

CANADA

→ ONTARIO OVERVIEW

Although not necessarily related to hydropower, a huge volume of work is taking place across Ontario in eastern Canada, especially Toronto, Canada's largest city and the provincial capital.

Deep geologic repository project

A world away from hydropower, arguably 'renewable' to some, but certainly contentious to many, nuclear power provides opportunities for the underground construction industry – and Canada is no exception.

On June 18, the Joint Review Panel for the Deep Geologic Repository Project for Low and Intermediate Level Radioactive Waste (DGR) announced that it had scheduled a public hearing for the project. The facility is not proposed for the storage or management of used nuclear fuel, but would manage around 200,000m³ of waste. The operating mandate is strictly for waste from Ontario Power Generation (OPG)-owned or operated nuclear generating stations in Ontario.

Located 680m underground, the DGR will lie in low-permeability limestone below a 200m-thick layer of low-permeability shale. OPG said these sedimentary bedrock formations will provide natural barriers to safely isolate and contain the waste for the planned specification.

The DGR includes two shafts and two panels of emplacement rooms. The facility includes a main shaft for waste transportation, plus a ventilation shaft to complete the circuit, along with various services areas. The facility design completed in May 2010 advanced the previous conceptual design work from 2008.

World Tunnelling was told that the safety assessment for the facility has rigorously



An arch of seven interlocking TBM-bored cover tunnels was used at the Billy Bishop pedestrian tunnel, Toronto

included operational and long-term phases. For some, these may be (confusingly) termed the pre-closure and post-closure phases, but it is important to remember the intent of the facility and the safe long-term management and storage of nuclear waste, so post-closure when the facility is effectively unmanned is a key consideration.

Conclusions of the safety assessment include:

- the facility can be built and operated safely;
- the host rock is effective in providing long-term isolation and containment;
- most of the radioactivity will decay in and around the repository;
- the potential dose to a person assumed to be living on top of the repository would be negligible and well below both the public dose limit and natural background radiation dose rate.

ONTARIO: TORONTO**Billy Bishop Toronto City Airport Pedestrian Tunnel**

On July 5, as *World Tunnelling* was preparing to go to press, the Toronto Port Authority (TPA) announced that excavation had begun on the main pedestrian tunnel to Billy Bishop Toronto City Airport.

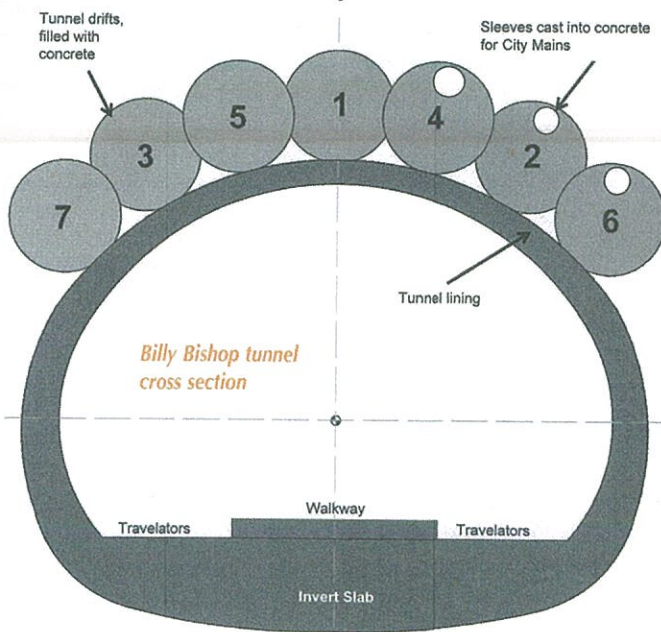
The US\$78 million project is being carried out under a partnership between TPA and Forum Infrastructure. Mooted since the 1930s, the 244m tunnel was budgeted at US\$61 million, with a 10% contingency. The higher winning consortium price was explained by the TPA as:

- the tunnel connects to a different location than originally planned, so it is 50% longer;
- all consortia suggested building the tunnel deeper than planned;
- industry demand caused price increases; and
- the contract proposed by the winning consortium meant it assumed all liability for cost overruns.

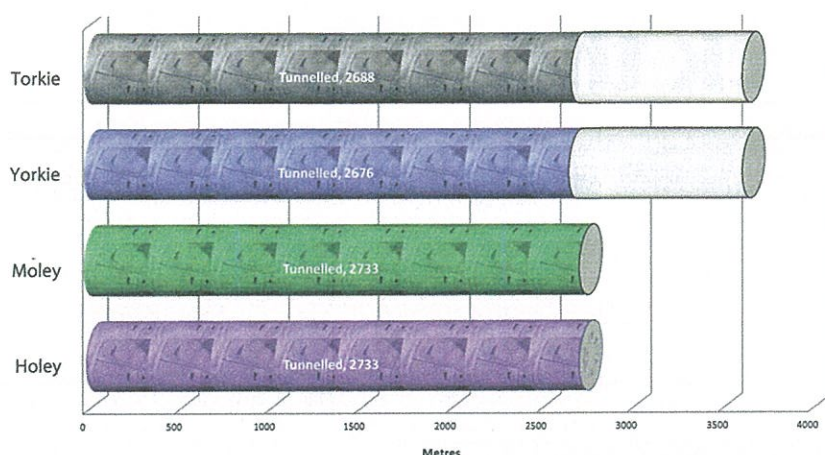
The tunnel is being built at no cost to taxpayers; instead it is paid for via a C\$20 levy on each envisaged passenger. This will also be used for ongoing tunnel availability cost budgets. The concept's arch of TBM-bored tunnels provides cover to the main tunnel profile. These were completed in May. The arch consists of seven interlocking bored tunnels over the crown of the pedestrian tunnel. They are backfilled with concrete to form horizontal secant piles, but three of them had City of Toronto water and sanitary mains installed first. Two 1.8m-diameter Canadian-made Caterpillar TBMs, 'Chip' and 'Dale', were used for crown pre-support.

Excavation will continue in two main phases:

- the top heading of the tunnel;
- sinking of the elevator shafts to final invert, after which the bottom heading will be excavated. All excavation should be complete by Q3, 2013.



"The US\$78m project is being carried out under a partnership between TPA and Forum Infrastructure"



Bar graph showing progress of the four TBMs on the Toronto-York Spadina Subway Extension, Toronto. Source: Toronto Transit Commission

Forum's construction partner is PCL and the tunnel partners are Arup Design and Technicore for the construction of the tunnelling works. One innovation that helps in the congested urban environment, for reducing noise and dust effects, as well as vehicle movements, is that PCL will pump concrete through the tunnel for airside construction use, so there is less need for concrete trucks to cross to the island side. The tunnel should be in use by mid-2014.

Toronto-York Spadina Subway Extension

On June 14, TBM 'Yorkie' broke through to the headwall at the extraction shaft on Steeles Avenue West as part of the ongoing works on the Toronto-York Spadina Subway Extension (TYSSE). The TBM's sibling, 'Torkie', had broken through previously on June 13.

Both TBMs are due to be launched on their final drive to the Vaughan Metropolitan Centre Station.

The project has been proceeding well, with significant excavations to date. Overall, the project is posted at 85% complete. The northern tunnels are being excavated by a consortium of OHL-FCC; the south tunnels by Aecon-McNally-Kiewit. Due for completion in September, the southern tunnels are being excavated by two 6.13m-diameter Caterpillar EPBMs. Expected geology includes silts and sands to firm water-bearing silts.

Crosstown Tunnel LRT

Also in Toronto, work on the Eglinton-Scarborough Crosstown Tunnel Light Rail Transit (LRT) is under way by the Crosstown Transit Constructors JV (Obayashi Canada, Kenny Construction, Kenaidan Contracting and Technicore Underground). MetroInx, an Ontario government agency overseeing the new LRT, is carrying out the work.

The JV was the first to be awarded any of the tunnelling works on the 11km project. With a second-lowest bid of US\$303 million, the JV is using owner-procured TBMs to excavate twin 5.75m ID running tunnels over 6.25km.



Jobsite at Toronto-York Spadina Subway Extension

Southeast Collector Project

In April, an underground explosion sent four workers to hospital on the York region's Southeast Collector Project in Toronto. The Ministry of Labour (MoL) was notified because it was a reportable incident. The methane explosion took place during a cutterhead intervention and led to the MoL placing a 'do not disturb' order on shaft No 10, where the event occurred. *World Tunnelling* learns that Shaft No 10 is the deepest shaft on the project and from which over 60% of the new sewer will be driven. The MoL went on to issue a requirement order for air testing.

Investigations by the MoL, main contractor Strabag and the Regional Municipality of York led to a review and revision of the intervention procedures and other items. Following this, in mid-May, the 'stop-work' order eventually issued for all four of the 3.62m-diameter Caterpillar EPBMs being used on the project was lifted and tunnelling resumed.

On June 1, the A1 TBM broke through on its 1,113m drive to shaft No 11, after launch from shaft No 10. Following any necessary post-inspection maintenance work on the cutterhead, the TBM will continue driving towards shaft No 12.

The 14,916m Southeast Collector project has to date been completed in these stages:

- Drive A1: 1,159m of 4,669m, (25% complete);
- Drive A2: 1,033m of 4,459m (23% complete);
- Drive B1: 1,655m of 2,902m (57% complete);
- Drive B2: 1,348m of 2,886m (47% complete).

Part of the York Durham Sewage System (YDSS), the Southeast Collector Trunk Sewer is being built to operate the YDSS responsibly and service approved growth, as well as permitting inspection and rehabilitation of the existing trunk sewer.

As a gravity system without the mechanical parts required for conveyance of sewage, the possibility of malfunction is considered low. Combined with the fact that the trunk sewer will not be a combined stormwater overflow, this means the system is considered very environmentally sound and was the first in Ontario to undergo an Individual Environmental Assessment (IEA) process: the most rigorous such process in the province.

ONTARIO: NIAGARA AREA

Niagara Tunnel

No brief Canada round-up would be complete without mention of the recent milestone on the Niagara Tunnel Project. During construction, it featured the world's largest-diameter TBM at that time. On March 21, Ontario Power Generation (OPG) announced that water was flowing through the 12.7m-diameter tunnel, 10.2km from the intake just upstream of the iconic Niagara Falls, to the Sir Adam Beck generating complex.

Early on in the project, difficult ground conditions in the crown led to excessive overbreak and slower-than-planned progress. In 2009, OPG and Strabag agreed to a revised schedule and budget with revised expectations of the ground conditions based on what had been encountered.

OPG calls the project one of the best-value renewable energy initiatives in Ontario, as the project cost will finally be reconciled at US\$95 million lower than the revised US\$1.5 billion, and with an in-service date nine months sooner than projected in 2009.

Perhaps one of the proudest achievements for the project is that, despite ground conditions, the difficulties encountered and the employment of over 580 workers at the project's peak, the safety performance was twice as good as the industry average.

THE FUTURE

This is just a brief overview of some of the recent milestones on a few of the projects in Canada. It is fair to say the industry is booming in Canada at all levels, and with projects such as Ottawa's long-planned light rail transit scheme, plus the Quebec and Western on-going hydropower projects in the works and planned, it seems the future is bright for Canadian tunnellers.