



Injection pipe ready for injection. Note the undisturbed landscaping.

Restoration with Minimal Site Disruption

The multi-unit residential building located at 3219-3223 W. Division St. has experienced considerable façade distress and some foundation wall settlement. A structural engineering report was prepared by MVA Engineering Consultants that addressed probable cause and remediation for the problem. The report dated December 11, 2013 indicated that the building distress was due to desiccation of the native clay soils. The report recommended remedial activity to stabilize the affected foundation wall sections.

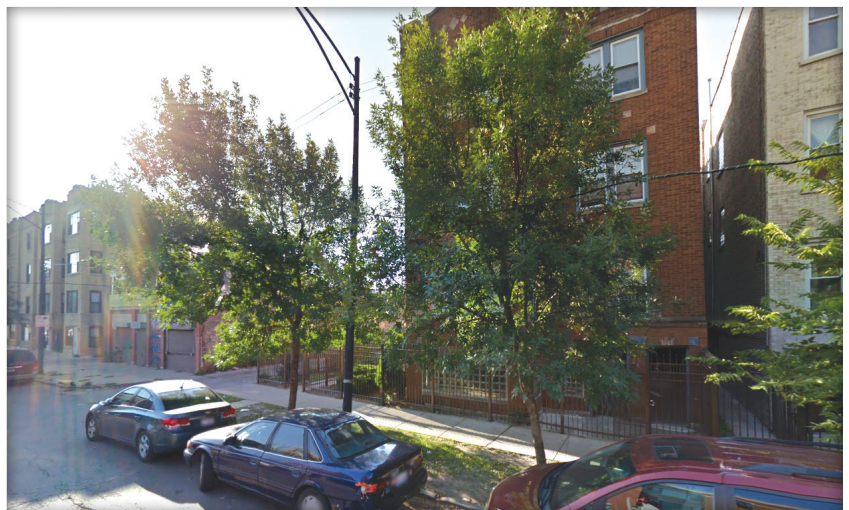
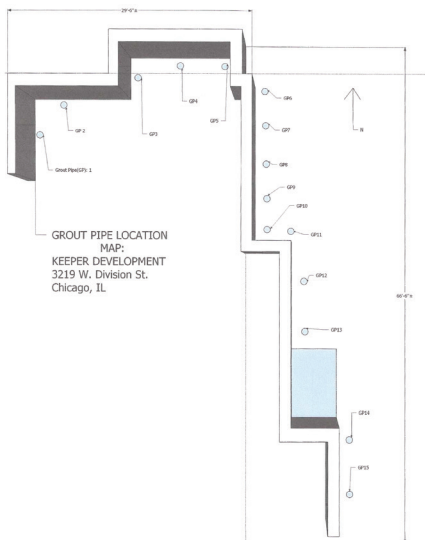
Procedures included the following:

- Grout mix designed for pumpability
- Low mobility grout with a slump of about 3 inches
- Measurement of grout placement pressures
- Structure and surface elevation monitoring +/- 1/16"
- Measurement of grout volume placed in ground

Undisturbed Stabilization

Compaction grouting was chosen as the technique to stabilize the perimeter foundation walls as recommended in the MVA Engineering "Structural Engineering Report with Remedial Measures". Compaction grouting would densify the loosened soil and fill the voids created by the desiccation. Lincoln Company followed standard industry procedures while performing the work.

Compaction grouting was used in order to minimize site disruption and restoration costs due to the minimally invasive nature of the procedure.



Multi-unit residential building located at 3219-3223 W. Division St., Chicago, IL.



Coring 3-inch diameter holes through the basement floor.



Pipes driven adjacent to exterior walls.

The 2-inch diameter grout injection pipes were driven to the design depth using a 140 pound pneumatic hammer. A total of 15 grout injection pipes were driven adjacent to the north wall and the northern most 67 feet of the east wall. The grout injection pipes were driven to between 10.5 and 12 feet below grade where the driving was terminated in soils of adequate bearing capacity. Five of the pipes were installed from within the basement by first coring 3-inch diameter holes through the basement floor.

Following driving, each of the pipes was extracted approximately six inches to release the sacrificial drive point and allow the grout to exit from the injection pipe. The remaining pipes were driven adjacent to the exterior walls.

The grout was injected in compliance with a three-fold termination criteria program using a high pressure Allentown grout pump. The first termination criterion was volume. A target volume of four cubic feet per two feet injection interval was initially established based on the area of influence of the grout pipe.

The second termination criterion was injection pressure. Compaction grouting systems are typically capable of applying over 500 psi of injected pressure for 2-inch to 3-inch slump materials at the injection point. Given the nature of the silty clay soil profile and the close proximity to the foundation walls, the termination criterion was established to be 400 psi maximum at the injection point.

The third termination criterion was surface heave. Surface movement was anticipated and was expected to range from 1/16" to 1/8" per injection stage. Indication of any movement resulted in the termination of the stage and withdrawal of the pipe to the next stage.

The termination criteria are indicators of on site conditions. They are routinely adjusted, within limits, as the grouting superintendent and field technical personnel interpret the responses measured in the structure(s).

The compaction grout material used was a mixture of fine sand, Type I Portland cement, Type C fly ash, and an anti-wash out admixture. The Redi-mix grout was supplied by H.J. Mohr and Sons. The compaction grouting procedure was controlled and monitored by Lincoln's grouting Superintendent.

The process of using compaction grouting to fill voids and densify loose soil zones is a progressive systematic process. The grout placement record for each location provides information as to the soil condition in a treated area. As voids are filled, and as loose soil zones are densified, closure of a treated area occurs. Performance is measured by a reduction in volume of grout placed, an increase in pumping pressure, and may also include an indication of controlled surface movement.

The grouting work proceeded as anticipated for this type of ground improvement work. The volume of grout placed varied within expected limits. The initial placement pressures were relatively high and steadily increased indicating the successful filling and densification of the treated zone. As the grout placement progressed the volume of grout placed reduced, the pressure increased, indicating complete void filling and densification of the treated area.

Based on Lincoln Company's experience with similar projects, and our ability to meet the established termination criteria, we are confident that the compaction grouting has increased the density of loosened soils to acceptable levels in the treated areas and filled the voids created by the desiccation.

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