



Appendix F: Detailed Assessment of Intersection Design Alternatives

Note: It should be noted that the Intersection Assessment was completed based on Exhibits 5-9 and 5-10 in Section 5.4 of the Environmental Study Report. The signalized intersections alternative (Alternative 1) was subsequently identified as preferred and was further refined as shown in the Recommended Plan in Chapter 6 based on input from stakeholders. Despite the refinement of the signalized intersection in the Recommended Plan, this should not change the outcome in the evaluation between the signalized intersections and roundabout pair alternatives.

Legend

More Preferred	
Equally Preferred	
Less Preferred	

Factors	Criteria	Alternative 1 Signalized Intersections	Alternative 2 Roundabouts Pair
Socio-Economic Environment			
Property and Access	Impacts to properties	Bradford St/Tiffin St NW quadrant: - Seven (7) properties will be directly impacted (buy-out) - 252, 250, 248 and 246 Bradford Street, and 34,32, 30 Tiffin Street) - Five (5) properties will have frontage impact – 244 Bradford Street, 44/46, 40, 38 and 36 Tiffin Street Bradford St/Tiffin St SW quadrant: - The west leg of the intersection will generally retain the existing alignment of Tiffin Street. With the addition of active transportation facility, there will be some property impact along the frontage of properties on the south side of Tiffin Street; there will be no direct impact to the existing buildings. Between Bradford St and Lakeshore Road north side: - The segment of road between the two intersections will generally follow the existing road alignment. The channelized right configuration and active transportation facilities will generally with within the existing road ROW with minor encroachment in the northwest corner of Lakeshore Road and Tiffin Street. Between Bradford St and Lakeshore Road south side: - There will be limited impact to properties on the south side between Essa Road and the GO Access, as the road alignment between the intersections will generally following the existing road alignment. The addition of active transportation facilities will have some frontage impact to existing property.	Bradford St/Tiffin St NW quadrant: - Seven (7) properties will be directly impacted (buy-out) - 44/46, 40, 38, 36, 34, 32, 30 Tiffin Street - Five (5) properties will have frontage impact – 252, 250, 248, 246 and 244 Bradford Street Bradford St/Tiffin St SW quadrant: - The west leg of the roundabout will be shifted away from the properties, however, both existing buildings will be directly impacted by active transportation facilities. Between Bradford St and Lakeshore Road north side: - The two roundabouts and the active transportation facilities will be shifted to the north and utilize area existing ROW. A portion of the Lakeshore Road / Tiffin Street roundabout will encroach in previously undisturbed area. Between Bradford St and Lakeshore Road south side: - There will be limited impact to properties on the south side between Essa Road and the GO Access, as the roundabout configurations including the active transportation facilities are largely to the north of the existing ROW. Lakeshore Road / Tiffin St NE quadrant:

Factors	Criteria	Alternative 1 Signalized Intersections	Alternative 2 Roundabouts Pair
		Lakeshore Road / Tiffin St NE and SE quadrants: - No changes to existing conditions. <i>*Note: The potential property impact noted above are based on a conceptual intersection design plan. Additional property may be required to accommodate additional turning lane / storage, feasibility of transit priority measures, as well as grading requirements (for example, there is a heavy transit movement from Tiffin Street onto Essa Road). These design elements will be explored further in the next phase (i.e., design phase) of the EA Study should the intersection option be identified as preferred.</i>	- Due to the heavy right turn volume from Tiffin Street onto Lakeshore Road, a channelized configuration is provided. This resulted in a shift of the existing active transportation facility. Lakeshore Road / Tiffin St SE quadrant: - A portion of the roundabout together with the active transportation facilities will encroach onto the property of the Allandale Station. <i>*Note: The potential property impact noted above are based on a conceptual roundabout design plan. Additional property may be required to accommodate additional turning volumes, feasibility of transit priority measures under a roundabout condition, as well as grading requirements (for example, there is a heavy transit movement from Tiffin Street onto Essa Road). These design elements will be explored further in the next phase (i.e., design phase) of the EA Study should the roundabout option be identified as preferred.</i>
	Impacts to accesses	Bradford St/Tiffin St NW quadrant: - Reconfiguration to driveway at five (5) properties (244 Bradford Street, 44/46, 40, 38 and 36 Tiffin Street); access to 38 and 36 Tiffin Street will become right-in/right-out only due to the median. Bradford St/Tiffin St SW quadrant: - Access to existing parking to the plaza will remain. Between Bradford St and Lakeshore Road north side: - N/A Between Bradford St and Lakeshore Road south side: - Access to properties on the south side will become right-in/right-out only due to continuous centre median. Lakeshore Road / Tiffin St NE and SE quadrants: - N/A	Bradford St/Tiffin St NW quadrant: - Reconfiguration to driveway at five (5) properties (252, 250, 248, 246 and 244 Bradford Street); access to 252, 250 and 248 Bradford Street may be limited to right-in/right-out only proximity to the roundabout. Bradford St/Tiffin St SW quadrant: - Access to existing parking to the plaza will remain. Between Bradford St and Lakeshore Road north side: - N/A Between Bradford St and Lakeshore Road south side: - Access to properties on the south side will become right-in/right-out only due to continuous centre median. Lakeshore Road / Tiffin St NE and SE quadrants: - N/A
Community Impacts	Impacts to community features	- Parkette at Tiffin Street / Bradford Street would need to be relocated to accommodate improvements. Potential to relocate to northeast quadrant of intersection.	- Parkette at Tiffin Street / Bradford Street would need to be relocated to accommodate improvements. Potential to relocate to northeast quadrant of intersection.

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Factors	Criteria	Alternative 1 Signalized Intersections	Alternative 2 Roundabouts Pair
	Noise Impacts	- More vehicle delay and acceleration/deceleration through the signal cycles may increase noise impacts compared with roundabouts.	- Less vehicle delay and acceleration/deceleration by vehicles at the roundabout may have less noise impacts compared with signalized intersections.
City Policies and Priorities	Compatible with City objectives, goals, and policies	- City's overall goal and vision is to support multi-modal use and efficient people and goods movement. - Some level of vehicle congestion may encourage shift to use other modes of transportation (walking, cycling, transit, etc.)	- While the City does not have a specific policy re: implementation of roundabout, City's overall goal and vision is to support multi-modal use and efficient people and goods movement. - The roundabout will accommodate all modes of transportation for pedestrians, cyclists, transit and vehicular traffic
Context-sensitive design	Compatible with planned land use transformation and key designations (Mobility Hub, Lakeshore/Waterfront)	- Land use in the proximity of the intersection of Bradford Street / Tiffin Street / Lakeshore Road are largely designated for high density with the implementation of a community hub at the Allandale GO station. - A signalized intersection will have a smaller overall physical footprint which will lead to a more "compact" environment which is more complementary to the future land use and built form. Buildings and development in the area will be in closer proximity to each other and may be more desirable from a human scale perspective, (i.e., less physical distance between establishment on opposite sides of the intersection, therefore, less distance travelled for pedestrians and cyclists). - In the downtown area and high-density development context, it is expected that there will be greater pedestrian and cyclist movement, as well as general accommodate for active transportation. Per above, a more "compact" footprint from a signalized intersection may be more desirable from a human scale and movement perspective.	- Land use in the proximity of the intersection of Bradford Street / Tiffin Street / Lakeshore Road are largely designated for high density with the implementation of a community hub at the Allandale GO station. - The roundabout has a larger physical footprint which would result in greater distance between Buildings and development in the area on opposite side of the intersection. While a roundabout may have a less "compact" design, vehicles travelling through the roundabout are required to slow down. - There are examples of single roundabout functioning as "placemaking" for local communities. It is expected multi lane roundabouts may also serve a similar function with the exception that there will be more pavement area. - In the downtown area and high-density development context, it is expected that there will be greater pedestrian and cyclist movement, as well as general accommodate for active transportation. Per above, a roundabout design has a larger physical footprint and may be less desirable from a human scale and movement perspective.
	Community Expectation	- More familiar to users - Aging population / user expectation	- Less familiar to users - More public education and outreach
Streetscape / Landscape	Opportunity to enhance streetscape / landscape (furnish street with functional and aesthetic items that provide amenities to users and create gateway to downtown / Lakeshore)	- Aesthetic treatments and gateway feature to Lakeshore and downtown will be provided outside of the area of the immediate to the intersection (e.g., in the relocated Parkette at Tiffin Street). - More accessible to streetscape features	- Within the central island of the roundabout, there are opportunities for aesthetic treatments (monuments, landscaping, etc.) to create a gateway feature to Lakeshore and downtown. - Visually, the features may be easier for those passing through the roundabout to observe. - Signifies change in driving environment between Tiffin Street / Lakeshore Drive / Bradford Street - Less accessible to streetscape features in the central island

Factors	Criteria	Alternative 1 Signalized Intersections	Alternative 2 Roundabouts Pair
Socio-Economic Environment Summary		- Both the alternatives will result in significant impact to properties, particularly in the northwest and southwest quadrants. However, the signalized intersection will have a smaller physical footprint which would lead to a more “compact” build form. This is deemed to be more complementary to the future intensification and redevelopment. - Alternative 1 is more familiar to users and may be easier to navigate for an aging demographic. Alternative 2 would require a high level of public education and outreach and may still be perceived as a barrier to segments of the community. - While both Alternatives have potential for streetscaping and aesthetic enhancement of the area, the opportunities around Alternative 1 are more accessible by the community. Landscaping within the centre of the roundabout will be attractive but is not generally accessible or useable. Per above, Alternative 1 is considered more suitable from a socio-economic perspective.	
Cultural Environment			
Built cultural heritage	Impacts to Cultural Heritage Resources (# / area of property)	- The flagpole and the commemorative stone marker at the intersection of Bradford Street / Tiffin Street NE quadrant will be directly impacted and will have to be relocated. 252, 250, 248, 246 will result in direct property impact; properties are identified as Potential Cultural Heritage Landscape 34, 32, 30 Tiffin Street will result in direct property impact; properties are identified as Potential Cultural Heritage Landscape	- The flagpole and the commemorative stone marker at the intersection of Bradford Street / Tiffin Street NE quadrant will be directly impacted and will have to be relocated. 44/46, 40, 38, 36, 34, 32, 30 Tiffin Street will result in direct property impact; properties are identified as Potential Cultural Heritage Landscape - Will result in an edge impact to the Allandale Station lands – no impact to the building will occur.
Archaeology	Impacts to Archaeological Features (# / area of property)	Areas in the proximity of the intersection are generally disturbed by previous activities; however, construction monitoring is required.	Areas in the proximity of the intersection are generally disturbed by previous activities; however, construction monitoring is required.
Cultural Environment Summary		- Both the alternatives will result in direct impacts to properties that have been identified as Potential Cultural Heritage Landscapes. In both cases, further evaluation of heritage resources will be completed and all process and documentation requirements under the Ontario Heritage Act will be met. - Alternative 2 is likely to have an edge impact to the Allandale Station lands. Impact to this designated heritage property will require additional heritage process, documentation and mitigation measures, under the OHA. - Potential for archaeological values will be addressed in both Alternatives. Therefore, Alternative 1 is slightly more desirable in the context of cultural environment.	
Natural Environment			
Natural Environment Features	Potential impacts to terrestrial and aquatic species and habitats, including Species at Risk	N/A - There are no natural environment features in the proximity of the intersection.	N/A - There are no natural environment features in the proximity of the intersection.
Climate Change Considerations	GHG emissions	Vehicles generally come to a complete stop at a queue. This may increase overall emissions by increasing the number of acceleration/deceleration cycles and time spent idling compared with roundabouts.	Vehicles continue to advance slowly in moving queues rather than coming to a complete stop. This may reduce emissions slightly by reducing the number of acceleration/deceleration cycles and time spent idling.

Factors	Criteria	Alternative 1 Signalized Intersections	Alternative 2 Roundabouts Pair
Natural Environment Summary		Alternative 2 is preferred from an air quality perspective since roundabouts will have less “stop and go” traffic and therefore slightly lower emissions loading compared to a signalized intersection. Alternative 2 is considered to be more preferred under Natural Environment (based on potential impact to air quality).	
Transportation			
Traffic Operations	Peak Capacity (Operational Efficiency)	- Intersections operate beyond capacity causing higher delay during peak hours in 2051	- Roundabouts operate with sufficient capacity to accommodate demand during peak hours in 2051 and has lower delay. When operating at capacity, roundabouts typically operate with lower vehicle delay.
	Off Peak Capacity	- Intersections operate with sufficient capacity during off-peak hours in 2051	- Roundabouts operate with sufficient capacity during off-peak hours in 2051. Generally, roundabouts are more efficient than signalized intersections off-peak due.
	Queue Storage	- Potential for traffic queue spillback due to close spacing between intersections. Signal timing may help manage queue length between intersections.	- Roundabouts balance traffic flows and manage queue lengths between intersections. Less potential for traffic queue spillback between intersections compared with signalized intersections.
Traffic Safety	Collisions	- More potential for severe (high-speed angle and turning movement) collisions for all users.	- Less potential for severe collisions for all users due to lower speeds, no left-turn conflicts, and fewer overall conflict points.
	Speed Control	- Overall traffic speeds will be higher compared with roundabouts.	- Speed control can be realized at all times of day due design elements that cause drivers to slow down.
Emergency Response	Priority	- Opportunity to provide explicit priority to emergency response vehicles.	- Cannot provide explicit priority for emergency response vehicles; however, emergency vehicles will have ROW.
Active Transportation	Safety	- Pedestrians are vulnerable to unprotected (higher speed) left-turn movements. - Longer crossing distance (also having to cross traffic in both directions) exposes users to vehicles for more time compared to roundabout	- Pedestrians will only have to consider one direction of conflicting traffic at a time (splitter island provides refuge) - Shorter crossing distance minimizes exposure to moving traffic. - Crosswalks are located back from circulatory roadway placing pedestrians in a more visible location. - Multi-lane crash threat when driver in first lane stops to yield to a pedestrian blocking the sight lines between the pedestrian an any vehicles in the next lane
	Comfort and Security	- Offer guidance to pedestrians and cyclists by providing visual and audible pedestrian signal indications – decision making process for pedestrians requires less judgement. This can provide a false sense of security to users (e.g., This still require pedestrian to “double check” to ensure a safe crossing condition). - More familiar configuration to pedestrians and cyclists - Crossing may require more waiting time depending on signal phasing. - Potential for less out-of-way travel due to more compact footprint compared with roundabout. Path of travel depends on origin/destination of pedestrian or cyclists.	- Pedestrian and cyclists are responsible for judging crossing opportunity. - May be unsettling to pedestrians and cyclists depending on age, mobility, visual impairment, or ability to judge gaps in traffic. - Experienced and skilled on-road cyclists may be comfortable travelling through roundabouts like other vehicles. Roundabouts slow drivers’ speeds reducing high-speed conflicts. - Crossing may be accomplished with less waiting time. - Potential for more out-of-way travel due to large footprint and location of crosswalks
Transit	Priority	- Opportunity to provide transit signal priority. - Opportunity to provide transit priority lane.	- Not configured to provide transit signal priority. Transit vehicles will operation with mix traffic. - There may be opportunities to provide transit priority lane through centre of roundabout.

Factors	Criteria	Alternative 1 Signalized Intersections	Alternative 2 Roundabouts Pair
	Potential Future Higher Order Transit	- Conventional treatments can be applied to signalized intersections to safely accommodate potential future higher-order transit.	- Less conventional treatments can be applied to roundabouts to accommodate higher-order transit. Roundabout management may change, which can have consequences on driver behaviour. - In general, higher-order transit runs through the centre of the roundabout. The roundabout works conventionally when transit vehicles are not present. Traffic lights are provided where the road crosses the tracks to give transit vehicles priority when the approach the roundabout. Adequate visibility, perception by pavement, markings, and signs, protection by separation, and roundabout size must be considered.
Accessibility		- Dedicated cross ride and crossing marking for cyclists and pedestrians. - Signals may provide audible signal indications for accessibility needs.	- Wayfinding – pedestrians with visual impairment may have trouble finding crosswalks because crosswalks are located outside the projection of approaching sidewalk and the curve linear nature of roundabouts. A landscape strip or detectable edge treatment between sidewalks and roundabout can help lead all pedestrians to a crosswalk. - Alignment – roundabouts do not typically include the normal audible and tactile cues used by pedestrians with vision impairments to align themselves with the crosswalk. This can be simplified if sidewalk ramps, and splitter island cut-through walkways are aligned with crosswalk and if detectable warnings are installed on curb ramps and splitter islands. - Gap and yield detection – difficult to determine by sound along whether a vehicle has stopped or intends to stop. Potential treatments include installation of accessible (audible) pedestrian signals and rectangular rapid flashing beacons.
Transportation Summary		• Alternative 2 is technically more preferred from traffic operations and safety perspectives (safety statistics). • Alternative 1 may be perceived as being easier to access, navigate by pedestrians and cyclists, and therefore may be preferred from the perception of comfort and security. • Roundabouts are less familiar to most drivers, contributing to the perception of pedestrians and cyclists of driver behaviour being unpredictable. • From an accessibility perspective – Alternative 1 is typically considered more accessible to visual and hearing impaired. While treatments are available to make roundabouts more accessible, a multi-lane roundabout will be challenging. • Alternative 1 is better able to accommodate transit priority measures (e.g., transit-only lanes, transit signal) • Alternative 1 provides more direct connections for pedestrians and cyclists. Alternative 2 may involve more out-of-way travel or may require two-way crossings which is atypical for roundabouts. Per above, from an operational and safety perspective, Alternative 2 is considered to be more preferred; however, from an accessibility, ability to accommodate transit priority measures and user familiarity perspective, Alternative 1 is preferred.	
Technical Considerations			
Constructability	Efficiency and ease to construct	Less complex design	Overall, more complex design and more challenging to construct due to location of roundabouts near existing intersections and required traffic control.

Factors	Criteria	Alternative 1 Signalized Intersections	Alternative 2 Roundabouts Pair
Construction Staging	Construction duration and disruption	Shorter construction duration and less disruption to traffic as construction may be staged by shifted traffic from one side of the road to another while maintaining traffic operation.	Likely to expect multi-year, multi-stage project with longer construction duration and more disruption to traffic compared with signalized intersections.
Cost	Capital Cost (High Level Cost Estimate)	~ \$3.3M	~ \$4.5 M
	Operations and Maintenance Cost (assume 20-year)	~ \$115K Operational and maintenance cost include traffic signal maintenance and that a complete re-build of the traffic signal will be required beyond the 20-year horizon.	~ \$46K Operational and maintenance cost associated with the central island.
Technical Considerations Summary		- Alternative 2 is expected to cost less in ongoing operation and maintenance cost. - Alternative 1 is expected to cost less in terms of capital cost and is generally less complex in construction.	