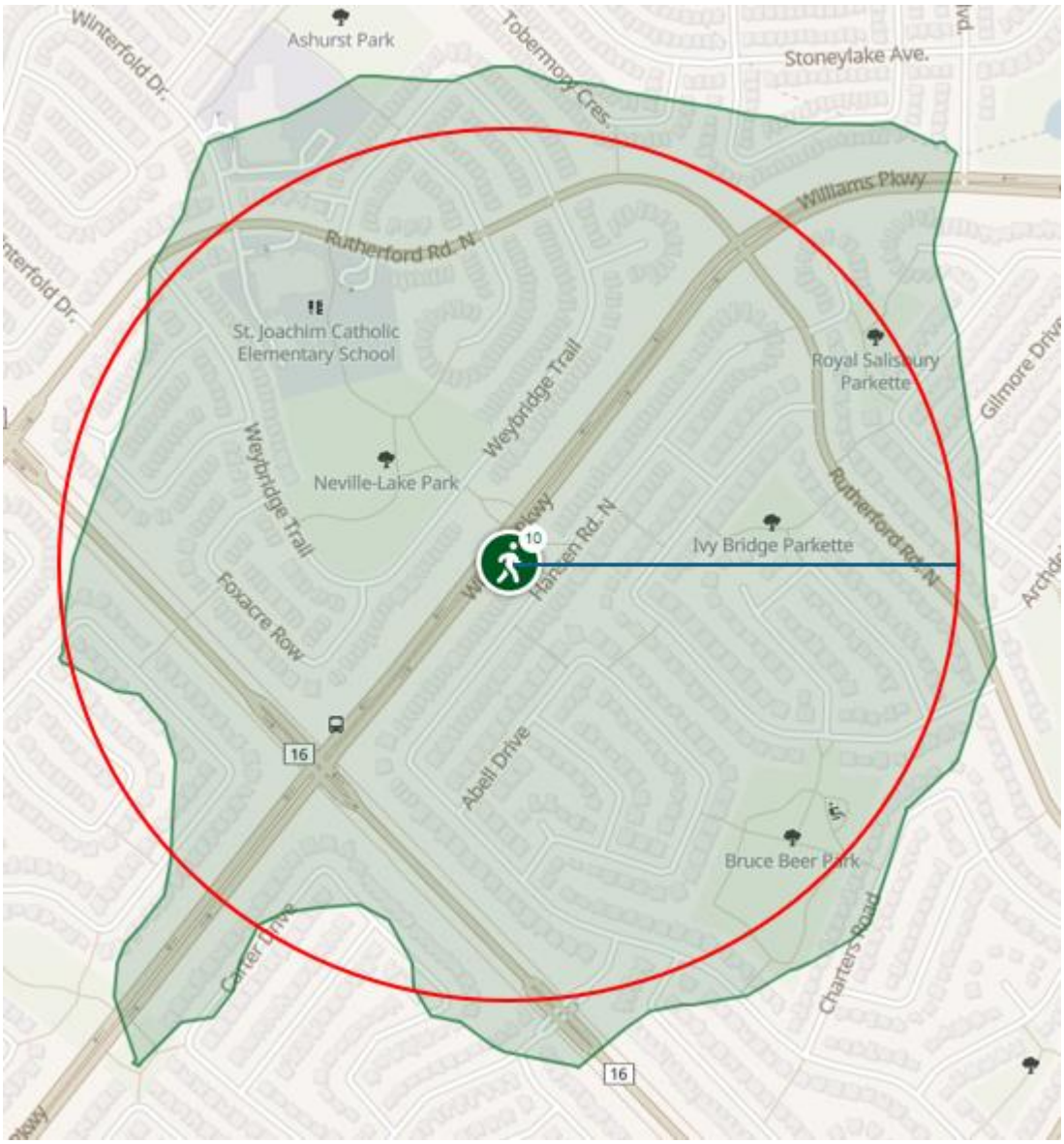


- There is a shelter proposed at the transit stop with seating/benches. There are 2-3 passenger amenities present at this transit stop. (LOS D)
- There is no real time communication service present at this stop. (LOS E)
- There are no bike racks present. (N/A)

Final LOS: C

Transit Stop #6: Williams Pkwy btwn Kennedy Rd & Rutherford Rd

- The following walkshed analysis is done using an open source walkshed analysis software:



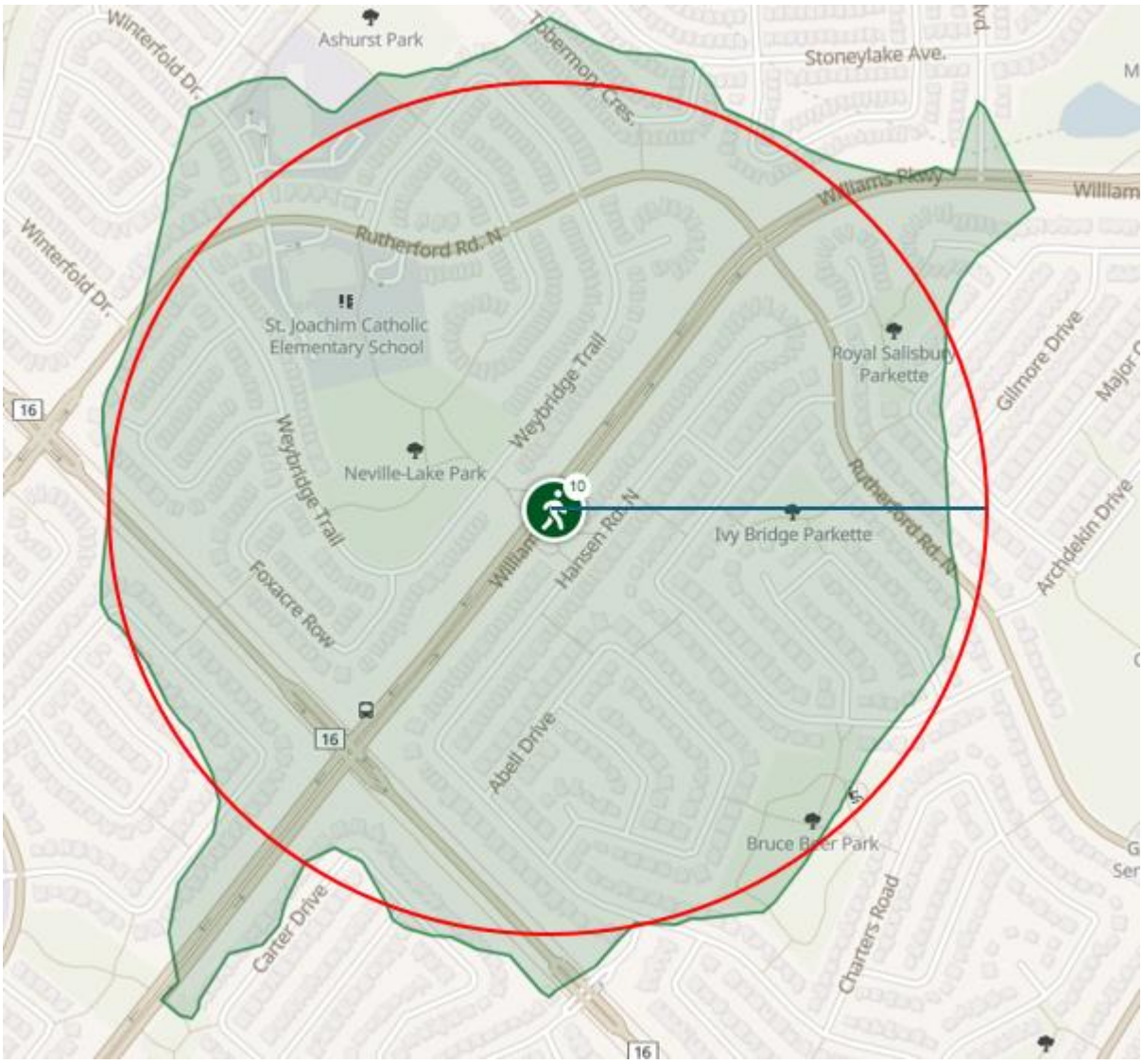
81-100% of the walkshed area can be reached via a 10 minute walk. (LOS A)

- With the proposed midblock crossing at Weybridge Trail, the distance to the nearest crossing is less than 10m. (LOS A)
- There is a shelter proposed at the transit stop with seating/benches. There are 2-3 passenger amenities present at this transit stop. (LOS D)
- There is no real time communication service present at this stop. (LOS E)
- There are no bike racks present. (N/A)

Final LOS: C

Transit Stop #7: Williams Pkwy btwn Rutherford Rd & Kennedy Rd

- The following walkshed analysis is done using an open source walkshed analysis software:



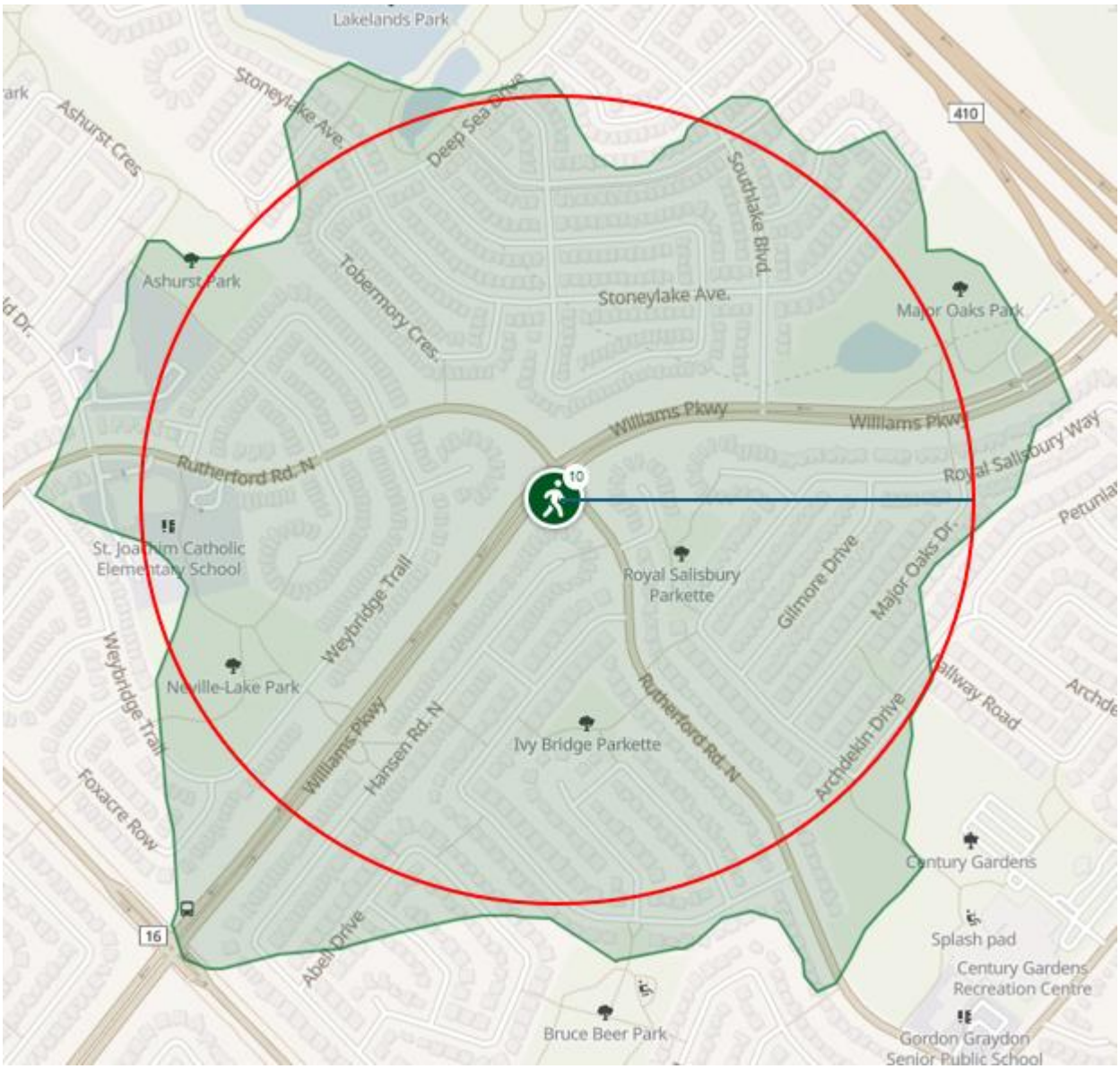
81-100% of the walkshed area can be reached via a 10 minute walk. (LOS A)

- With the proposed midblock crossing at Weybridge Trail, the distance to the nearest crossing is less than 10m. (LOS A)
- There is a shelter proposed at the transit stop with seating/benches. There are 2-3 passenger amenities present at this transit stop. (LOS D)
- There is no real time communication service present at this stop. (LOS E)
- There are no bike racks present. (N/A)

Final LOS: C

Transit Stop #8: Williams Pky w/of Rutherford Rd

The following walkshed analysis is done using an open source walkshed analysis software:



81-100% of the walkshed area can be reached via a 10 minute walk. (LOS A)

- With the proposed midblock crossing at Weybridge Trail, the distance to the nearest crossing is between 10-30m. (LOS A)
- There is a shelter proposed at the transit stop with seating/benches. There are 2-3 passenger amenities present at this transit stop. (LOS D)
- There is no real time communication service present at this stop. (LOS E)
- There are no bike racks present. (N/A)

Final LOS: C

The following table summarizes the results of the transit stop analysis.

Transit Stop Analyzed	Score
Transit Stop #1	C

Transit Stop #2	C
Transit Stop #3	C
Transit Stop #4	C
Transit Stop #5	C
Transit Stop #6	C
Transit Stop #7	C
Transit Stop #8	C
Average Transit Stop Score	**C**

The final Transit Stop LOS is C.

Transit Stops

Project	**Williams Parkway Reconstruction 100% Design Drawings**
Segment	**Williams Parkway between Centre Street and Rutherford Road**
Number of Transit Stops	8

Mode	**Transit Stop**
Target	C
Actual	C

Transit Stop	Transit Stop #1: Williams Pky E e/of Centre St N				
	Walkshed Reachability	**Nearest Marked Crossing**	**Transit Passenger Amenities**	**User Experience Services**	**AT facilities (Bonus)**
Transit Stop	81-100%	31 - 50m	2-3 passenger amenities present	No real time communication of service (e.g. time of bus arrival) to customers through electronic displays at bus stops and stations as well as real time route tracking through mobile/ web based applications.	No provision of secure bicycle parking /storage at transit stops and stations
LOS	A	C	D	E	N/A
WEIGHTED SCORE	**C**				

Transit Stop	Transit Stop #2: Williams Pkwy btwn Kennedy Rd & Centre St				
	Walkshed Reachability	Nearest Marked Crossing	Transit Passenger Amenities	User Experience Services	AT facilities (Bonus)
Transit Stop	61-70%	<10m	2-3 passenger amenities present	No real time communication of service (e.g. time of bus arrival) to customers through electronic displays at bus stops and stations as well as real time route tracking through mobile/ web based applications.	No provision of secure bicycle parking /storage at transit stops and stations
LOS	C	A	D	E	N/A
WEIGHTED SCORE	C				

Transit Stop	Transit Stop #3: Williams Pky E btwn Centre St N & Kennedy Rd N				
	Walkshed Reachability	Nearest Marked Crossing	Transit Passenger Amenities	User Experience Services	AT facilities (Bonus)
Transit Stop	61-70%	<10m	2-3 passenger amenities present	No real time communication of service (e.g. time of bus arrival) to customers through electronic displays at bus stops and stations as well as real time route tracking through mobile/ web based applications.	No provision of secure bicycle parking /storage at transit stops and stations
LOS	C	A	D	E	N/A
WEIGHTED SCORE	C				

Transit Stop	Transit Stop #4: Williams Pky w/of Kennedy Rd				
	Walkshed Reachability	Nearest Marked Crossing	Transit Passenger Amenities	User Experience Services	AT facilities (Bonus)
Transit Stop	81-100%	10 - 30m	2-3 passenger amenities present	No real time communication of service (e.g. time of bus arrival) to customers through electronic displays at bus stops and stations as well as real time route tracking through mobile/ web based applications.	No provision of secure bicycle parking /storage at transit stops and stations
LOS	A	B	D	E	N/A
WEIGHTED SCORE	C				

Transit Stop	Transit Stop #5: Williams Pky e/of Kennedy Rd				
	Walkshed Reachability	**Nearest Marked Crossing**	**Transit Passenger Amenities**	**User Experience Services**	**AT facilities (Bonus)**
Transit Stop	81-100%	10 - 30m	2-3 passenger amenities present	No real time communication of service (e.g. time of bus arrival) to customers through electronic displays at bus stops and stations as well as real time route tracking through mobile/ web based applications.	No provision of secure bicycle parking /storage at transit stops and stations
LOS	A	B	D	E	N/A
WEIGHTED SCORE	**C**				

Transit Stop	Transit Stop #6: Williams Pkwy btwn Kennedy Rd & Rutherford Rd				
	Walkshed Reachability	**Nearest Marked Crossing**	**Transit Passenger Amenities**	**User Experience Services**	**AT facilities (Bonus)**
Transit Stop	81-100%	<10m	2-3 passenger amenities present	No real time communication of service (e.g. time of bus arrival) to customers through electronic displays at bus stops and stations as well as real time route tracking through mobile/ web based applications.	No provision of secure bicycle parking /storage at transit stops and stations
LOS	A	A	D	E	N/A
WEIGHTED SCORE	**C**				

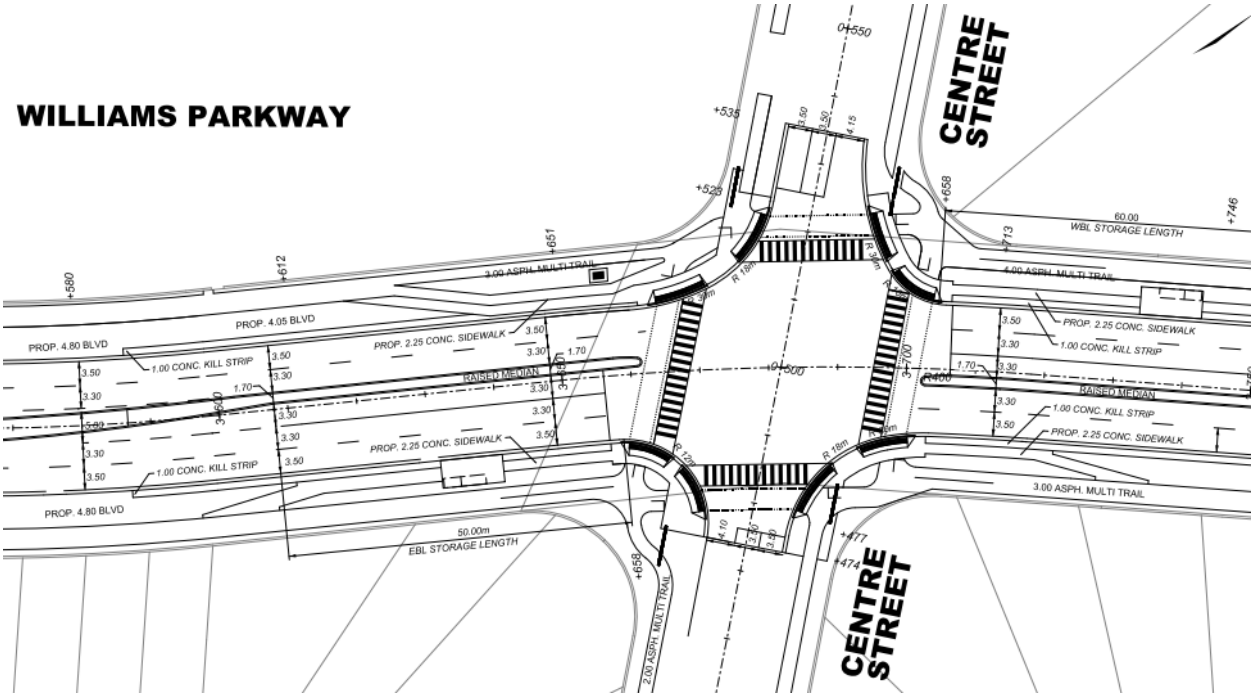
Transit Stop	Transit Stop #7: Williams Pkwy btwn Rutherford Rd & Kennedy Rd				
	Walkshed Reachability	**Nearest Marked Crossing**	**Transit Passenger Amenities**	**User Experience Services**	**AT facilities (Bonus)**
Transit Stop	81-100%	<10m	2-3 passenger amenities present	No real time communication of service (e.g. time of bus arrival) to customers through electronic displays at bus stops and stations as well as real time route tracking through mobile/ web based applications.	No provision of secure bicycle parking /storage at transit stops and stations
LOS	A	A	D	E	N/A
WEIGHTED SCORE	**C**				

Transit Stop	Transit Stop #8: Williams Pky w/of Rutherford Rd				
	Walkshed Reachability	Nearest Marked Crossing	Transit Passenger Amenities	User Experience Services	AT facilities (Bonus)
Transit Stop	81-100%	10 - 30m	2-3 passenger amenities present	No real time communication of service (e.g. time of bus arrival) to customers through electronic displays at bus stops and stations as well as real time route tracking through mobile/ web based applications.	No provision of secure bicycle parking /storage at transit stops and stations
LOS	A	B	D	E	N/A
WEIGHTED SCORE	C				

Signalized Intersections:

- V/C ratios and intersection delay information is obtained from the Williams Parkway Traffic Reassessment Study (McLaughlin to Dixie Road, August 2022)

Intersection #1: Williams Pkwy and Centre St



Pedestrian Analysis

- The design includes **5 lanes** of traffic. (LOS C)
- The corner with the largest radius is **30m.** (LOS F)
- **No channelized right turn lane** is being proposed. (LOS A)
- Singal cycle length of **160 seconds.** (LOS F)
- **Standard ladder bar crossing** will be present. (LOS B)

- Uncontrolled Conflicts Calculation:
    - # of Uncontrolled Conflicts Present: 12
    - # Value of measure: 12/4=**3** (LOS F)

The final Pedestrian Signalized Intersection LOS is a D.

Bicycle Analysis

- **Two stage crossing with cross rides.** (LOS A)
- **Protected Intersection with bike signals** present.(LOS B)
- The corner with the largest radius is **30m.** (LOS F)
- Singal cycle length of **160s.** (LOS F)
- Uncontrolled Conflicts Calculation is the same as the pedestrian metric. (LOS F)

The final Bicycle Signalized Intersection LOS is a D.

Transit Analysis

- **No transit priority measures** are included on any approach. (LOS D)
- Since transit is operating in a mixed traffic condition, the average Transit Movement Delay is taken to be the same as the intersection delay which is **146s.** (LOS F)

The final Transit Signalized Intersection LOS is D.

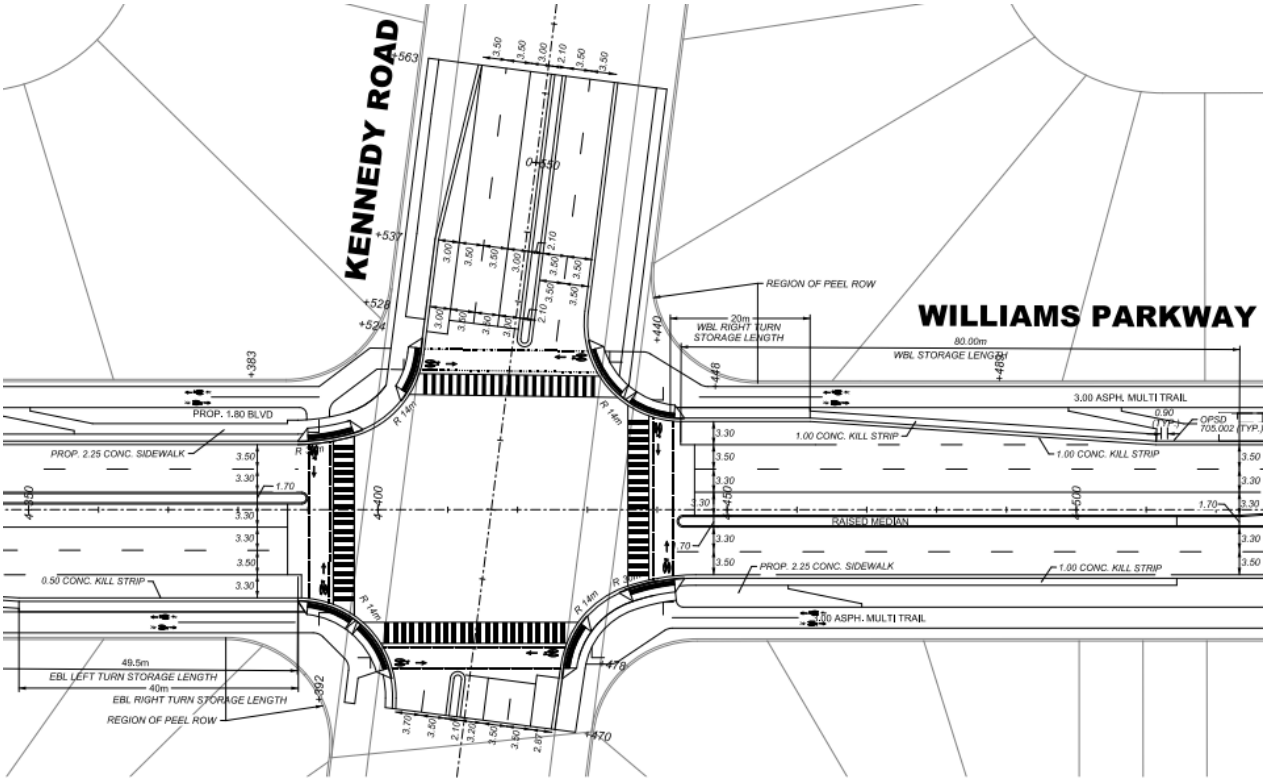
Vehicle Analysis

- The intersection V/C ratio is 2.31. (LOS F)

The final Vehicle Segment LOS is F.

Truck Analysis

- The smallest turning radius is **12m** with **more than one receiving lane.** (LOS B)
- The 'Vehicle Level of Service' metric is tied to the above V/C ratio of **2.31**. (LOS F)



Intersection #2: Williams Pkwy and Kennedy Rd
Pedestrian Analysis

- The design includes **6 lanes of traffic.** (LOS D)
- The corner with the largest radius is **30m.** (LOS F)
- **No channelized right turn lane** is being proposed. (LOS A)
- Singal cycle length of **160 seconds.** (LOS F)
- **Standard ladder bar crossing** will be present. (LOS B)
- Uncontrolled Conflicts Calculation:
    - # of Uncontrolled Conflicts Present: 12
    - # Value of measure: 12/4=**3** (LOS E)

The final Pedestrian Signalized Intersection LOS is an D.

Bicycle Analysis

- **Two stage crossing with cross rides.** (LOS A)
- **Protected Intersection with bike signals present.** (LOS B)
- The corner with the largest radius is **30m.** (LOS F)
- Singal cycle length of **160s.** (LOS F)
- Uncontrolled Conflicts Calculation the same for the pedestrian metric. (LOS E)

The final Bicycle Signalized Intersection LOS is a D.

Transit Analysis

- **No transit priority measures** are included on any approach. (LOS D)
- Since transit is operating in a mixed traffic condition, the average Transit Movement Delay is taken to be the same as the intersection delay which is **93s.** (LOS F)

The final Transit Signalized Intersection LOS is D.

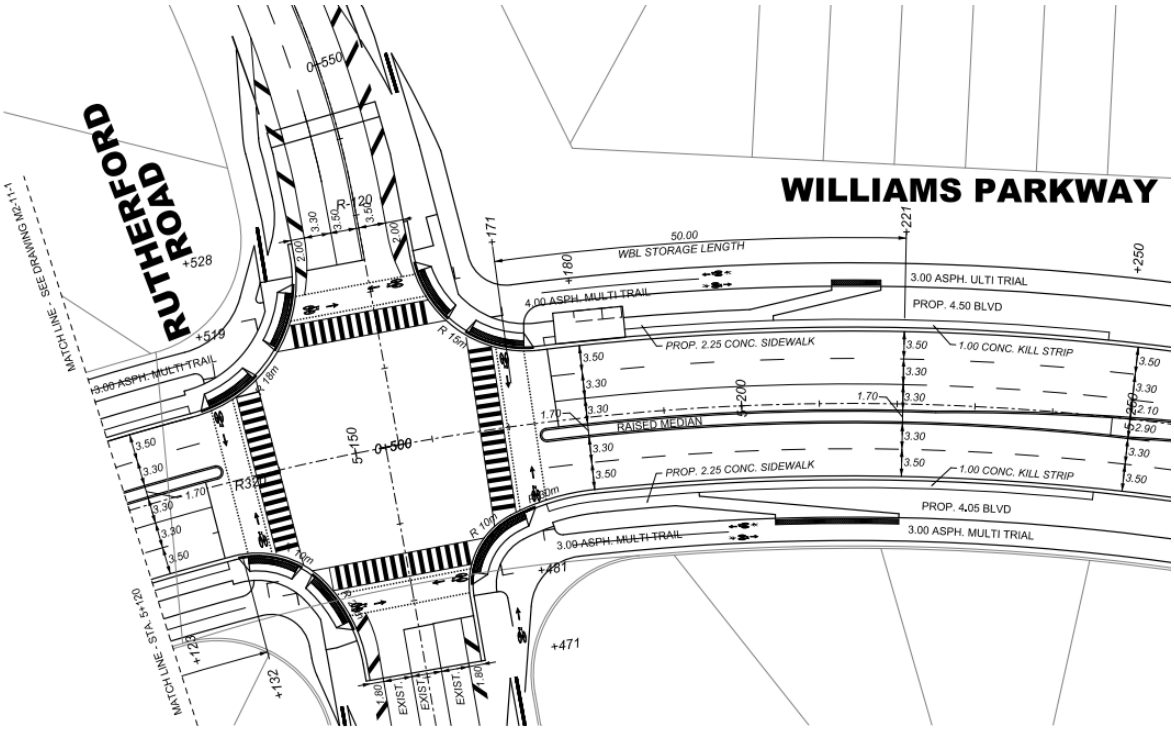
Vehicle Analysis

- The intersection V/C ratio is **1.27.** (LOS F)

The final Vehicle Segment LOS is F.

Truck Analysis

- The smallest turning radius is **14m** with **more than one receiving lane.** (LOS B)
- The 'Vehicle Level of Service' metric is tied to the above V/C ratio of **1.27**. (LOS F)



Intersection #3: Williams Pkwy and Rutherford Rd

Pedestrian Analysis

- The design includes **6 lanes of traffic.** (LOS D)
- The corner with the largest radius is **30m.** (LOS F)
- **No channelized right turn lane** is being proposed. (LOS A)

- Singal cycle length of **160s.** (LOS F)
- **Standard ladder bar crossing** will be present. (LOS B)
- Uncontrolled Conflicts Calculation:
    - # of Uncontrolled Conflicts Present: 12
    - # Value of measure: 12/4=**3** (LOS E)

The final Pedestrian Signalized Intersection LOS is a D.

Bicycle Analysis

- **Two stage crossing with left cross rides.** (LOS A)
- **Protected Intersection with bike signals present.** (LOS B)
- The corner with the largest radius is **30m.** (LOS F)
- Singal cycle length of **160s.** (LOS F)
- Uncontrolled Conflicts Calculation the same for the pedestrian metric. (LOS E)

The final Bicycle Signalized Intersection LOS is a D.

Transit Analysis

- **No transit priority measures** are included on any approach. (LOS D)
- Since transit is operating in a mixed traffic condition, the average Transit Movement Delay is taken to be the same as the intersection delay which is **49s.** (LOS F)

The final Transit Signalized Intersection LOS is D.

Vehicle Analysis

- The intersection V/C ratio is **0.95**. (LOS E)

The final Vehicle Segment LOS is E.

Truck Analysis

- The smallest turning radius is **10m** with **more than one receiving lane.** (LOS B)
- The 'Vehicle Level of Service' metric is tied to the above V/C ratio of **0.95**. (LOS E)

Signalized Intersections

Project	Williams Parkway Reconstruction 100% Design Drawings
Segment	Williams Parkway between Centre Street and Rutherford Road
Number of Signalized Intersection	3

Mode	Pedestrian	Bicycle	Transit	Vehicle	Truck
Target	C	C	C	D	D
Actual	D	D	D	E	N/A

Signalized Intersection	Williams Pkwy and Centre St						
	Number of Lanes	Corner Radius	Right Turn Channel	Signal Cycle Length	Crosswalk Treatment (worst intersection leg)	Number of Uncontrolled Conflicts	Leading Pedestrian Interval (Bonus)
Pedestrian	5 lanes of traffic	≥18m	No Channelized Right Turn	>120s	Standard Ladder Bar Markings	2.6-3	N/A
LOS	C	F	A	F	B	E	N/A
WEIGHTED SCORE	D						
	Left-turn Crossing Infrastructure for Cyclists and Posted Speed	Enhanced Cycling Measures	Corner Radius	Signal Cycle Length	Number of Uncontrolled Conflicts (# of conflicts/approach)		Intersection V/C
Bicycle	Two Stage Crossing with Crossride; Left Turn Bike Box	Protected intersection with bicycle signals without passive bicycle detection or fixed signal timing on appraoches with dedicated cycling infrastructure	≥18m	>120s	2.6-3	Vehicle	>1
LOS	A	B	F	F	E	LOS	F
WEIGHTED SCORE	D					WEIGHTED SCORE	F
	Transit Priority Measures	Transit Movement Delay	Pedestrian Signalized Level of	Bicycle Signalized Level of		Corner Radius	Vehicle Level of Service
Transit	No transit priority measures on any approach	> 80s	D	D	Truck	10 to 15m and more than one receiving lane	F
LOS	D	F	D	D	LOS	B	F
WEIGHTED SCORE	D				WEIGHTED SCORE	N/A	

Signalized Intersection	Williams Pkwy and Kennedy Rd						
	Crossing Distance	Corner Radius	Right Turn Channel	Signal Cycle Length	Crosswalk Treatment (worst intersection leg)	Number of Uncontrolled Conflicts	Leading Pedestrian Interval (Bonus)
Pedestrian	6 lanes of traffic	≥18m	No Channelized Right Turn	>120s	Standard Ladder Bar Markings	2.6-3	N/A
LOS	D	F	A	F	B	E	N/A
WEIGHTED SCORE	D						
	Left-turn Crossing Infrastructure for Cyclists and Posted Speed of Side Streets	Enhanced Cycling Measures	Corner Radius	Signal Cycle Length	Number of Uncontrolled Conflicts (# of conflicts/approach)		Intersection V/C
Bicycle	Two Stage Crossing with Crossride; Left Turn Bike Box	Protected intersection with bicycle signals without passive bicycle detection or fixed signal timing on appraoches with dedicated cycling infrastructure	≥18m	>120s	2.6-3	Vehicle	0.91-1
LOS	A	B	F	F	E	LOS	E
WEIGHTED SCORE	D					WEIGHTED SCORE	E
	Transit Priority Measures	Transit Movement Delay	Pedestrian Signalized Level of Service	Bicycle Signalized Level of Service		Corner Radius	Vehicle Level of Service
Transit	No transit priority measures on any approach	> 80s	D	D	Truck	10 to 15m and more than one receiving lane	E
LOS	D	F	D	D	LOS	B	E
WEIGHTED SCORE	D				WEIGHTED SCORE	N/A	

Signalized Intersection	Williams Pkwy and Rutherford Rd						
	Crossing Distance	Corner Radius	Right Turn Channel	Signal Cycle Length	Crosswalk Treatment (worst intersection leg)	Number of Uncontrolled Conflicts	Leading Pedestrian Interval (Bonus)
Pedestrian	6 lanes of traffic	≥18m	No Channelized Right Turn	>120s	Standard Ladder Bar Markings	2.6-3	N/A
LOS	D	F	A	F	B	E	N/A
WEIGHTED SCORE	D						
	Left-turn Crossing Infrastructure for Cyclists and Posted Speed of Side Streets	Enhanced Cycling Measures	Corner Radius	Signal Cycle Length	Number of Uncontrolled Conflicts (# of conflicts/approach)		Intersection V/C
Bicycle	Two Stage Crossing with Crossride; Left Turn Bike Box	Protected intersection with bicycle signals without passive bicycle detection or fixed signal timing on appraoches with dedicated cycling infrastructure	≥18m	>120s	2.6-3	Vehicle	0.91-1
LOS	A	B	F	F	E	LOS	E
WEIGHTED SCORE	D					WEIGHTED SCORE	E
	Transit Priority Measures	Transit Movement Delay	Pedestrian Signalized Level of Service	Bicycle Signalized Level of Service		Corner Radius	Vehicle Level of Service
Transit	No transit priority measures on any approach	36 - 55s	D	D	Truck	10 to 15m and more than one receiving lane	E
LOS	D	D	D	D	LOS	B	E
WEIGHTED SCORE	D				WEIGHTED SCORE	N/A	

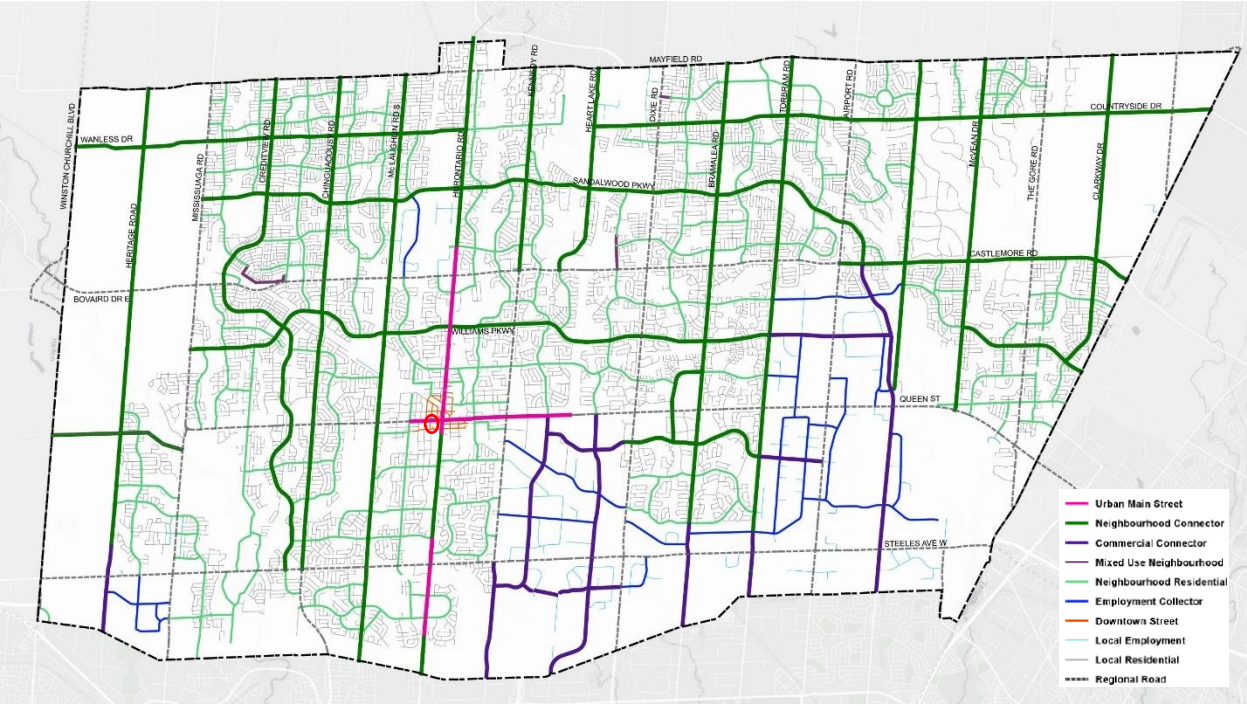
Overall Summary (Average of Segment, Transit Stop, Sginalized Intersection, Unsignalized Intersection)

Mode	 Pedestrian	 Bicycle	 Transit	 Vehicle	 Truck
Target	C	C	C	D	D
Actual	C	C	C	C	B

Mill Street between Queen Street and Wellington Street

Step 1: Establishing Context – Street Classification and Land Use

In Brampton's Complete Streets Guide street typologies map, Mill Street is classified as a Downtown Street.



Step 2: Corridor Details

Corridor details include:

- Segment Length: 170 m
- Two travel lanes per direction
- Posted speed at 50 km/h
- 2 unsignalized intersections
- No Transit Service
- Low density residential and commercial land use

Figure 2 summarizes some of the details along the study corridor.

Figure 2: Site Details (Aerial Photo of Existing Conditions)

Step 2: Spreadsheet Analysis Tool

Enter details into the tool.

Project	Mill Street between Queen Street and Wellington Street
Segment	Mill Street between Queen Street and Wellington Street

Street Typology	Local Residential Street
Target	Final
Transit Route	No
Presence of Higher Order Transit	No
Truck Route	No

Step 3: Data Collection

The following data has been collected to perform the analysis:

- PM peak hour midblock v/c
- Intersection v/c

Step 4: Segment Analysis

Since the road characteristics and land use are not significantly different along the chosen section, there would be no benefit in splitting the corridor into multiple segments.

Pedestrians:

- There is an existing **1.5m sidewalk** on both sides of the corridor. (LOS C)
- The predominant buffer width between the sidewalk and the travel lane is **1.5m**. (LOS D)
- The posted speed limit is **50 km/h**. The sum of the facility and buffer width is **3m**. (LOS C)
- The distance between Queen Street and Wellington Street is **170m**. (LOS C)

- Placemaking amenities include **street trees**. There is a **low presence** of placemaking amenities along this segment. (LOS D)
- Street trees are placed as a single row of trees on **both sides of streets** spaced at intervals averaging **8 metres or less**. (LOS B)
- The **street trees and light poles** act as vertical buffers. (LOS A)

The final Pedestrian Segment LOS is C.

Bicycle:

- There are existing **sharrows** along Mill Street. (LOS A)
- There are **two travel lanes** in each direction and the posted speed is **50 km/h**. (LOS C)
- There is **no presence of heavy vehicles**. (LOS A)
- No wayfinding signage present. (LOS F)

The final Bicycle Segment LOS is C.

Vehicle LOS:

- The northbound midblock V/C ratio is 0.29 (LOS A) and the southbound midblock V/C ratio is 0.19 (LOS A) (taken from EMME Model, PM Peak)

The final Vehicle Segment LOS is A.

Segment

Project	Mill Street between Queen Street and Wellington Street
Segment	Mill Street between Queen Street and Wellington Street





Mode	Pedestrian	Bicycle	Transit	Vehicle	Truck
Target	B	B	C	D	N/A
Actual	C	B	N/A	A	N/A

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	Facility on Both Sides of the Street	Facility Width on Both Sides	Buffer Width from Travel Lane	Posted Speed and Buffer Width	Distance between Controlled Crossings	Placemaking	Street Trees	Vertical Buffer
Pedestrian	Yes	Sidewalk Width 1.5 - 2.0m	1.5 - 2.5m	Sidewalk width + buffer between 3.5-2.6 m; ≤50 km/h	151 - 250m	Low amount of placemaking amenities	Single row of trees on both sides of streets spaced at intervals averaging 8m or less	Presence of vertical elements at average intervals of 12m or less
LOS		C	B	C	B	D	C	A
WEIGHTED SCORE	C							

	Facility Type	Number of Travel Lanes and Operating Speed	Pavement Markings	Presence of Heavy Vehicles (Trucks and Buses)	Signage	N/A	N/A	N/A	N/A	N/A
Bicycle	Mixed Traffic	2 vehicle lanes, ≤ 40 km/h, no marked centre lane in	Pavement markings such as sharrow/shoulder markings.	No	No signage present					
LOS		A	A	A	F					
WEIGHTED SCORE	B									

	Midblock V/C Ratio (North/East)	Midblock V/C Ratio (South/West)		Curb Lane Width	Vehicle Level of Service
Vehicle	0-0.6	0-0.6	Truck	≥3.5m	A
LOS	A	A	LOS	A	A
WEIGHTED SCORE	A		WEIGHTED SCORE	N/A	

Step 5: Unsignalized Intersection Analysis

Mill Street and Queen Street Intersection

Pedestrians:

- Pavement markings at **100% of movements**. (LOS A)
- Crossing distance of **12m**. (LOS C)
- The largest corner radius is **6m**. (LOS A)

Bicycle:

- There are **2 lanes** along Mill Street and the sides street is being crossed at **50 km/h**. (LOS B)

Vehicle:

- Intersection V/C LOS A.

Mill Street and Wellington Street Intersection

Pedestrians:

- Pavement markings at **100% of movements**. (LOS A)
- Crossing distance of **10m**. (LOS B)
- The largest corner radius is **6m**. (LOS A)

Bicycle:

- There are **2 lanes** along Mill Street and the sides street is being crossed at **50 km/h**. (LOS B)

Vehicle:

- Intersection V/C LOS A.

Unsignalized Intersections

Segment	Mill Street between Queen Street and Wellington Stree
Number of Unsignalized Intersectio	2

Street Typology	Neighbourhood Residential
Target	Final





Mode	Pedestrian	Bicycle	Transit	Vehicle	Truck
Target	B	B	D	D	N/A
Actual	A	B	N/A	A	N/A

Unsignalized Intersection	Queen Street						
	Pavement Markings at Controlled Crossings	Crossing Distance (m)	Corner Radius (m)		Transit Movement Delay (s)	Pedestrian Level of Service	Bicycle Level of Service
Pedestrian	100% of movements	11.6 - 13m	<9.0m	Transit	Select	B	B
LOS	A	C	A	LOS	N/A	B	B
WEIGHTED SCORE		B		WEIGHTED SCORE		N/A	
	Number of Travel Lanes and Posted Speed of Side Streets		Intersection V/C		Corner Radius	Vehicle Level of Service	
Bicycle	3 or less lanes being crossed at 50 km/h	Vehicle	0-0.6	Truck	Select	A	
LOS	B	LOS	A	LOS	N/A	A	
WEIGHTED SCORE	B	WEIGHTED SCORE	A	WEIGHTED SCORE	N/A		

Unsignalized Intersection	Wellington Street						
	Pavement Markings at Controlled Crossings	Crossing Distance (m)	Corner Radius (m)		Transit Movement Delay (s)	Pedestrian Level of Service	Bicycle Level of Service
Pedestrian	100% of movements	9 - 11.5m	<9.0m	Transit	Select	A	B
LOS	A	B	A	LOS	N/A	A	B
WEIGHTED SCORE		A		WEIGHTED SCORE		C	
	Number of Travel Lanes and Posted Speed of Side Streets		Intersection V/C		Corner Radius	Vehicle Level of Service	
Bicycle	3 or less lanes being crossed at 50 km/h	Vehicle	0-0.6	Truck	Select	A	
LOS	B	LOS	A	LOS	N/A	A	
WEIGHTED SCORE	B	WEIGHTED SCORE	A	WEIGHTED SCORE	D		

Overall Summary (Average of Segment, Transit Stop, Sginalized Intersection, Unsignalized Intersection)





Mode	Pedestrian	Bicycle	Transit	Vehicle	Truck
Target	B	B	C	D	N/A
Actual	B	B	N/A	A	N/A