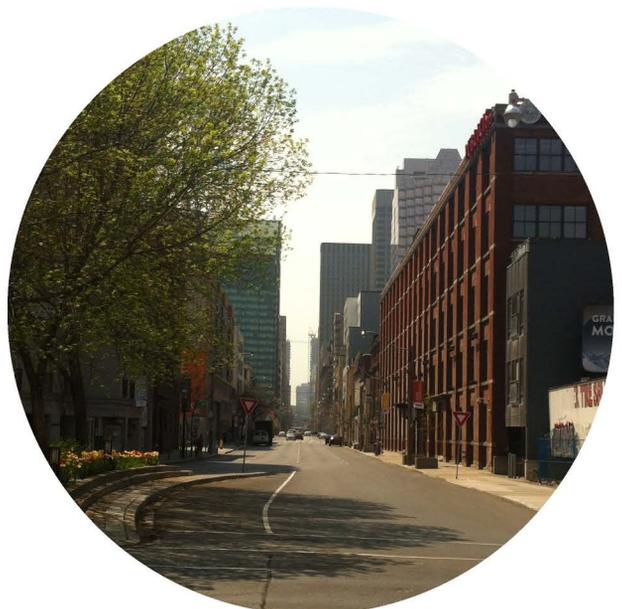


RELIEF LINE INITIATIVE SUBMISSION

JUNE, 2015

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Acknowledgements

This document is submitted on behalf of Transport Action Ontario, whose board of directors were involved in input for and review of its content. As Transport Action Ontario's representative on the Stakeholder Advisory Group for the Relief Line Initiative and the author of this submission, I would like to thank the following from Transport Action Ontario for their contributions and time in reviewing the content:

- Peter G. Miasek, PhD, President
- Bruce F. Budd, Secretary
- Kenneth Westcar, Director

As a submission for the City of Toronto regarding a City of Toronto project, imagery from City of Toronto resources have been used to provide supporting illustrations with the text in this submission. Some of the materials from the Relief Line website have been rich in information and were very helpful in enabling the development of this submission. In addition, the City of Toronto's interactive mapping [Geographic Information System] site was also used for ortho [satellite/aerial] imagery as well as contour maps. Thanks to the City for making such useful and informative resources available to the public in this important process.



Executive Summary

The current evaluation framework for the Relief Line station locations is focussed largely on the urban planning aspects and related policy goals. Transport Action Ontario believes that the constructability of the alignment and the capital costs are also influential parameters for whether the project proceeds, and therefore require heavier consideration early in the process.

Key alignment considerations include:

- TTC geometry standards as related to radius and tangent minimums while avoiding deep building foundations at the same time
- The crossing of the Don River, where an elevated crossing carries less risk than would a tunneled crossing
- Optimizing the interchange with the Bloor-Danforth line by avoiding a near-perpendicular intersection between alignments to provide superior circulation for transfers within the interchange
- How the surface feeder network relates to the Relief Line, where a Broadview Ave terminus offers advantages to optimizing the bus network in a way that alleviates the Bloor-Danforth line
- A connection to the Greenwood yards and shops; Broadview's triple-track structure east of the existing station could be re-purposed for non-revenue movements to/from the Relief Line while causing minimal property impact
- Crossing downtown without severely disrupting existing transit services for a prolonged period; Adelaide St or Wellington St provide the least disruptive opportunities

Based on these factors, two constructible alignments emerged. Which is preferred depends on policymakers' weighting regarding a connection between the Relief Line and SmartTrack/Regional Express Rail, as well as the Lever site:

- The "Sackville St Alignment," which runs from University Ave and Adelaide St W to Broadview Ave and Mortimer Ave using a direct route.



- The “River St Alignment,” which runs from University Ave and Wellington St W to Broadview Ave and Mortimer Ave via a connection with SmartTrack and the Lever site.

Both alignments have viable future extensions to the north from Mortimer Ave and to the west from University Ave.

Regardless of which alignment is chosen, it is important that planning for the Relief Line coordinate with ongoing work for the expansion of the streetcar system, so that both are working together and not competing for ridership. The evaluation needs to treat the system as a network.

The most important criterion, however, remains the constructability of the project. The alignment, and all the constraints that it is subject to, will be more influential on the location of the stations than the preferred locations of stations will be on the alignment.



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1. Introduction

Transport Action Ontario (TAO) is a non-government organization that advocates for passenger and freight transportation that is economically, socially, and environmentally sustainable. TAO has been active for 39 years, most of that time under its previous name, Transport 2000 Ontario. TAO is pleased to be a part of the Stakeholder Advisory Group for the Relief Line Initiative.

TAO believes that the Relief Line is an urgent project important to the Toronto Transit Commission (TTC) subway network's future growth and sustainability, including the alleviation of existing system bottlenecks currently under excessive stress. It is noted that the focus to date has been on the planning considerations for determining station locations, along with the evaluation criteria. However, certain other factors could be especially influential in whether this important project moves forward.

TAO is concerned that the planning considerations related to the selection of Relief Line alignment and stations need to be tempered by a more up-front consideration of constructability. Constructability is a criterion the city has identified, but it is felt by TAO that it needs to be more prominent in a project as unusually complex as the Relief Line. Related to the constructability for the Relief Line specifically is the cost of the project due to the political unpopularity of spending money on downtown Toronto, particularly among senior levels of government.

While the line needs to have a thoughtful and considered alignment in order to achieve both the ridership and the other policy goals impacted and/or influenced by rapid transit projects that the City desires, the combination of cost and a downtown location is a concern for getting the project funded. In order for anything to get built, it will have to have a defensible cost, and by extension the Relief Line has to be as short as practical.

The shortest alignment within the study area would connect the Relief Line with the Bloor-Danforth subway at the Broadview station. TAO believes that constructability among other considerations discussed in this submission make the Broadview station connection, along with Broadview Ave north of Danforth Ave, very favourable for the Relief Line.

2. Key Alignment Considerations

2.1. Geometric Constraints

On constructability, the issue of subway track geometry is paramount, because the TTC demands a minimum radius of 300 metres for main line track curvature. Additionally, the TTC requires an absolute minimum of 46 metres of tangent between curves, and prefers 150 metres of tangent. These TTC geometry standards create complications with the City's preference of keeping new rapid transit tunnels beneath existing municipal rights-of-way.

The broader central area of Toronto is densely developed, with many large buildings with very deep foundations spread out across the study area. Central Toronto is built predominantly on a grid-based roadway network, with few large open green spaces. This creates high potential for significant technical challenges, in some cases comparable to those that have been encountered in other jurisdictions such as London, UK, which has built new rapid transit infrastructure beneath large, very old, and even very vibration-sensitive structures.

In a built-up environment such as old Toronto, there will inevitably be many constraints on alignment alternatives, especially when dealing with curves along either the subway geometry below or the roadway geometry above. Going very deep to try to pass beneath larger structures with deeper foundations could add significant cost from considerably deeper stations, not to mention minimization of settlement of existing structures that may require treatments such as jet-grouting¹. TAO therefore has concerns with the rationale/sequencing of the station locations consultation, which is currently detached from constructability.

¹ Injecting grout into the ground by hose-like equipment to turn soil into a much more structurally solid state

2.2. Crossing the Don River

The looming challenges associated with the crossing of the Don River are already acknowledged by the City. The Don River has an industrial history dating back to the late 1800s, a time with very few environmental controls or concerns. As such, nobody is really sure what lies along and beneath the riverbed today – it has been said that some are afraid to find out.

This history creates substantial uncertainty about what may be involved in trying to go underneath the Don River, including the depths required of the tunnel. There could also be significant concerns about the environmental condition of the spoil² collected from beneath the Don River, which could require decontamination treatments or secure landfill storage.

There is likely a substantial incentive in going above the river, instead of below, to reduce uncertainty and environmental risk, thereby potentially bringing significant savings on capital cost.

² Excavated soil from a tunnel boring machine

2.3. Transfers from the Bloor-Danforth Line

One of the key considerations will be the ability of the Relief Line transfer station with the Bloor-Danforth line to efficiently handle large volumes of transferring passengers. Any opportunity to avoid reproducing problematic layouts like what exists today at the Bloor-Yonge station would have significant value. The Bloor-Yonge station experiences constraints in its accommodation of transfer volumes due to the near perpendicular layout of the interchange as shown in Figure 1. **This is not a detailed design issue**; it is a fundamental issue of the alignment design as it revolves around the angle of intersecting subway lines.

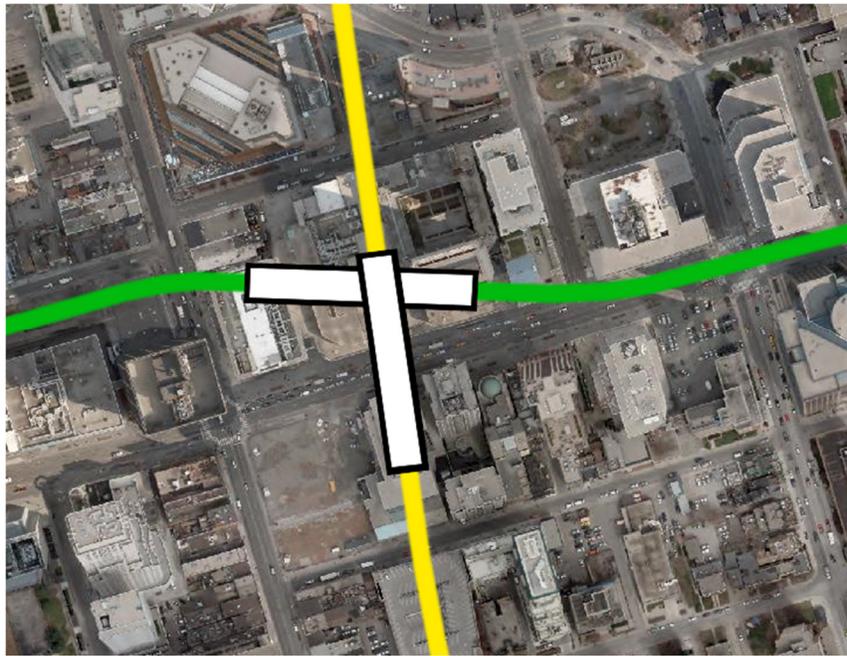


Figure 1 - Bloor-Yonge General Arrangement

The Bloor-Yonge station's constraints are caused by three phenomena:

1. Bloor-Danforth passengers wishing to go southbound are required to access the Yonge line from the west end of the Bloor-Danforth platform while northbound passengers must use the east end of the Bloor-Danforth platform
2. All Yonge line passengers, regardless of direction, must access the Bloor-Danforth platform from the north end of either of the Yonge line platforms
3. Both halves of the Bloor-Danforth platform must be shared between four directions of transfer. These fall into two main groupings:

- a. The west half of the Bloor-Danforth platform is shared between south-to-west, south-to-east, east-to-south, and west-to-south transfers, all using only two stairwells.
- b. The east half of the Bloor-Danforth platform is shared between north-to-west, north-to-east, east-to-north, and west-to-north transfers, all using only two stairwells.

These constraints serve as choke points for the passenger transfer volumes. It is a better situation at St George where all directions can be distributed across all stairwells along the full length of both platforms, allowing for the maximum number of alternative routes through the interchange to make a transfer between lines.

Perpendicular crossings of subway alignments are undesirable and would best be avoided wherever possible; the closer to parallel two subway alignments cross, the better the interchange station's transfer passenger distribution and circulation. It is recognized that a parallel arrangement such as St George will not be feasible since St George was only

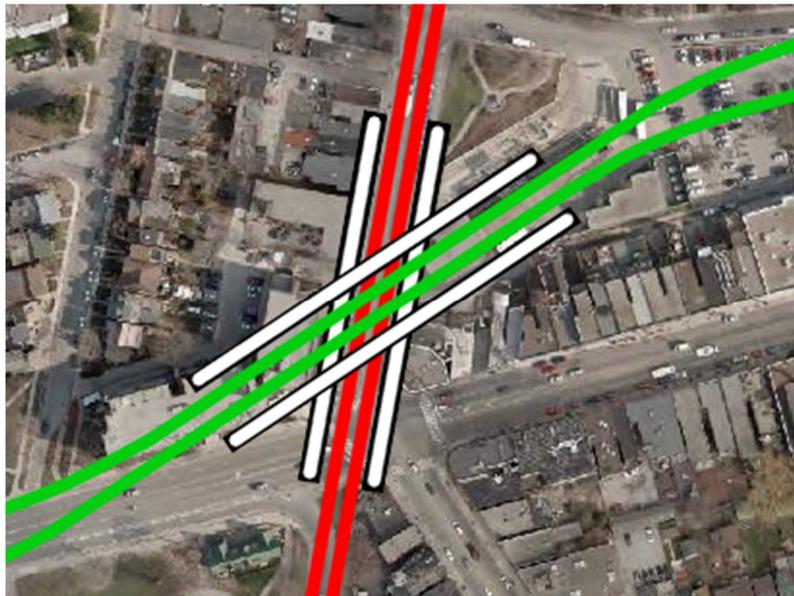


Figure 2 - Broadview-Danforth Station General Arrangement

possible because both levels were built together as a single project/structure³, but a near-perpendicular arrangement can be avoided by having the interchange at the Broadview station. At the Broadview station, the angle between intersecting lines would be in the neighbourhood of 45 degrees, as shown in Figure 2, which presents a significant opportunity for the Relief Line.

³ The Bloor-University Subway was a single project approved in the late 1950s

2.4. The Surface Feeder Network

At least as important as the Bloor-Danforth connection to the Relief Line are the relationships the Relief Line will have with the feeder⁴ bus system, especially in the Old East York⁵ area. This applies both to the Relief Line's initial phase and to its subsequent extension(s). Streetcar connections will also be important, but they do not meaningfully impact the subway system's capacity whereas the buses that connect to the Bloor-Danforth or Yonge lines do as direct, peak direction feeder services.

Broadview Ave is currently a trunk route of sorts for buses, as the Mortimer, Cosburn, Flemington Park, and Broadview bus services converge upon it. All of these bus services are also present at the intersection of Broadview Ave and Mortimer Ave, a location within the study area and where the final stop for the first phase of the Relief Line could be located.

To divert some bus traffic from the Yonge subway, the option would be available to reroute the Bayview and Leslie buses to the intersection of Mortimer Ave and Broadview Ave to connect with the Relief Line instead. This can be done while maintaining service to other areas. In the case of the Leslie service, the Eglinton-Crosstown Light Rail Transit line will be in operation years before the Relief Line and so is no longer necessary for it to serve the Yonge St to Laird Dr portion of Eglinton Ave E. In the case of the Bayview service, only the Davisville Ave portion would be affected, which has its own dedicated route running between Yonge St and Bayview Ave that could have its frequency increased as necessary to compensate for the rerouting of the Bayview service.

⁴ A bus or streetcar service from which most passengers transfer to the subway, typically the last bus stop

⁵ Bounded by the Don Valley to the west, Massey Creek to the north, Victoria Park to the east, and an frequently jogged southern boundary between Danforth Ave and Mortimer Ave.

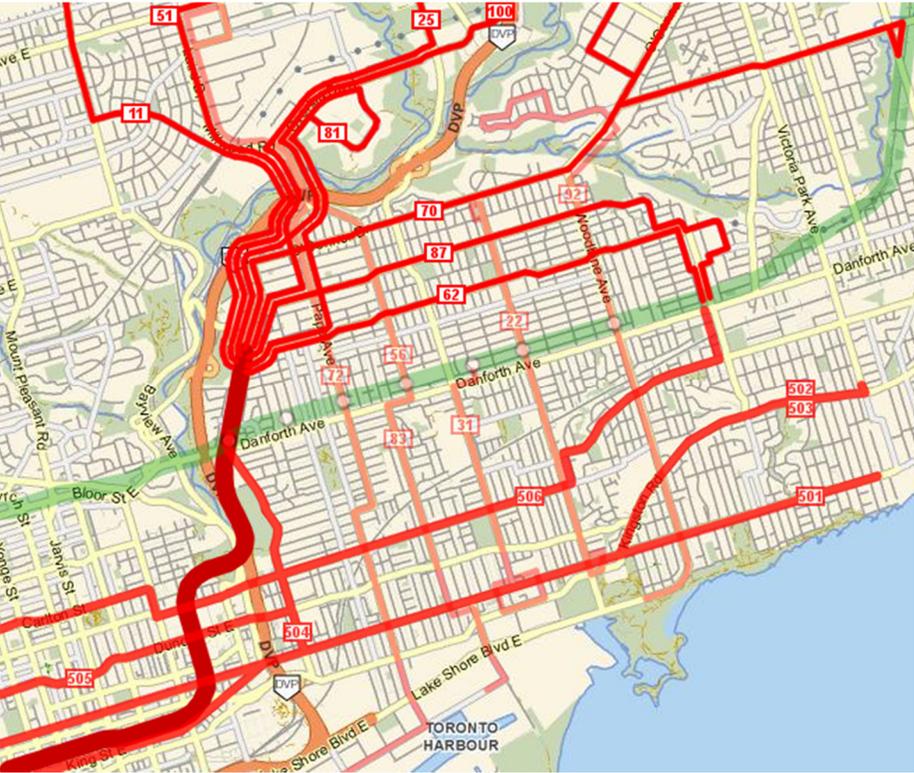


Figure 3 – Conceptual Surface Feeder Network for the Relief Line

Other buses serving the Old East York area could also be rerouted away from the Bloor-Danforth subway to the Relief Line. In particular, several opportunities can be created by extending the Pape, Coxwell, and Woodbine South buses north of Danforth Ave, either to O'Connor Dr or a short distance north

of O'Connor Dr. This would allow a number of changes to become possible, all of which would increase connectivity with the Relief Line while providing needed alleviation to the Bloor-Danforth subway. These changes, summarized visually in Figure 3, include:

1. Limiting the feeder network catchment area of the Bloor-Danforth line between Woodbine Ave and Broadview Ave to be predominantly within the Old East York boundaries, thereby alleviating demand on the Bloor-Danforth subway.
2. Rerouting the Thorncliffe Park and Don Mills bus services off of Pape Ave at either Cosburn Ave or Mortimer Ave to connect with the Relief Line, while the northerly-extended Pape bus serves the Pape corridor proper to replace service lost or as appropriate to reflect changing travel patterns from the Relief Line.
3. Merging the Broadview and O'Connor bus services into a single route while the northerly-extended Coxwell bus service replaces service lost by the O'Connor rerouting off of Coxwell. The extended Coxwell bus service could use the same loop that is used today by the Broadview bus.

4. The Woodbine corridor is served by two services: “Woodbine” north of Danforth Ave and “Woodbine South” south of Danforth Ave. Except for the primary (“A”) branch of the “Woodbine” service, most of the branches’ routing are not actually on Woodbine Ave proper. The O’Connor bus service could merge with the “non-Woodbine” portions of the non-primary “Woodbine” branches (“B,” “C,” and “D”) into a single service, with various branches. The “Woodbine South” service could merge with the primary (“A”) branch of the “Woodbine” service, thereby simplifying service along the Woodbine Ave corridor by having the same route north and south of Danforth Ave.

The terminal station at Mortimer with the bus connections described above could see strong feeder traffic relative to other terminal subway stations, as illustrated in Table 1. This highlights the importance of having the Mortimer station as a part of the initial phase of the Relief Line in order to have subway-to-subway transfers and subway-to-bus transfers at separate stations. Under normal operating conditions, this will help maintain manageable transfer passenger volumes within a given station complex.

AM Peak Buses/Hour by Subway Terminal Station				
Kennedy	Mortimer	Kipling	Don Mills	Downsview
108.7	95.6	86.5	81.1	76.6

Table 1 - Estimated Buses per Hour at Subway Termini

From the east, streetcar services along Gerrard St E and Queen St E are expected to be key links with the Relief Line because of their termini being farther east than other streetcar services, at Main St and Victoria Park Ave [Neville Park Blvd], respectively. The King streetcar may not even have a direct connection with the Relief Line, but it will certainly see alleviation from the Relief Line as they share common territory at Broadview and Danforth, and again at a location closer to downtown. The King streetcar will still be required to serve a local ridership for which the Relief Line is poorly oriented to serve. This is expected to be synergistic by rebalancing the distribution of the longer distance riders coming in from other routes (bus or subway), and local riders whose trips start on the streetcar (e.g. along Broadview Ave south of Danforth Ave), to their best-suited modes.

2.5. Yard Connection

The Relief Line will require some form of access to the Greenwood yards and shops for its first phase. In the case of using the Broadview station as the subway-to-subway interchange, there is an opportunity for a non-revenue connection to the Bloor-Danforth line at this location that may be uniquely favourable from a property perspective due to the 45-degree angle between the intersecting subway lines requiring minimal deviation from TTC or City rights-of-way, as illustrated in Figure 4.

The Bloor-Danforth line has a triple-track structure⁶ between the Broadview and Chester stations. This could be retrofitted to be a single-track non-revenue connection with the Relief Line. After clearing the switch at the east end of the centre track in this existing structure, the new connecting track could begin its descent to attain



Figure 4 - Conceptual Broadview Non-Revenue Service Connection

vertical clearance with the

Bloor-Danforth tracks before the existing curve west of the triple-track structure. The connecting track's descent would continue to clear beneath the Relief Line's Broadview station structure by the point structures horizontally intersect. When clear of all conflicting structures south of Danforth Ave, the non-revenue connecting track would be able to rise and connect with the Relief Line near its Broadview portal.

⁶ Also known as a double-ended pocket track

3. Two Constructible Alignment Concepts

Based on the aforementioned considerations and goals, this submission proposes two concepts for constructible alignments. Both meet two important criteria:

1. They go over the Don River instead of under; and
2. They connect with the Bloor-Danforth subway at Broadview, which offers the only non-perpendicular angle between intersecting subway lines.

For simplicity, the alignments are referred to by their unique north/south-oriented segment: The Sackville St alignment and the River St alignment. Other than cost, length, and number of stations, the biggest difference between the Sackville St alignment and the River St alignment is whether or not the Relief Line serves the Lever Site and a SmartTrack/Regional Express Rail connection. That is a policy decision that will be influenced by various other considerations, some of which are the City's jurisdiction and others that are the Province's jurisdiction.

The chart below outlines a very high-level comparison of these two alignments with two other options from previous studies: A Queen St - Leslie St/Donlands Ave alignment⁷ and a King St – Pape Ave alignment⁸. The Sackville St alignment stands out for its short length, along with a part of that length being elevated. Both the Sackville St and River St alignments involve shorter tunnels by going over the Don River.

Alignment	Don Crossing	Elevated (km)	Tunneled (km)	Total (km)	Yard Access via
Sackville	Over (Riverdale)	1.1	4.8	5.9	Broadview Pocket
River	Over (Riverdale)	1.1	6.1	7.2	Broadview Pocket
Pape	Under (Don Mouth)	0	7.4	7.4	GO Kingston S/D
Leslie	Under (Queen St E)	0	7.6	7.6	West Yard Limits

Table 2 - High-Level Comparison of Alignments

⁷ Queen Subway proposal from the late 1960s

⁸ Downtown Rapid Transit Expansion Study, 2012

3.1. Crossing Downtown

An important consideration is minimizing the disruption to existing transit service from the construction of the Relief Line, as transit capacity into the core today is already strained. The streetcar services are especially sensitive in this case, as they have limited opportunities to be put on a diverted route and their capacity cannot be provided by replacement bus services. To protect streetcar services from disruptions, the Relief Line should not run directly beneath King St or Queen St in order to avoid prolonged streetcar service disruptions from station construction, as it runs the risk of damaging ridership in the corridor in the lead-up to the introduction of higher capacity and higher quality service. The remaining streets are Front, Wellington, Adelaide, and Richmond. Front St W is a poor candidate due to the obstruction of the existing Union subway station structure potentially compromising its feasibility, although Front St E east of Church St would be available. Richmond St has some locations where the geometry of the roadway combined with large buildings that have recently been erected along both sides of the street cannot accommodate a feasible subway alignment. Therefore, Wellington and Adelaide are the remaining appropriate options available for a subway alignment across the downtown core.

The Sackville St alignment makes use of the Adelaide St route across downtown. The River St alignment makes use of the Wellington St route across downtown.

3.2. Sackville St Alignment

Beginning at the north end of the St Andrew station on Adelaide St W, the alignment follows Adelaide St W across Yonge St and along Adelaide St E to Church St. East of Church St, the subway would have to deviate beneath St James Park’s northern fringes to remain on Adelaide St E east of Jarvis St, as illustrated in Figure 6. The alignment

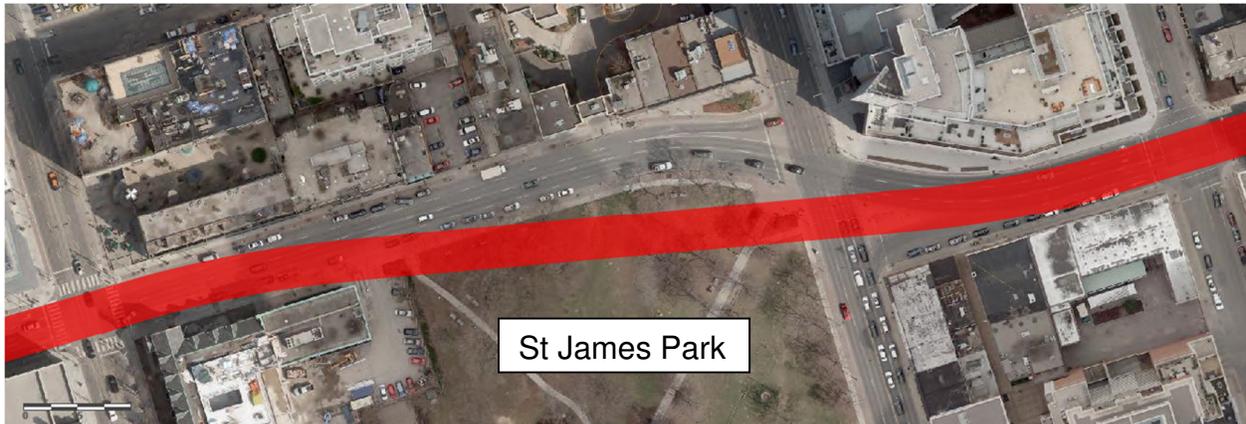


Figure 6 - Relief Line Across St James Park

continues along Adelaide St E from Jarvis St until just west of Parliament St where a left-hand turn begins off Adelaide and onto Sackville St – much of this curve is accommodated within public lands, as illustrated in Figure 5 (City Transportation lands in aqua, school board in purple).



Figure 5 - Relief Line Sackville South Curve

The alignment proceeds north along Sackville until Gerrard St E, where it enters a right-hand turn, half of which is also on public lands as shown in Figure 7 (school board lands in purple), onto the eastern tail-end of Carlton St where it emerges out into the Don Valley through Carlton portal.

Carlton portal is exceptionally favourable from a topography perspective: At the eastern end of Carlton St, the ground falls off at a slope of over 20% for a fall of almost 20 metres as shown in Figure 8. The elevation at which the Relief Line emerges from the Carlton portal, about 87 m, should be almost high enough already to clear the GO Transit railway crossing beside the Don River, which is about 80 m, requiring an average gradient of less than one percent between the portal and the GO corridor.



Figure 7 - Relief Line Sackville North Curve

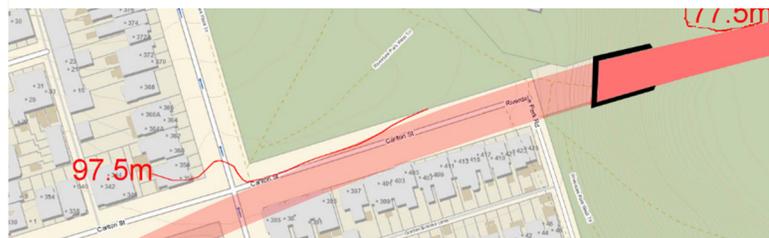


Figure 8 - Carlton Portal

Both of the curves at either end of the Sackville St portion being accommodated to a large extent within public lands combined with the steep and high-altitude fall off for the Carlton portal is an exceptionally favourable combination, especially for a route that is relatively direct and thereby able to provide very competitive travel times. All of these features help reduce the capital cost of the project.

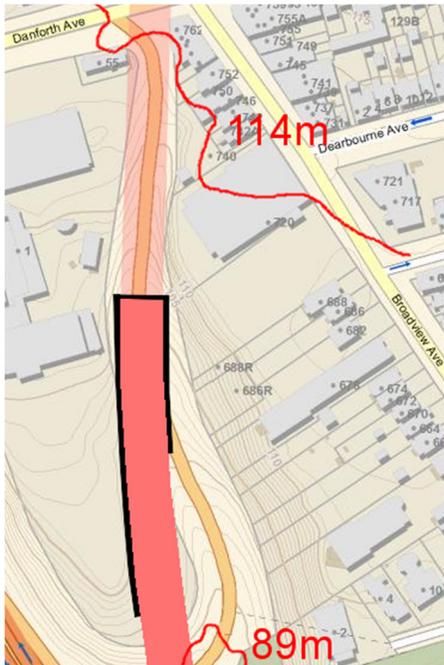


Figure 9 - Broadview Portal

The alignment proceeds along an elevated structure over the GO corridor, the Don River, and the Don Valley Parkway, along a path very close to the Don Valley Parkway towards the Danforth Ave northbound on-ramp. A short distance south of Danforth Ave would be the Broadview portal, which has a height of around 25 metres as per Figure 9. The Broadview portal may involve an on-ramp realignment, although this would be influenced by any opportunities related to Transit-Oriented Development with the Toronto District School Board-owned lands enveloped by the on-ramp that are currently used for the City Adult Learning Centre. The alignment would be underground again north of the portal as it enters its interchange station with the Bloor-

Danforth line. The connection point for its non-revenue connection towards the Chester station to provide access to the Greenwood yards and shops may be on either side of the portal depending on the detailed design.

Beneath Broadview Ave, the alignment continues north to its terminus at Mortimer Ave where several bus connections with the Relief Line could be made.

Figure 10 on the following page shows which Key Activity Areas identified by the City would be within 500 m of the Sackville St alignment stations' access points, identified with a green circle.

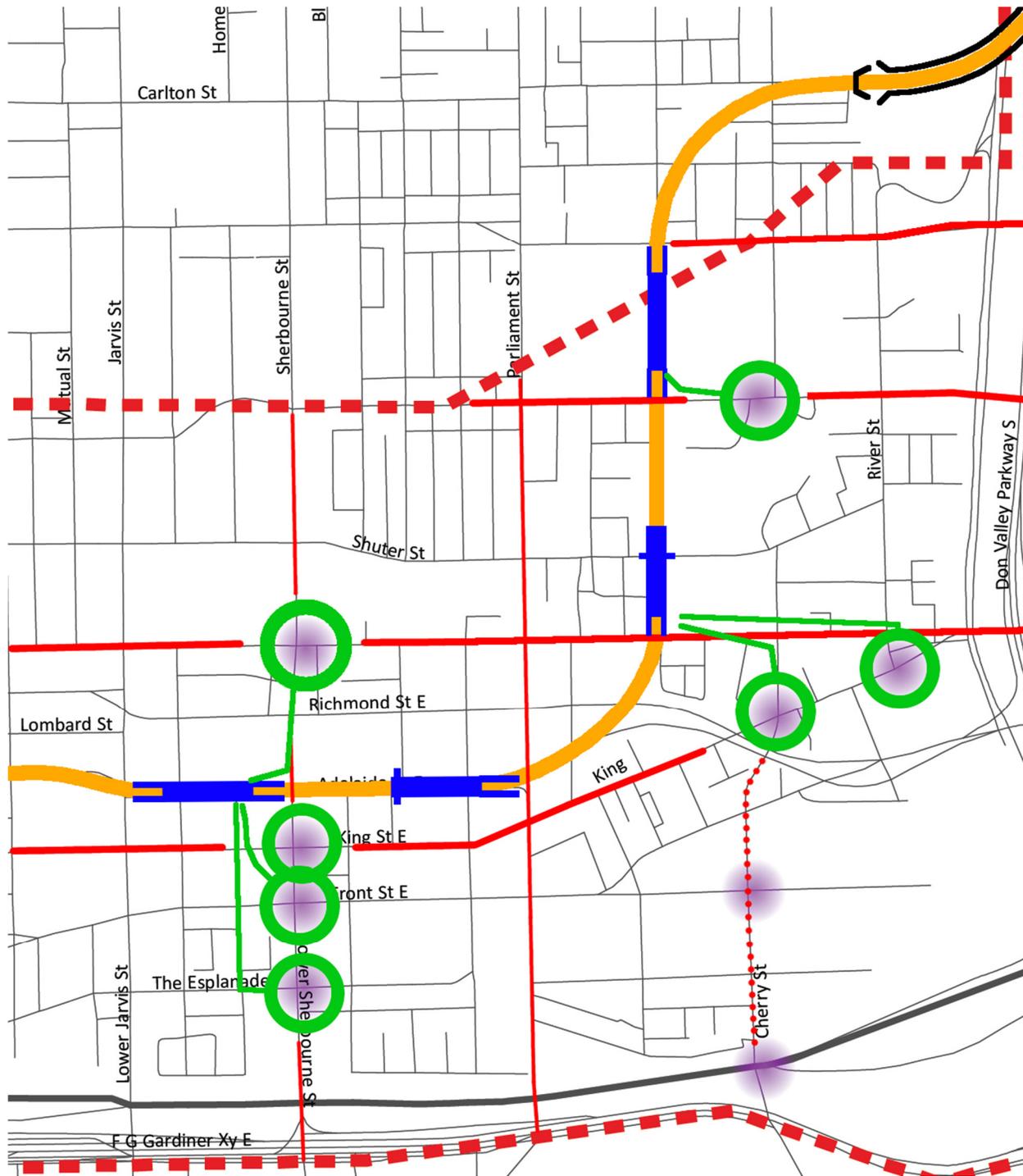


Figure 10 - Sackville St Alignment from Church St to Carlton St

3.3. River St Alignment

Beginning south of the St Andrew station, the alignment follows Wellington St through the core until it merges with Front St E. The alignment proceeds beneath Front St E via

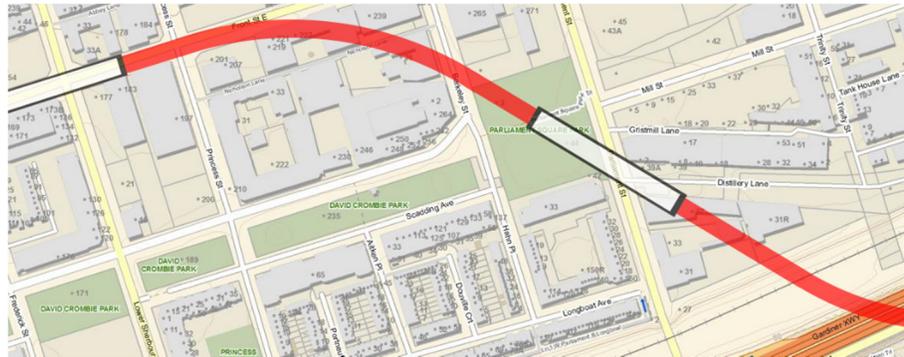


Figure 12 - Relief Line Berkeley Curve

the St Lawrence market until a block or so east of Sherbourne St, where a right-hand turn to an off-street alignment heads towards the Distillery district and the Keating precinct as shown in Figure 12. This curve passes beneath some older buildings, including some with Heritage designation, that are used as performance venues and may require additional mitigation. From the Keating precinct at Cherry St, a very long left-hand turn in the alignment as in Figure 11 leads to a station connection with the GO system in the Corktown Common, which could also provide a pedestrian link to the Lever site.



Figure 11 - Relief Line Keating Curve

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From the Corktown Common, the alignment proceeds north beneath green space, St Lawrence St, and then turning onto River St around King St E. Beneath River, it proceeds north until Spruce portal. The topography for Spruce portal is reasonable, with a slope of around 9% and a fall of around 12 metres, as in Figure 13. North of Spruce portal, the alignment is very similar in principle to the Sackville St alignment, although its geometric details would be different.

Figure 14 shows which Key Activity Areas identified by the City would be within 500 m of the River St alignment stations' access points, identified with a green circle.



Figure 13 - Spruce Portal

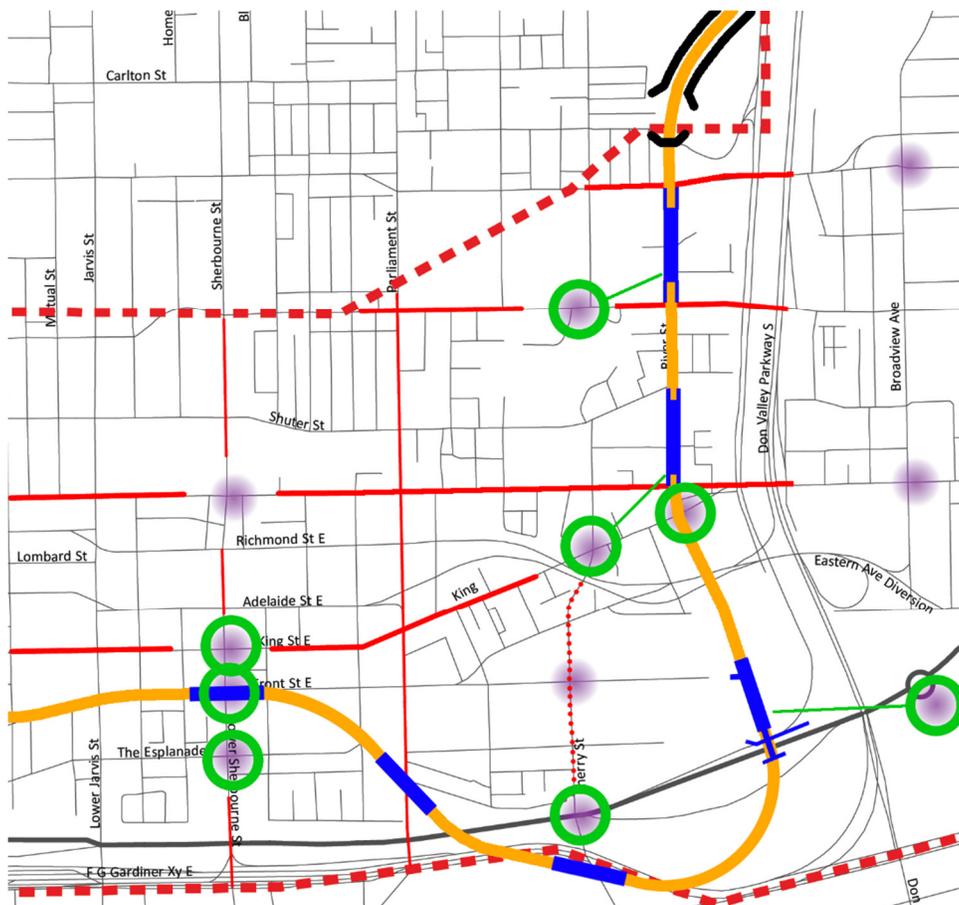


Figure 14 - River St Alignment from Church St to Carlton St

3.4. Comparisons of Alignments

3.4.1. Natural Heritage

The Sackville St alignment is better protected from risks of flooding than the River St alignment. There are two key factors involved. First is the River St alignment south of Queen St E and east of Yonge St being within the Toronto Region Conservation Authority’s regulatory limit and the Lower Don Flood Plain, as shown in Figure 15. However, the flood plain issue, which is under review, may be resolved with the naturalization of the Don Mouth. Second is the expected elevation of the portal north of

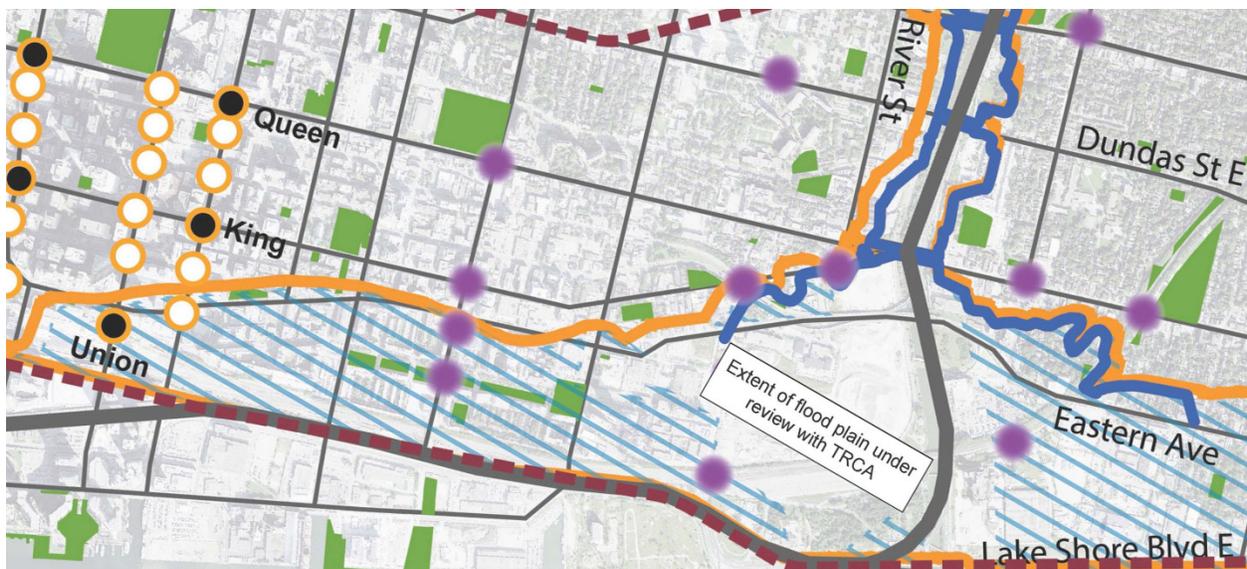


Figure 15 - Don River Flood Plain South of Queen St E

Gerrard St E. The Sackville St alignment would emerge at an elevation of around 87 metres, while the River St alignment would emerge at an elevation of around 81 metres. This difference in elevation is significant as the nearby Richmond Hill GO corridor, at an elevation of around 80 metres, was exposed to significant water levels in the flooding of July, 2013. The River St alignment’s Spruce portal would be expected to potentially be at a risk of water infiltration at its elevations. This is much less of a concern for the Sackville St alignment’s Carlton portal and its six metres’ higher elevation, as even in a repeat of the July, 2013 storm event and associated flooding, water would not infiltrate the Carlton portal. The Don Mouth naturalization, however, is expected to prevent flooding levels such as those observed in July, 2013 from happening in future.

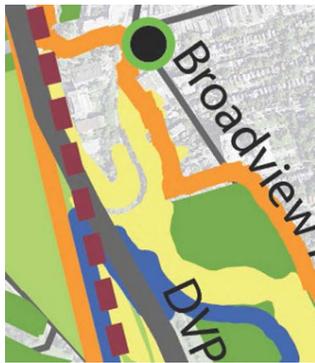


Figure 16 - Terrestrial Natural Heritage System

North of the Riverdale Park pedestrian bridge, the two alignments' environmental mitigation measures would be roughly equivalent. Environmentally sensitive areas are very minimal, confined to the immediate vicinity of the Don River itself. A Terrestrial Natural Heritage System occupies the Broadview portal and approach area per Figure 16, and mitigation measures would be about equivalent for both alignments.

3.4.2. Population Growth

Both alignments serve the already dense yet redeveloping Regent Park area, as well as the Trefann Court area that is projected to grow. Given the limited connections across the Union Station Rail Corridor, the area of projected growth between Parliament St and Jarvis St south of Queen St E is also expected to be served about equally between the two alignments.

The West Don lands and the Keating precinct, both of which are to see significant growth, are served only by the River St alignment. This is also an area where other transit infrastructure investment has been built⁹ or proposed¹⁰.

West of Jarvis St, the Sackville St alignment appears to serve the larger projected future population base. This is influenced by the block of growth identified northeast of the intersection of Yonge St and Queen St, which is within the catchment area of the Sackville St alignment only. The area southwest of Bremner Blvd and York St would be within the River St alignment's catchment area, but due to the Union Station Rail Corridor, only a small portion of this area would fall within the 500 metre walk to the terminating station.

3.4.3. Employment Growth

Through the core, the Sackville St alignment is best positioned to capture the zones of projected employment growth. Main areas of growth from the City's data are between

⁹ Cherry St streetcar right-of-way

¹⁰ SmartTrack/Regional Express Rail station, southerly extension(s) of Cherry St streetcar right-of-way

Dundas St and Queen St from Parliament St to University Ave, and between Queen St W and King St W from Yonge St to Spadina Ave.

North of Queen St E and east of Sherbourne St, the two alignments are about equal, although only the Sackville St alignment would capture the mixed-use Parliament corridor, east and west sides, which is a mixed-use area that is projected to see employment growth. Both alignments would also boost the transit accessibility to employment in the Broadview station area south of Danforth Ave.

South of Queen St E and east of Parliament St, the River St alignment serves territory that the Sackville St alignment does not, but as previously noted, that territory is also an area where other transit investments either are already planned/under study or were recently completed. How the network would behave in this area and how the River St alignment would impact other recent and planned transit investments would need to be considered carefully and assessing the network as a whole.

3.4.4. Development

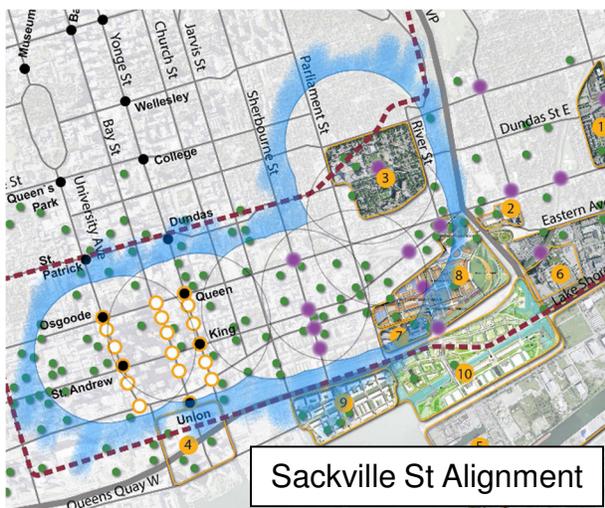


Figure 18 - Sackville St Alignment Development

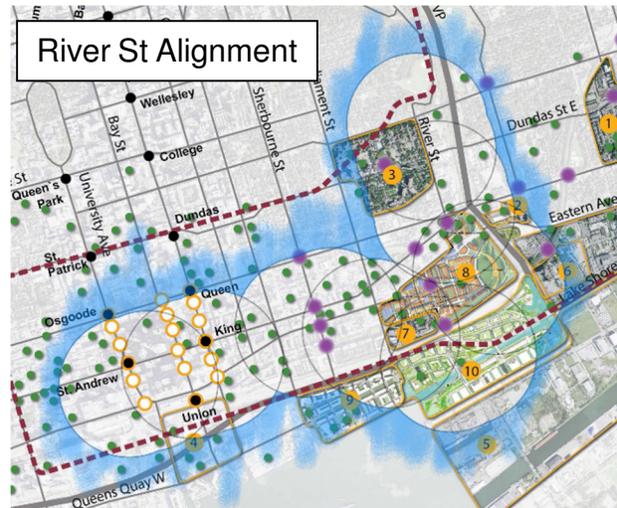


Figure 17 - River St Alignment Development

Both of the alignments are expected to benefit 60 to 70 recent or planned development sites, as identified by the green dots inside the blue-enclosed areas in the images above. Approximately 62 developments would be within the catchment area for the Sackville St

alignment while approximately 67 developments would be within the catchment area for the River St alignment; a difference of five sites. This count was based on a University Ave terminus, but a check was done for a Spadina Ave terminus and the difference between the two alignments remained at five, as both gained the same number of sites at Spadina Ave, although not the same combination of sites. Such a small difference would likely vanish upon the selection of an alignment for the Relief Line, as such a decision would be expected to stimulate development near its proposed stations, especially as there are very few areas along the alignment designated as stable neighbourhoods, per the yellow-shaded areas in Figure 19.



Figure 19 - Land Use and Relief Line Alignments

3.4.5. Key Destinations

Both alignments hit many of the same key destinations as per the map provided by the City, as shown with catchment area overlays in Figure 20. These sites are:

- Young Centre
- Distillery District
- St Lawrence Market
- Daniels Spectrum
- John Innes Community and Recreation Centre
- Regent Park North Recreation Centre
- Regent Park South Community Centre
- St Lawrence Community Centre
- Metro Hall
- Opera House
- Union Station
- Sony Centre for the Performing Arts
- Roy Thomson Hall



Figure 20 - Relief Line Alignments and Key Destinations

Within the downtown core west of Church St, there were some destinations within the catchment area of the Sackville St alignment only:

- City Hall
- Toronto Eaton Centre
- Massey Hall
- St Michael's Hospital
- St Michael's Choir School

West of Bay St, the Air Canada Centre and the Metro Toronto Convention Centre North Building were within the catchment area of the River St alignment only. However, both of those locations are exceptionally well served through direct connections from the Union GO rail station.

3.4.6. PATH Network

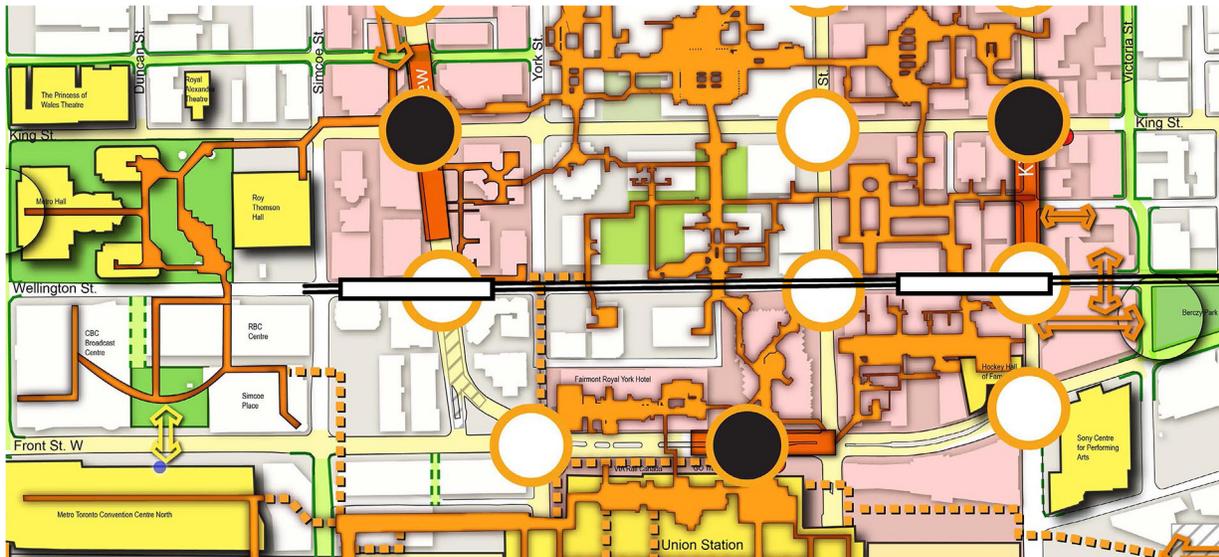


Figure 21 - River St Alignment PATH Relationship

Both alignments have the potential for strong connections to the PATH network, but would serve different areas of it. The River St alignment would provide more convenient connections to the east and south while the Sackville St alignment would provide more convenient connections to the west and north; see Figure 21 and Figure 22, respectively, for the immediate PATH area around each alignment. There are a couple of below-grade knock-out panels in buildings along Adelaide St W that could be exploited by the Sackville St alignment, as highlighted in Figure 22.

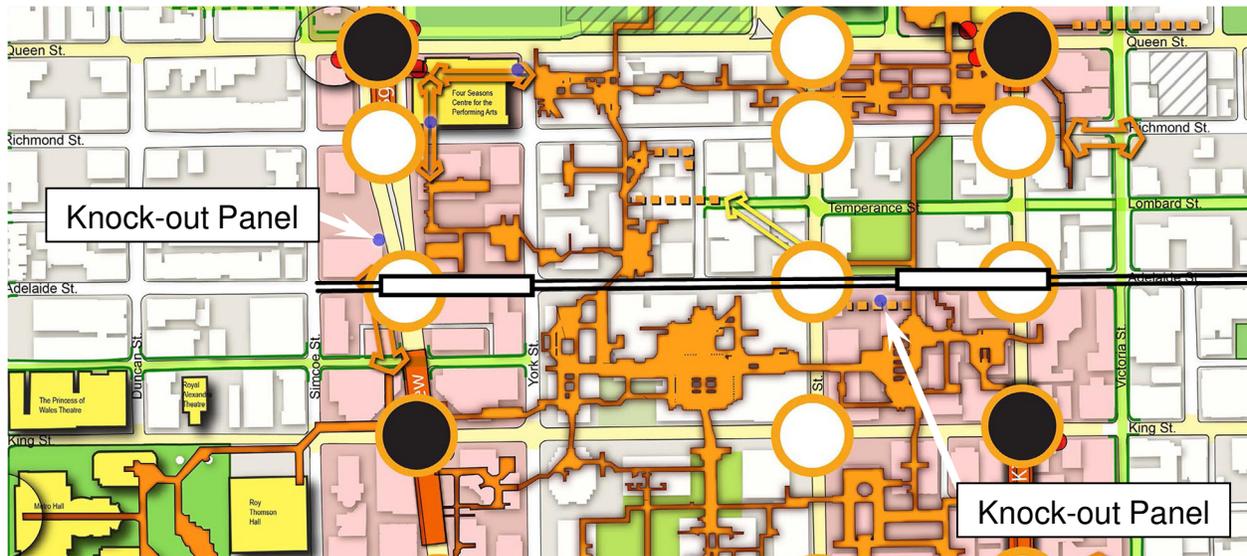


Figure 22 - Sackville St Alignment PATH Relationship

3.4.7. Bike Network

Both alignments have comparable but different cycling access. Both provide connections to bike lanes at Simcoe St, Sherbourne St, and Shuter St, as well as the proposed bike lanes along Broadview Ave at Mortimer Ave. Both have a bike lane above a portion of their route; along River St in the case of the River St alignment, and along Adelaide St in the case of the Sackville St alignment. Both alignments have access by bicycle to the Regent Park station, but from different directions, with the River St alignment providing good access from the east and the Sackville St alignment providing good access from the north. Either alignment could potentially be tied into the Don River Trail system.

The River St alignment would also connect with the Waterfront and Martin Goodman trails.

3.4.8. Planning Frameworks

Both alignments pass through the following planning areas:

- Regent Park Neighbourhood Improvement Area & Regent Park Secondary Plan
- King Spadina Secondary Plan
- King Parliament Secondary Plan
- T.O. Core Study

The River St alignment passes through the following planning areas in addition to the above:

- St Lawrence Neighbourhood Urban Design Charrette
- St Lawrence Heritage Conservation District
- Keating Channel Precinct Plan
- West Don Lands Precinct Plan
- Central Waterfront Secondary Plan

Due to the relationship the River St alignment would be expected to have with the Lever site, the South of Eastern Strategic Direction area may also be affected by the River St alignment, even though the River St alignment is not physically within or along the boundary of that area.

3.5. Streetcar System Relationships to the South

The City has just invested substantial resources in the renewal of its streetcar infrastructure, including tracks, overhead wiring, shops, storage facilities' retrofits, and fleet replacement, a process that is now almost complete after about 15 years of construction. The City is continuing to invest in this network, including expansion of the system – new tracks were recently built along Cherry St north of the Union Station Rail Corridor, with service to start after the Pan-Am Games. An environmental assessment is in place for a new corridor along Queen's Quay E, and a proposal is being assessed to extend Broadview Ave south to Commissioners St, including streetcar infrastructure. Planning work for the Relief Line should coordinate with the work ongoing for the expansion of the streetcar system so that both are working together towards a common goal of providing effective transportation within the city, and not competing with one another for serving the same trips.

From the south, Cherry St and Broadview Ave would serve as links to the waterfront, where future demand projections for transit service are strong. Some of these investments have already been made along Cherry St, and plans for other waterfront area streetcar investments are already agreed upon and approved, plus some others that are

in development, summarized in Figure 23. How these proposals will fit with the Relief Line, and how the Relief Line fits with these proposals, requires careful consideration in order to ensure one transit service does not cannibalize the ridership of another.

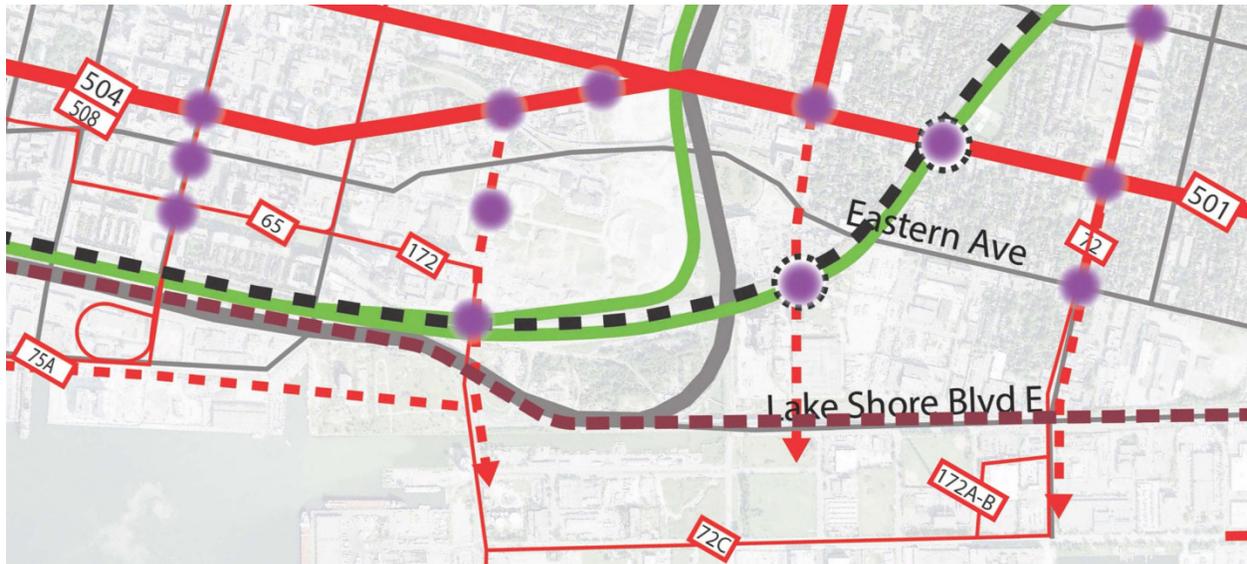


Figure 23 - Streetcar Network Expansion Plans

4. Future Extensions

The Relief Line is required to have viable extensions in future to both the north from Mortimer Ave and the west from University Ave. Both the Sackville St and the River St alignments are able to provide this.

4.1. From Broadview

Broadview Ave has no real advantages or disadvantages compared to Pape Ave or Donlands Ave as it relates to the challenges of crossing the Don Valley to reach the Thorncliffe Park area¹¹, one of the densest communities in Toronto outside of a growth centre. All options across the Don Valley will require an elevated structure around 700 to 800 metres in length.

In terms of direct routes, the Broadview alignment does have an advantage over Pape Ave and Donlands Ave, as Broadview Ave follows an alignment that is pointing towards the core instead of straight towards Lake Ontario like Pape Ave. This means Broadview Ave would provide the fastest travel times, as the “L-shape” influence on travel time is minimized by Broadview Ave’s “off-grid” alignment.

The integration of bus services in Old East York also favours Broadview Ave for future extensions as there would be a more intuitive bus network structure from Mortimer, Cosburn, and O’Connor bus services than would result with a Pape Ave or Donlands Ave alignment. Many buses terminating at Mortimer for the initial phase of the Relief Line, other than the Mortimer bus service itself, would move to a station in Thorncliffe Park in phase two, except for the Cosburn and O’Connor services, which would serve a new station at Cosburn. This would result in a dramatic reduction in buses using the Leaside Bridge. At an absolute minimum, the Donlands bus would be expected to continue to cross the Leaside Bridge.

¹¹ South of Overlead Blvd east of Millwood Rd

4.2. From University

There are many questions to be answered about the western extension that are beyond the scope of this study. However, both Adelaide St W and Wellington St W provide viable options to extend the line further west. Adelaide St W runs as far as Shaw St, while Wellington St W runs as far west as Strachan Ave, where it becomes Douro St and follows the rail corridor to King St W. The terminus of Adelaide St W at Shaw St is at the eastern limits of the large Centre for Addiction and Mental Health complex occupying a huge majority of the block bounded by Queen St W, Shaw St, King St W, and Dovercourt Rd. The Relief Line, if running along Adelaide St W, could conceivably cut across beneath this complex, emerging at Sudbury St which, like Douro, follows the rail corridor, and would take the Relief Line to Queen St W, where there may be a GO rail station in the future.

While the Adelaide St W route is straighter, the main challenge along this alignment is crossing beneath St Mary's Church on the west side of Bathurst St. The Wellington St W alignment has at least two jogs, one just east of Spadina Ave, and another at Portland St. The jog at Portland St may be expected to cause problems as it provides less green space through which to negotiate an 'S'-curve compared to the jog at Spadina Ave.

What functions and which ridership is GO rail service able to serve in the west end, and what gaps are there that would need to be met by other transit services? This is a broader network question beyond the scope of this study, but it has a significant impact on what the western extension of the Relief Line would be required to accomplish. The future roles of the Kitchener and Milton GO rail services are especially relevant to this question. The western extension of the Relief Line may be very short depending on the answer.

5. Conclusion

Both the Sackville St alignment and the River St alignment are geometrically viable. Key qualities of both alignments are their north-of-Danforth alignment along Broadview Ave, and their crossing the Don River with an elevated structure instead of a tunneled structure. Both alignments have the benefits associated with the Broadview station being the interchange with the Bloor-Danforth subway as it relates to circulation capacity for subway-to-subway transferring passengers at Danforth Ave. Both alignments have the opportunity to re-purpose the existing triple-track structure for a non-revenue access track to the Greenwood yards and shops with minimal property impacts. Broadview Ave also provides an intuitive bus network, particularly for a subsequent northern extension, but to a lesser extent in the initial phase as well. A high level summary comparison of the two alignments is provided in Table 3.

Criterion	Length (km)	Cost	Direct Route	Travel Time	Smart Track	Lever Site	Flood Plain
Sackville	5.9	Lower	Yes	Shorter	No	No	Outside
River	7.2	Higher	No	Longer	Yes	Yes	Inside

Table 3 - Summary Comparison

The remaining key differentiator is the SmartTrack/Regional Express Rail connection (and, by extension, service to the Lever site), and how much weight policymakers or evaluation methodology place on that connection. Is it a “must have” or a “nice to have?” What kind of network phenomena result from such a connection? Are those results desirable and manageable? These questions remain unanswered, but they will be very influential.

If the SmartTrack/Regional Express Rail and Lever site connections are not essential, the Sackville St alignment offers more advantages overall, including speed, cost, property, topography, and downtown core densities and destinations within the catchment area.



If the SmartTrack/Regional Express Rail connection is essential, along with service to the Lever site, and is weighted higher than other criteria, then the River St alignment would be preferable over the Sackville St alignment.

The most important criterion, however, remains the constructability of the project. The alignment, and all the constraints that it is subject to, will be more influential on the location of the stations than the preferred locations of stations will be on the alignment.

