

RELIEF LINE

S O U T H

WELCOME

**RELIEF LINE
TRANSIT PROJECT
ASSESSMENT PROCESS**

**PUBLIC INFORMATION
CENTRE**

RELIEF LINE

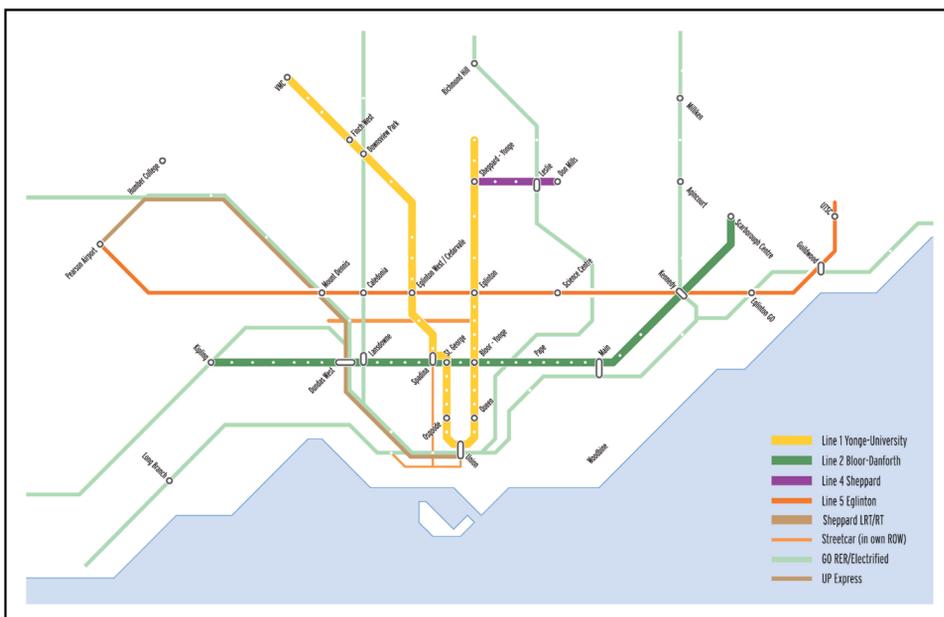
SOUTH

The Relief Line is an Important Part of the City's Future Rapid Transit Network

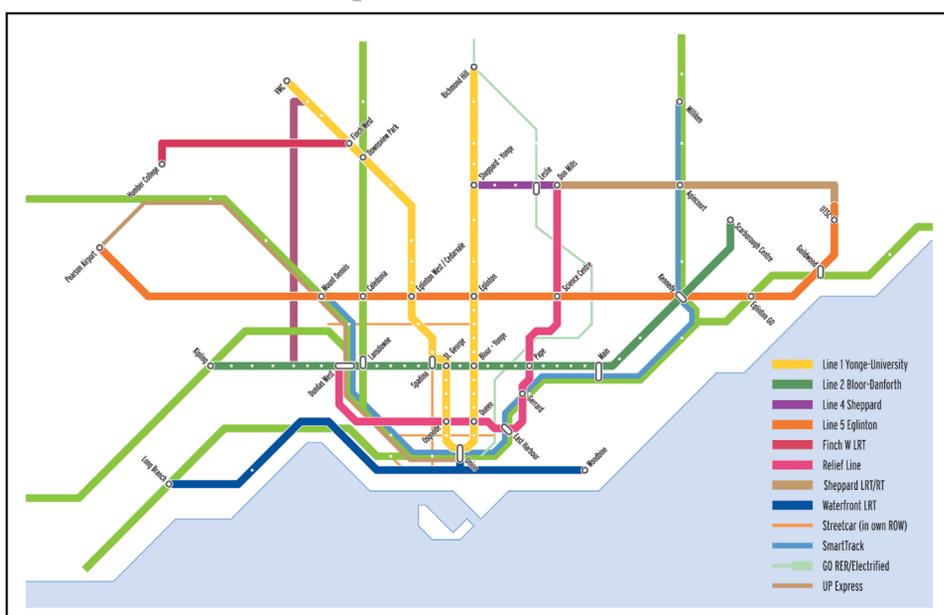
The City of Toronto, TTC and Metrolinx are working together to bring more transit to communities across the city.

One of the most important rapid transit projects underway is the Relief Line, which will relieve crowding on Line 1 Yonge-University and provide more travel options to transit riders throughout Toronto. The Relief Line is being studied in two parts – Relief Line South and Relief Line North*.

Our Rapid Transit Network Today



Future Rapid Transit Network



* For information on Relief Line North please visit www.reliefinorth.ca

- Parts of the city's transit network are over capacity today and struggling to meet demand. There are billions of dollars of transit investment committed, new vehicles entering service, and construction underway to expand the rapid transit network and add capacity to the subways, streetcars and GO rail system.
- Even with these improvements in place, the Relief Line will still be needed as an important piece of the transit network.
- Relief Line South is a 7.5 km long subway line with 8 stations that would connect Line 1 Yonge-University downtown to Line 2 Bloor-Danforth at Pape.
- The Relief Line South will help to relieve crowding on Line 1 Yonge-University south of Bloor, at the Bloor-Yonge Station, and on the surface transit routes coming in and out of downtown.

What We've Heard



38

Public and Stakeholder Meetings Held 2014-2017



3,000+

People Attended the Meetings



3,300

People on the Project Mailing List



84,000

Unique Visits to the Project Website

Key Messages From Public And Stakeholders

- There is overall support for the results of the evaluation process that has resulted in the preferred corridor and station locations.
- The Relief Line is considered by many to be the top priority transit project and is essential to relieving overcrowding on Line 1.
- Decisions on the route should protect for the northern and western extensions (e.g., future proofing).
- The Relief Line should support major redevelopment opportunities, such as the Unilever site.
- Potential impacts during construction need to be identified and addressed, such as disruptions to existing streetcar and bus routes, traffic disruption, noise and vibration.
- There needs to be good communication with the community during the construction period.

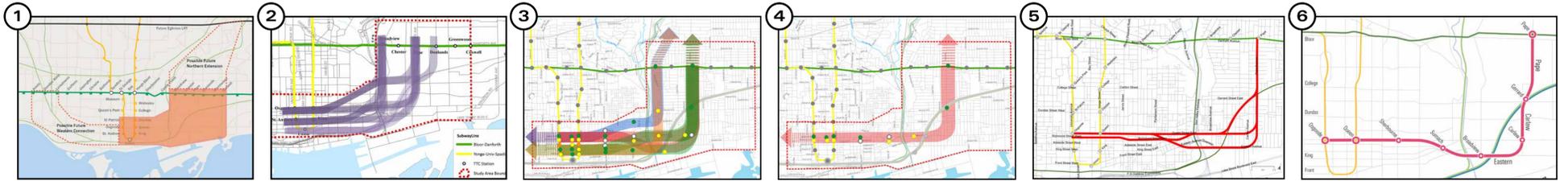
Background & Key Milestones

2009	City Council approves Yonge North Extension EA, contingent on Relief Line and City/TTC commence study to determine need for the Relief Line
2012	Downtown Rapid Transit Expansion Study concludes that initial phase of Relief Line and GO Transit improvements would help ease crowding on the transit network.
2012	Relief Line identified as part of the “Next Wave” of transit projects in the Metrolinx Big Move plan and is identified by Metrolinx as a priority for future transit investment.
2014	Relief Line Project Assessment launched. City/TTC commence planning for the preferred route alignment and station locations for the Relief Line.
2015	Yonge Relief Network Study recommendations approved by Metrolinx Board. Allows project development for the Yonge North Subway Extension. Affirms that the Relief Line Project Assessment should continue, to ensure that a project is ready for when needed in 2031.
JULY 2016	City Council approves Relief Line Initial Business Case and Preferred Alignment for Relief Line (Pape to Downtown via Queen/Eastern) subject to assessment of an additional alignment west of Pape, within a local segment between Gerrard and Queen.
MAY 2017	City Council approves Carlaw alignment within the local segment and directs staff to move forward with TPAP and preliminary design.
MARCH 2018	Metrolinx, in partnership with the City and TTC, initiates Relief Line North study.

RELIEF LINE

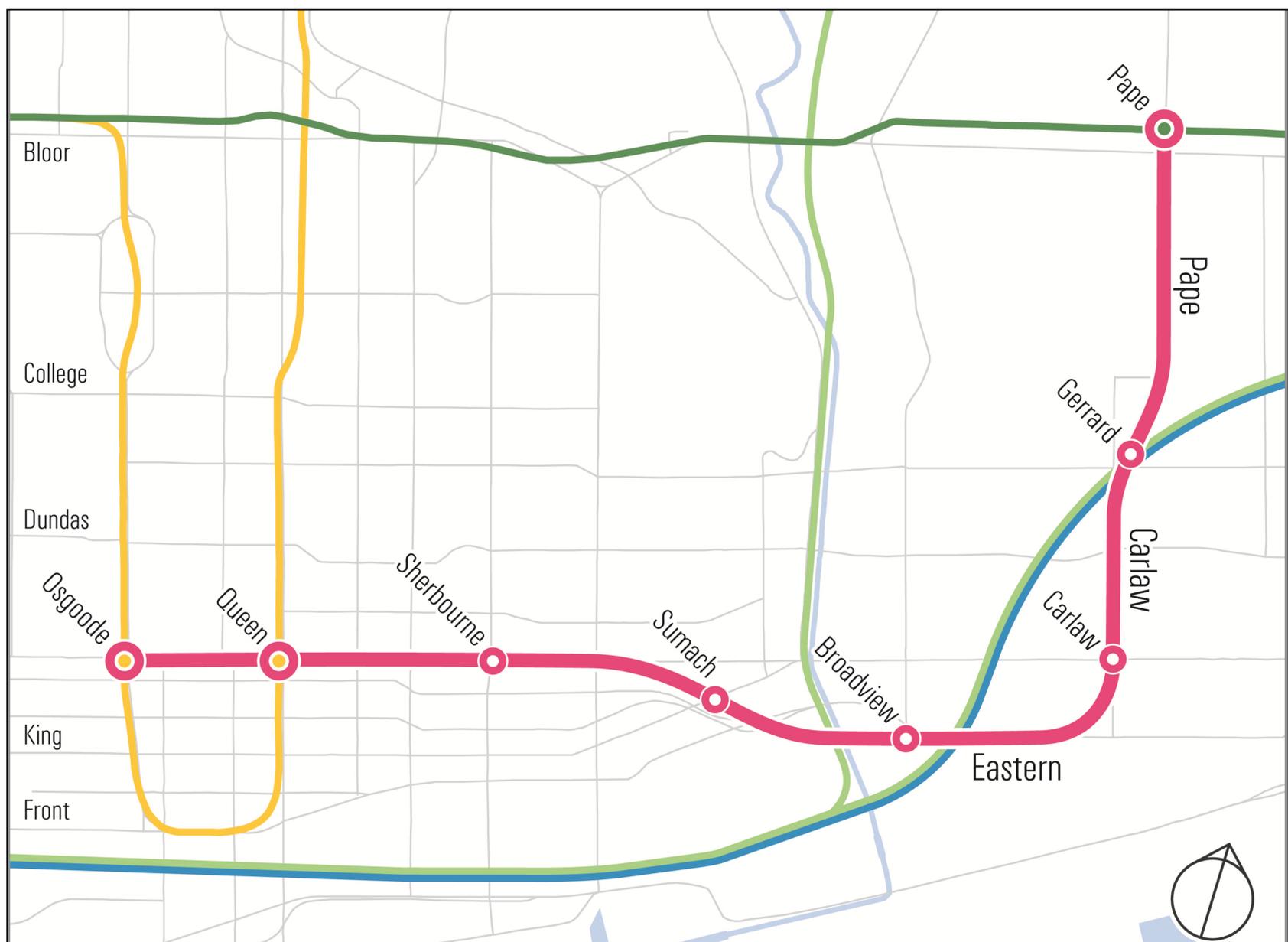
S O U T H

Preferred Alignment & Station Locations



May 2017 City Council Decision:

- Approved the Relief Line alignment and stations
- Authorized commencing the Transit Project Assessment Process (TPAP)
- Authorized advancing preliminary design (15-30%) and report back on Class 3 cost estimates in Q4 2019.



Evaluation Framework

Serving People



CHOICE

Develop integrated network that connects different modes to provide for more travel options



EXPERIENCE

Capacity to ease crowding/congestion; reduce travel times; make travel more reliable, safe and enjoyable



SOCIAL EQUITY

Do not favour any group over others; allow everyone good access to work, school, and other activities

Strengthening Places



SHAPING THE CITY

Use the transportation network as a tool to shape the residential development of the City



HEALTHY NEIGHBOURHOODS

Changes in the transportation network should strengthen and enhance existing neighbourhoods; promote safe walking and cycling



PUBLIC HEALTH AND ENVIRONMENT

Support and enhance natural areas, encourage people to reduce how far they drive

Supporting Prosperity



SUPPORTS GROWTH

Investment in public transportation should support economic development; allow workers to get to jobs more easily; allow goods to get to markets more efficiently



AFFORDABILITY

Improvements to the transportation system should be affordable to build, maintain and operate

Transit Project Assessment Process

- The City, TTC and Metrolinx are working together to undertake the Transit Project Assessment Process (TPAP) under Ontario Regulation 231/08 to assess the potential environmental effects of the Relief Line South.
- Public and stakeholder consultation is an important component of this process.
- TPAP includes a suite of supporting technical studies based on field work and data collection and analysis:
 - Cultural Heritage, Archaeology, Socio-Economic, Natural Environment, Noise and Vibration, Air Quality, Traffic and Transportation, and Tree Inventory
 - Technical studies are drafted and under review by regulatory agencies
 - > Existing environmental conditions were determined and the significance of specific features evaluated through field work and desktop studies
 - > Potential impacts of the project on these features are identified and documented
 - > Mitigation measures, monitoring strategies and future studies are recommended
- The Environmental Project Report is being prepared for public review in August/September 2018.



RELIEF LINE

SOUTH

Highlights of Environmental Studies

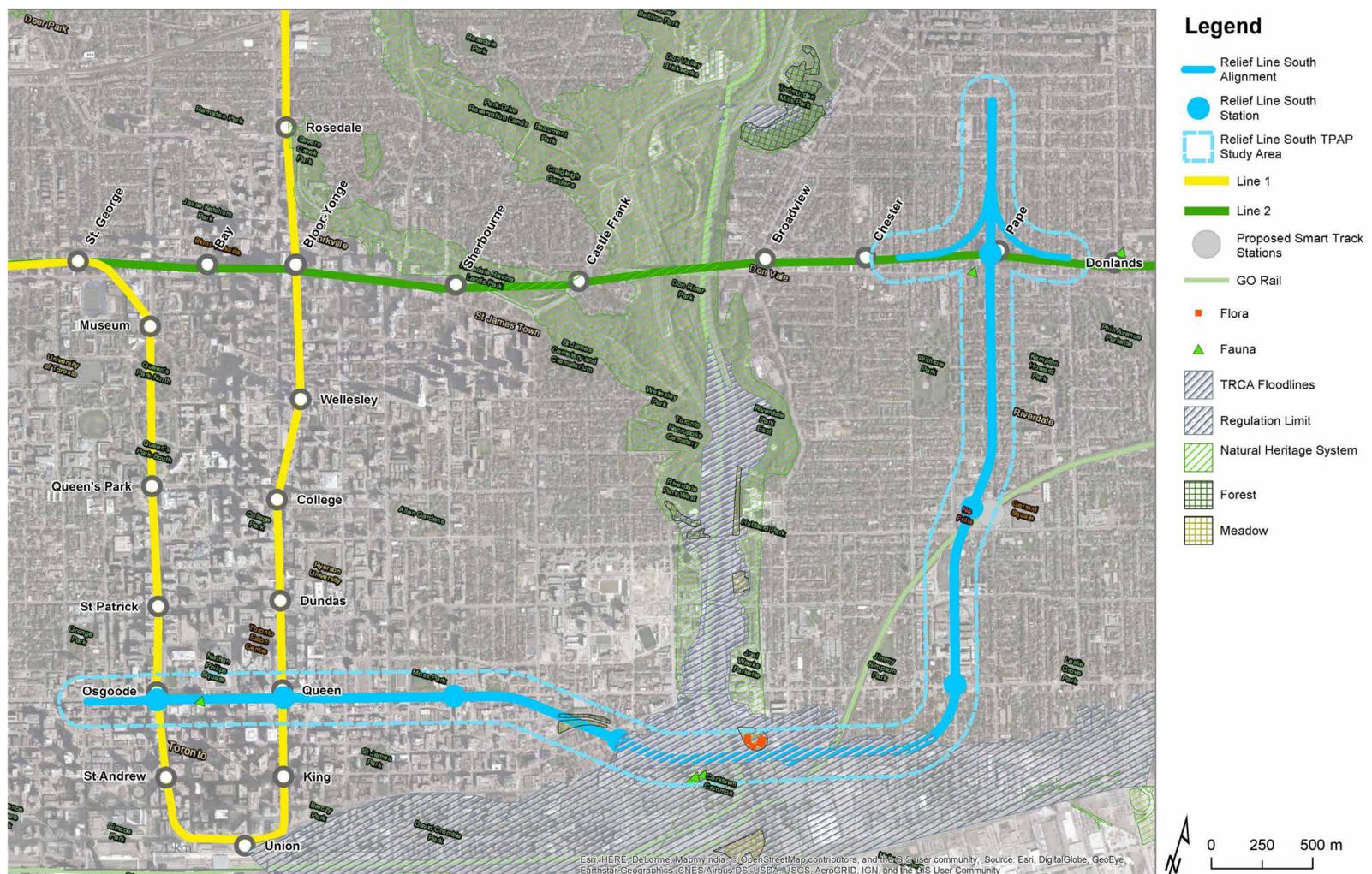
NATURAL ENVIRONMENT

Potential Effects

- Minimal impacts to vegetation, wildlife, and terrestrial habitat due to underground nature of the project and urbanization of project area
- No impacts to critical habitats
- Disturbance/destruction of nests of migratory birds
- Sediment release in Don River affecting fish habitat conditions and vibrations influencing fish behavior
- Increased runoff from the roofs of permanent surface structures
- Temporary sedimentation and soil erosion during the cut-and-cover construction.
- Ground movement and settlement associated with tunneling and box structure construction
- Temporary impacts to the groundwater conditions may be expected during construction.

Mitigation Measures

- Schedule construction outside of overall bird nesting season (April 1-August 31); where not possible, complete nest surveys
- Restore vegetation following construction
- Implement a monitoring regime of impacts on Don River, such as sediment barriers and a spill response plan
- Implement stormwater treatment measures in the vicinity of surface structures to enhance runoff quality where feasible
- Implement an Erosion and Sediment Control plan prior to construction
- Complete detailed settlement analysis during detailed design; apply ground movement mitigation measures, such as shoring, and implement a settlement monitoring program.
- Develop a tree preservation, removal and compensation plan during detail design
- Station and tunnel construction plan will employ strategies to limit groundwater infiltration.



Highlights of Environmental Studies

SOCIO-ECONOMIC

Potential Effects

- Temporary use of/access to adjacent lands during construction
- Temporary visual effects resulting from construction activities (e.g., stockpiling, storage/laydown sites)
- Temporary and permanent property requirements
- Temporary impacts to businesses including reduced visibility, reduced on-street parking, access restrictions
- Temporary nuisance effects during construction (e.g., air quality and noise)
- Permanent changes to the visual character of a neighbourhood with the construction of stations and other structures
- Increased potential for tripping and slipping hazards and bike lane and sidewalk closures or detours
- A risk of spills or discharge of pollutants during construction.

Mitigation Measures

- Provide alternative access and signage
- Notify and consult with property owners and local residents about construction activities
- Confirm potential access/easement and property requirements and consult with property owners
- Visual screening of construction site to extent possible
- Attention will be paid to the location and design of stations, emergency exit buildings, and other ancillary structures during the detailed design phase of the project. The approval process will include review by the City of Toronto's Design Review Panel.
- Explore opportunities for public realm improvements
- Develop spill contingency plan, including clean up procedures.

UTILITIES

Potential Effects

- Deep tunneling construction minimizes impacts to utilities, however there may be conflicts, especially at cut and cover works
- Disruptions to services during relocations and switching between permanent and temporary services.

Mitigation Measures

- Permanently relocate utilities in direct conflict with permanent works or large utilities that cannot be temporarily braced
- Disruptions to customers will be minimized through discussions with the utility companies and careful planning.

ARCHAEOLOGY/CULTURAL HERITAGE

Potential Effects

- Potential to recover archaeological resources; Stage 1 Archaeological Assessment including historical data and field review submitted to Ministry of Tourism, Culture and Sport.
- Direct or indirect impacts to 101 known or potential properties of cultural heritage value or interest as identified in the Cultural Heritage Assessment Report.

Mitigation Measures

- Conduct Stage 2 Archaeological Assessment (AA) per recommendations of Stage 1 AA prior to construction
- Complete further archaeological studies in the event that an isolated or deeply buried archaeological deposit is unearthed during construction.
- Conduct site-specific cultural heritage evaluation reports and/or heritage impact assessments during detailed design phase
- Address impacts to properties of known or potential cultural heritage value or interest in Heritage Impact Assessments and mitigate through design modifications.

RELIEF LINE

SOUTH

Highlights of Environmental Studies

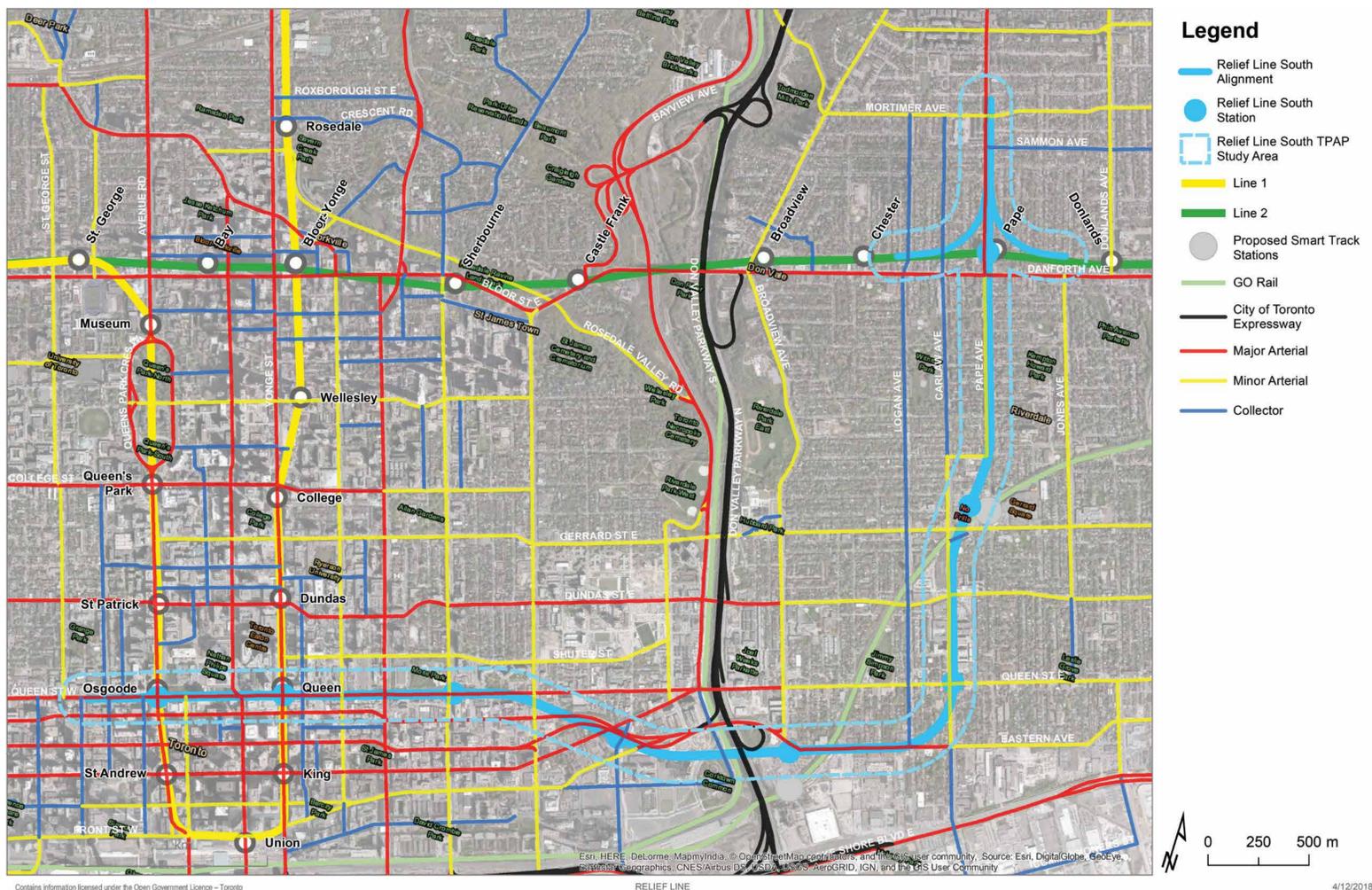
TRANSPORTATION

Potential Effects

- Project will add significant transportation capacity to the eastern half of Toronto, reducing automobile kilometres travelled and improving transit speed and reliability
- Proposed stations have the potential for localized negative impacts due to increased activity
- Construction disruption in cut-and-cover construction areas including:
 - surface transit routes on Pape, Carlaw, Queen, King, Cherry, and Eastern
 - subway service at connecting stations on Lines 1 and 2
 - pedestrian, cyclist, and vehicular movements
 - vehicle accesses and building entrances/exits for adjacent properties.

Mitigation Measures

- Develop traffic management plans during the design phase to maintain vehicle and pedestrian access to streets, driveways and property entrances
- Carry out work in a manner that ensures the least interference with pedestrians and cyclists, and to ensure provision of safe, accessible, and continuous routes
- Monitor traffic volumes on public roads and transit schedules post-construction to identify future issues and develop mitigation measures.
- Prepare supporting traffic impacts studies to ensure continued functioning of the road network around each station.



Highlights of Environmental Studies

NOISE AND VIBRATION

Potential Effects

- Perceptible noise and vibration for the construction of surface infrastructure – such as excavation for stations and tunnel launch shafts, pile driving, pavement breaking (e.g., jackhammers), earth-moving (e.g., bulldozers, trucks), and material placement (e.g., cranes). Tunnel boring will be deep underground through bedrock, with potential short periods of vibration.
- Construction impacts will be temporary in nature; those associated with tunnel boring anticipated to be less than two weeks in any one location
- No anticipated vibration or noise impacts related to ongoing operations of the trains in the tunnels. Noise impacts possible around stations, to be assessed during detailed design.

Mitigation Measures

- Comply with City of Toronto by-law for noise and vibration for construction operations, including for allowable operating hours
- Consider alternate criteria to mitigate damage in older buildings
- Monitor vibration during construction near Sumach Station as there is potential to exceed COT by-laws
- Pro-actively communicate with the community and establish protocols for complaints
- Maximize distance between residential areas and construction laydown areas where possible
- Construction equipment will be kept in good repair.

Relief Line South will use modern track design to minimize vibration



Previous track design consisted of wooden ties on a gravel bed.



Contemporary track design consists of double ties with rubber pads known as Isolation Pucks.

AIR QUALITY

Potential Effects

- Generally positive impact on air quality through a reduction in trips made by vehicles
- Temporary construction impacts including emissions from engines of construction equipment, dust emissions from cut and cover and tunneling, demolition, and material handling
- Construction impacts will be of relatively short duration and unlikely to have lasting effects.

Mitigation Measures

- Comply with Ministry of the Environment and Climate Change regulations pertaining to Suspended Particulate Matter for construction operations
- Develop and implement a Controls and Methods Plan to address dust suppressant measures during construction (e.g., covering dump trucks, minimizing loading/unloading of soils and washing of construction equipment and vehicles)
- Construction equipment will be kept in good repair to control tailpipe emissions.

Potential Property Impacts

- Subways require a variety of infrastructure at regular intervals along the alignment, including station entrances, emergency exit buildings, fire ventilation systems, and traction power substations. These are required to provide access to the subway station, evacuate subway passengers in the event of an emergency, evacuate smoke from the subway in the event of a fire, and provide electricity for the operation of the subway.
- Preliminary property requirements for the new Relief Line subway have been determined based on the conceptual design work completed to date.
- More detailed design will be carried out over the next 18 months to more precisely define the property requirements and refine cost estimates.
- Once the design work is advanced, property impacts may be further refined.

TIER	DESCRIPTION	POTENTIALLY IMPACTED PROPERTIES
1	Permanent full or partial property requirement for a new surface structure (e.g. station entrances, vent shafts, or emergency exits)	31
2	Permanent underground easement for new underground structure (e.g. tunnelling, underground passageway). A temporary easement during construction may also be required at some properties.	427
3	Permanent easement preferred by the TTC for above and below ground TTC structures. The general requirement is a 3 m lateral easement with some exceptions. A temporary easement during construction may also be required at some properties.	291
4	Temporary easement required during construction. Main activity of property can continue through construction (e.g., access road, temporary shoring underneath property).	1
5	Temporary full property requirement (e.g., a proposed staging area occupying a majority of a property including any structures)	10

What could we expect during construction?

Maintaining Surface Transit During Construction

- Optimize sequencing of construction of the Relief Line
- Temporary diversion of streetcar and bus services may be required
- Use of replacement buses



Example of decking above construction area – allows for near normal traffic operations

Maintaining Vehicle Movement

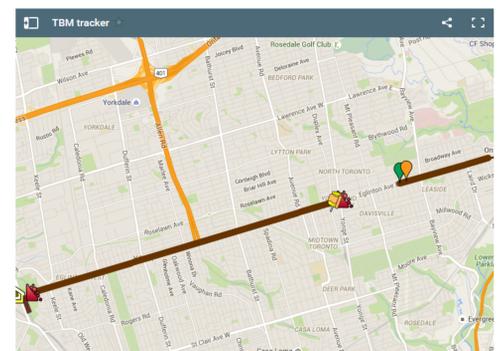
- Optimize sequencing of construction of the Relief Line
- Deck over construction open cut locations to permit traffic movement above while completing station construction
- Explore alternative station construction methods to the traditional open cut method – such as mining the station from underground
- Use of standard traffic engineering improvements (e.g. adjusting signal phasing and green time, prohibiting curb parking, enforcing prevailing traffic and parking prohibitions, etc.)



Tunnel Boring Machine (TBM) being used on the Eglinton Crosstown

Recent case studies

- Toronto-York Spadina Subway Extension (TYSSE)
 - At Finch West Station, decking has allowed for the preservation of one travel lane in each direction
 - At Pioneer Village Station complete decking has allowed for near normal traffic operations above
- The Eglinton Crosstown
 - Some stations are being mined rather than using open cut (such as Forest Hill Station and Avenue Station)



TBM tracker on the Eglinton Crosstown LRT – available on the project website

Would my property be affected?

Potential property impacts are based on the conceptual design work that has been completed to-date. More design work still needs to be carried out to more precisely define the property requirements. We anticipate that preliminary design will be completed in late 2019, with additional detailed design to follow. Once the design work is advanced, property impacts may be further refined.

What to expect

- Short-term access limitations during construction
- Longer-term access limitations during construction necessary where ground stabilization, underpinning, and other construction activities close to or within buildings would occur
- Possible acquisition of property for construction access and staging for tunnelling below
- Permanent acquisition of private property along alignment to allow for construction of station entrances, ancillary facilities (such as ventilation), and emergency exits

Affected owners

- For locations where it would not be feasible for the project to maintain reasonable access to residents and businesses, compensation may be considered for lost rental value, temporary relocation, etc.
- For property takings, compensation based on fair market value and, in the case of partial takings, reduction (if any) of the value of the remaining property
- Compensation for relocation services, replacement housing, etc.

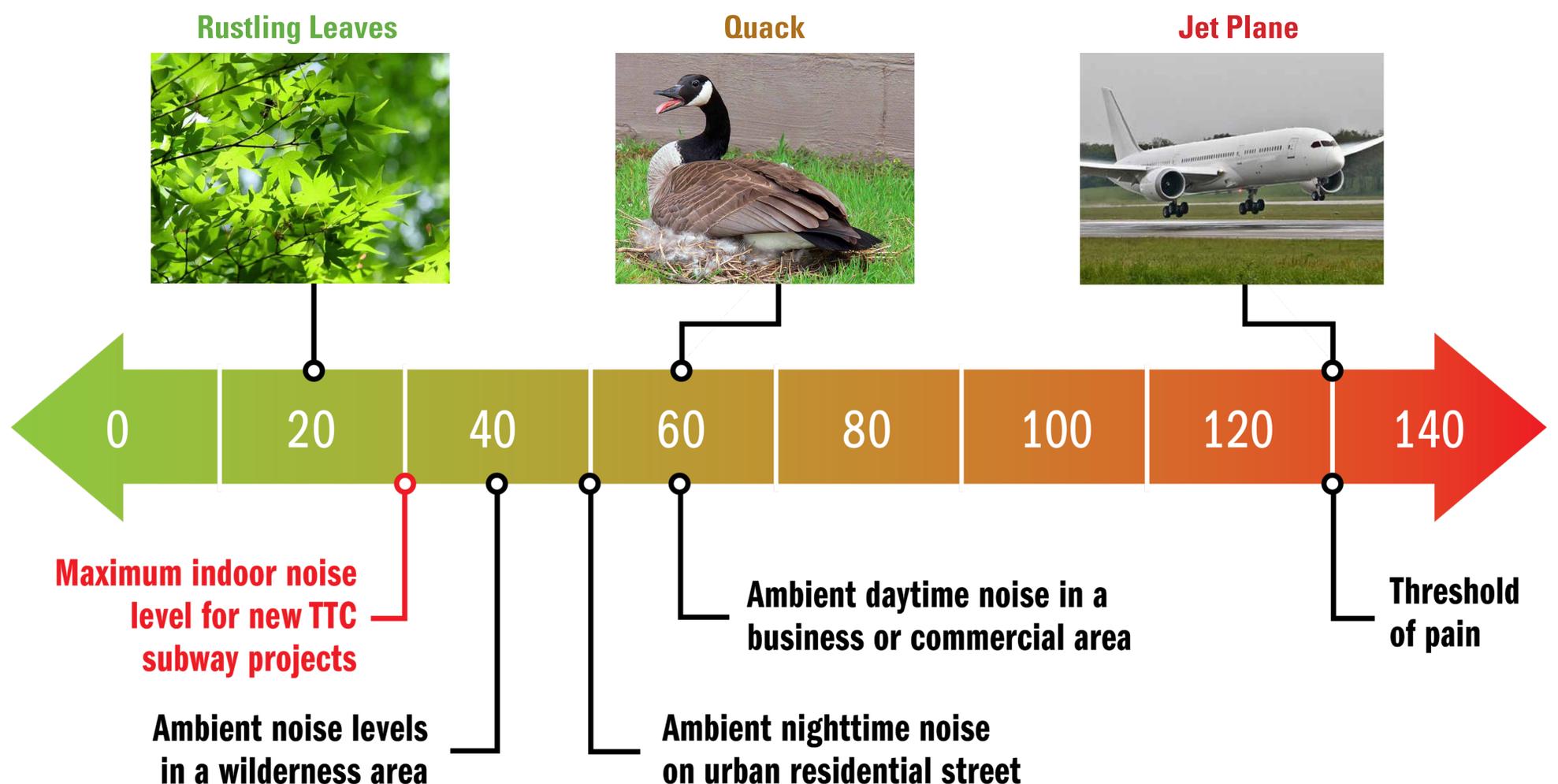
Noise Control on the Relief Line

Regulatory Approach

- Noise will be assessed in accordance with the TTC/Ministry of Environment and Climate Change protocol
- Construction noise will be further constrained by City of Toronto by-laws.

Land use	Maximum Noise Level (dBA)
Sensitive Receptors (includes residential)	30
Institutional	35
Commercial	40
Industrial	45

The subway will be designed to be below 30 dB in residential areas, lower than the typical background noise for urban residential areas.



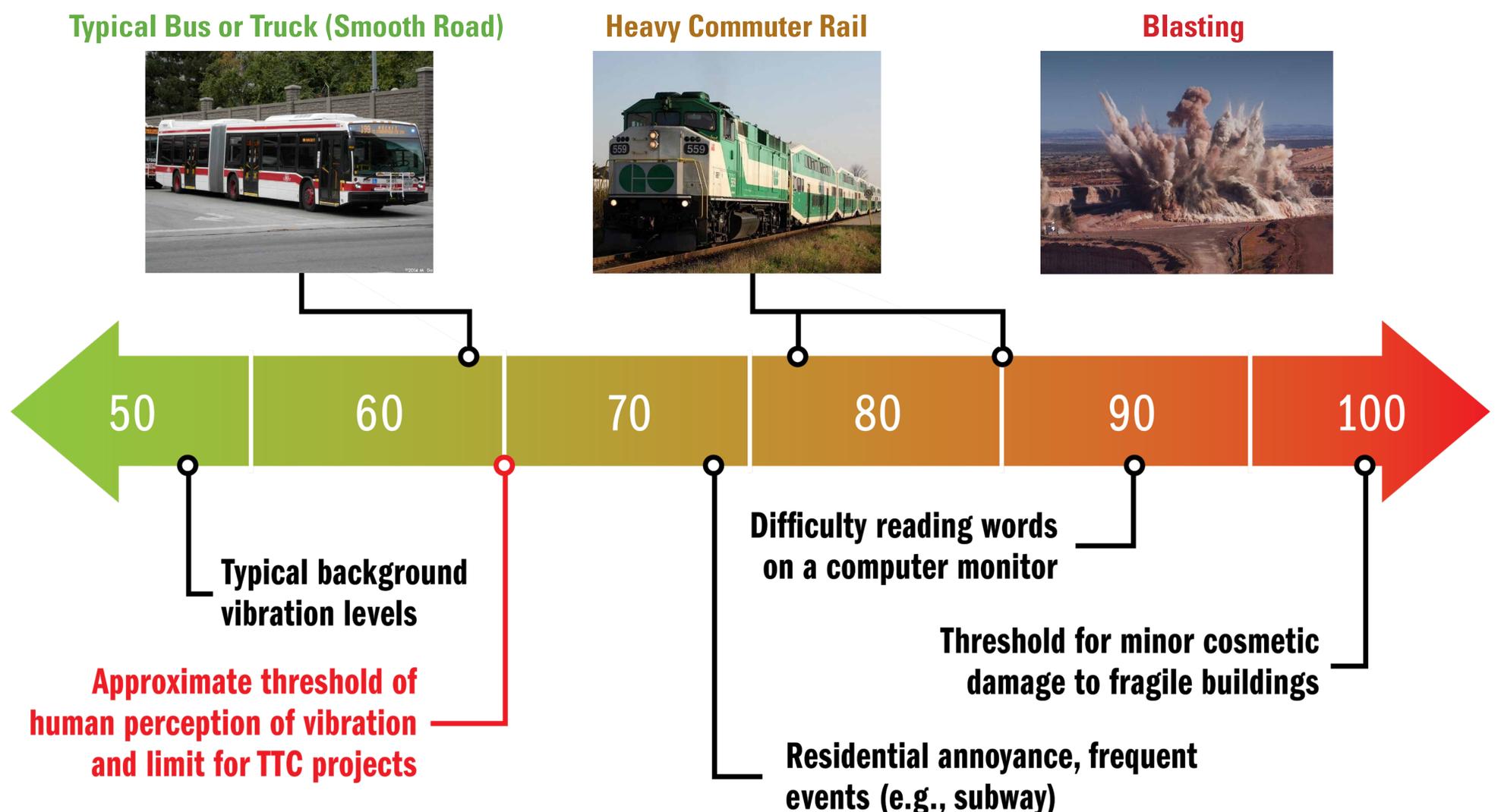
Vibration Control on the Relief Line

Regulatory Approach

- Vibration will be assessed in accordance with the TTC/Ministry of Environment and Climate Change protocol
- Construction vibration will be further constrained by City of Toronto by-laws.

Land use	Maximum Vibration Level (VdB)
Sensitive Receptors (includes residential)	65
Institutional	70
Commercial	75
Industrial	80

The subway will be designed to be below the approximate level of human perception (65 VdB)



Vibration Control on the Relief Line

Vibration Comparison – Line 4 Sheppard and Line 2 Bloor-Danforth

Vibration levels for Line 4 Sheppard and Line 2 Bloor-Danforth were measured to compare differences. Sheppard is much more comparable to Relief Line since it is deeper than Bloor-Danforth.

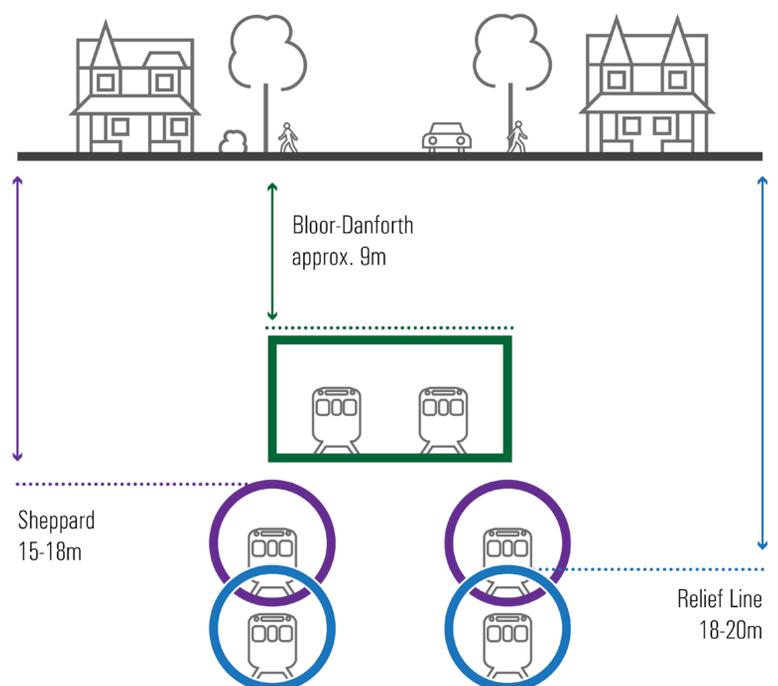
Key Conclusions

- The deeper the tunnel, the greater the reduction
- Bedrock absorbs vibration better than soft soils
- Contemporary track design for Sheppard results

Implications for the Relief Line

- Relief Line is more comparable to the Line 4 Sheppard as it will be deeper than Danforth, and possible even deeper than the Sheppard line (~18-25 metres).
- Tunnel will be mostly in bedrock
- Relief Line will be built with state-of-the art tunnel design (floating slab)
- Depth combined with geotechnical conditions and newer technologies will help to reduce potential for vibration/noise.

Comparison of Subway Tunnel Depth



All subway projects must now be designed to meet or exceed TTC and Ministry of Environment and Climate Change's stringent noise and vibration standards.

Building a Subway

Tunnelling

Two methods are proposed being used to build the Relief Line South. Much of the corridor uses tunnel boring technology to build the subway tunnels while the stations are built using cut and cover construction.

Tunnel Construction

The Relief Line South Subway Twin Tunnels are built by tunnelling underground with Earth Pressure Balance tunnel boring machines, a powerful circular cutting machine that bores a tunnel in soil or rock with minimal disruption to the surface above.



Tunnel Boring Machine "Torkie" from Toronto-York Spadina Subway Extension

Launch Shafts Near Eastern Avenue

The tunnel boring machines are launched from a deep excavated shaft called a "launch shaft" and bores a tunnel to an end location called an "extraction shaft". The material removed by the tunnel boring machine is moved out of the tunnel by a conveyor system and rail cars to the launch shaft and then transported away by dump trucks.



Typical Launch Shaft

Building a Subway

Tunnel Liners

As the tunnel boring machine advances, pre-cast concrete tunnel segments called “liners” are set in place behind the machine to form the tunnel. As they are pre-made off-site, there is some truck activity as the liners arrive on site.



Delivery of Tunnel Liners

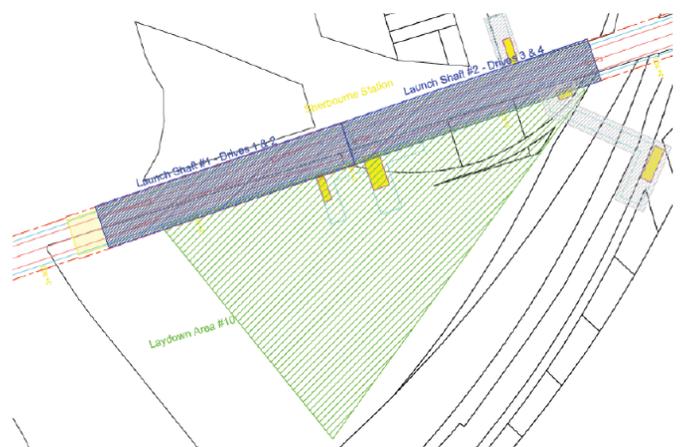
Operations and Extraction

The tunnel boring machine operates 24 hours a day, 7 days a week. Tunnelling takes place deep underground with minimal disruption to the ground above. Once it finishes a “tunnel drive”, the tunnel boring machine is broken down into several parts at the extraction shaft and transported by truck to the next launch shaft to be prepared for its next tunnel drive. Two tunnel boring machines drill in parallel about a month apart, in the same direction, to create the twin tunnels for the subway.



Typical Launch Site

A construction staging area, or worksite, is prepared at the launch shaft prior to the arrival of the tunnel boring machine and the tunnel liners. A smaller extraction shaft area is also prepared before the tunnel boring machine reaches its destination.



Relief Line South Proposed Launch Site

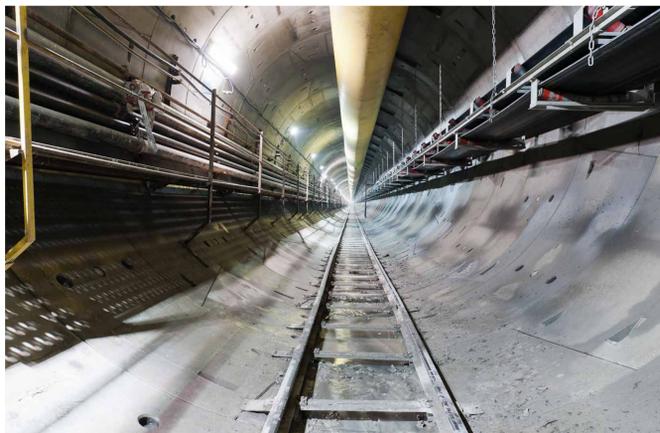
Building a Subway

Tunnel Fit Out

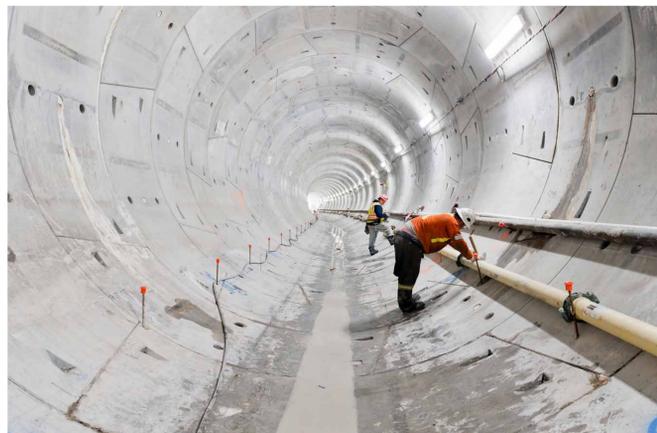
Now that tunnelling is complete, there is a lot of work yet to be done in the tunnels to get them ready for subway trains to ride in them!

Tunnel Stripping

The next step after tunnelling is complete and the tunnel alignment survey is done is to strip the tunnels of all of the equipment used for tunnelling (seen in the photo at the top); rail, conveyor system, ducts and pipes, power, ventilation system must all be removed.



Typical Complete Tunnel Before Stripping



Typical Complete Tunnel After Stripping

Invert Construction

The invert is the flat concrete slab constructed at the bottom of the tunnel on which the track ties and track will sit. The last step before track installation is forming and building the safety walkways. These walkways also contain conduits that carry cables for the many systems that are required to operate the subway including communications, power, signals, and emergency systems.



Typical Invert

Building a Subway

Installing Track

Once the invert is poured and the curbs are installed, the next stage to ready the tunnels for service involves the installation of track. A specialized contractor is now performing a series of steps to complete this work.

First, concrete double ties (reinforced concrete pads) each weighing 2,400 kg are delivered and stacked in the tunnels in preparation for installation. Next, special vibration isolation pucks, resembling giant hockey pucks, are pre-fastened to the underside of the concrete ties, separating the ties from the concrete trackbed and forming a cushion to absorb noise and vibration. Then a special machine nicknamed "Gizmo" is used to place the concrete ties in the tunnels.

Next, the rail is positioned on and secured to tie plates which are affixed on top of the double ties. A pip-jig supports the rail in the correct position and bolts are then fastened into the holes in the ties with epoxy. A grout pad is then poured under the tie plates, filling the void.



Concrete double ties, ready for installation



Vibration Isolation Puck



Typical Track Completed

RELIEF LINE

S O U T H

What Information Would be Helpful?

We are committed to keeping you informed as work on the Relief Line South advances.

We are planning some follow-up events to provide information to area residents and business:

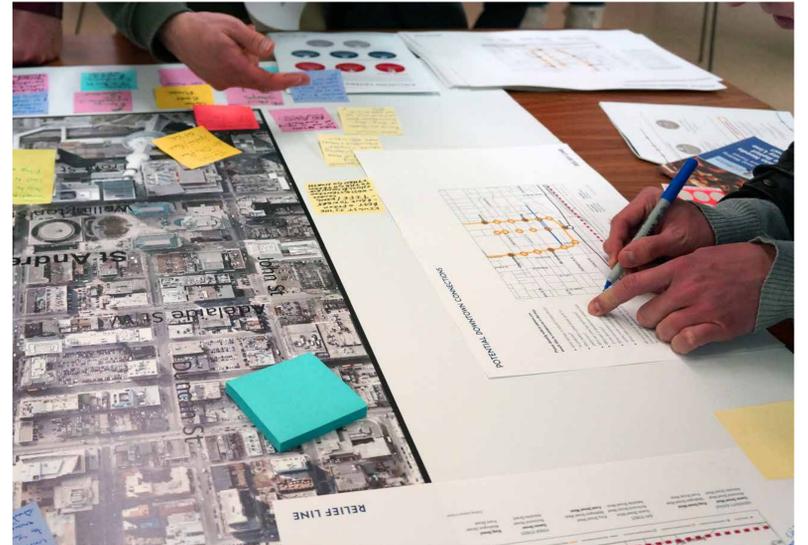
- **New Subway Construction 101** – information session on subway construction methods and techniques
- **New Subway Noise and Vibration Site Visit** – experience what a new subway sounds and feels like during operation, at an actual location along the new Spadina Subway extension

Please let us know what additional information would be helpful to you. Place your suggestions below ...

Share Your Thoughts and Stay Involved

Please complete a feedback form and stay informed and involved.

- Please submit your feedback by May 4, 2018
- All feedback will be recorded and will be summarized in the Draft Environmental Project Report
- You can submit your comments in a variety of ways:
 - On-line at www.reliefline.ca
 - By email to reliefline@toronto.ca
 - By phone at 416-338-1065
 - Complete a comment sheet
 - Speak with project staff
 - Document your comments with a note taker
- Make sure you are on our mailing list if you would like to receive project updates. You can leave your email or mailing address at the welcome table or sign-up on the website
- Twitter users: Share your ideas using #TransitTO



Thank you for attending the meeting today!