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Memorandum

To: Peter Giles, City of Ottawa (Peter.Giles1@ottawa.ca); Robin Van de Lande, City of Ottawa (Robin.vandeLande@ottawa.ca)

Date: July 21, 2022

From: Ron Clarke, Parsons - Principal/Director (Ronald.Clarke@parsons.com) , Ben Allen, Parsons – Junior Transportation Planner (Ben.Allen@parsons.com

Subject: Summary Reporting Memo

St. Joseph Boulevard Conceptual Design Study

This summary memorandum has been prepared to accompany the circulation of the draft final deliverables of the above-noted study. The package includes:

1. **St. Joseph Boulevard Concept Plan** (a colourized plan illustrating the existing, interim and ultimate cross sections in various locations along the corridor); and
2. **St. Joseph Boulevard Interim Buffered Bike Lanes** (a geometric design plan illustrating a concept that could inform a future functional design study); and
3. **St. Joseph Boulevard Streetscape Opportunity Zones** (a colourized plan showing the future ROW as protected in the Official Plan, and corresponding spatial opportunities to embellish the streetscape incrementally over the long term).

These drawings address the project limits of St. Joseph Boulevard between Forest Valley Drive easterly to a point to the west of Tenth Line Road in Orléans. These deliverables result from the completion of a study process which included the following key activities:

1. Project Start Up in October 2021
2. Existing Conditions and Transportation Study in October to November 2021
3. Technical Advisory Committee Meeting on December 8, 2021 (reviewed early draft concepts)
4. Identification and Evaluation of Alternatives in December 2021 through March 2022
5. Support at Public Open House on January 25, 2022
6. Technical Advisory Committee Meeting on April 6, 2022 (review draft Interim Buffered Bike Lanes design and Streetscape Opportunity Zones plan)
7. Comment Review and Plan Refinements (April through July 2022)

A brief description of the package components is provided below.

1.0 St. Joseph Boulevard Concept Plan

The Concept Plan responds to the street's planned function as a designated Arterial Road and Mainstreet Corridor in the Official Plan, and with segments designated as a Cycling Spine Route and Cross-Town Bikeway in the Ottawa Cycling Plan. In addition, the Plan responds to the anticipated changes to land uses on the corridor as outlined by the ongoing Orléans

Secondary Plan update. This Plan illustrates the existing transportation conditions in terms of intersection locations and types, existing curb lines, the location of both single and multiple private approaches, the location of OC Transpo bus stops, existing property lines, and Official Plan protected Right-of-Way (ROW) limits for the corridor. As well, six key, representative cross-section locations were chosen, and the existing roadway arrangement illustrated at these points.

Building upon these existing conditions, and informed by the completion of technical studies, including a focused transportation study and feedback from the Study's Technical Advisory Committee (TAC), proposed future roadway arrangements were determined and illustrated as cross-section diagrams. Two future arrangements were identified. The first is an "ultimate" arrangement, which reflects the long term vision for the corridor as a multi-modal 'complete street' and mainstreet for the surrounding community. The second is an "interim" arrangement which is meant to achieve some of the transportation goals for the corridor prior to the full, capital-intensive roadway reconstruction that would be necessary for the realization of the ultimate vision.

2.0 St. Joseph Boulevard Interim Buffered Bike Lanes Plan

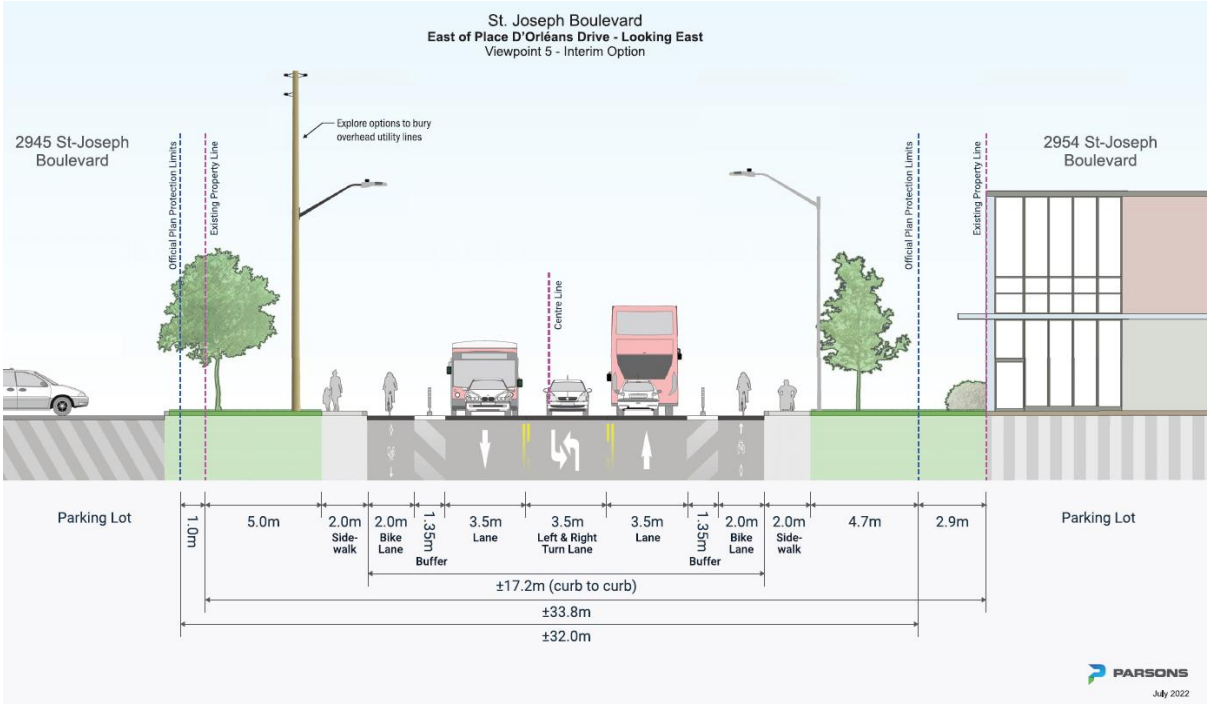
A draft design was prepared to reflect the proposed 'interim' street arrangement from the Concept Plan discussed above. Overall, the intent of this Plan is to re-allocate the existing roadway to open up space in between the existing curbs for on-street, buffered bike lanes, in a cost effective manner, and in a manner that does not require full street reconstruction. These changes reflect the roads intended role as a pedestrian, cyclist, and transit oriented "mainstreet" for the Orléans community, reducing the overall traffic intensity on the corridor and improving safety for active modes. The Plan is also intended to inspire and inform a subsequent more-detailed functional design study.

This design responds to the desire to accomplish some of the transportation goals for the roadway in the shorter-term, prior to the full reconstruction of the roadway that might take place in the more distant future. Although this plan is referenced here as an 'interim' option, it is acknowledged that this interim design may be in place for an extended period of time. As such some targeted civil works are necessary to ensure the proper function and safety of the rearranged roadway, especially at intersections, although the curb lines of the existing roadway were largely maintained.

Of note, the Interim Buffered Bike Lanes Plan is limited to the corridor to the east of the Jeanne D'Arc roundabout. Traffic analyses completed as part of this assignment found that the section of St. Joseph west of Jeanne D'Arc would not function suitably under projected future traffic conditions under a 2/3-lane scenario, being a lane reduction arrangement. For this reason, the plan starts to the east of the Jeanne D'Arc roundabout. To the west of Jeanne D'Arc, the option of adding separated cycle tracks outside of the existing curb lines remains potentially viable, with the option being to totally rearrange the boulevard area to deliver separate concrete sidewalks and asphalt raised cycle tracks. This in turn would precipitate the need for a capital-intensive reconstruction of each signalized intersection as protected intersections under the City's new Protected Intersection Design Guide. Such a project may also trigger costly utility relocations. The preparation of a geometric design plan for this concept is over and above the scope of this current assignment, however the City is now in a position to prepare a functional design for this westerly segment, as informed by this Concept Plan.

A typical proposed cross-section for the buffered bike lane arrangement for the sector to the east of Jeanne D'Arc is shown below in Figure 2-1.

Figure 2-1: Draft St. Joseph Boulevard cross-section arrangement (2/3 lanes with buffered bike lanes)



Cross-section dimensions were adjusted through the design process, responding to stakeholder feedback. Some of the key design criteria applied in the development of this Plan design included:

- A corridor design speed which corresponds with a posted speed of 50 km/h;
- Minimum 2.0m wide proposed concrete sidewalks along either side of the corridor (note that the existing sidewalk will not meet this minimum in all cases);
- A minimum 1.5m painted bike lane with buffers of a minimum width 0.3 where possible, and ideally wider;
- A minimum travel lane width and center two-way left-turn lane width of 3.5m according to the corridor design speed; and
- Shared through/right-turn lanes where applicable were the preferred arrangement at intersections, intended to minimize pedestrian crossing distances and reduce right-turn lane conflicts with cycles;

Of note, the accompanying Plan illustrates the construction of 2m wide sidewalks where the design has triggered the need to reconstruct sidewalks. It is also recommended, although not noted on the design itself, that opportunities should be pursued to renew sidewalks through the full project limits to a minimum of 2m, and constructed with contemporary accessibility features.

Comments received from City staff during the development of this draft design are outlined below, arranged by their department of origin.

Comment 1. The target intersection BLOS for the corridor is "A"; additional intersection treatments are needed to meet this target.

Cyclist left-turns at intersections are addressed using 2-stage left-turn bike boxes, where applicable, allowing the draft design for intersections to achieve the target BLOS "A".

Comment 2. Orléans Boulevard is being targeted for significant active transportation improvements, leading with the section north of St. Joseph. South of St. Joseph, pending future study, it may be necessary to divert north-south cyclist traffic to side streets, such as Boyer to the west or Belcourt to the east.

Belcourt exists as a signalized intersection; the proposed buffered bike lane would connect north-south cyclists to and from Orléans Boulevard to this intersection. The Boyer intersection is unsignalized in the

existing but is closer to Orléans, and so is a better candidate for a continuation of the cycling route. Accordingly, Boyer is identified in the draft design as a "Potential Signalized Intersection", with the need for additional interventions linking it to Orléans to be determined through future study.

Comment 3. On road bike lanes should not be carried through signalized intersections as shown; drop to dashed line or cycling bend-out/separation would be the desired treatment.

Design adjusted to drop the buffered bike lanes to a dashed line 15m in advance of signalized intersections. On-street bike lanes are not continued through signalized intersections, but are retained through unsignalized intersections (with a green thermoplastic paint surface). Cyclist cross-rides and cyclist bend-outs added at signalized intersections where appropriate.

Figure 2-2: Bike lanes at signalized T-intersection (Grey Nuns)

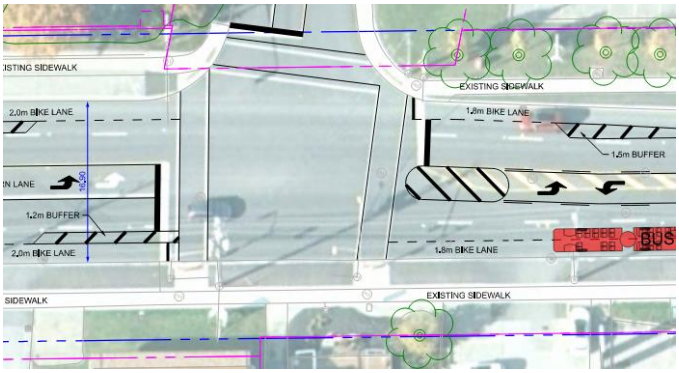
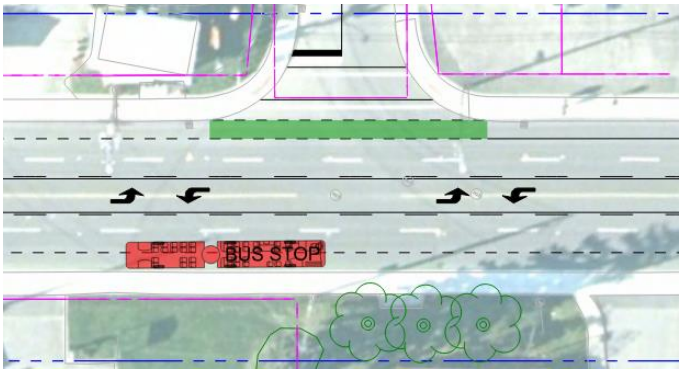


Figure 2-3: Bike lane through an unsignalized T-intersection (Dusserre)



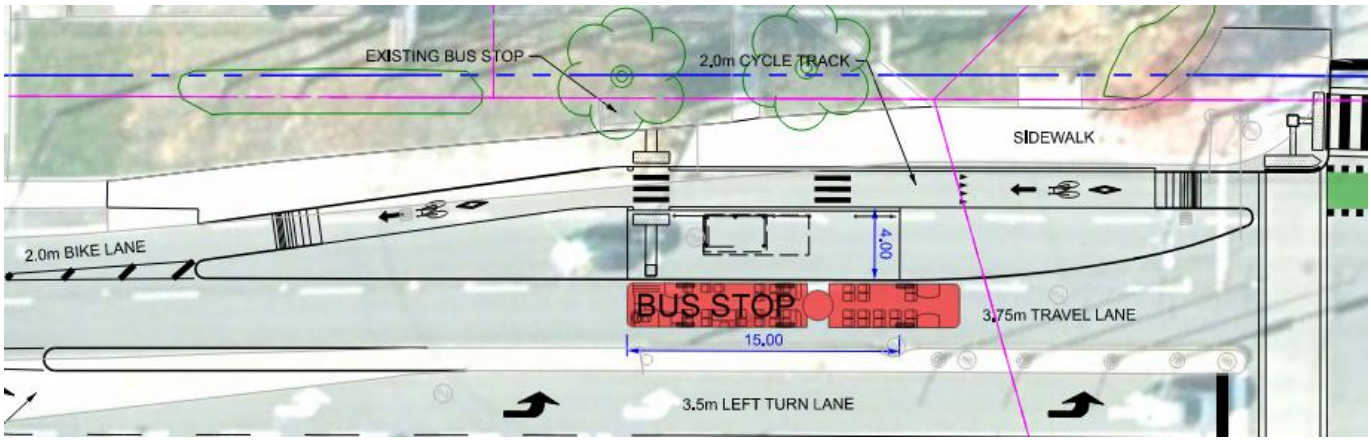
Comment 4. Concern that left-turn queuing at select signalized intersections will exceed available storage as shown in the draft design, which has the potential to negatively impact operations and to create safety issues including interference with the proposed cycling facilities.

Concern over left-turn queueing is addressed by the inclusion of the centre TWLTL. Queue spillback, should it occur, would be accommodated with no impact to east-west travel. The queue spill back could have limited impacts to adjacent private approaches. There will likely be an opportunity to reduce the number of private approaches along the corridor over time to mitigate this concern and improve the cycling and pedestrian experience.

Comment 5. OC Transpo preference is to remove the bus-bays along St. Joseph, keep the bus stops more or less in the same locations, and provide new bus stops in contemporary arrangements. The objective is to improve service reliability, allow for improved bus stop areas, and provide the ability to safely manage cyclists, pedestrians, and transit.

Several options were explored for addressing the existing bus-bays on St. Joseph that would avoid any significant civil works, including relocating stops away from intersections, and filling in the bus-bays with wide painted buffers. As a recommended solution, a "ride-over bus bulge" design has been introduced, consistent with the guidance provided by the *OC Transpo Bus Stop-Cycle Track Interaction Zone Guidelines*. This design improves the level of service for transit users on the corridor by filling in the existing bus-bays with a raised concrete waiting area; and for cyclists by providing short, separated sections of cycle track at intersections, reducing the level of interaction between cyclists and transit vehicles. An example is shown in Figure 2-4.

Figure 2-4: Ride-over bus bulb-out west of Orléans intersection



Comment 6. The white line between general traffic lanes and cycle lanes should be dashed 34m upstream of bus stops and 18m downstream.

Comment reflected in the draft design.

Comment 7. A minimum of 3.5m lane width is required for buses; ensure that this minimum is met, and that sufficient buffer distance is provided between travel lanes and cycle lanes.

The target cycling arrangement for the corridor was to provide a 1.5m bike lane with a minimum 0.3m buffer. Wherever space exists, the widest possible buffer is provided while still maintaining the minimum 3.5m for vehicle travel lanes required by OC Transpo. However, on constrained segments of the roadway it is not possible to meet both the minimum 3.5m travel lane and 0.3m buffer widths. On these segments, a 1.7m, un-buffered bike lane is provided to maintain sufficient separation to vehicle travel lanes. The potential for vertical flex-posts to further delineate the bike lane may be evaluated through future study.

Figure 2-5: Unconstrained section with 1.5m buffered bike lane

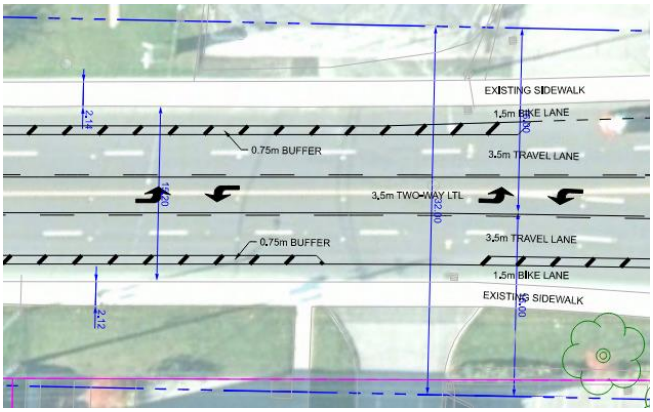
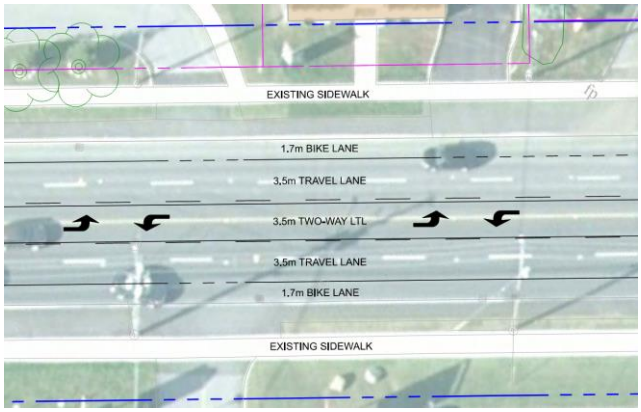


Figure 2-6: Constrained section with 1.7m un-buffered bike lane



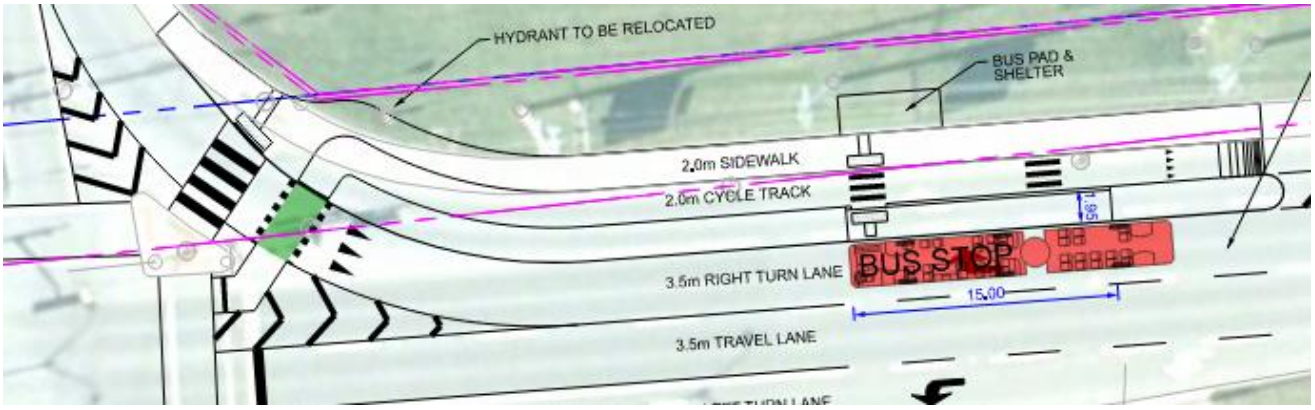
Comment 8. The analysis should consider the provision of specific transit priority measures, such as bus-only queue jumps. O-Train service will not replace bus-service on St. Joseph, and high-quality local service still needs to be maintained on the corridor.

It is recognized that local, high-quality bus service will continue to serve the community and businesses along St. Joseph. However, the level of detail required to sufficiently address the variety of transit priority options at an intersection detail is currently beyond the current scope of this conceptual design study. The need for additional transit priority measures can be considered during future design studies.

Comment 9. The draft design should try to minimize the use of "floating" bike lanes where a lengthy auxiliary right-turn lane is provided, as this creates dangerous interactions between cyclists and vehicles.

The floating bike lane at Prestone has been addressed using a “jug-handle” cycle track design, which allows cyclists to stay on the curb edge as they approach the intersection, separated from traffic, and cross the right-turn channel at a right angle. In other cases, such as at the Duford intersection, the turning radius of the right-turn channel is tightened and a green thermoplastic paint treatment used.

Figure 2-7: "Jug-handle" cycle tracks at the St. Joseph / Prestone intersection



A Class C Cost Estimate was conducted for the Buffered Bike Lanes Plan, to assess the anticipated cost of implementing the Study’s interim vision. A summary of the cost estimate is shown below in Table 1.

Table 1: DRAFT Class C Cost Estimate - St. Joseph Boulevard (Jeanne D'Arc Boulevard - Tenth Line Road)

WBS #	DESCRIPTION		COST
1.0	**WEST SEGMENT** **East side of the Jeanne D'Arc roundabout to Gabriel Street**		**$ 1,259,601.00**
1.1	General		$ 131,106.00
1.2	Removals		$ 100,000.00
1.3	New Construction		$ 724,449.00
1.4	Landscaping		$ 136,846.00
1.5	Traffic Signals		$ 167,200.00
2.0	**TOWN CENTER SEGMENT** **East of Gabriel Street to West of Tenth Line Road**		**$ 1,081,893.20**
2.1	General		$ 81,821.20
2.2	Removals		$ 78,000.00
2.3	New Construction		$ 651,703.00
2.4	Landscaping		$ 120,769.00
2.5	Traffic Signals		$ 149,600.00
Construction Subtotal			***$ 2,341,494.20***
Engineering and Architectural Services		25%	$ 585,373.55
Utilities		15%	$ 351,224.13
City Internal Costs		10%	$ 234,149.42
Miscellaneous (Permits, applications, Comm's etc		5%	$ 117,074.71
Subtotal (a+b+c+d+e)			*$ 3,629,316.01*
Contingency		30%	$ 702,448.26

Total Estimated Cost	$	4,331,764.27
Total Estimated Cost (Rounded)	**$**	**4,331,760**

3.0 St. Joseph Boulevard Streetscape Opportunity Zones

Also included in the package is a Streetscape Opportunity Zones plan, which documents the location of potential public places and enhanced streetscaping areas. Property parcels along the corridor are divided into two categories. Firstly, the plan illustrates the "Existing ROW Improvement Areas". These are parcels in the ROW *currently* owned by the City of Ottawa, and so represent an opportunity for targeted streetscaping improvements. Secondly, the plan illustrates "Future ROW Improvement Areas". These are parcels located within the Official Plan protected ROW Limits, but which are not currently owned by the City of Ottawa. In the fullness of time, as the corridor redevelops, the City will be entitled through the development process under the Planning Act to acquire these pieces of property at no cost, enabling future streetscaping improvements. Shown as well on the roll-plan is the approximate location for future street trees to be planted. These are also divided into two categories, those that could feasibly be planted in the existing, available road ROW; and those that could be planted in the future, should additional property become available.

Of note, the "Official Plan Protection Limits" for the ROW as shown on this plan are rough estimates only and have been prepared by Parsons based on experience of how the ROW protection policies are implemented equally from the historic surveyed "centreline" within the ROW. However, the actual ROW protection limits can only be determined with accuracy by the City Surveyor and this determination is typically only made during the review of development applications under the Planning Act.

Further shown are the locations of "Bus Stop Place-Making Areas", where space exists behind the sidewalk at existing bus-stops on the corridor for targeted placemaking improvements, such as additional or enhanced street furnishing; and the location of a potential future public park in the space adjacent to Bilberry Creek at 2757 St. Joseph Blvd.

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Memorandum

To:	Connor Bomhower, Project Manager, Traffic Mgt & Control	Date: 25 March 2022
From:	Jake Berube, P.Eng	Project: 477976 -02000
Copy:	Robin van de Lande, RPP, MCIP	
	Mark Baker, P.Eng	
Subject:	**St. Joseph Blvd Conceptual Design Study:**	
	Future Travel Implications Analysis v.2	

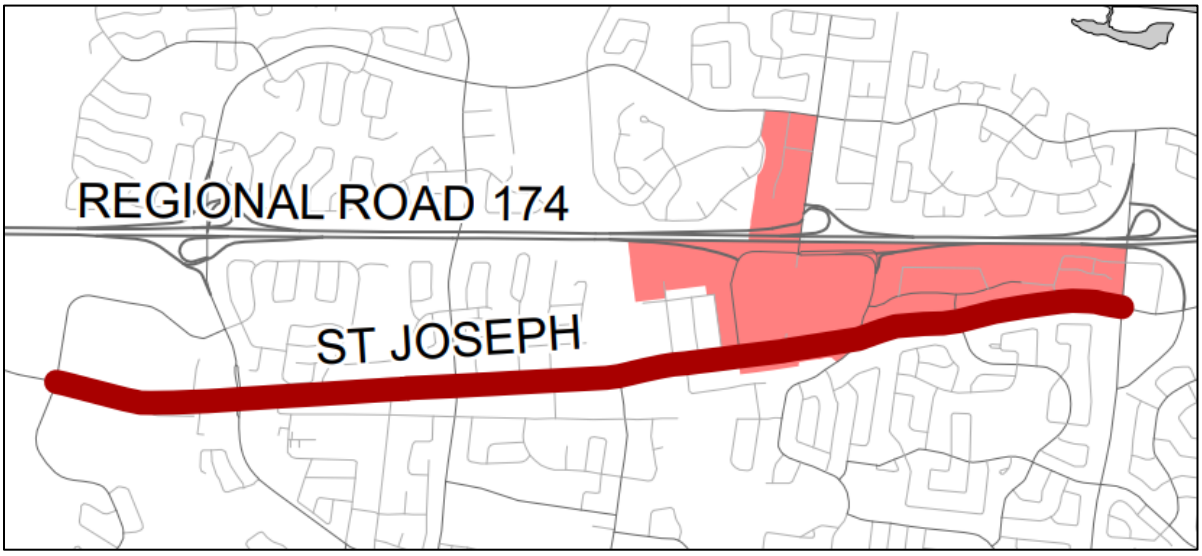
1.0 Introduction

The direction of the St Joseph Blvd Conceptual Design Study is to identify public realm design choices to enhance the corridor for all modes of transportation. The following memo provides an analysis for reducing the number of general purpose lanes along the St. Joseph corridor east of Jeanne D'Arc Blvd. The analysis includes a variety of protected intersection measures for consideration along the corridor at select locations.

Figure 1 illustrates the St. Joseph Blvd. corridor Study Area, where the focus of the subsequent analyses will be on the following seven (7) key intersections:

- Forest Valley Drive/Youville Drive;
- Jeanne D'Arc Boulevard (roundabout);
- Orleans Boulevard;
- Belcourt Boulevard;
- Place D'Orleans Drive (West Leg);
- Duford Drive/ Place D'Orleans Drive (East Leg); and
- Prestone Drive.

Figure 1: St. Joseph Conceptual Corridor Design Study Area



2.0 Summary of Existing Operations

2.1 Existing Traffic Operations

Table 1 summarizes the results of the baseline intersection capacity analysis at the 7 key intersections that was undertaken utilizing Synchro™ 10 for signalized intersections and Sidra™ 8 for the single roundabout intersection along the corridor. The analysis assumes the baseline 2021 traffic volumes for the morning (AM) and afternoon (PM) peak hours in conjunction with the most recent existing signal timing plans.

A review of Table 1 indicated that the Study Area intersections operate at an overall LoS 'C' or better during the weekday morning and afternoon peak hours, with the exception of the Jeanne d'Arc roundabout intersection and the Forest Valley/Youville intersection, which reported a LoS 'D' and 'F' during the morning peak hour, respectively. In regard to critical movements, turning movements were noted to be operating at an LoS 'E' or better during both peak hours, with the exception of the Jeanne d'Arc and Forest Valley/Youville intersections which both reported a failing westbound through movement during the morning peak hour.

Table 1: Study Area Baseline 2021 Intersection Performance – AM (PM) Peak Hours

Intersection	Weekday AM Peak (PM Peak)					
	Critical Movement			Intersection		
	LoS	max. v/c or avg. delay (s)	Movement	Delay (s)	LoS	v/c
Forest Valley/Youville	F(C)	1.28(0.75)	WBT(EBT)	113.9(19.8)	F(C)	1.15(0.72)
Jeanne d'Arc (roundabout)	F(B)	82.4(12.6)	WBT(NBL)	36.0(5.7)	D(A)	1.09(0.79)
Orleans	B(C)	0.69(0.79)	NBT(NBT)	18.8(30.4)	A(C)	0.58(0.76)
Belcourt	A(D)	0.45(0.82)	EBT(SBT)	12.5(17.3)	A(C)	0.39(0.74)
Place d'Orleans (West)	A(E)	0.56(0.91)	SBL(SBL)	9.9(18.5)	A(A)	0.36(0.60)
Duford/Place d'Orleans (East)	A(C)	0.49(0.79)	NBT(SBL)	22.9(28.7)	A(A)	0.46(0.60)
Prestone	A(B)	0.37(0.61)	NBL(SBL)	7.4(10.1)	A(A)	0.31(0.41)
Note: Analysis of signalized intersections assumes a PHF of 0.90 and a saturation flow rate of 1,800 veh/h/lane.						

The poor operational findings at the Forest Valley/Youville intersection during the morning peak hour is a result of the conflict between the westbound through (WBT) movement (1,800 veh/h), the northbound left-turn (NBL) movement (500 veh/h) and the southbound right-turn (SBR) movement (350 veh/h). These volumes represent demands that are at, or above, capacity for their respective movements, each competing for signal time during the morning rush. Some model adjustments were included to represent the operating conditions at this intersection more appropriately during the morning peak hour and are listed as follows:

- The Peak Hour Factor was increased to 0.95 for all movements, while the heavy WBT, NBL, and SBR movements were increased to 1.00
- A 'Lost Time Adjustment' of -2 seconds was applied to the heavy WBT, NBL, and SBR movements
- The signal timing was adjusted to provide an additional 4 seconds of green time to the concurrent EBT and WBT phases, taken from the concurrent NBL and SBL phases

In addition to the above model adjustments, the roundabout analysis at the Jeanne d'Arc intersection was modified to include an increased Peak Hour Factor of 0.95 for the NBL, NBT, and WBT movements during the morning peak hour.

2.2 St. Joseph as an Emergency Detour Route

The Emergency Detour Routes (EDR) form a transportation network that provides temporary detour opportunities for major highways in Ontario. The role of the EDR is to act as the secondary route choice in the event of a highway closure. The route is marked by specific EDR signage which typically parallels the highway. The presence of the EDR is expected to increase transportation network resiliency.

St. Joseph Boulevard is the designated EDR for Ottawa Road 174. It effectively provides a parallel route from west of the Greenbelt to Trim Road. The only other similar major facility is the Blackburn Hamlet Bypass to the south, which connects the Highway 417 corridor to Dunning Road.

The proposed changes to St. Joseph would decrease overall east-west capacity parallel to OR174. However, St. Joseph would effectively remain an arterial roadway in form and function. According to the "MTO's Emergency Detour Route – Guideline and Best Practices" (February 2004), in the case of closures congestion is to be expected on the designated EDR and parallel routes. It is anticipated that St. Joseph would continue to operate as the EDR as it would remain a 4-lane corridor for a significant portion of its length.

3.0 Future TRANS Model Assessment

3.1 TRANS Volume Scenarios

The study team engaged the City of Ottawa TRANS model to provide a series of peak hour forecast analysis results to provide a baseline assessment for the future of the St. Joseph corridor.

Table 2 summarizes 7 TRANS model scenarios which either vary the background land use assumptions (2011, 2031 or 2046) or the network link assumptions (2-lane St. Joseph, 6-lane OR174). The purpose of these runs is to identify the relative network-wide impacts of reducing St Joseph vehicle capacity on adjacent facilities and the required additional capacity requirements of having a reduced St. Joseph cross-section.

Table 2: Summary of TRANS Model Scenarios

Scenario	Network Description	
Land Use - 2011		
A	2011 Conditions	Assumes 4-lane St. Joseph, 4-lane OR174
Land Use – 2031		
B	2031 Affordable Network	Assumes 4-lane St. Joseph, 4-lane OR174
C	2031 Affordable Network – With Lane Reductions on St. Joseph	Adopts 2-lane St. Joseph corridor
Land Use – 2046		
D	2031 Affordable Network	Assumes 4-lane St. Joseph, 4-lane OR174
E	2031 Network Concept	Assumes 4-lane St. Joseph, 6-lane OR174
F	2031 Affordable Network – With Lane Reductions on St. Joseph	Adopts 2-lane St. Joseph corridor
G	2031 Affordable Network – With 6-lane OR174 & Lane Reductions on St. Joseph	Adopts 2-lane St. Joseph corridor, 6-lane OR174

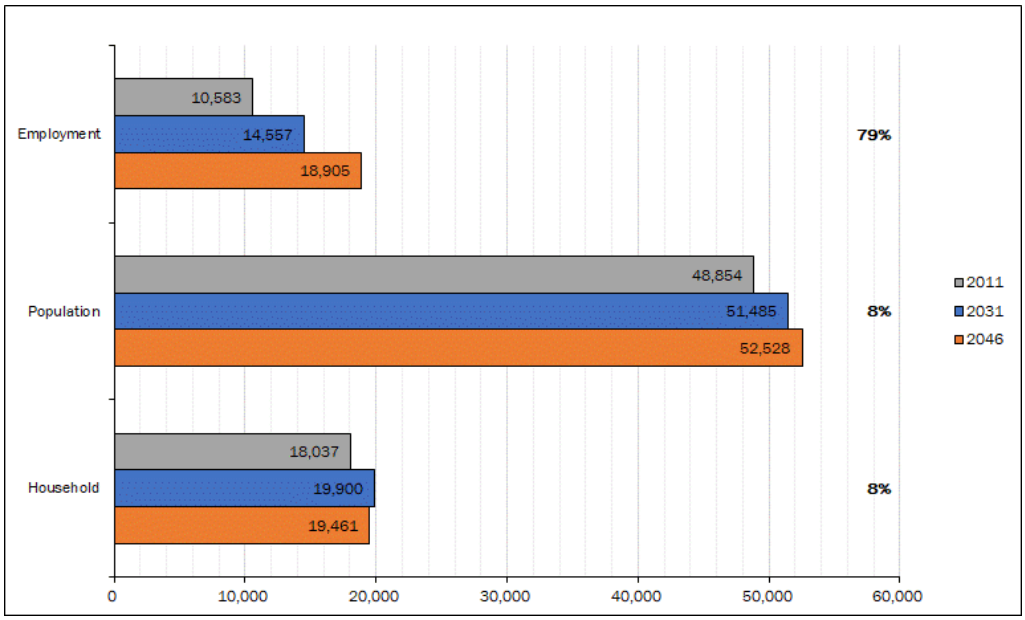
3.2 25-Year TRANS Model Land Uses

The traffic zones within the Study Area from the TRANS Model were reviewed for overall employment, population, and household growth for the 2011, 2031, and 2046 horizon years. A summary illustration of the model forecasts is provided below in **Figure 2**. Overall, the total land use growth within the St. Joseph Boulevard Study Area, between 2011 and 2046, corresponds to a Household and Population increase of approximately 8% and a nearly 80% increase in Employment.

The City's Draft New Official Plan (August 2021) indicates that city-wide growth is projected to increase by approximately 15% across all land use categories (i.e. Household, Population, and Employment) between 2031 and 2046. By comparison, the land use growth in the St. Joseph Boulevard Study Area is more heavily attributed towards increased Employment, rather than increased Household and/or Population.

It is important to note that the TRANS model traffic forecasts do not, at this time, incorporate additional population or employment density following the directions of the recently approved Official Plan.

Figure 2: TRANS Model Employment, Population, and Household Forecasts surrounding St. Joseph Boulevard



3.3 The Bilberry Creek Screenline

Figure 3 illustrates the SL45 Screenline (Bilberry Creek) that intersects with the St. Joseph corridor east of the Belcourt intersection, operating parallel to the Orleans Blvd and Jeanne D'Arc South corridors. Aside from St. Joseph, the east-west capacity of the Bilberry Creek Screenline is composed of Jeanne D'Arc North (4-lanes), the OR174 (4-lanes), Innes Road (4-lanes) and the more recently completed Brian Coburn Blvd (4-lanes). Any significant impacts to east-west capacity on St. Joseph could shift auto travel to these adjacent corridors, should they have available capacity.

3.4 Future Screenline Volume Results

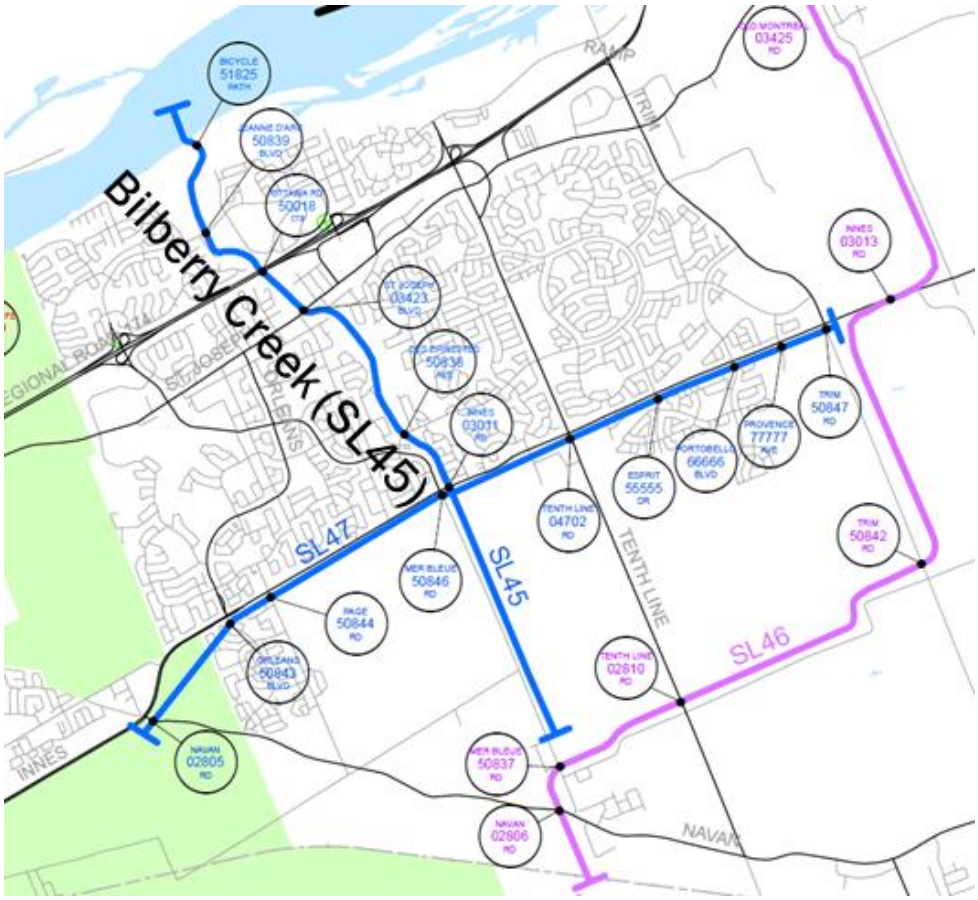
Table 3 summarizes the TRANS model forecasts and observed volume results across the Bilberry Creek Screenline. The table provides the peak morning hour of travel demand in the peak direction at each screenline station assuming the 5 TRANS scenarios and observed screenline counts. The 2031 and 2046 scenarios consider the modal impacts of the easterly extension of the LRT system to Trim Road.

The impact of reducing east-west capacity along St. Joseph:

- Assuming 2031 land uses, a 35% reduction in westbound volumes along St. Joseph nearest Belcourt, the majority of which appears to have diverted to the OR174 corridor immediately to the north. The remaining corridors were found to experience nominal increases in traffic; and
- Assuming 2046 land uses, a 37% reduction in traffic in westbound volumes along St. Joseph nearest Belcourt, approximately half of which shifted north to the OR174 corridor. The Des Epinettes station experienced nearly a 10% increase in traffic, while the remaining stations experience nominal shifts in traffic growth.

Overall, it could be expected that between 30% -to-40% of St. Joseph travel demand could shift away from the corridor due to the reduction in east-west vehicle capacity. A significant portion of this traffic is expected to impact the OR174 corridor, and to a lesser extent, the Des Epinettes corridor to the south.

Figure 3 Study Area Screenlines



Inspection of the TRANS data also determined a Screenline growth of approximately 1.2% per year between 2011-and-2031, followed by negligible east-west growth in the following 15-year period to 2046. Similarly, should St. Joseph maintain a 4-lane capacity (and therefore no capacity restrictions), westbound growth was found to occur at a rate of 0.8% per year over the first 20-years and decrease to 0.3% per year in the following 15-year period. These modelling results thereby indicate a low propensity for growth in the coming decades.

3.5 Future Screenline Operations

Table 4 summarizes the estimated volume-to-capacity ratio for westbound AM peak hour vehicle trips crossing the Bilberry Creek screenline using two sources, namely observed ground counts from the peak hour intersection turning movement counts (2021) and simulated values from the TRANS regional model scenarios previously identified (AM peak only). The City of Ottawa recognizes a correlation between volume-to-capacity ratio and level of service. The City of Ottawa MMLOS guidelines indicate, for the majority of auto segments, a minimum level-of-service “D” (corresponding to a

volume-to-capacity threshold of 0.90). For vehicle facilities within 600m of a rapid transit station, the minimum auto level of service decreases to a LOS "E" (v/c threshold of 1.00). Given that the Billberry Creek Screenline crosses a large number of facilities, a volume-to-capacity ratio threshold of 0.90 is desirable.

In review of the TRANS regional model outputs, the results suggest that:

- In the 2011 model year…
  - St. Joseph operates below 60% capacity during the morning peak hour (LOS 'A'); and
  - SL45 would operate at 81% capacity (LOS 'D'); and
  - Innes Road (LOS "F") and OR174 (LOS "E") exhibit the greatest volume to capacity ratios.
- In the 2021 observed volume data set…
  - St. Joseph continues to operate around 70% capacity (LOS "C")
  - SL45 currently operates at 90% capacity (LOS 'D'); and
  - Jeanne D'arc, Innes Road and Brian Coburn Boulevard operate at, or above, 90% capacity during the peak morning hour of travel demand.
- In the 2031 forecast model year
  - St. Joseph is forecast to operate below 70% capacity (LOS 'B') as a 4-lane facility;
  - St. Joseph, as a 2-lane facility, is expected to operate at 80% capacity (LOS "D")
  - SL45 would exceed 80% of its capacity despite the advent of a 4-lane Brian Coburn Boulevard;
  - The widening of the OR174 corridor across the screenline to a true 6-lane cross section would maintain acceptable forecast v/c ratios. Without this widening, a LOS "F" would occur; and
  - Innes Road is forecast to exceed a v/c ratio of 1.0 (LOS 'F') assuming their existing lane arrangements.
- In the 2046 forecast model year
  - SL45, and each of its station, operate with a similar LOS to the 2031 scenario given the minimal growth rate across the screenline;
  - St. Joseph, as a 2-lane facility, is expected to operate above 80% capacity (LOS "D"); and
  - The widening of the OR174 corridor to a 6-lane facility would serve to meet future travel demand and support the shift of travel away from a reduced-capacity St. Joseph facility

Should St. Joseph be reduced to a single lane of traffic, the capacity of SL45 would be reduced by approximate 8%, which was found to result in a net volume-to-capacity increase of approximately 5%-to-7% across other roadways identified along the screenline. The overall screenline capacity was found to be acceptable, however, the 4-lane OR174 corridor is notably above capacity.

Table 3: Summary of TRANS Model Results, Bilberry Creek Screenline

Screenline Count Location	A. 2011 Peak Hour Vol.	B. 2031 Peak Hour Vol. Base case Network	C. 2031 Peak Hour Vol. 2-Lane St. Joseph	D. 2046 Peak Hour Basecase Network	E. 2046 Peak Hour Basecase Network with 6-lane OR174	F. 2046 Peak Hour Vol. 2-Lane St. Joseph	G. 2046 Peak Hour Vol. 2-Lane St. Joseph & 6-lane OR174	Observed Volume (2021)
Jeanne D'Arc (50839)	431	510	520	555	533	564	547	1,125
OR174 (50019)	3,169	3,655	3,830	3,698	3,576	3,872	3,800	2,345
St. Joseph (3423)	839	977	637	1,033	895	649	609	1,157
Des Epinettes (50838)	397	381	391	354	342	381	364	510
Innes (3011)	1,823	1,788	1,806	1,763	1,748	1,795	1,759	2,192
Brian Coburn Blvd ()	N/A	922	933	944	933	970	943	1,479
Total:	**6,659**	**8,233**	**8,117**	**8,347**	**8,027**	**8,231**	**8,022**	**8,808**

Table 4 Project Screenline Performance – Volume-to-Capacity Ratios

Screenline Count Location (Station No.)	*No. of Lanes*	Per Lane Directional Capacity (veh/h)	Total Capacity (veh/h)	A. 2011 Peak Hour Vol.	B. 2031 Peak Hour Vol. Basecase Network	C. 2031 Peak Hour Vol. 2-Lane St. Joseph	D. 2046 Peak Hour Basecase Network	E. 2046 Peak Hour Basecase Network with 6-lane OR174	F. 2046 Peak Hour Vol. 2-Lane St. Joseph	G. 2046 Peak Hour Vol. 2-Lane St. Joseph & 6-lane OR174	Observed Volume (2021)
Jeanne D'Arc (50839)	2	600	1,200	0.36	0.43	0.43	0.46	0.44	0.47	0.46	**0.94**
OR174 (50019)	2 (3)[1]	1,600	3,200 (4,800)[1]	**0.99**	**1.14**	**1.20**	**1.16**	0.75	**1.21**	0.79	0.73
St. Joseph (3423)	2 (1)[2]	800	1,600 (800)[2]	0.52	0.61	0.40	0.65	0.56	0.81	0.76	0.72
Des Epinettes (50838)	1	600	600	0.66	0.64	0.65	0.59	0.57	0.64	0.61	0.85
Innes (3011)	2	800	1,600	**1.14**	**1.12**	**1.13**	**1.10**	**1.09**	**1.12**	**1.10**	**1.37**
Brian Coburn Blvd	2	800	1,600	N/A	0.58	0.58	0.59	0.58	0.61	**0.59**	**0.92**
Total:			9,000 - 11,400	0.68	0.84	0.81	0.84	**0.90**	0.85	0.70	**0.91**

1. OR174 assumed widened to 6-lanes by 2031. Capacity of 4,800 veh/hr applied to Scenarios B-thru-E
2. St. Joseph Corridor reduced by 1 lane in each direction in scenarios C and E.

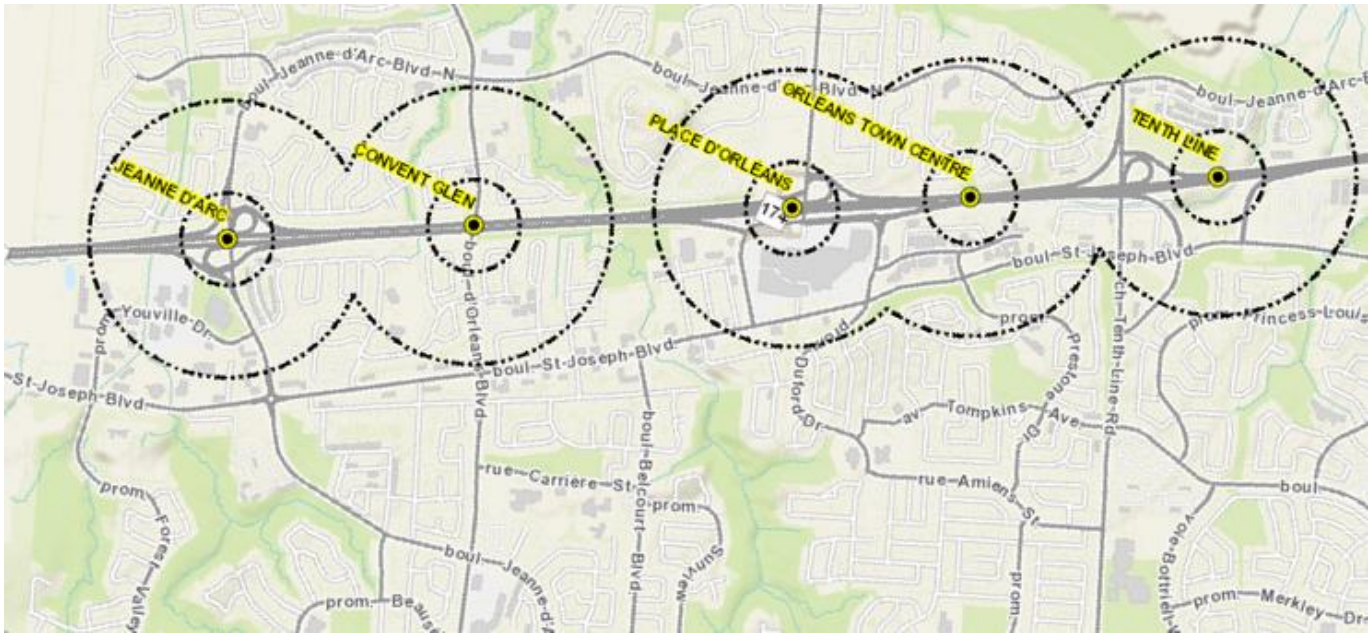
4.0 Planned Conditions

4.1 LRT Phase 2 Confederation Line Extension

Figure 4 illustrates the 200m and 600m buffer zones surrounding the future transit stations located along the OR174 corridor immediately north of the Study Area. A significant portion of the St. Joseph corridor is within 600m of a future LRT station, with sidewalk connections along major north-south arterial routes to connect existing active modes with the future LRT stations.

The advent of the future LRT east extension is anticipated to increase east-west transit capacity, resiliency and reliability for the Orleans community. The presence of the LRT is also anticipated to have an effect on transit desire lines, particularly between south Orleans and the stations themselves. These transit routes are envisioned to run as local and high frequency routes to effectively 'feed' the LRT extension. The replacement of the established BRT system with this type of feeder system is not anticipated to have significant mode change effects on the built areas of Orleans, particularly along the Study Area segments of St. Joseph.

Figure 4: Distances to Future Transit Stations, 200m and 600m buffers



4.2 Planned Developments

According to the City's development application search tool, the following developments are planned within the vicinity of the St. Joseph Boulevard Study Area corridor (600 m radius from Study Area intersections).

2. 1258 Marenger: The proposed development includes two buildings consisting of 12 stacked townhouse dwellings. One building includes eight units and the other includes four units. No Transportation Impact Assessment was found for this development
3. 1994 St. Joseph Boulevard: The proposed development is a two-storey personal services building with a ground floor area of approximately 582 square metres. The Transportation Impact Assessment (prepared by Stantec) projects an increase in two-way traffic volumes along St. Joseph Boulevard of approximately 10 to 16 veh/h during peak hours.
4. 1401 & 1411 Henri Lauzon: The proposed development includes the construction of 33 townhouses. No Transportation Impact Assessment was found for this development.

5. 6588 Carriere: The proposed development includes the construction of a new sports dome with a gross floor area of approximately 8,715 square metres at the école secondaire catholique Garneau. No Transportation Impact Assessment was found for this development.
6. 6758 & 6766 Rocque: The proposed development includes two low-rise apartment buildings totaling 12 units. No Transportation Impact Assessment was found for this development.
7. 211 Centrum: The proposed development is a retirement home facility including a 9-storey building and 17-storey building which comprise of a total of 397 units. The Transportation Impact Assessment (prepared by CGH) projects an increase in two-way traffic volume along St. Joseph Boulevard of approximately 12 to 15 veh/h during peak hours.

In terms of active development applications, there does not appear to be significant development demand along the St. Joseph corridor at this time.

4.3 Future Land Use Intensification Potential

Given the directions of the new Official Plan, there remains the opportunity for additional densification of this area. The Official Plan designates a target density of 120 persons + jobs/gross hectare along a Main Street corridor. In discussions with the City of Ottawa, the following re-development potential exists along the St. Joseph corridor:

- Re-development of the existing Maison Notre-Dame-de-la-Providence site, operated by The Sisters of Charity of Ottawa, as mid-to-high rise residential buildings. While further details beyond this intention are unknown, the site access is likely to be relocated to Forest Valley Drive. The re-development of the site would also encourage additional PXO needs along St. Joseph east of Youville/ Forest Valley.
- Re-development of the Youville Drive area north of St. Joseph with additional mid-and-high density residential opportunities. A revised street and active transportation network is envisioned to promote local connectivity; and
- Increased residential density opportunities exist at the quadrants of the Jeanne D'Arc and Orleans Blvd. intersections, as these lots have ideal dimensions to be viable for re-development. Existing lots along St. Joseph are understood to be too shallow to accommodate significant densification.

The above re-development opportunities are conceptual at the time of this study, with their timing being largely unknown. The design of the future sites would best target low-auto mode shares through site design, access to transit and the application of TDM opportunities. The proximity to the future LRT will benefit the transit share of these communities, particularly for commuters destined to and from the downtown core. In the absence of these intensification initiatives, it is unlikely that significant traffic growth along St. Joseph would occur in the near future as to significantly modify existing travel patterns.

4.4 Forecast Design Volumes

The Orleans Corridor Secondary Plan Study envisions a transformed downtown Orleans centered around the future LRT, a main street St. Joseph and the principals of a 15-minute neighborhood. St. Joseph as a main-street has select opportunities for intensification that, aside from a proposal nearest Forest Valley, remains to be defined.

A high-level approach is proposed to address the wide variety of potential outcomes regarding the long-term transportation demand forecasts that truly reflect the vast number of changes to the Orleans Secondary Plan area. Future travel demands need to fully consider the available road network capacity. Based on a review of the TRANS model data, the testing of a 2-lane St. Joseph facility, the following two demand scenarios are considered for evaluation:

- Volume Scenario A (**Figure 5**) – Travel Demand is Constant: This scenario assumes that baseline east-west traffic demands remains constant, where the net impact of any intensification/re-development initiatives are absorbed by non-auto modes such as the LRT, cycling or walking. This also assumes that there is no displacement of thru-traffic or re-routing of local traffic in the case where east-west capacity is limited. This can be considered a worst-case scenario in terms of auto vehicle peak hour demand for the St. Joseph corridor; and

- Volume Scenario B (**Figure 6**) – Travel Demand Decreases: This scenario assumes a 30% reduction in east-west traffic demands along St. Joseph Boulevard. A 30% traffic shift is a conservative assumption based on the TRANS model analysis findings, as well as rationalization of the potential capacity of a 2-lane St. Joseph corridor. This shift would account for the advent of the LRT, additional shifts of regional travel due to the potential reduction to a 2 general-purpose lane concept and the shift of local traffic to alternate modes due to intensification.

It is believed that a significant increase in traffic volumes due to intensification is likely to occur given that these growth opportunities are likely limited to select major intersections where existing lots can permit such development typology and in areas surrounding each future LRT station which can support a higher density of trips. While the intensification of the St. Joseph corridor could generate additional vehicle demand, it can be expected that an equal shift to transit would take place resulting in a nominal change to travel patterns in the long-term.

Figure 5: Volume Scenario A, Existing Peak Hour Volumes

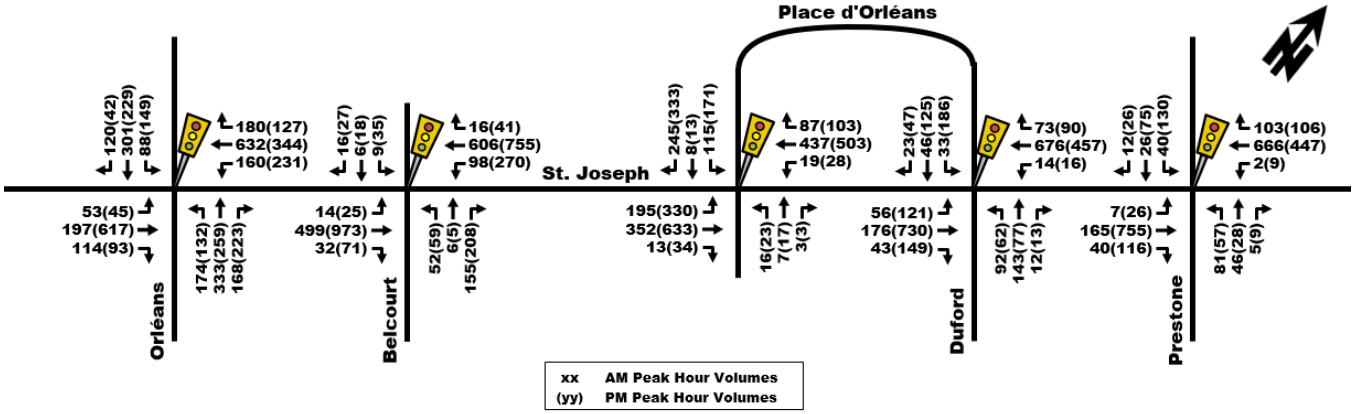
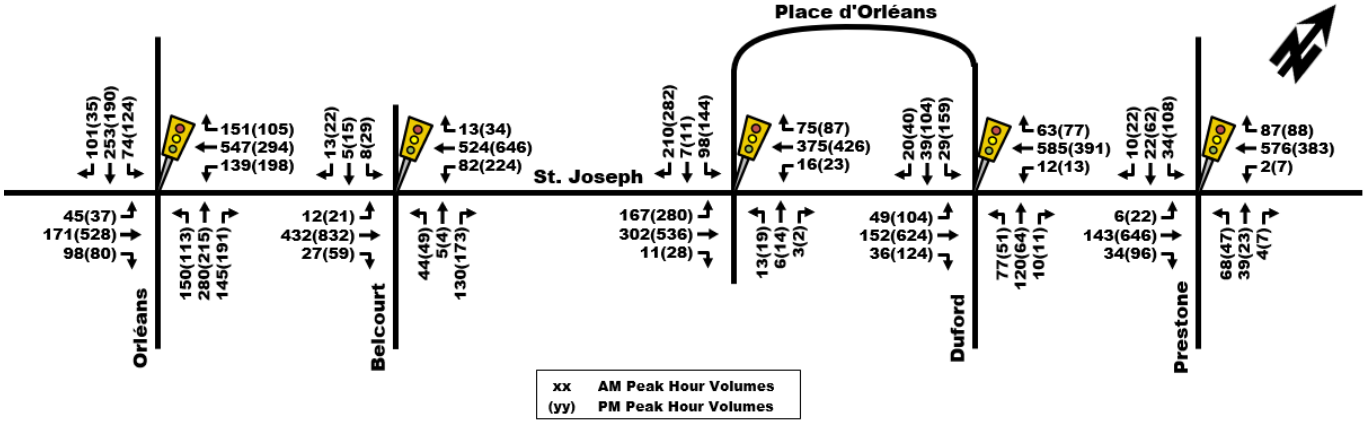


Figure 6: Volume Scenario "B", 30% East-West Reduction in Peak Hour Volumes



5.0 Operational Assessment of a 2-Lane St. Joseph Blvd.

5.1 Description of Analysis Scenarios

The new Official Plan designates the St. Joseph corridor as a Main Street corridor, with several of the abutting lands deemed as Design Priority Areas, providing an opportunity to evaluate how the corridor accommodates all modes of travel within the available right-of-way. An analysis was completed to evaluate the impacts of a reduced cross-section along the Study Area corridor assuming two traffic volume scenarios. This assessment assumed that St. Joseph Boulevard would be reduced to a 2/3-lane roadway (one lane per direction with center two-way left turn lane) from west of Orleans Boulevard and to east of Prestone Drive. The following analyses make a simplification that no right-turn lanes

will be provided along St. Joseph to minimize crossing distances. This assumption will be revisited in a later section as a mitigation measure where appropriate. The purpose of this analysis is to test various protected intersection choices in the context of St. Joseph as a main street corridor.

For this evaluation, three scenarios were included and are described as follows:

- Scenario A: This scenario assumes that baseline east-west traffic demands remain constant, while St. Joseph provides for one through lane per direction (between Orleans and Prestone).
- Scenario B: This scenario assumes a 30% reduction in east-west traffic demands along St. Joseph Boulevard and one through lane per direction (between Orleans and Prestone). A 30% traffic shift is a conservative assumption based on the TRANS model analysis findings.
- Scenario C: This scenario assumes a 30% reduction of east-west auto volumes, a 2/3-lane corridor (between Orleans and Prestone), and the application of Protected Intersection Design elements including Leading Pedestrian Intervals and RTOR-restrictions. Traffic signal timings were optimized with increased cycle lengths to accommodate these changes.

For each scenario, signal timing plans were adjusted to account for shorter crossing distances across St. Joseph Boulevard (i.e. reduced all-red and flashing don't walk times). In general, where a right turn lane has been provided, it has since been converted to a shared thru/right turn lane. In addition, the signal timing plans were optimized at all intersections within the limits of the lane reduction. A Synchro™ 10 model was developed for standard intersection capacity analysis. This model was also modified to provide reasonable SimTraffic™ results for the purpose of comparing relative travel time increases in each scenario.

5.2 Intersection Capacity Analysis

Table 5, Table 6 and **Table 7** summarize the results of the Synchro™ 10 intersection capacity analysis for Scenarios A through C, respectively. Each scenario assumes a 2-lane St. Joseph corridor with updated traffic signal timing parameters. For the purposes of this assessment, an overall intersection volume-to-capacity ratio of less than 1.0 would be considered acceptable as St. Joseph will be considered a main street corridor tailoring to all modes..

Table 5: Scenario A (Baseline Demands) Intersection Capacity Analysis Results – AM (PM) Peak Hours

Intersection	Weekday AM Peak (PM Peak)					
	Critical Movement			Intersection		
	LoS	max. v/c or avg. delay (s)	Movement	Delay (s)	LoS	v/c
Orleans	E(F)	**1.00**(**1.10**)	WBT(EBT)	43.2(**62.8**)	E(**F**)	**0.96**(**1.03**)
Belcourt	B(F)	0.70(**1.32**)	EBT(EBT)	15.5(**90.3**)	A(**F**)	0.57(**1.18**)
Place d'Orleans (West)	B(F)	0.67(**1.28**)	SBL(SBL)	9.2(35.8)	A(D)	0.56(0.89)
Duford/Place d'Orleans (East)	E(F)	0.92(**1.38**)	NBL(SBL)	39.5(54.3)	D(**E**)	0.83(**0.99**)
Prestone	A(C)	0.58(0.74)	WBT(EBT)	10.6(14.0)	A(B)	0.54(0.69)
Note: Analysis of signalized intersections assumes a PHF of 0.90 and a saturation flow rate of 1,800 veh/h/lane.						

A review of Scenario A (**Table 5**) indicates:

- During the morning peak hour, all intersections operate below a 1.0 v/c (LOS "E") threshold. The WB-Th movement at the Orleans Blvd intersection was found to operate at capacity;
- During the afternoon peak hour, the Orleans and Belcourt intersections operate with a v/c greater than 1.0 (LOS "F"). The EB-Th movements at 4 of the 5 Study Area intersections are also well over capacity.
- 95th percentile WB-LT queues at St. Joseph/Orleans and St. Joseph/Belcourt intersections were noted to exceed the existing storage lengths afforded to the movements. While this may have an impact on nearby accesses, the proposed centre TWLTL will mitigate spillback into east-west St. Joseph traffic flow.

Overall, should demand along the corridor remain unchanged, peak direction delays are anticipated to increase substantially, particularly during the afternoon peak hour. This level of east-west demand is likely near the maximum that the corridor could sustain in the long-term.

Table 6: Scenario B (30% Reduced East-West Demands) Intersection Capacity Analysis– AM (PM) Peak Hours

Intersection	Weekday AM Peak (PM Peak)					
	Critical Movement			Intersection		
	LoS	max. v/c or avg. delay (s)	Movement	Delay (s)	LoS	v/c
Orleans	E(E)	0.93(0.99)	NBL(SBL)	34.0(41.8)	C(D)	0.80(0.82)
Belcourt	A(**F**)	0.51(**1.31**)	EBT(SBT)	12.4(36.1)	A(E)	0.44(**0.91**)
Place d'Orleans (West)	B(**F**)	0.67(**1.09**)	SBL(SBL)	10.0(24.5)	A(B)	0.45(0.67)
Duford/Place d'Orleans (East)	E(E)	0.92(**1.00**)	NBL(SBL)	33.5(36.3)	B(C)	0.63(0.78)
Prestone	A(B)	0.45(0.62)	NBL(SBL)	10.2(12.2)	A(A)	0.40(0.51)
Note: Analysis of signalized intersections assumes a PHF of 0.90 and a saturation flow rate of 1,800 veh/h/lane.						

A review of Scenario "B" (**Table 6**) which adopted a 30% east-west decrease in traffic volumes found overall improved level of services, where all Study Area intersections were found to operate with an "overall" LOS "E" or better. The analysis found that several minor movements were above capacity, which is recognized as a suitable trade-off in this scenario. These operations are considered overall satisfactory for the purpose of the re-allocated St. Joseph corridor.

Scenario "B" best replicates a long-term scenario that sees a significant change in existing travel patterns for regional traffic.

Table 7: Scenario C (30% Reduced East-West Demands, Leading Pedestrian Intervals) Intersection Capacity Analysis– AM (PM) Peak Hours

Intersection	Weekday AM Peak (PM Peak)					
	Critical Movement			Intersection		
	LoS	max. v/c or avg. delay (s)	Movement	Delay (s)	LoS	v/c
Orleans	D(D)	0.86(0.85)	WBT(EBT)	37.8(46.2)	D(D)	0.84(0.84)
Belcourt	B(E)	0.64(1.00)	NBT(WBL)	24.7(46.6)	A(**E**)	0.48(**0.93**)
Place d'Orleans (West)	D(D)	0.83(0.89)	SBR(SBR)	26.6(41.7)	A(D)	0.58(0.81)
Duford/Place d'Orleans (East)	D(**F**)	0.82(**1.01**)	NBL(SBL)	36.4(47.1)	B(D)	0.66(0.81)
Prestone	A(B)	0.43(0.62)	WBT(SBL)	12.4(14.5)	A(A)	0.41(0.54)
Note: Analysis of signalized intersections assumes a PHF of 0.90 and a saturation flow rate of 1,800 veh/h/lane.						

A review of Scenario "C" (**Table 7**), which introduced Leading Pedestrian Intervals and RTOR restrictions at each of the reported intersections, found a general increase in overall volume-to-capacity at each of the study area intersections. However, all but the Belcourt intersection remains below a v/c of 0.9 (LOS 'E') threshold. In general, the intersection most critical movements remain as minor movements to and from the St. Joseph corridor. An example of a significant change in operations is that of the Place d'Orleans West intersection, which reported a decrease in LoS from 'C' to 'D' during the PM peak hour.

It is worthwhile to note that some improvement to critical movement capacity was realized due to the signal timing modifications. The implementation of RTOR restrictions results in an increase in right-turn demands during the green interval period, therefore resulting in longer green times for minor movements. Overall, this results in a small bias towards improving delays on the minor legs due to the higher allocation of signal time. However, this does have a negative impact on the primary movements.

Altogether, Scenario "C" signal timing strategies are considered viable for the St. Joseph corridor when considering the preferred conceptual design.

5.3 Additional Protected Intersection Mitigation Measures

The City's Protected Intersection Design Guide (September 2021) provides additional direction with respect to introducing measures at signalized intersections to protect pedestrians and cyclists, including and beyond the application of Leading Pedestrian/Bicycle Intervals and RTOR restrictions. The preferred conceptual for the St. Joseph corridor will fully consider a variety of protected intersection measures that have an effect on intersection signal capacity, such as providing fully protected left-turn phases, right-turn overlaps, and/or fully protected right-turn phases.

Section 7 of the Protected Intersection Design Guide provides warrant indications for protected left turns and right turns. In the current case of the conceptual design, a protected right turn would require a dedicated right-turn lane on approach to the intersection within the conceptual plans. Therefore, an analysis of a representative intersection (Orleans Boulevard) has been undertaken to establish potential operations of a fully protected intersection with right turn lanes.

The St. Joseph/Orleans intersection was selected as a candidate location to evaluate additional measures for the development of protected intersections within the Study Area. This intersection was noted to serve left-turn and right-turn volumes that exceed 100 veh/h on all approaches, satisfying the volume warrants suggested by the design guide. The measures selected for this evaluation are listed below and summarizes the results of the capacity analysis at the subject intersection.

- Fully Protected Left-Turn Movements (All Approaches)
- Fully Protected Right-Turn Movements (All Approaches)
  - Auxiliary right-turn lanes required on all approaches
  - Right-turn phasing overlaps the corresponding protected left-turn phase on the intersecting street
- RTOR restricted on all approaches

Table 8 summarizes the analysis of a protected intersection design configuration at the Orleans intersection. The analysis indicates the following:

- A substantial increase in overall average intersection delay of approximately 25-to-30 seconds/vehicle during both peak hours when compared to Scenario "C";
- A nominal increase in overall volume-to-capacity, where the intersection continues to operate an overall acceptable LOS "D", with critical movements operating at a LoS 'E';
- The major east-west and north-south movements are effectively near-capacity as they exhibit

Table 8: Mitigation Measures (30% Reduced East-West Demands, Protected Intersection Design) Intersection Capacity Analysis– AM (PM) Peak Hours

Intersection	Weekday AM Peak (PM Peak)					
	Critical Movement			Intersection		
	LoS	max. v/c or avg. delay (s)	Movement	Delay (s)	LoS	v/c
Orleans Blvd Protected Intersection	E(E)	0.96(0.95)	NBT(NBR)	67.6(71.2)	D(D)	0.88(0.89)
	E(D)	0.95(0.88)	WBT(EBT)			
Note: Analysis of signalized intersections assumes a PHF of 0.90 and a saturation flow rate of 1,800 veh/h/lane.						

6.0 High Level Assessment of Travel Time Implications

This analysis is a comparison between Scenario A and B to identify potential high level traffic impacts from a generic reduction in east-west capacity. The actual results are likely highly nuanced when factoing in a variety of protected intersection measures, impacts of future modal shares and potential for higher pedestrian crossings that can be generated by the complete street vision. Given this uncertainty, the following analysis is one approach to identifying potential impacts to auto vehicles and transit vehicles along the future St. Joseph main street corridor.

6.1 SimTraffic Travel Time Impact Evaluation

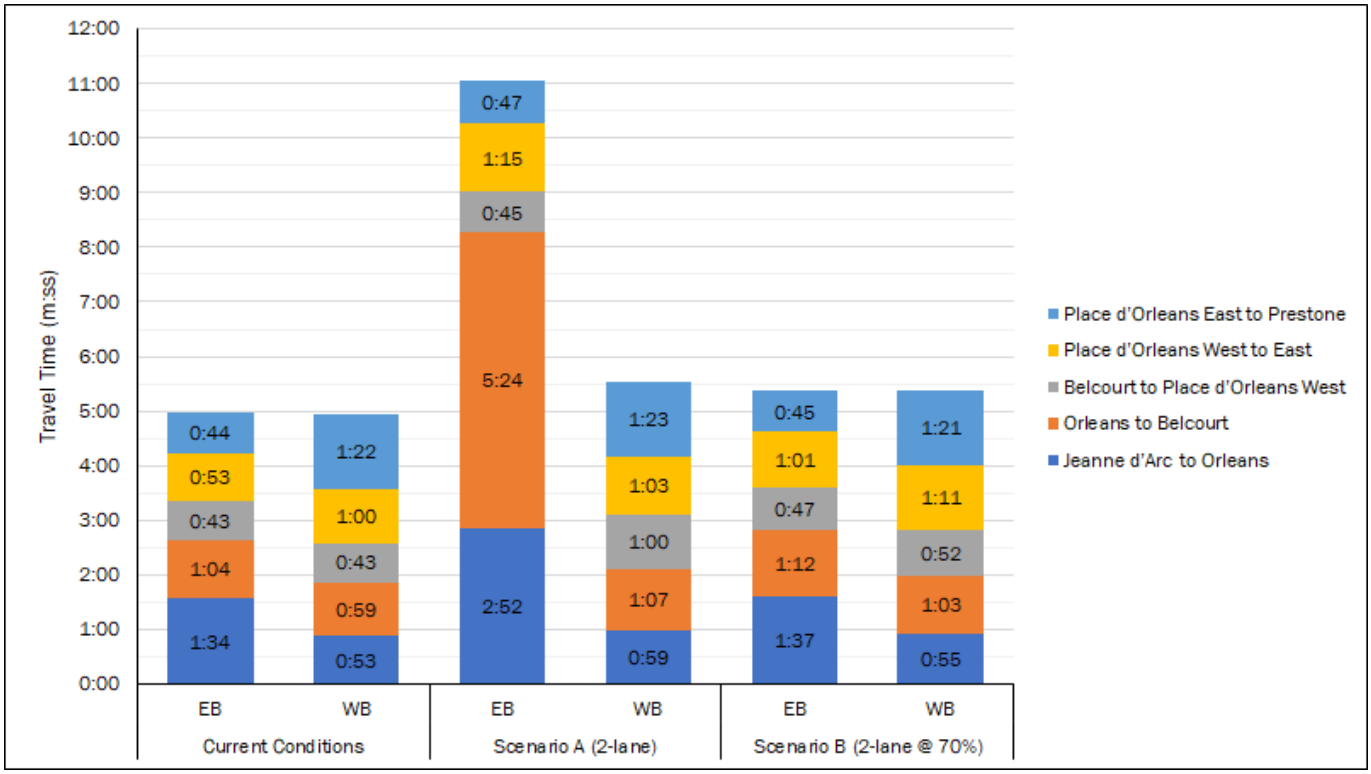
Figure 7 provides a comparative illustration of the travel time evaluation assuming the PM peak hour of travel demand, as this was considered the worst-case peak hour. The model simulations were setup for a one-hour evaluation and results were averaged from five simulation runs. The figure illustrates the reported travel time between each intersection, accounting for intersection delays and queue lengths, for the existing, Scenario A and Scenario B networks. The analysis exclusively reflects travel time delays at study area intersections and does not include potential delays due to bus activity (expected to be infrequent) and mid-block left-turns (accommodate by a TWLTL).

A review of the figure indicates that:

- When compared to the baseline conditions, Scenario A results in an additional 6 minutes of travel time, which is effectively doubling the amount of travel time to navigate the full corridor;
- The delays along St. Joseph within the context of Scenario A are primarily due to poor operations at the Orleans and Belcourt intersections. As these intersections are above capacity, the excessive delay reflects the presence of queue spillback effects and the lack of an ability for each intersection to accommodate the demand; and
- Scenario B was found to result in an overall travel time increase of 10% when compared to the baseline, with delays equally distributed across the corridor.

Based on the analysis of Scenario A and Scenario B, it is evident that a reduced cross-section with baseline vehicle demands would result in significant intersection delays, particularly for intersections west of Belcourt. In order to achieve similar travel times to the current St. Joseph corridor, a 30%-to-40% shift in existing traffic volumes to other travel modes (e.g. transit, walking, cycling), alternate corridors (e.g. OR-174, Innes), and time periods (e.g. spreading of the 2.5-hour peak period) must occur. This finding is in the absence of any additional intensification growth along the corridor as contextualized by the new Official Plan.

Figure 7: SimTraffic Corridor Travel Time Results – Afternoon Peak Hour



6.2 Impact to Existing Local Transit Routes

As previously discussed in Section 2.3 (Transit), St. Joseph Boulevard currently serves 7 transit routes along the corridor. Most existing local transit routes using St. Joseph provide east-west travel along OR-174 or transfers at the Jeanne d'Arc and Place d'Orleans bus stations, connecting residents to higher-order facilities (i.e. bus-only lanes) to travel into the City's downtown core. Lane reductions along the subject corridor are expected to increase delays to all vehicle users (i.e. automobiles and buses) on the roadway within the Study Area.

The following existing routes, noted as "local connections" would be negatively impacted:

- Route 32, from Grey Nuns to Belcourt, would have increased delays accessing St. Joseph;
- Routes 31 131, from Jeanne D'Arc to Place D'Orleans, would experience east-west delays at Orleans Blvd., Grey Nuns and Belcourt;
- Route 138 from Jeanne D'Arc to Orleans Blvd would experience delays at the Orleans Blvd. intersection.

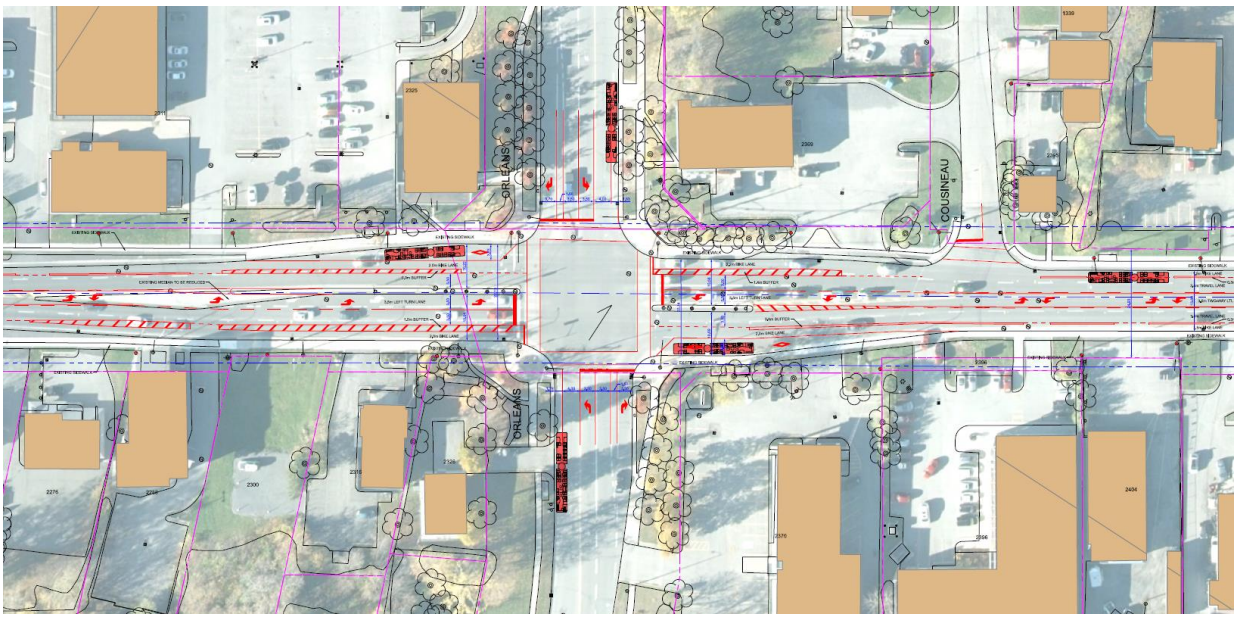
The construction of the Stage 2 LRT line is scheduled for completion by 2024 and will replace the existing bus transitway with rail service between Blair Road and Trim Road. In addition, a new LRT station is planned to be included at the Orleans Boulevard overpass at OR-174 (i.e. Convent Glen station). As a result, opportunities to reroute transit onto alternate north-south corridors to serve LRT stations without having to use significant portions of St. Joseph Boulevard may exist. For example, Local Routes such as Routes 32, 33 and 138 could remain on Orleans Boulevard and travel directly to/from Convent Glen station, instead of using St. Joseph Boulevard to travel to/from Jeanne d'Arc station or further west to the current Line 1 termination.

St. Joseph is anticipated to continue to operate with local routes developed to connect the greater Orleans community to the Stage 2 LRT extension or to the local businesses along the main street itself. To benefit east-west travel, there could be consideration for queue jump lanes or transit priority lanes near Orleans Blvd, Grey Nuns and Belcourt to reduce transit travel time congestion attributed to vehicle traffic.

7.0 Future Multi-Modal Level of Service

To inform the preferred conceptual design of St. Joseph, a sampling of intersections and segments have been considered for a MMLOS analysis according to City of Ottawa guidelines. The objective is to provide a reasonable assessment of key locations to inform the selection of corridor alternatives. **Figure 8** illustrates the interim demonstration plan of a "tactical intervention" strategy that would see improvements made within the available curb-to-curb area of St. Joseph Blvd. The following sections detail MMLOS analysis considering this type of strategy for the corridor.

Figure 8: Draft Interim Demonstration Plan, Orleans Boulevard Intersection, Tactical Intervention Concept



7.1 Intersection Analysis

The St. Joseph/Orleans Blvd intersection has been selected as a prototypical arterial-to-arterial connection within the Study Area for the purpose of assessing future MMLOS based on City of Ottawa criteria. Additionally, the St. Joseph/Belcourt intersection was selected as a representative local/collector connection within the Study Area.

Table **Table 9** summarizes the MMLOS analysis undertaken utilizing the City of Ottawa's *Multi-Modal Level of Service (MMLOS) Guidelines (2017)* and Addendum (May 2017). A review of the analysis indicated results below the level of service targets for both a "Traditional Main Street" and an intersection "Within 300m of a school".

Inspection of the table indicated the following intersection MMLOS deficiencies:

- Unsatisfactory PLOS 'F" at both intersection locations, due to the length of crossing distance of St. Joseph Blvd;
- Unsatisfactory BLOS "D" at both intersection locations due to the left turn configuration;
- Unsatisfactory TLOS "F" due to increased delays at each intersection, which was found to occur in both Scenario "C" (LPI, No RTOR) and Scenario "D" (protected right turn) configurations.

Table 9: MMLOS – Future Conditions

Intersection	Level of Service Traditional Mainstreet							
	Pedestrian (PLoS)		Bicycle (BLoS)		Transit (TLoS)		Truck (TkLoS)	
	PLoS	Target	BLoS	Target	TLoS	Target	TkLoS	Target
St. Joseph/Orleans Blvd.	**F**	C	D	A	F	n/a	E	D
St. Joseph/Belcourt Blvd.	**F**	C	E	A	F	n/a	n/a	D

To achieve improved levels of service, the following could be considered:

- To achieve a PLOS "C", the pedestrian crossing distance of St. Joseph would need to be reduced by at least 7.0m and fully protected left turn/right turn movements (with RTOR prohibited) instigated. This can be partially accomplished by removing the bus lay-by areas in the northwest and southeast quadrants of each of the intersections. This would require a fairly novel approach to developing a 'floating island' transit stop design that integrates with the cycling facilities;
- To achieve a BLOS "A", and assuming the presence of cycle tracks in either direction along St. Joseph, left turns at intersections would need to be addressed through 2-stage bike boxes. Any other alternative would result in an insufficient BLOS. This will be considered a refinement in the design concept.
- Existing transit routes travel east-west along St. Joseph and north-south along Orleans Blvd and Belcourt Blvd. The protected intersection design at Orleans Blvd including fully protected left turns, fully protected and RTOR-prohibited right turns, and with a single dedicated thru-lane in each direction increases TLOS delays beyond 40 seconds (i.e. TLoS 'F'). A transit queue jump could be possible by implementing transit signal priority with the dedicated right-turn movement.

7.2 Segment Analysis

The future concept cross-sections currently include a 2.0m sidewalk with curbside bike lanes in both directions. In addition to these improvements, the number of travel lanes in each direction has been reduced from 2-lanes to 1-lane.

Two representative cross-sections have been considered for this assessment of the interim "tactical intervention" strategy, which sees improvements in the current curb-to-curb space.

- **Figure 9** illustrates a typical 4-lane cross-section west of Jeanne D'Arc, which is expected to remain a 4-lane corridor.

- **Figure 10** depicts a typical cross-section east of Cousineau which is recommended to form a the 2/3-lane cross-section. While there remains various arrangements east of Jeanne D'Arc in terms of sidewalk width, bike lane width and buffe area, this analysis is likely representative of the 2/3-lane St. Joseph corridor.

Figure 9: Recommended Interim "Tactical Intervention" Strategy – West of Marenger

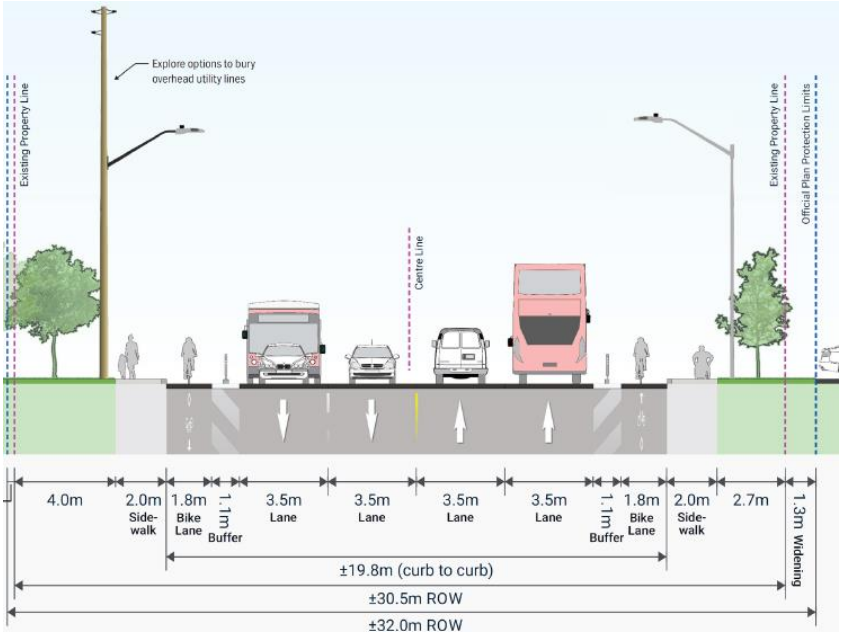


Figure 10: Recommended Interim "Tactical Intervention Strategy" – East of Cousineau

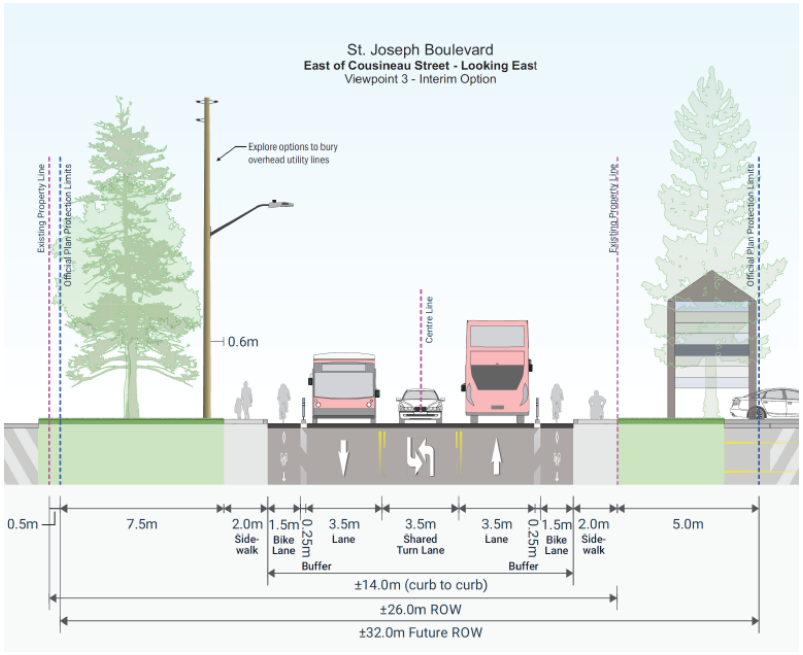


Table 10 summarizes the MMLOS analysis for the St. Joseph corridor assuming the future concept conditions. Inspection of the analysis found that cyclist modes do not meet the targeted levels of service within the policy area. However, to achieve a BLOS 'A', re-construction of the curb line would be required to accommodate separated cycle tracks.

Table 10: MMLOS – Future Conditions

Typical Segment	Level of Service Traditional Mainstreet							
	Pedestrian (PLoS)		Bicycle (BLoS)		Transit (TLoS)		Truck (TkLoS)	
	PLoS	Target	BLoS	Target	TLoS	Target	TkLoS	Target
West of Jeanne d'Arc	C	C	C	A	D[1]	n/a	A	D/E
East of Orleans	C	C	C	A	E[1]	n/a	C	D/E

1. Average speed ranges from 20 km/h to 40 km/h. Study segments free of intersection delay typically performed higher. Vt adopted as 30 km/h. Vt/Vp, the ratio of average transit travel speed to the posted speed limit, was found to be approximately 0.5.

8.0 Summary of Findings

A review of the study findings indicated that:

- There remains significant existing capacity for intersections east of Jeanne D'Arc. For the intersections of Youville and Jeanne D'Arc, the significant traffic volume makes reducing capacity likely inappropriate ;
- St. Joseph can remain an Emergency Detour Route for the OR174 corridor as it continues to offer a similar arterial function even after the reduction in number of general purpose lanes. It will remain a 4-lane corridor for much of its length and is supported by parallel arterials such as Jeanne D'Arc and Innes Road;
- According to the TRANS model, approximately 30% of the existing St. Joseph traffic could shift to alternate east-west corridors given the reduction in general capacity;
- Traffic growth along the St. Joseph corridor is anticipated to be overall negligible, with any significant intensification taking place in areas well supported by the upcoming LRT extension;
- Assuming no changes in the traffic volume demand, a 2/3-lane St. Joseph corridor would result in constrained intersection operations at 4 of the 5 study area intersections;
- Adopting a 30% reduction in east-west traffic volumes, the study area intersections are found to offer acceptable overall volume-to-capacity ratios and levels of service. This finding remained true when adopting protected intersection measures such as LPI/LBI timings and RTOR-restrictions;
- Installing dedicated right turn movements with protected phasing at key intersections was found to have a negligible impact on overall volume-to-capacity but would vastly increase delays to overall travel.
- To achieve intersection PLOS targets, elimination of the bus lay-by areas would need to be considered to reduce crossing distances. This would require novel design efforts to develop a 'floating' transit stop that integrates with the cycling infrastructure;
- To achieve BLOS targets, bike boxes would need to be considered on key approaches.

The following study conclusions are intended to inform the preferred conceptual design:

- A shared through/right-turn lane approach is considered the preferred interim configuration at study area intersections given the potential turning demands and the effects of protected right turn phases.
- Discussions with OC Transpo should be considered to determine if there is an appetite to eliminate the bus lay-by areas and acceptable transit stop designs within the context of St. Joseph Blvd.
- Left-turn bike boxes should be considered on key cycling corridors such as Belcourt.