

Yonge Street Express Subway - Downtown Toronto to Richmond Hill Preliminary Plan and Construction Feasibility

1.0 Main Features

- 26 kilometres of all new subway line from Lake Shore Blvd. to Richmond Hill
- Twinning of the existing subway on Yonge St. will provide real congestion relief
- The latest operating technology can be used for the new Express line without being incumbered by existing outdated signaling and driver operation. It could be full subway or LRT style.
- All new tunnel construction is within existing right-of-ways – no property is required
- There is minimal impact on residents and businesses for such a major project
- Connections with the existing subway provided at Davisville and York Mills Stations
- There is potential for an extension to Toronto Islands or Billy Bishop Airport, the CNE, Ontario Place, BMO Field and the Humber Community



2.0 Tunnelling from Lake Shore Blvd. to Steeles Ave. - 17.5 kilometres total length

Note: at all shaft locations, the existing Yonge St. subway is offset from Yonge St. itself so there is no conflict. There will be some utility and sewer relocations involved.

2.1 Tunnel Shafts and Working Areas

Shaft	Location	Traffic Impact
Yonge St. and Lake Shore Blvd.	South of Gardiner Expressway	Yonge St. and Lake Shore Blvd. E. to be closed for approximately 3 years
Yonge St. at Mt. Pleasant Cemetery	In the hollow of Yonge St. south of existing Davisville Station	Yonge St. would have to be closed for approximately 3 years
Yonge St. and York Mills Rd.	On west side of Yonge St. north of Don River Bridge and partially under York Mills Rd.	Yonge St. and York Mills Rd. would have lane restrictions for approximately 3 years
Yonge St. and Steeles Ave.	On west side of Yonge St. south of Steeles Ave.	Yonge St. would have lane restrictions for approximately 3 years

2.2 Tunnels – Twin Bore 6.2 Metre Diameter Precast Segments

Preliminary investigation indicates a clear window for the new tunnels. Tunnel mining can take place in any direction although up-grade is preferred. The sequencing would depend on the number of tunnel boring machines ("TBM") secured for the project. Tunnel lengths of 6,000 metres from a shaft are feasible.

Tunnel Drive	Drive Length	Tunnel Window
Lake Shore Blvd. to Mt. Pleasant Cemetery	5,800 metres of twin tunnel	Passes under the Gardiner Expressway, under the railway bridge south of Front St., under existing Yonge St. subway from Front St. to Wellesley Ave., under the proposed Ontario Line subway at Queen St., under the Bloor-Danforth subway line, under the railway bridge at Summerhill, above the Hydro-One Midtown Tunnel at Birch St. and again under the existing Yonge St. subway on a skew north of St. Clair Ave.
Mt. Pleasant Cemetery to York Mills Rd.	5,400 metres of twin tunnel	Passes under the Kay Gardiner bridge, under the Eglinton Crosstown subway, under the existing Yonge St. subway from Eglinton Ave. to Hoggs Hollow and then under the Don River
York Mills Rd. to Steeles Ave.	6,000 metres of twin tunnel	Passes under the existing pedestrian tunnel, under the existing Yonge St. and Sheppard Ave. subways from north of York Mills Rd. to Finch Ave. and then to Steeles Ave.

2.3 Geotechnical Considerations

The new Express subway tunnels would be mined in shale bedrock from Lake Shore Blvd. to somewhere north of Bloor St. approaching the old Lake Iroquois shoreline south of St. Clair Ave.

Once out of the bedrock, the tunnel would be mined in variable glacial soils including cohesionless silts and sands and clay tills. Boulder are almost always found in glacial tills and can have a negative impact on tunnelling operations.

2.4 Tunnelling Risks

Shaft construction would be relatively straightforward utilizing concrete secant piles to prevent water and soil intrusion. There would be no impact on adjacent structures expected from shaft construction.

The tunnelling methodology would be the same as the Eglinton Crosstown subway utilizing a sophisticated Earth Pressure Balanced TBM that can mine soil or soft rock. The cutting face is pressurized with a slurry as the soil is being excavated so no ground is “lost” that could cause settlement above. Once the segments are assembled within the TBM “tail can”, the exterior of the completed rings are grouted to fill any voids.

Tunnelling under an existing operating subway line requires extreme care in the mining. Extensive ground and structure monitoring is also required.

In the section from Front St. to Wellesley St., the Express tunnel would be parallel to and under the existing Yonge St subway. It would also cross under the Queen St. streetcar sub-station and the presumed even-deeper proposed Ontario Line subway. The new Express subway tunnels would be mined completely in sound shale bedrock and the risk to the infrastructure above would be minimal.

At Summerhill station, the tunnels would pass under the railway bridge which likely has footing elevations well above the express tunnel elevation. Again, extreme care in mining and monitoring is required. Just north of the railway bridge at Birch Ave., the Express tunnels would be mined in overburden and well above the elevation of the Hydro-One Midtown Utility Tunnel mined in shale bedrock in 2014.

North of St. Clair Ave., the new Express tunnels would pass under the existing subway tunnels that cross Yonge St. on a skew. There would be approximately 10 metres of vertical separation between the new tunnels and the existing subway constructed in open cut above. The new tunnels would be mined through variable glacial soils and precise mining would have to be mandated while the existing subway structure was carefully monitored.

At Eglinton Ave., the new tunnels would pass under the newly constructed Eglinton Crosstown subway tunnels. The design separation of the two tunnels crossing at 90 degrees would be dictated by geotechnical conditions and depth of any piling installed for the Crosstown subway within the Yonge St. right-of-way. There is flexibility in the Express subway design to go deeper if necessary.

North of Eglinton Ave., the existing subway returns to the Yonge St. right-of-way and the new Express tunnels would run under it all the way to the slope down to Hoggs Hollow where the existing subway diverts to east of the Jolly Miller Tavern. Geotechnical information needs to be determined for this deep

section of Express tunnel, but it is likely the tunnel would be in glacial soils perhaps catching weathered bedrock. There would be approximately 25 to 35 metres of vertical separation between the new Express tunnels and the existing subway tunnels which were tunnelled with cast iron segments. This separation mitigates the potential for any settlement to reach the existing tunnel before ground stabilization measures can be implemented.

The crossing of the Don River will be of concern depending on the soil or bedrock underlying it. If the soils are cohesionless (sands and silts), then a temporary piping of the Don River flows through the tunnel site might be warranted.

North of York Mills Rd., the Express tunnels would pass under the pedestrian tunnel that crosses Yonge St. at 90 degrees. The existing subway tunnels return to the Yonge St. right-of-way south of Hwy 401. At this point the Express tunnels would be approximately 15 metres beneath the existing tunnel elevation. This separation increases to approximately 20 metres for the balance of the tunnel drive to Finch Ave. North of Finch Ave. the Express tunnels would be mined clear of the existing subway.

2.5 Business and Resident Impacts

At Yonge St. and Lake Shore Blvd., the shaft and work site would be surrounded by high-rise condominiums with ground level storefronts. The tunnel construction would take over all the public right-of way and certainly impact the life of the residents there for a period of 3 years. A mitigating factor is that the area is subject to the never-ending noise of the Gardiner Expressway.

At the Yonge St. and the Mt. Pleasant Cemetery shaft location, there are no businesses or residents in the immediate area. Apartment buildings overlook the Davisville TTC Yard on the west side. There is a new condominium on the east side of Yonge St. north of the Kay Gardiner railway bridge.

At York Mills Rd., there are condominium buildings on the west side south of the Don River who will be somewhat impacted by the construction but will enjoy a direct 10 minute ride downtown when complete. Businesses in the complexes on the north side of York Mills Rd. will not be directly impacted.

At Steeles Ave., the likely shaft and working area would be on the south-west corner of Yonge St. and Steeles Ave. which is flanked by a shopping mall parking lot. There would be minimal business or residential impacts at this location.

Construction traffic will be significant at the shaft work sites as a large volume of tunnel spoil is removed from the shafts and pre-cast segments are delivered to the site on a daily basis.

2.6 Traffic Impacts

Tunnel construction will require the closing of the Yonge St. and Lake Shore Blvd. intersection for approximately 3 years so the right-of-ways can be used for tunnel and station construction. This will be disruptive and push a lot of traffic to Queen's Quay but there is no other option in constructing a Downtown Express Station.

Yonge St. will also have to be closed for approximately 3 years south of Davisville Ave. which will push traffic onto Mt. Pleasant Rd. and Avenue Rd. causing delays there for north-south traffic.

At York Mills Rd. and Steeles Ave. lane closures will be required but at least one lane in each direction should be able to be provided. Significant traffic backups will occur at these two locations.

3.0 Extending the Express Subway as a Local Subway from Steeles Ave. to Richmond Hill

The Provincial Government has committed to building a subway to Richmond Hill. The initial concept was to extend the existing subway from Finch Ave., however this concept will just increase congestion on the existing subway to the point of dysfunction at peak times. Extending the Express Line from Steeles Ave. to Richmond Hill will provide a local subway to satisfy the Province's requirement while also resolving the congestion problem in the City of Toronto for the foreseeable future.

We have not gotten into the details of the construction of the Express line north of Steeles Ave. It could be a combination of tunnel and open cut construction. Tunnels are definitely required under Hwy 407 and Hwy 7. Likely stations are at John St., Hwy 7, 16th Ave. and Major Mackenzie Dr.

4.0 Extending the Express Subway to Toronto Islands

This would be relatively easy to accomplish from a tunnelling perspective once the shaft is in place at the Yonge St. and Lake Shore Blvd. location. Marine works and barging would be required to construct the subway tunnels from approximately the middle of the harbour where the shale bedrock drops below the subway elevation. Materials and equipment to build the terminal station could be brought through the new tunnel without having to cross the harbour by barge.

A subway to the Island would be a significant improvement in pedestrian accessibility over the current ferries. It would also change the character of the Island experience which is something that would have to be considered from a planning and community perspective.

5.0 Western YES Extension – Billy Bishop Toronto City Airport, CNE, Ontario Place, BMO Field and Humber Bay

The Express Subway could also be extended from the Downtown Station location under the harbour curving towards Billy Bishop Toronto City Airport where it would provide the rapid transit connection to the airport that is sorely needed.

The next stop would be the CNE grounds where the Express subway would provide access to the CNE, BMO Field, a reimagined Ontario Place, Direct Energy Centre and the high-density Liberty Village community.

From the CNE, the Express subway would run straight across Humber Bay under Lake Ontario to a station at Humber Bay Park. This station would provide direct access to the CNE, Billy Bishop Airport and downtown for the many living in the Humber Bay Shore hi-rise community as well as all the Etobicoke residents who can connect through surface transit on Lakeshore Blvd West.



6.0 Extending the Existing Subway North of Finch Ave.

If desirable, the existing subway line could be extended north to Steeles Ave. to make another connection point with the Express Subway.

The new station at Steeles Ave. could be a joint station for the Express subway and Line 1.

7.0 TTC Operations

The Express subway would require a new maintenance facility located online. This would likely be somewhere north of Steeles Ave. on land to be acquired outside the Yonge St. right-of-way.

At each shaft location, the length of the shaft must be long enough to install switches outside of the station for crossing between the tunnels.

Emergency exits and access for first responders have to be designed into the new subway. It will be challenging to try to meet existing TTC standards for the spacing of these given the depth of the tunnels and available locations but these situations have been resolved in other long tunnels.

Report prepared by:

YES YONGE
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Gary E. Benner, P. Eng., Principal