Discussion of Potential One-Way Street Conversions in Downtown Ottawa

Draft November 28, 2012

Within the context of the Downtown Moves initiative, this paper is intended to further inform the ongoing discussion regarding the opportunities and constraints of potentially converting all or some of downtown Ottawa's one-way streets to two-way operation. This matter has subject to ongoing discussion in Ottawa for several years, and has been referenced in the 2004 Downtown Ottawa Urban Design Strategy (DOUDS), and more recently in the Mid-Centretown Community Design Plan. It is important to note that the ensuing high-level technical assessment focuses on the transportation and traffic operational issues, for which there is little literature/analysis available. It also reports on the urban planning dialogue, for which there is an abundance of literature available.

1.0 Background

1.1 Summary of Literature

There is considerable literature available on the opportunities and constraints of converting existing one-way streets to two-way operation, and depending on one's perspective, convincing arguments can be made for the merits of each system. In short, it is obvious that there is no clear winner in this on-going debate.

Some interesting web-sites and documents include:

1. http://www.ite.org/membersonly/itejournal/pdf/Jha98a47.pdf
2. http://www.google.ca/url?sa=t&rct=j&q=are%20child%20pedestrians%20at%20increased%20risk%20of%20injury%20on%20one-way%20compared%20to%20two-way%20streets&source=web&cd=2&ved=0CCcQFjAB&url=http%3A%2F%2Fjournal.cpha.ca%2Findex.php%2Fcjph%2Farticle%2Fdownload%2F185%2F185&ei=_2xOUJ_rE4GxqgGI5YHADg&usg=AFQjCNFaDchj_k8cU7R6AqCRF4pt5vv-hA
3. http://www.worldtransitresearch.info/research/1631/
4. http://www.ti.org/vaupdate30.html
5. http://onlinepubs.trb.org/onlinepubs/circulars/ec019/Ec019_f2.pdf
6. http://www.scribd.com/doc/48005607/No-Two-Ways-About-It-One-Way-Streets-Are-Better-Than-Two-Way

From the literature review, it is apparent that the dialogue on this topic is informed by both technical studies and rhetoric. Opinions expressed are often strong in support of one side or the other. An attempt has been made to translate the information in a manner that informs the discussion pertaining to downtown Ottawa. The results follow.

From a transportation perspective, the advantages of two-way streets are summarized as follows:

- **Decreased vehicle distances travelled:** By eliminating indirect routes, the distances that vehicles are required to travel to reach a destination may be slightly lower (i.e., eliminate driving around the block).

  Counterpoint: Similar behaviour can occur as drivers search for on-street parking spaces immediately adjacent to their destination; major parking facilities often provide multiple access/egress points efficiently serving a one-way street network.

- **Slower travel speeds:** With the additional friction resulting from two-way traffic operation, mid-block speeds are typically lower on two-way streets.

  Counterpoint: Intersections are the critical points within the corridor, and any resulting congestion at intersections could adversely impact transit service reliability and the ability of emergency vehicles to respond to calls.

- **Improved pedestrian (and cyclist) safety:** With the foregoing lower travel speeds, pedestrians on the sidewalk (and cyclists within the travelled asphalt) may be considered safer.

  Counterpoint: Appropriately designed sidewalks and on-road cycling facilities on one-way streets can help to enhance the pedestrian and cycling environment.

Again, from a ***transportation planning*** perspective, the advantages of one-way streets are:

- Narrow street cross-section: A street can accommodate relatively high traffic volumes with only two (2) travel lanes, given that turning movements can happen from one lane or the other. By comparison, a two-way street will need a wider, three (3) lane cross-section to accommodate a turning lane (otherwise traffic would come to standstill waiting for a single vehicle to turn). This wider cross-section would occur at intersections where pedestrian crosswalks would therefore be lengthened in the two-way scenario.

- Improved signal coordination: Coordination of traffic signals is more easily attained within an area such as downtown Ottawa where signals by necessity are closely spaced (i.e., short blocks). This results in improved traffic and bus transit flow with fewer stops, less idling, and lower emissions. Note that signal timing parameters (i.e., offsets) can be used to regulate travel speeds.

  Counterpoint: Higher travel speeds for vehicles are the result of well-coordinated traffic signals, which is not considered conducive to a welcoming pedestrian environment and safe cycling.

- Increased capacity: The capacity of one-way streets can be approximately 10% to 20% greater than that of two-way streets. Increased capacity can translate into fewer lanes and fewer through streets within a one-way grid system, or alternatively, the option to reprogram any surplus capacity/space for other purposes (i.e., dedicated parking lanes, bicycle lanes, wider sidewalks).

  Counterpoint: None.

- Reduced congestion and delay: Congestion and delay is reduced for all modes, including pedestrians, vehicles and transit. Delay is often reduced as the cycle length can be much shorter with one-way streets. The extra phases to accommodate left-turn movements are unnecessary with one-way streets.

  Counterpoint: The one-way system forces drivers to follow out-of-direction routes, and this recirculation results in an increase in traffic volume on a given segment or intersection within a one-way system.

- Improved pedestrian safety at intersections: The pedestrian has fewer directions to be concerned about at intersections involving one-way streets, and drivers have fewer potential conflicts to process (and can give more attention to pedestrian safety). Safety studies conducted from the 1930's to the 1970's of before and after conditions (as cities switched from two-way to one-way) consistently found that one-way streets had 10% to 20% lower accident rates than when previously two-way, and pedestrian accidents dropped by 30% to 60%.

  Counterpoint: At intersections of two-streets that are each two-way, pedestrians have an expectation of potential vehicular conflicts with their path as they cross the intersection. These expectations can be different at the intersection of one-way streets, which may create a less safe pedestrian environment. According to a public health study in the 1990's (web reference #2, above) using traffic collision data in Hamilton, a child on a one-way street is two and a half times more likely to be killed by a car than a child on a two-way street. It is apparent that studies are often conflicting and as a result, inconclusive.

From an ***urban planning*** perspective, the advantages of two-way streets are:

Creating Calmer Communities: By increasing the direction of vehicle access and range of vehicle turning movements to and from adjacent uses, and ultimately slowing vehicle travel speed, the impacts of vehicles on adjacent land uses is less. This is particularly important for residential neighbourhood streets in inner-city areas.

Supporting Street-Oriented Land Uses: By providing opportunities for on-street parking and passenger pick-ups (buses, taxis and service vehicles) along the passenger side of vehicles along the street, and by "doubling" the visual exposure to signs serving businesses and institutions, a two-way street will be more-supportive of street-oriented land uses. This is particularly important to "mainstreets" and streets where street-oriented retail and service businesses are encouraged.

1.2 Guidance from the City of Ottawa Transportation Master Plan (TMP)

There is no specific reference to one-way street conversions anywhere in the current version of the City of Ottawa's Transportation Master Plan (TMP). However, there are several relevant policies contained within the TMP that may be used to guide decisions on any major reconfigurations of the downtown street network, as follows:

- Section 3.4 - Managing the Transportation System (page 31) establishes a target for the performance of signalized intersections, which ultimately determines system performance. Specifically, the policy states to endeavour to maintain a maximum 90% volume-to-capacity ratio for mixed traffic at signalized intersections during weekday peak hours, where feasible, except in the Central Area where a 100% ratio will be acceptable.

  The Central Area is shown in Figure 1. All this is to say, the portion of the Downtown Moves study area north of Gloucester Street is subject to the 1.0 overall v/c ratio target for performance of the signalized intersections, and the portion south of Gloucester Street is subject to the lower 0.9 target.

- Section 6.1 - City of Ottawa Roads (page 56) provides a description of the process of identifying roadway modifications within the TMP at a planning level. Specifically, using travel projections produced by the TRANS regional travel demand model as a basis, the TMP is suggesting that additional roadway capacity across a screenline should be considered when the demand crossing a screenline exceeds 90% of the assumed capacity in the AM peak hour (except in the Urban Core where 100% is acceptable).

  The TMP provides no guidance per se for the scenario when there is considerably more capacity across a screenline than required by projected demand. The Urban Core (as shown in Figure 2) is defined as the area bounded by the Ottawa River, Rideau River, Queensway and O-Train line.

Figure 1: Central Area Illustrated

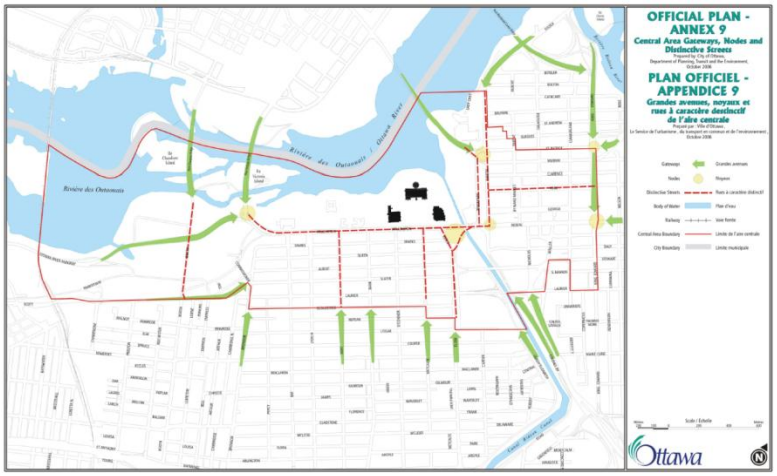
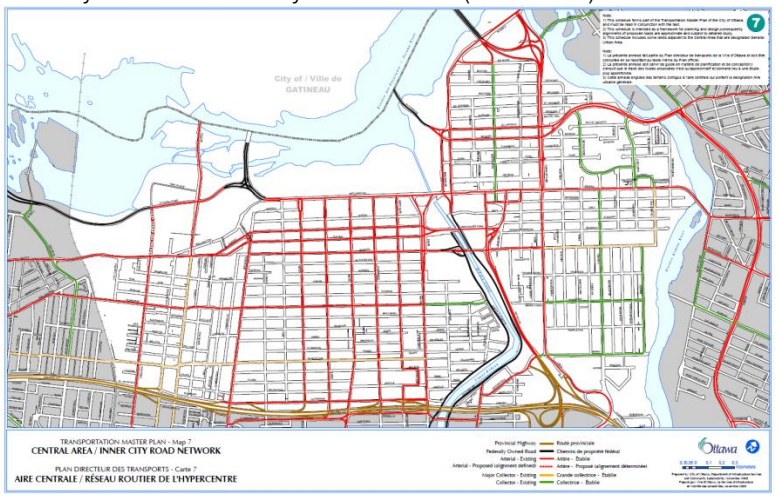


Figure 2: City of Ottawa Inner City Road Network (Urban Core)



2.0 EXISTING CONDITIONS IN DOWNTOWN OTTAWA

2.1 Existing Street Configuration in Downtown Ottawa

Figure 3 is Schedule F of the City of Ottawa Official Plan. This map illustrates the existing road network within the immediate study area of the Downtown Moves Project and its broader context extending southerly to the Highway 417 Corridor. The characteristics of the primary one-way streets within the Downtown Moves study area are summarized in Table 1.

Figure 3: Downtown Ottawa Road Network

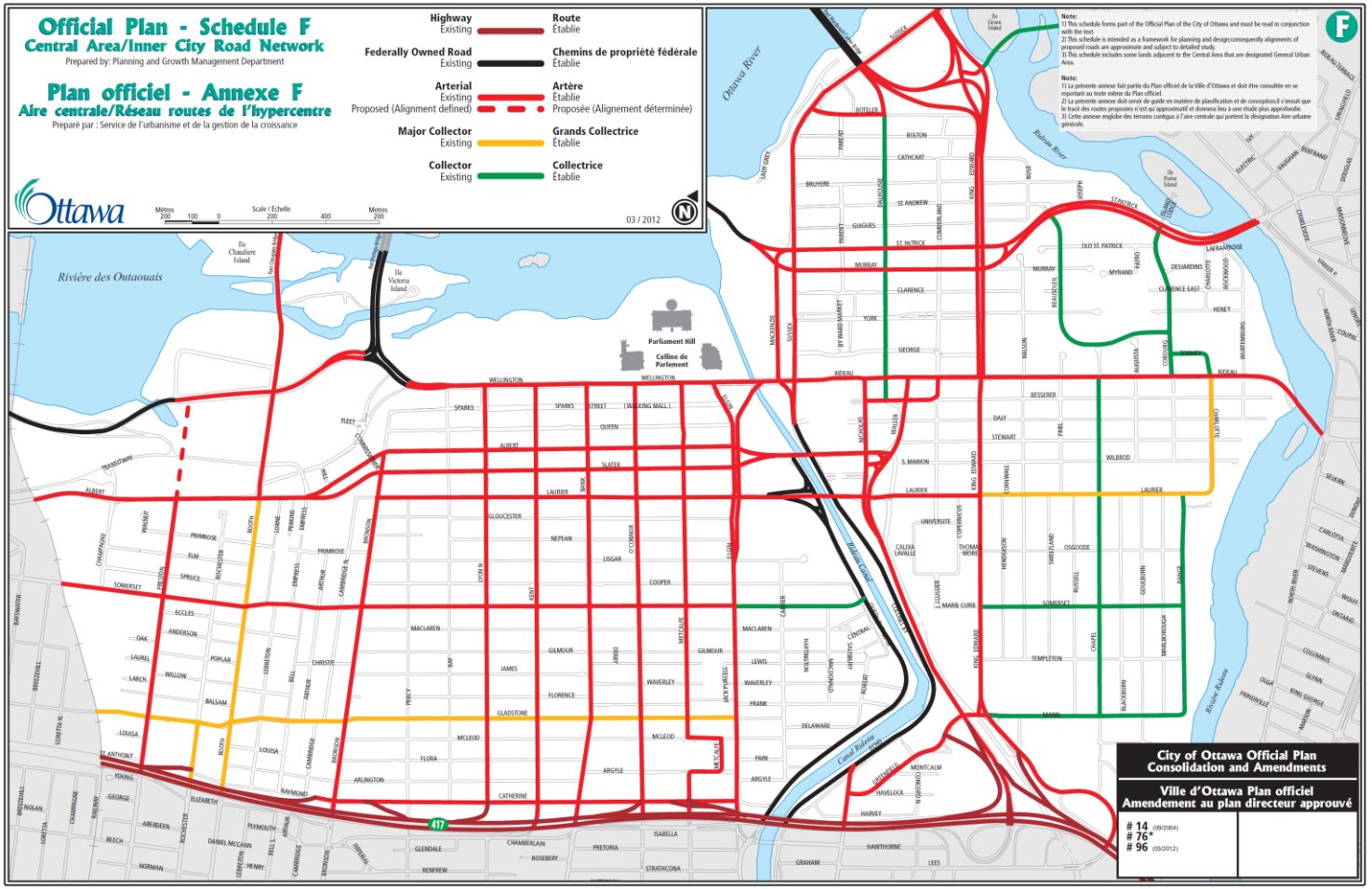


Table 1: Roadway Characteristics of Major One-Way Streets in Downtown Ottawa

Street Name	Predominant Number of Travel Lanes	Description	Assumed Total Vehicle Capacity (veh/h)
Albert Street	2 + 1 bus WB 4 lanes in sections	Arterial road liming Elgin Street (MacKenzie King Bridge) in the east to Wellington Street in the west; forms part of the existing BRT network	1,600
Slater Street	2 + 1 bus EB 4 lanes in sections	Arterial road linking Elgin Street (MacKenzie King Bridge) in the east to Wellington Street in the west; forms part of the existing BRT network	1,600
Lyon Street	3 SB Varies between 4 (north of Queen) to 2 (south of Somerset	Arterial road linking Wellington Street in the north to Highway 417 WB in the south (single lane on-ramp)	2,400
Kent Street	3 NB Varies between 4 (north of Laurier) to 3 (at Catherine)	Arterial road linking Chamberlain Ave/Highway 417 EB in the south (single lane on-ramp) to Wellington Street in the north.	2,400
O'Connor Street	3 SB Varies between 4 (south of Sparks) to 3 (south of Somerset	Arterial road linking Wellington Street in the north to Isabella St/Highway 417 in the south.	2,400
Metcalfe Street	3 NB Varies between 3 lanes and 2 lanes (approaching McLeod)	Arterial road linking Monkland Avenue in the south (south of Highway 417) to Wellington Street in the north; discontinuity between Argyle and McLeod at the Canadian Museum of Nature	2,400

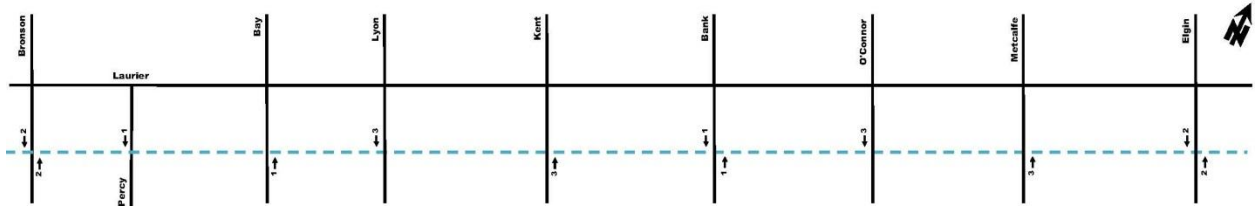
Notes:

(1) Assumes nominal per lane capacity of 800 veh/h, which is consistent with the current assumptions of the TRANS Regional Demand Model. Note that there is no allowance in the capacity value related to any potential operational benefits of one-way versus two-way streets, or impact of lane interaction/friction within a multi-lane facility.

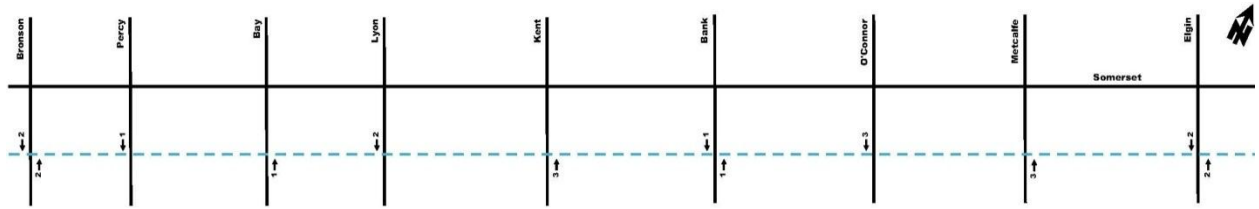
2.2 Existing Mid-Block Performance

Based on the most recent intersection turning movement counts provided by the City of Ottawa, a screenline assessment was performed at various mid-block locations within the expanded study area for the Downtown Moves Project, as follows:

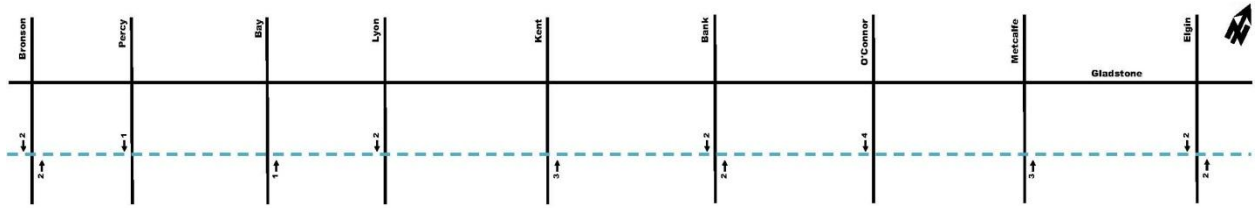
Laurier Avenue



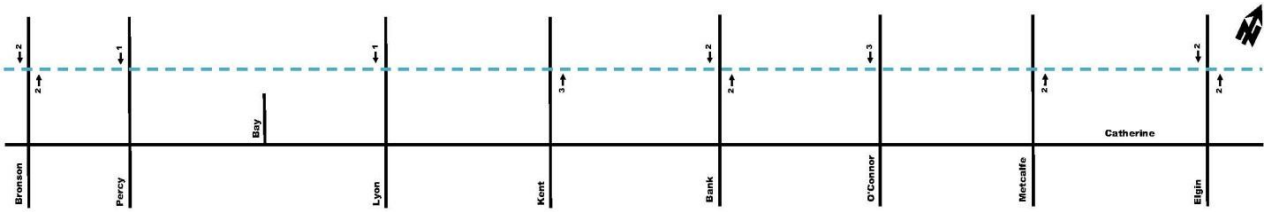
Somerset Street



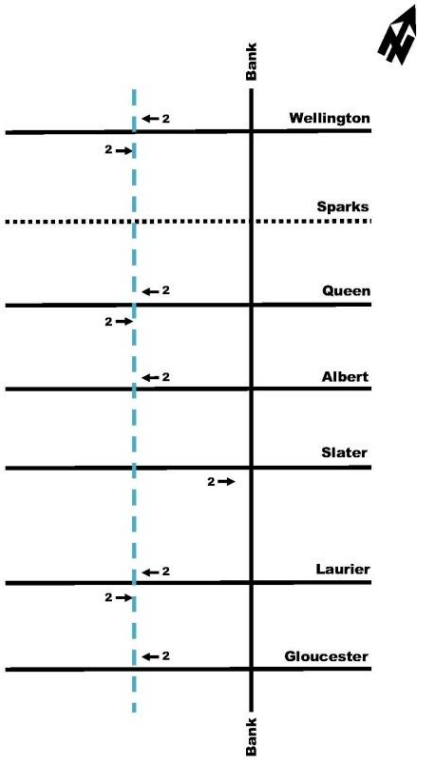
Gladstone Avenue



Catherine Street



Bank Street



Note that only the screenline at Laurier Avenue represents an actual screenline modelled within the TRANS regional model, whereas the other screenlines were derived to demonstrate conditions at various locations within the study area.

The results of the screenline analysis are summarized in Table 2 for the four screenlines traversing in the east-west direction (capturing north-south travel) and Table 3 for the lone north-south screenline (capturing east-west travel). Note that all the subject screenlines are contained within the Urban Core, and therefore a v/c ratio of less than 1.0 is the desired target.

Table 2: Existing East-West Screenline Performance

Screenline	V/C Ratio			
	Northbound		Southbound	
	AM Peak	PM Peak	AM Peak	PM Peak
Laurier Avenue	0.50	0.43	0.35	0.40
Somerset Street	0.53	0.33	0.29	0.51
Gladstone Avenue	0.54	0.41	0.33	0.66
Catherine Street	0.78	0.60	0.36	0.59

Table 3: Existing North-South Screenline Performance

Screenline	V/C Ratio			
	Northbound		Southbound	
	AM Peak	PM Peak	AM Peak	PM Peak
Bank Street	0.49	0.51	0.30	0.41

The foregoing preliminary assessment of mid-block volume-to-capacity (v/c) ratios indicates that there is considerable spare capacity available on all of the screenlines that were evaluated. The estimated mid-block v/c ratios range between approximately 0.30 and 0.8.

It should be noted, however, the assumed capacity is considered "ideal". In reality, the ideal capacity is rarely achieved in the field as a result of numerous non-recurring factors, including collisions/lane closures, friction in the shoulder lane from bus activity, turning movements to/from mid-block driveways, the presence of parked cars within a travel lane, etc.

2.3 Intersection Operational Constraints

Despite the preliminary findings of the mid-block performance assessment, it must be recognized that there often exist traffic operational constraints at the intersection of roads, and/or compatibility requirements with existing major transportation infrastructure such as bridges.

Included in Table 4 is a summary of intersection performance for the intersection of Somerset Street with the major north-south roadways. The analysis is based on existing geometry, traffic volumes and signal timing plans. Recall that the target threshold for this portion of the study area is an overall intersection v/c ratio is 0.90 or less, which equates to the transition between LoS D/E.

Table 4: Existing Intersection Performance at Somerset Street

Intersection	Weekday AM Peak (PM Peak)					
	Critical Movement			Intersection		
	LoS	max. v/c	Movement	Delay (s)	LoS	v/c
Bronson/Somerset	D(D)	0.81(0.89)	NBT(NBT)	21.2(30.5)	A(B)	0.58(0.61)
Percy/Somerset	A(B)	0.45(0.62)	SBT(SBT)	10.3(12.5)	A(A)	0.21(0.48)
Lyon/Somerset	C(F)	0.78(1.27)	SBT(SBT)	20.1(119.4)	B(F)	0.64(1.19)
Kent/Somerset	B(E)	0.63(0.95)	NBT(NBT)	17.2(32.8)	A(D)	0.55(0.87)
Bank/Somerset	C(C)	0.71(0.74)	EBT(EBT)	18.1(20.1)	A(A)	0.42(0.52)
O'Connor/Somerset	A(C)	0.58(0.78)	EBT(WBT)	15.6(21.5)	A(B)	0.29(0.63)
Metcalfe/Somerset	B(A)	0.66(0.58)	NBT(NBT)	18.8(17.4)	A(A)	0.55(0.47)
Elgin/Somerset	A(C)	0.58(0.72)	EBT(EBT)	11.2(12.9)	A(A)	0.30(0.40)

Note: Analysis of signalized intersections assumes a PHF of 0.95 and a saturation flow rate of 1800 veh/h/lane.

The capacity analysis results for Somerset Street indicate that, as a whole, the majority of the intersections are currently operating at LoS B or better during both peak periods, which is indicative of very good performance. The notable exceptions are at Lyon/Somerset with an overall intersection v/c ratio of 1.19 (LoS F) during the PM peak, and at Kent/ Somerset with an overall intersection v/c of 0.87 (LoS D). Note that for many locations, the north-south movement is the most critical movement at the intersection with maximum approach v/c ratios often ranging between close to 0.7 to over 1.0.

These values suggest that there is minimal opportunity to reduce capacity on the major one-way street network in Ottawa. Both Lyon Street southbound and Kent Street northbound are currently operating close to, or over, capacity approaching Somerset, whereas, theoretically, there is some spare capacity on O'Connor Street southbound and Metcalfe Street northbound approaching Somerset.

2.4 Compatibility with Existing Highway 417

As identified previously in Table 1, all of the north-south one-way streets considered as part of this assessment provide either direct or indirect vehicular connectivity to the Highway 417 Corridor. Table 5 provides a summary of the existing connectivity, as well as potential opportunities and constraints associated with any possible future connectivity.

Table 5: Existing Ramp Connectivity to Highway 417

Street Name	Existing Connectivity	Opportunities/Constraints
Lyon Street	Travelling southbound on Lyon, vehicles have direct access to Highway 417 WB in the form of a single lane on-ramp; no access to Highway 417 EB.	If Highway 417 access was needed to a future northbound lane on Lyon, WB traffic would exit at Metcalfe (to Catherine) or EB traffic would exit at Bronson (to Gladstone).
Kent Street	Destined for northbound on Kent, vehicles from Highway 417 EB exit at Bronson (to Chamberlain) and vehicles from Highway 417 WB exit at Metcalfe (via Catherine).	If Highway 417 access was needed from a future southbound lane on Kent, traffic destined WB would enter at Lyon (via Catherine) and traffic destined EB would enter at Metcalfe (via Chamberlain).
O'Connor Street	Travelling southbound on O'Connor, vehicles have direct access to Highway 417 WB in the form of a single lane on-ramp, and Highway 417 EB at Metcalfe (via Isabella).	If Highway 417 access was needed to a future northbound lane on O'Connor, WB traffic would exit at Metcalfe (to Catherine) or EB traffic would exit at O'Connor.
Metcalfe Street	Destined for northbound on Metcalfe, vehicles from Highway 417 EB exit at O'Connor (to Isabella) and vehicles from Highway 417 WB exit directly at Metcalfe.	If Highway 417 access was needed from a future southbound lane on Metcalfe, traffic destined WB would enter at O'Connor (via Catherine) or traffic destined EB would enter at Metcalfe.

Figure 4: Highway 417 Corridor Air Photos

The potential conversion to two-way operation of any the major north-south streets in Ottawa would place considerable additional pressure on Catherine Street and Chamberlain Avenue/Isabella Street to accommodate the diverted traffic.

A review of the Preliminary Design Study and EA for the Highway 417 Corridor indicates no significant changes are being proposed to the existing interchange configuration east of Bronson Avenue and Metcalfe Street. However, it is noted that at Bronson Avenue, Chamberlain Avenue will be realigned to intersection Bronson Avenue at the existing eastbound off-ramp. This requires demolition of an existing building adjacent to the Highway Corridor, thereby eliminating the existing Imperial Avenue connection. It is understood that southbound left-turn from Bronson Avenue to Chamberlain Avenue will be prohibited as a result of the realignment.

2.5 Compatibility with MacKenzie King Bridge

Both of the east-west streets considered as part of this assessment provide vehicular connectivity at their eastern terminus (at Elgin Street) to from the MacKenzie King Bridge. The easterly extension of Slater (eastbound) forms the southern lanes of the Bridge, while the northern lanes of the Bridge extend westerly to Albert (westbound). The existing configuration, as shown in Figure 5, would need to be modified to permit either Albert Street, or Slater Street, or both, to function as two-way operation in the vicinity of the MacKenzie King Bridge.

Figure 5: Elgin/Albert/Slater Intersection – MacKenzie King Bridge

3.0 EXPERINCE FROM OTHER CITIES

There are many cities in Canada and the United States that have been converting their one-way streets since the 1990s, including for example:

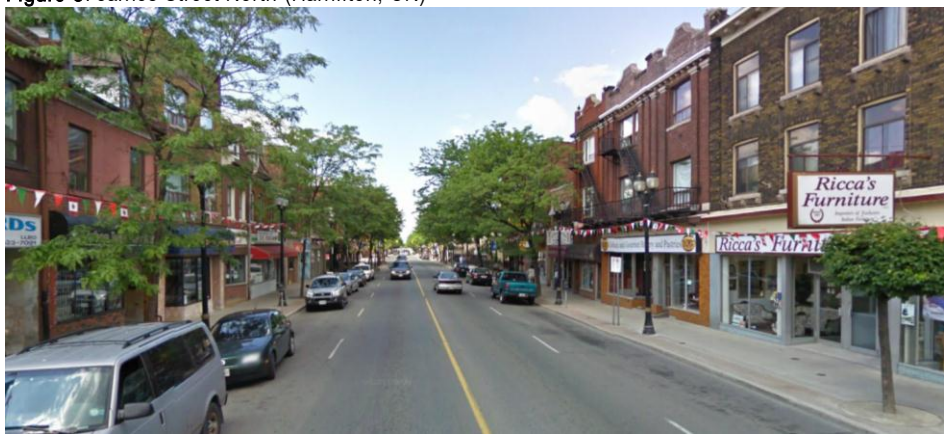
- Berkeley CA
- Calgary AB
- Cedar Rapids IA
- Columbus OH
- Denver CO
- Greensboro NC
- Iowa City IA
- Jacksonville FL
- Louisville KY
- Milwaukee WI
- Minneapolis MN
- Oklahoma City OK
- Oregon City OR
- Rochester NY
- Sacramento CA
- San Francisco CA
- St. Petersberg FL
- Vancouver WA
- Wichita KA.

The rationale for such conversions has tended to focus on creating a pedestrian friendly environment, calming traffic, attracting new neighbourhood businesses, and reducing the navigation confusion for visitors. Below are two somewhat recent examples of one-way conversions in Ontario, although there is no quantitative evidence of traffic impacts that could be identified and/or provided[1].

[1] Representatives from the relevant municipalities were contacted for any lessons learned and other feedback.

Hamilton, ON: Hamilton is infamous for having mainly one-way streets throughout its downtown core. Conversion back to two way streets began in 2002, including John Street and James Street (considered two main north-south arterial roads). The conversions were understood to be politically driven, and the public outreach prior to conversion reached no clear consensus (50% opposed and 50% in favour). Figure 6 provides an indication of a portion of the street environment after the conversion, which features sidewalks, on-street parking (on both sides), two travel lanes, but no dedicated cycling lane.

Figure 6: James Street North (Hamilton, ON)



Although the John and James Street conversions have been viewed as successful by those that supported the original conversion (in terms of being a significant economic development engine), the City of Hamilton has no firm evidence to support either position. Other one-way street conversions are identified in the City's TMP, but these projects have been subject to available funding. Recently, Hamilton City Council approved a motion to create a "one-way to two-way street study team" to report on possible one-way conversions in the downtown area.

St. Catharines, ON: Two years ago (2009/2010), city crews went to St. Paul Street — the one-way commercial spine of downtown St. Catharines — took down the "no entry" signs, painted new lines and opened up a portion of the street to two-way traffic. Figure 7 provides an indication of the street environment prior to and after the conversion. For the segment shown, which is noted to be mid-block and at a pedestrian crossing location, the converted street features one travel lane per direction, on-street parking (one side only), sidewalks, but no dedicated cycling lane.

Figure 7: Mid-Block St. Paul Street (St. Catharines, ON)

Before: one-way street

After: two-way street

It is important to note that James Street in Hamilton and St. Paul Street in St. Catherine are both traditional commercial main streets with street-oriented retail and service uses. It may have been that two-way direction was deemed to have been more appropriate for such a land use, following the theory that two-way streets provide for the best visibility, access and choice when travelling by different modes. It is understood that the conversion achieved the desired outcome of slowing cars down, making the downtown more pedestrian friendly, spurring retail development, and reducing the confusion for visitors.

It also clear in reviewing the literature that there are many examples of North American cities that offer an attractive pedestrian environment even with the presence of one-way street networks. For example, **New York City, NY** features a road network that is almost exclusively one-way streets, and it is considered an extremely vibrant pedestrian environment (and New York City achieves the highest transit share in the US).

Also in **Montreal, QC**, Rue Sainte Catherine and Boulevard de Maisonneuve and others are one-way streets, and are considered very successful commercial streets within the downtown core of the City. In both of these cases, the width of the road, width of sidewalks, presence of on-street parking, access to public transit and most importantly, built form of the buildings on the street, each impact street life far greater than one-way traffic.

It is also worth of mention that Princess Street and Brock Streets in downtown **Kingston, ON** are successful one-way streets. The City has recently invested significantly in the renewal of Princess Street as a one-way street, which may suggest that the City remains confident in the one-way street, the corresponding pedestrian environment and retailing environment.

4.0 THE DOWNTOWN OTTAWA OPPORTUNITY

4.1 Downtown Ottawa Right-of-Ways

For most of the one-way streets in the downtown of Ottawa, the available street ROW width is in the order of 18m. As identified in Section 3, the existing cross sections consist of three or four travel lanes (possibly on-street parking in one lane during off peak times) and sidewalks on both sides. Auxiliary turn lanes are seldom provided at major intersection because they are not essential given the one-way operation (i.e., no conflicting movement in the opposite direction, and turning movements accommodated from one of the two available lanes at intersections). None of the existing one-way streets currently have dedicated, high quality, on-road cycling facilities.

4.2 On-Street Cycling and Pedestrian Implications

One of the findings of the Downtown Moves study is that, when limited to an 18m ROW, and when striving for sidewalks of appropriate width (3m), especially at intersections, it is not possible to have road cross-sections including three lanes of traffic and on-street cycling facilities. It is also concluded that in the downtown environment, for a two-way street, a turn lane is required at most intersections. This is to provide for a basic level of vehicle mobility, but also to enable the movement of emergency services vehicles through a congested or blocked intersection (such as during an accident), as well as transit vehicles and general traffic. This results in a three-lane cross-section at intersections, for two-way streets. However, for one-way streets, it may be appropriate to have only a two-lane cross-section at intersections. If one of the lanes is blocked either by a turning vehicle or an accident, there is an available lane for vehicles to "slip around" the blocked lane, and keep traffic flowing, including buses.

The corresponding conclusion is that, on downtown Ottawa 18m wide streets where a dedicated cycling facility is to be provided and sidewalks are to be of appropriate width, this can most readily be accomplished in a one-way vehicular arrangement. One needs to keep in mind that Laurier Avenue is the odd street in downtown Ottawa, with a 20m ROW. Even with the wider ROW, the current Laurier Bike Lanes experience is that there is not a centimeter to play with. The ROW is completely programmed, and there are no gains for the pedestrian. However, if dedicated cycling is not a requirement and shared use vehicle/cycling lanes are appropriate, then a two-way, two-lane (three-lane at intersections), with ample pedestrian sidewalk space can be accommodated in an 18m ROW.

Figure 8 on the following page shows a two-way street, without cycling facilities, and sidewalks of appropriate width and quality. Figure 9 shows a one-way street, with sidewalks of appropriate width and quality, *and* with a bi-directional cycling facility. This demonstrates the special potential of a one-way street to provide for a high-order cycling facility. It is a question of choices and priorities.

Figure 8: Sample Cross-Section of Two-Way Street

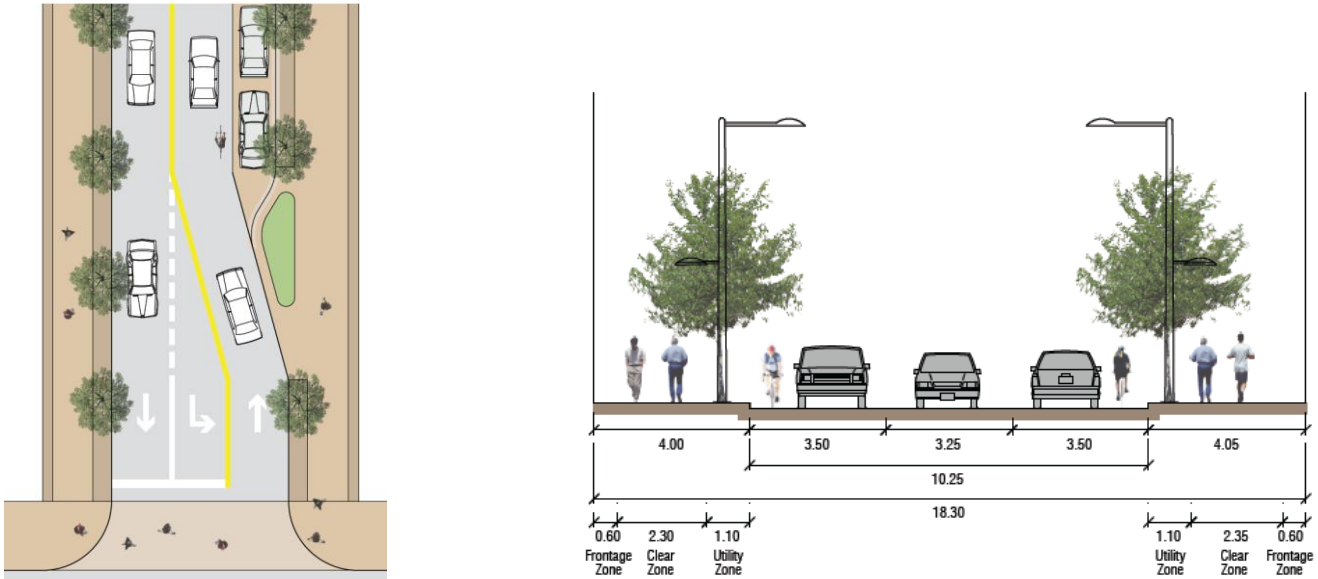
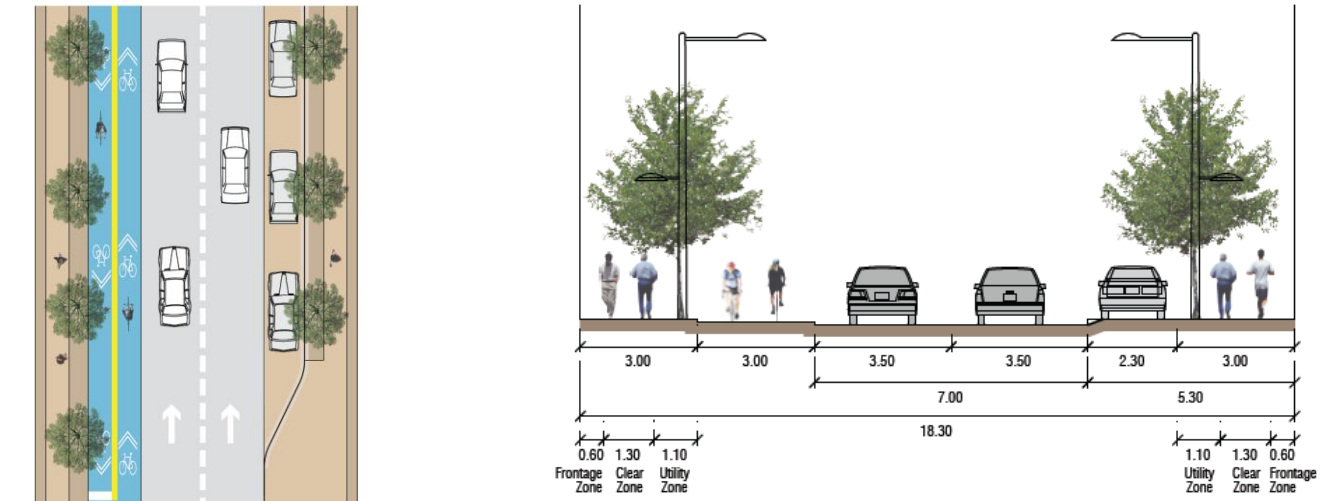


Figure 9: Sample Cross-Section of One-Way Street



4.3 Metcalfe Street – Possible Test Scenario

Metcalfe Street has frequently been discussed as a potential street to convert from one-way to two-way. To further this discussion, a preliminary assessment is offered of hypothetically converting an arbitrary portion of Metcalfe Street (say somewhere north of McLeod and south of Somerset) to two-way operation. According to the analysis northbound Metcalfe Street approaching Somerset operates at a maximum v/c ratio of 0.65, which implies that approximately one third of the available theoretical capacity is not utilized during the critical morning peak hour. Given a conversion of this segment to two-way operation, the existing approximate 18m ROW would permit only a single lane in each direction and the provision of auxiliary left-turns in both directions (3 lane cross-section, similar to existing), plus sidewalks on both sides.

Under this scenario, there would not appear to be sufficient ROW available to provide a dedicated on-road cycling facility, which we recognize to be an important consideration. An approximate one lane worth of northbound traffic (estimated 400 to 600 veh/h) that previously used Metcalfe Street to access downtown would likely be displaced to some combination of Elgin Street, Bank Street and Kent Street. Often the conversions are completed in pairs, which begs the question *could O'Connor Street be converted to two-way vehicular operation to provide additional northbound capacity, with the competing objectives of improving the pedestrian and cycling environment on O'Connor?* Furthermore, if the hypothetical conversion of Metcalfe Street is extended all the way to Wellington Street, *what is the feasibility of converting the existing entrance to the parking facility at the World Exchange Plaza just north of Albert to an outbound ramp? What is the impact on the existing on-street parking?*

Alternatively, Metcalfe Street could be rearranged to provide two continuous lanes northbound, and one lane southbound, by restriping the current lane arrangement, and providing a new traffic signal plant. This arrangement would provide considerable northbound capacity, however turning movements would need to occur from one of the two lanes, as the case may be. In the southbound direction, since there would be only one lane, turning movements may need to be restricted, at least at certain intersections. Again, no cycling facility would be provided.

Also, on-street parking may need to be discontinued. If provided, parking could perhaps be permitted along the curb lane in the northbound direction, but only in off-peak hours.

Clearly, there are many unresolved issues, and the detailed analysis needed to answer the many technical questions is considered beyond the scope of the Downtown Moves Study. Further investigations would be needed as part of a future transportation study that considered vehicular behaviour within the extensive road network of the broader Downtown Moves study context (extending as far south as the Highway 417 Corridor). This is not a trivial task, and would require the development of a detailed dynamic traffic assignment model that is sensitive to the traffic operational issues (i.e., congestion) that are likely to result from the conversion of one-way to two-way streets.

From a more practical perspective, the City may also want to consider a trial conversion in the field, and to explicitly monitor the behaviour of traffic patterns before and after the trial. A possible initial field trial to consider would be to convert Metcalfe Street to two-way operation between McLeod and Laurier. This segment of Metcalfe Street is proposed given the complexities to the south of maintaining effective connectivity with Highway 417 and the existing routing around the Canadian Museum of Nature, and to the north integration of the existing street network with the ramps to/from the World Exchange Plaza. In advance of conducting a trial however, a more thorough feasibility assessment would be needed of the potential costs to: modify the street geometry (i.e., auxiliary turn lane requirements); modify traffic signal control location and settings; and modify on-street parking regulations/signage; etc. within, and adjacent to, the Corridor. Furthermore, public input should be solicited.

5.0 SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

The foregoing high-level assessment has revealed there are valid arguments for both maintaining an existing one-way street network in Downtown Ottawa, and conversely, converting one-way operation to two-way operation for all or some streets.

There are many examples of one-way street conversions in other cities, typically on roads carrying modest traffic volumes, leading to improved commercial and pedestrian environments. Similarly, there are many examples of successful commercial and pedestrian environments within existing one-way street corridors, including in New York City and Montreal. These successes demonstrate that there are likely elements at play other than direction of traffic flow that characterize a successful street such as the width of the roadway, number of travel lanes, width of sidewalks, presence of on-street parking, cycling facilities, access to public transit, the quality of built form and streetscaping along the street, and market conditions.

In the documented instances of one-way street conversions completed in other cities, a desired outcome for a community was often established based on urban planning principles (i.e., better pedestrian environment, improve retail commercial viability, etc.). In most cases, from anecdotal evidence only, the outcome appears to have been achieved. However, there is a surprising lack of quantitative evidence demonstrating the effects of the conversion from one-way to two-way operation. Pedestrian safety appears to be the most-cited metric of before-and-after studies, with many studies claiming a one-way street system was safer. However, other studies claim the exact opposite. The conversions appear to be taking place primarily in retail/mainstreet land use contexts. In short, the technical findings were certainly varied and non-conclusive.

Traditional traffic measures of performance, such as impact to traffic volume, intersection performance, or travel time/delay were not evident in the literature, and therefore it was not possible to learn much from the experiences of previous one-way street conversions in this regard.

In downtown Ottawa's case, the primary one-way street network is considered somewhat unique given the connectivity the subject streets provide to key elements of the region's transportation infrastructure, namely the Highway 417 Corridor and bridge crossings of rivers/canals. It is also worthy to note that the downtown streets with the most mixed and street-oriented land use (Bank Street, Rideau Street, and to some degree, Laurier Avenue), and with high and sustained pedestrian activity, are two-way streets. More importantly, the existing narrow (18m) ROW reality of downtown Ottawa streets creates an added pressure on the streets to operate as efficiently as possible for all modes. Since the vision for Downtown Moves is to pursue streets that can provide wider sidewalks and on-street cycling facilities (on some streets), as well as basic functionality for vehicles and buses, this tends to balance the scales towards one-way operation, provided the very narrow ROW can be re-arranged accordingly.

In regards the street typology established by the Downtown Moves project, and considering the opportunities and constraints of one-way versus two-way street orientation, it is evident that two-way streets are most supportive of:

- Main Streets;
- Ceremonial Streets;
- Downtown Neighbourhood Streets; and
- Showcase Streets.

These are streets that either have street-oriented land uses (such as designated Priority Building Orientation on the Downtown Moves Pedestrian Vision Plan) or where it is important that the visual environment can be appreciated while travelling in motorized vehicles in both directions. This applies to streets like Bank Street, Rideau Street, Elgin Street, and Wellington Street. In general terms, one-way orientation is less important for the very narrow Business Streets in the downtown.

On the other hand, it is evident that one-way streets are most supportive of streets that are identified on the Downtown Moves Vision plans as:

- High Pedestrian Capacity;
- Priority Pedestrian Crossing;
- Green Link;
- Separated (Cycling) Facilities;
- Bus Transit Streets;
- Bus-LRT Interface Blocks;
- Queensway Connecting Streets; and
- Perimeter Connectors.

The common thread of these Vision Plan designations is that that the available 18m ROW needs to be used as efficiently as possible in order to deliver the desired gains either to the pedestrian space or to cycling facilities. The opportunities are greater with one-way operation, given that there is a possibility that the street can operate with just two vehicle lanes in total, particularly at intersections where the desire for improvements to pedestrian mobility are greatest.

Candidates for initial conversion (if any), based solely on a limited selection of existing traffic volumes, would appear to be Metcalfe Street and possibly O'Connor Street. This is provided that the streets are not selected as routes for separated/segregated on-street cycling facilities. As only three vehicle lanes exist on Metcalfe (and two in one location downtown), this becomes an "either or" choice. If converted to two-way and without a cycling facility, the challenge is how to effectively monitor the impacts and benefits of such a conversion.

For monitoring transportation implications, two options are offered. One is to develop a detailed traffic operational model of the study area to simulate driver behaviour (given candidate changes to the network structure), and the other is to conduct a trial implementation in the field and monitor changes to travel patterns. For monitoring urban planning implications will be more difficult, perhaps relying on social research or tracking reinvestment in adjacent properties. This evaluation should be completed before wholesale changes are recommended for the entire downtown.

Finally, it is recommended that the decision-making in regards converting any narrow one-way streets to two-way streets in Downtown Ottawa, including any tests, be informed by a holistic evaluation that addresses not only the transportation considerations, but also matters such as: community liveability, street-oriented land use, and the quality and functionality of the pedestrian, cycling and transit environments. Annex A, attached, provides a useful evaluation matrix to inform this ongoing civic dialogue, building on the Downtown Moves "street typology". It will be enable this street-specific, value-based evaluation, such as the kind of evaluation that may be carried out for an Environmental Assessment (EA) for any "municipal road projects" in downtown Ottawa.

It is important to note that this matrix includes only those "distinguishing criteria", meaning criteria where there is likely to be a difference in rating between a one-way street and a two-way street. For example, the quality of sidewalk surfaces or streetscaping are not included, since those street design considerations are not dependent of the directional arrangement of the street.

This paper and the evaluation matrix demonstrates that decisions regarding one-way versus two-way streets need to be context sensitive and value-based, having regards to the Vision expressed in Downtown Moves, and having special regard to the multiplicity of planned functions and competing interests for the precious and constrained ROW of any given street.

ANNEX A: Evaluation Criteria and Relative Values for Street-Direction Conversions, Using Downtown Moves Street Typology

Comparison Criteria	Measure	Relative Importance/Value By Downtown Moves Street Type					
		Business	Ceremonial	Neighbour-hood	Main	Plaza	Showcase
COMMUNITY LIVABILITY							
Vehicle Speed	Downtown streets with lower vehicle speeds are more-desired places to live and work.	Low	Medium	High	High	N/A	High
Vehicle Noise	Downtown streets with lower street speeds result in less noise and are more-desired places to live and work.	Low	Low	High	Low	N/A	Medium
Air Quality	Downtown streets with superior air quality are more-desired places to live and work. More congestion results in greater emissions and poorer air quality.	Low	Low	High	Low	N/A	Medium
Neighbourhood Cut-through traffic	Street networks that discourage cut-through traffic are more-desired places to live and work.	Low	Low	High	Low	N/A	Medium
STREET-ORIENTED LAND USE SUPPORTIVE							
Business Frontage Visibility	Downtown streets that offer the greatest visibility to street users are more supportive of street-oriented land uses.	Medium	Medium	Low	High	N/A	Medium
Ease of On-Street Parking	Downtown streets that provide ease of manoeuvrability into on-street parking are more supportive of street-oriented land uses.	High	Low	High	High	N/A	Medium
Flexibility to Provide On-Street Parking in Off-Peak Periods	Downtown streets that provide the opportunity for on-street parking in off-peak travel periods are more supportive of street-oriented land uses.	High	Low	High	High	N/A	Medium
Ease of On-Street Loading	Downtown streets that can accommodate loading from the curb lane are more supportive of street-oriented land uses.	High	Low	High	High	N/A	Medium
Ease of Driveway Access	Downtown streets that provide ease of manoeuvrability into driveways are more supportive of street-oriented land uses.	High	Low	High	High	N/A	Medium
SIDEWALK AND CROSSWALK USERS							
Crosswalk Conflicts	Downtown street crosswalks that have the fewest conflicts between pedestrians and vehicles are pedestrian friendly.	High	High	High	High	High	High
Quantity of Vehicles Turning	Downtown street networks that have fewer turning movements at intersections create safer crosswalks.	High	High	High	High	N/A	High
Wayfinding	Downtown street networks that are easy for visitors to navigate promote walkability, transit use, and tourism	Medium	High	Low	Medium	High	Medium
Corner Curb Radii	Downtown streets with lesser curb radii provide shorter crosswalk distances and more staging area for pedestrians	Medium	Medium	High	Medium	N/A	Medium
Universal Accessibility	Downtown Streets that provide for ease of curb-side pick-up are more accessible	High	Low	High	High	N/A	Medium

Comparison Criteria	Measure	Relative Importance/Value By Downtown Moves Street Type					
		Business	Ceremonial	Neighbour-hood	Main	Plaza	Showcase
CYCLISTS							
Cyclist Separation	Downtown streets that provide separation of cyclists and vehicles are more cyclist-friendly	High	High	High	Medium	Low	Low
Access to Curb-Side Bike Parking	Downtown streets that maximize choice and access to on-street bike parking in the ROW are cyclist friendly.	Medium	Low	Low	High	High	High
Safety/Ease of Left-Turn	Downtown streets that provide for protected left-turn movements are cyclist friendly	High	High	Medium	High	Low	Low
BUS TRANSIT							
Route Choices	Downtown streets that can accommodate maximum flexibility of bus routes are preferred	High	Low	Low	Medium	N/A	Low
Turning Movements	Downtown street intersections that provide for bus turns (sufficient radius) provide more route choices	High	Low	Low	Medium	N/A	Medium
Stopping In Lane	Downtown streets that provide for bus stopping in-lane promotes transit priority	High	Low	Low	Medium	N/A	Low
Wayfinding	Downtown bus transit networks that are intuitive (easy to comprehend) for infrequent users require less wayfinding interventions and result in less unnecessary walking to transit stops	High	Low	Low	Medium	N/A	Low
MOTOR VEHICLE TRAVEL							
Network Capacity	Downtown street networks require sufficient capacity for all vehicle modes	High	Medium	Low	Medium	N/A	Low
Direct Travel	Downtown street networks that results in more direct routing (less circling, less VMT) are preferred	Medium	High	Medium	Medium	N/A	Low
Travel Time (Through Trips)	Downtown street networks that provide more-direct through-routes reduces travel time for travellers passing through a community	High	Low	Low	Medium	N/A	Low
Travel Time (Local Trips)	Downtown street networks that result in less out-of-direction travel reduces travel time for travellers moving within a community	High	Low	Low	High	N/A	Low
Wayfinding (Visitors, including LRT users)	Downtown street networks that are intuitive (easy to comprehend) for infrequent users require less wayfinding interventions and result in less unnecessary turning	Medium	High	Low	High	N/A	High
SERVICE VEHICLES AND TRUCKS							
Turning Movements at Intersections	Downtown street intersections need to provide for safe turning movements of a range of vehicle sizes at intersections	High	Low	Medium	High	N/A	Low
Turning Movements at Driveways	Downtown streets need to provide for safe turning movements of a range of vehicle sizes into major driveways and service areas	High	Medium	Medium	High	N/A	Low
Vehicle Stopping in Curb Lane	Downtown streets that provide for emergency or short term stopping in curb lanes provide for greater level of service and accessibility	High	Low	High	High	N/A	Medium