

# Shoring Wall Braced with Extra-Long Soil Anchors

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## **Shoring Wall Braced with Extra-Long Soil Anchors**

A revolutionary type of tieback soil anchor used to solve the problem of drilling through fill, soft clay and saturated sands, and terminating in till, worked so well in 1998 that the shoring contractor is using the same technique again. This time however, the special soil anchor is being applied to a lesser extent to solve a similar problem at the new Yonge Street subway station.

The general contractor at both sites is Mississauga-based Ellis-Don Construction Ltd., which has a \$105 million contract with the Toronto Transit Commission for the Yonge work and a \$54 million contract for the bridge assignment at Leslie Street.

The 6.4 km long Sheppard Subway from Yonge St. east to Don Mills Road. is probably the largest concentration of shoring operations currently under way in the country. The most extensive job by far is at the Yonge/Sheppard corner where Toronto-based Anchor Shoring & Caissons Ltd. is installing 28 000 m<sup>2</sup> of shoring, more than 11 000 m<sup>2</sup> of timber traffic decking and more than 800 struts as the excavation--in places 21 m deep--takes shape for the station.

The soldier pile and lagging at both the Yonge and Don River bridge sites is braced by regroutable anchors. According to Dawn Tattle, P.Eng., president of Anchor Shoring, these are not common in the Toronto area. "We require high capacity tiebacks and very long anchors. A conventional soil anchor would be less than 60 ft (18 m). These new anchors are up to 40 m in length.

"There were very large loads on the tiebacks and the site was underlain by up to 21 m of fill, soft clays and loose, saturated sands. The anchors were founded in the dense till below. Conventional anchors could not be used under these conditions."

The tieback drilling was done by Crown Drilling Ltd., a sister company of Anchor Shoring. A drill rig was converted by one of Crown's partners, Brian MacMillan, for installing the extremely long, high-capacity tiebacks. "The cased system was expensive to set up, but it was ideal because of the nature of the soil and the anchor length required," Tattle says.

She describes the grouting operation: "We drilled a 7 in. diameter (178 mm) cased hole, then installed high-strength steel cables and hoses inside the casing. Grout was pumped into the casing and the casing was then extracted. The next day, the tiebacks were regrouted under pressure, causing bulbs to form along the anchor length." The regrouting increased the anchor's capacity.

Mike LeSage, P.Eng., Anchor Shoring's superintendent, who is now on the Yonge job, says about 2500 m<sup>2</sup> of soldier pile and lagging shoring was constructed at the site of the 65 m long Don River bridge which carries the subway tunnel.

The soldier piles went in for two shoring walls near the river (east wall and west wall) and for the bridge abutments. Another 3530 m<sup>2</sup> of shoring was installed for sections of open cut box tunnel leading up to the bridge, as well as for the Leslie station.

Canadian BBR Inc. was retained by the shoring contractor to supply, grout and stress the more than 6000 m of anchors at the Leslie station and the bridge. Besides the converted tieback rig, the Leslie bridge shoring crews used three crane-mounted drill rigs with vibratory hammers to install the soldier piles. According to Anchor Shoring's manager of field operations, Tom Stack, boulders and other obstructions and a high watertable complicated the drilling.

The shoring contractor also erected a steel falsework deck over the river for the bridge formwork. Designed by the general contractor, the falsework took shape atop HP piles driven into the riverbed by subcontractor Bermingham Construction Ltd.

The subcontractor also drove HP piles for the bridge abutments as well as for 11 m high cast-in-place retaining walls which the general contractor monolithically poured in front of the east and west shoring walls. The 80 m long east shoring wall took shape along Sheppard Ave. while the 70 m long west shoring wall (see HCN cover) was constructed to stabilize the access road to the North York General Hospital. The 15 m high shoring walls have been backfilled.

Tattle says her field crew is scheduled to return this month to the Leslie station site and install struts across the excavation after the Leslie St. traffic is detoured. (Soldier piles were installed last year.) Shoring design for both the Leslie and Yonge jobs was done by RWB Engineering Ltd., Willowdale.

Meanwhile the company president is spending most of her time fine-tuning the work with her crew at the 15-month Yonge station shoring job which is expected to wind down in December 1999.