

Transportation and service infrastructure remain as a major market for the use of underground space. Canada's expansive mining and hydroelectric sectors are continuing to push the development of underground technologies and utilization, and recent developments with natural gas and oil pipelines are presenting further opportunities provided politics can be overcome.

Eastern Canada:

Transportation

Transportation tunnelling continues at a rapid pace with Metro projects underway in Toronto and Ottawa. Work was completed in 2013 on tunnelling for the \$700 million Spadina Subway Extension. Toronto's Transit Commission is now completing the infrastructure within the bored tunnels with a view to entering this new section into service in 2015.

Toronto's Island Airport is undergoing a major expansion as part of the overall revitalisation of the downtown core. This includes the construction of a new pedestrian tunnel below the inner harbour.

The Eglinton Cross Town Light Rail also in Toronto is now underway with two EPB tunnelling contracts totalling about \$460 million. On the west contract, both TBMs have been launched. The East contract was awarded in October and includes another two TBMs.

The Ottawa LRT a \$2 billion project including LRT tunnels and four underground stations is now under construction.

Montreal is actively designing and preparing to tender extensions to their current transit systems.

In Windsor, the environmental assessment for the Detroit River Rail Tunnel project is complete.

Water and Sewer

Infrastructure improvements within urban centres are well underway with major upgrades and enhancements to existing utilities, these include the 15 km long \$300 million contract South East Collector north of Toronto, and this involved four separate TBMs. Two of the tunnel sections were completed in 2013 with the remaining two sections due for completion early 2014.

In other areas work commenced on both the 13 km Hanlan Feeder Main and The 7

km long Mid-Halton effluent sewer and outfall, both in Peel Region, the Strachan Storm Water Syphon tunnel where tunnel construction is now complete and the twinning of the West Trunk Sewer.

The City of Toronto is embarking on the design procurement for 22km of tunnels associated with a major CSO control project; this follows the completion of the Coxwell Emergency bypass, which bypassed a damaged section of a Main Toronto Trunk Sewer.

The Pan Am Games are planned for Toronto in 2015 and these games are providing the major for much expansion and development.

The City of Montreal is doing a call for tender for a 4 km long, 3.2 m diameter water conduit by the city of Montreal. Two other small utilities private tunnels are planned in Québec province; one for the Hotel-Dieu hospital expansion in Quebec City, and the other located on the McGill University campus in Montreal

Hydro Power

Hydro Power Quebec is nearing completion on the Romaine River Project, located on the North Shore of the St-Lawrence River a to develop four sites, the following projects Romaine 3 and Romaine 4 are presently under design.

Western Canada:

Transportation

Metro Vancouver's Evergreen Line Rapid Transit Project is underway; the design-build-finance contract has been awarded to EGRT Construction (led by SNC-Lavalin). The project includes a 2 km long 10 m diameter tunnel, to be excavated using a CAT EPB TBM (scheduled to arrive in late 2013)

After the successful completion of the North LRT to NAIT extension tunnels, the City of Edmonton is about to decide on the timing for construction of the \$1.8-billion, City Centre to Mill Woods line. Although most of the 13.1 km alignment will be at grade, crossing the North Saskatchewan River will require construction of an approximately 400 m long tunnel section.

Water and Sewer

Metro Vancouver's Seymour-Capilano Twin Tunnels are nearing completion. These 7.1 km long, 3.8 m diameter twin tunnels were constructed through a JV between Aecon, JF Shea and Frontier Kemper. Final shotcrete and steel liner installation is 50% complete. The Project is scheduled to be completed by summer 2014.

Seismic upgrades to Metro Vancouver's water and sewer mains are currently a key focus area. The Port Mann Water Supply Tunnel Project is underway. Sinking of the 670m deep north and south shafts is now completed. Excavation of the 1 km long, 3.5 m diameter tunnel will soon commence (late 2013/early 2014) using a CAT EPB TBM. Construction is being undertaken by the McNally-Aecon JV. The project was featured in the Fall 2011 issue of the TAC Magazine. Proposed projects for Metro Vancouver include: the Second Narrows Water Supply Tunnel Project, a 1.1 km long water supply tunnel connecting North Vancouver and Burnaby. The 5.7 m diameter tunnel will be driven through variable soils and bedrock beneath Burrard Inlet. Preliminary design is underway, with construction to commence in 2016. Also, the Annacis Main No 5 Water Tunnel is a proposed water supply tunnel beneath the Fraser River connecting New Westminster and Surrey. Conceptual design and route selection is underway, with construction to commence in 2018.

Maximizing protection of the environment through the upgrading of their sanitary sewer systems remains a key focus area for the cities of Calgary and Edmonton, which continue to grow at a rapid rate due to the healthy state of the economy in the Province of Alberta. In Calgary, two tunnels have been completed and one is in planning as part of the Nose Creek sanitary upgrades in north Calgary. These range in length from 170 to 300 m, and 2 to 3 m in diameter, constructed using small diameter TBMs. Liner strategies have consisted of ribs and lagging primary support followed by placement of centrifugally cast fibreglass reinforced polymer mortar pipe (CCFRPM), with grouting of the annulus. Construction has not been without its challenges, generally associated with the high variability of the local weak mudstones.

In Edmonton, Stage W13 of the West Edmonton Sanitary Sewer project is underway, which includes a 1.2 km long and 2.3 m diameter tunnel. Another significant project is the Mill Woods Double Barrel Replacement tunnel, 1.7 km long and 2.9 m in diameter, also under construction. As in past projects, these tunnels are being excavated by TBMs owned and operated by the City of Edmonton, with either precast concrete segmental (one pass) liners, or ribs and lagging primary support and cast in place concrete secondary liners. The geological conditions along the tunnel alignments include lacustrine clays and glacial tills, thick sand strata and weak Cretaceous clay shale and sandstone.

Hydro Power & Mining

British Columbia is also currently experiencing an increase in activity in hydroelectric and planned mining project development. Tunnelling has completed at Columbia Power's Waneta Expansion in southeastern B.C. (contractor: SNC Lavalin) and on AltaGas's 195 MW Forrest Kerr Hydro Project in northern B.C. (contractor: Procon Mining and Tunnelling). The latter includes over 5 km of drill & blast access, tailrace and power tunnels.

Construction is underway on AltaGas's 66 MW McLymont Creek Hydro Project, 10 km downstream of the Forrest Kerr Project. Project includes a 2.7 km long power

tunnel. Tunnelling commenced in Q2 2013, by Procon Mining and Tunnelling. The project is scheduled for completion in late 2015.

The proposed B.C. Hydro John Hart Generating Station Replacement Project, located on Vancouver Island, includes the construction of a 2 km long tunnel and associated shafts. The project is currently in the RFP stage, with three short listed teams.

Seabridge Gold's proposed KSM mine in northwestern British Columbia is one of the largest undeveloped gold projects in the world. The project is currently undergoing its environmental impact assessment review. If approved, \$350 M of tunnelling activities are planned including two parallel 23 km long ore conveyance tunnels.

NovaGold and Teck's proposed Galore Creek Project in northwestern British Columbia is one of the world's largest undeveloped copper-gold-silver deposits. The project received environmental approval but has stalled due to costs. A new prefeasibility study has been completed that lowers risk. If constructed (2018 at the earliest), the project would include a 12 km ore conveyance tunnel to connect the mine to the mill site.