



GEO-FOUNDATIONS Contractors Inc.

Rideau Regulator Chamber



Date: 2008

Technology: Soil Permeation Grouting

One component of the City of Ottawa's ongoing strategy to upgrade its critical infrastructure is the improvement of several overflow chambers making up part of the City's combined storm/sanitary sewer system. Expansion of the existing Rideau Regulator Chamber, buried deep beneath grade at the foot of the stepped walkway connecting historic Rideau Canal with Canada's parliament buildings, posed a unique set of challenges to the City's Engineers due to existing conditions above and below grade. The chamber is located beneath a narrow strip of land in the shadow of the Plaza Bridge that had to be kept open to pedestrian access. Below grade, the chamber is 14 metres deep, extending deep into bedrock, but is surrounded by debris-rich, loose sand fill and a high water table.

Grouting at this site was specified to achieve two goals – to adequately stabilize the fill soils to the extent necessary to facilitate safe excavation for construction of the expanded chamber, and for the long term mitigation of risk to the sewer system from potential future seismicity. Permeation grouting, employing both suspension and solution grouts, was designed and constructed over two phases by Geo-Foundations in the spring and autumn of 2008.

Double-head duplex drilling was used to temporarily case the holes to depth in order to install tube-a-manchette sleeve pipes. The drilling had to be successfully advanced through sand, silt and bedrock ledges underlain by more sand fill, as well as several concrete, wood and steel obstructions.

Sleeve pipes for permeation grouting were arranged on a 1 metre centre-to-centre grid spacing, and varied in depth from 6 metres to 14 metres. In total, 34 sleeve pipes were installed for grouting; an additional 3 sleeve pipes were installed at select locations to assess the in situ permeability of the target soil mass before and throughout the grouting work. Grout was injected in multiple passes over several days. Microfine cement grout was injected in the first pass, but only through sleeve pipes that were not within the footprint of the proposed excavation. All of the grout holes were injected with two passes of sodium silicate solution grout. In total, over 4,500 litres of microfine cement grout and more than 46,000 litres of sodium silicate grout were injected into the soil mass. There were 444 targeted sleeves, averaging 115 L of grout injected per sleeve. Real-time monitoring and recording of grout flow vs. time and pressure vs. time was employed throughout the work.

Comparison of hydraulic conductivity testing results from before and after grouting showed a reduction of permeability in the soil mass greater than one order of magnitude. The ultimate success of the grouting program was proved when the grouted soil remained self-supporting upon excavation throughout the entire advance of the temporary steel liner to 14 metres depth. A very minor amount of water seepage was observed during excavation, but its source was determined to be the untreated bedrock.



Installing sleeve pipes inside the limited-access site



Advancing the steel liner through grout-consolidated soils



View of site showing Parliament Buildings in background