



## GEO-FOUNDATIONS Contractors Inc.

### 9th Line Trunk Sewer



Date: 2006

Technology: Compaction Grouting

During the jack-and-bore excavation of a tunnel beneath an existing railway, extremely challenging soil and groundwater conditions led to the over-excavation of soil. Several months after the sewer tunnel had been constructed, subsidence of the rails was detected. After more months of monitoring the settlement, it was determined that remedial intervention measures would have to be undertaken to arrest the settlement. Compaction grouting was chosen as the method best suited to affecting the desired improvement while accommodating ongoing daily passenger rail service.

In order to safely execute the compaction grouting program, minimum offset clearances were established to keep the grout holes safely distant from existing gas services and the actual sewer tunnel itself. Non-percussive, double-head duplex drilling was used to install the grout holes. Grout was delivered in a bottom-upwards fashion in 1-metre stages via 2-metre long segments of reusable 127mm diameter drill casings. Grout holes were drilled at varying angles from plumb all the way to 35 degrees off vertical in order for the drill rig to be positioned outside the influence of passing rail traffic. Pre-bagged compaction grout was used from time to time to supplement the supply of ready-mix delivered grout.

In total, over 40 cubic metres of compaction grout was injected into the ground around and above the sewer. Grout was delivered through 46 different holes, arranged in primary and secondary arrays. Real-time, precision monitoring of the rail grade was maintained throughout the operation to ensure that ground heave exceeding 3mm cued the stoppage of grouting.



*Double-head drilling to install grout casings*



*Compaction grouting in progress*



*9th Line compaction grouting site*