



## **REPORT**

**of**

## **GEOTECHNICAL INVESTIGATION**

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**Proposed New Building  
74 Grand Street  
New York, NY**

Prepared for: TJD 21 LLC  
245 Park Avenue, Suite 2421  
New York, NY 110167

Prepared by: Geo Tech Consultants, LLC.  
52 East 2<sup>nd</sup> Street  
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GTC Job No: TJDL113  
Date: March 4, 2013



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TJD 21 LLC  
245 Park Avenue, suite 2421  
New York, NY 110167

Attn: Mr. John Dunne

Re: Geotechnical Investigation Report  
Proposed new Building  
74 Grand Street  
New York, NY  
GTC Job No.: TJDL113

Dear Mr. Dunne:

This report presents the results of a limited geotechnical investigation performed by Geo Tech Consultants (GTC) for the above referenced project. The work was performed in accordance with our proposal dated February 8, 2013 and your subsequent written authorization. The scope of our service was described in our proposal and included:

- Installation and full-time inspection of two (2) test borings;
- Performance of engineering evaluation to determine the stratification and physical characteristics of the subsoil, and to develop recommendations for the design and construction of foundations for support of the proposed building;
- Preparation of a written report complete with test data, analysis, conclusions, and recommendations.

## **1. PROJECT AND SITE DESCRIPTION**

The subject property, known as Block 475, Lot 60 of the Borough of Manhattan, City of New York, is located on the north side of Grand Street, approximately 25' west of Wooster Street. The site measures 25' by 100' and is currently vacant. The site is adjoined by a 2-story building on the east, a 6-story brick on the north, and a vacant parcel on the west.

Preliminary project information indicates that the proposed construction consists of an 8-story building with a full basement, the depth of which is reportedly to be established at 11'-6" below the proposed first floor or about 10' below existing sidewalk level.



No detailed structural loading information was available at the time this report was prepared.

## **2. FIELD EXPLORATION**

### **2.1 Test Borings**

The subsurface conditions of the project site were explored with two test borings, labeled as B-1 and B-2, at the locations as shown on drawing G-001, which is attached at the end of this report. The borings were installed by Craig Test Boring Company of Mays Landing, New Jersey on February 25 and 26, 2013 and inspected by GTC professional engineering staff.

Both borings were drilled to a depth of 102' below existing grade. Borings were advanced using mud rotary method. Soils encountered in the borings were generally sampled at five (5) ft interval except for the first 12' in boring B-1 and from 10' to 22' in boring B-2, where continuous samples were collected. Each soil sample was extracted using a Standard Split-Spoon sampler by performing a Standard Penetration Test (SPT) in accordance with ASTM D1586. Where refusal was encountered, rock coring was performed using NX double core barrels.

During drilling operations, extracted soil samples and rock cores were visually examined and classified by our field engineer. The soil samples were then placed in sealed glass jars and rock core in wooden box, both were later returned to driller's shop for storage.

Detailed description of the soils encountered in the borings was documented in the boring logs, which are presented on drawing G-001.

## **3. SUBSURFACE CONDITIONS**

The following provide a general description of the subsoil conditions inferred from the test borings. While the borings may indicate that the subsurface conditions appear to be relatively uniform across the site, it should be recognized that the number of borings was small compared to the size of the site, and that the existence of anomalies cannot be precluded.

### **3.1 Soil Profile**

According to a published geological map (Baskerville), the project site lies in a former swamp or marshland and the bedrock is at least 120' deep. The boring findings seem to confirm this mapping.

Within the maximum depth of exploration, the borings encountered three distinguishable soil strata, including in the order of increasing depth an upper fill stratum (0'-10'), a marshland deposit (10'-22'), and a glacial substratum that extends to the termination depth of the borings. The characteristics of each stratum are described below.



### **Stratum F – Miscellaneous Fill (NYC Class 7)**

Miscellaneous fill was encountered in both borings extending to a depth of about 10' below existing grade. The fill was found to consist of a mixture of sand and brick, typical of urban land fill. The fill is NYC class 7 material and is considered unsuitable for foundation bearing.

### **Stratum M – Marshland deposit (Sand, Peat & Silty Clay, NYC Class 6)**

The fill was underlain a marshland deposit that consists of interbedding layers of sand, organic silt/clay, and peat. These layers are of OL/Pt/ML (with occasional SM) Groups of USCS and are considered mostly NYC Class 6 material, which has limited supporting capacity. The marshland deposit extends to depths of about 20'-22' below existing grade.

### **Stratum G - Glacial Deposit (Sand and Gravel, NYC Class 3b to 2a)**

The marshland strata were underlain by a glacial deposit that extends to the maximum depth of the exploration.

Extracted soil samples suggest that the first 60'-65' of the glacial deposit consist predominantly of coarse-medium-fine sand with trace to some silt and gravel, consistent with SP/SM Group of the USCS. The sands registered mostly medium dense compact condition with penetration blow counts (N values) ranging between 10 and 30 blows per foot (bpf), matching NYC Class 3b material.

From the depth of 85' and down, the glacial deposit consists mostly of gravel, cobble, boulders and/or rock fragments and registered dense to very dense compact condition with N values exceeding 30 bpf, matching NYC Class 2a material.

The recovery of rock fragment near the maximum depth of the boring seems to suggest that bedrock may not be too far down. Available geological map and boring data from the adjacent sites suggest that bedrock is about 120' below grade near the area.

## **3.2 Groundwater**

Groundwater was observed within the marshland strata at depths of about 15' below existing grade. It should be pointed out that groundwater table is known to fluctuate with seasonal, tidal, and climatic conditions.

## **4. DISCUSSION AND RECOMMENDATIONS**

The boring logs indicate a general profile of 10' of miscellaneous fill, followed by 10'-12' of marshland sediments of sand, silt/clay and peat, and then 60'-75' of glacial deposit of sand and gravel, cobble and boulder.



Our analysis suggests that neither the miscellaneous fill nor the marshland deposit is suitable for foundation support. The proposed building in our opinion can best be supported on deep foundations such as piles. Our discussion and recommendations regarding the proposed piling systems are presented below.

## **4.1 Pile Foundations**

### **4.1.1 Type of Piles and capacity**

Two types of piles, namely Auger-Cast-In-Place piles and Micropiles, are considered in our analysis. Both piling systems generate little vibration and noise during installation and are considered suitable for this project. Micropiles however are generally more favorable in the urban setting and are our recommendation.

#### **A. Auger-Cast-In-Place Pile (ACIP)**

Auger cast-in-place pile involves augering a test hole of specified diameter in the ground to a predetermined depth, and then backfill the hole with pressure grout. The grout impregnates the surrounding soil and develops skin friction once it hardens.

Based on the boring data, our analysis indicate that auger cast-in-place pile of 16” diameter could develop allowable bearing capacity from 30 tons to 50 tons when installed to proper depth. Higher capacities beyond those recommended are possible with larger diameters.

ACIP piles require detailed structural design with proper grout strength and reinforcement to meet the structural requirements for design capacity. For estimation of geotechnical capacity, a nominal bonding strength of 4 psi between the grout and surrounding soil may be considered. It is likely that ACIP piles would be limited to 85’ of depth as the subsoil below this depth consists mostly of gravel, cobble and boulders, which would make auger advancing difficult.

#### **B. Micropiles**

Micropiles are drilled piles that penetrate into suitable bearing strata and derive bearing capacity from skin friction between the pile grout and the surrounding soil.

While many techniques are available, the installation of micropiles generally involves spinning a steel casing of desired diameter through soil to the depth specified or required. Once the casing reaches the required depth, grout is pumped under pressure into the hole through the casing while casing is being withdrawn. The casing will be pulled to a specified depth and then left in place with grouting continue inside the casing until it reaches the top of the casing or cutoff point.

Based on the soil profile and conditions established from this investigation, it is our opinion that micropiles to be used for this project should be at least 10” in diameter and can be designed for capacities ranging from 30 tons to 100 tons depending upon the loading requirements and penetration depth.



For the estimation of geotechnical capacity of the piles, a nominal bonding strength of 8 psi between the grout and the glacial sand soil (up to 85' of depth) may be considered. If piles need to advance below 85' into the gravel and boulder strata, a nominal bonding strength up to 20 psi may be considered for that layer.

To prevent piles from developing downward drag in the upper fill and marshland strata, and to provide them with some bending resistance, we suggest that piles be cased to a depth of 25' below existing grade. This casing requirement should apply to both piling systems.

Similar to ACIP piles, micropiles require detailed structural design with proper grout strength and steel reinforcement to meet the structural requirements for the specified pile capacity. The piling design shall be carried out in accordance with the requirements of NYC Building Code.

Due to the specialty of drilling techniques, both micropiles and ACIP are generally contracted out as performance specifications with contractor being responsible for design, installation and quality assurance. Once the project structural engineers specify the design capacity of the piles, the minimum required strength of the grout, and the strength of steel casing and reinforcement, the awarded contractor would then submit design drawings, calculations and installation procedures to project engineer for review prior to mobilization.

#### **4.1.2 Pile Load Tests**

Both micropiles and ACIP piles are friction piles and will require pile load tests to confirm their design parameters and pile capacities. Pile load tests shall be performed in accordance with NYC Building Code and ASTM 1143.

#### **4.2 Seismic Design Considerations**

For seismic design purpose, the site can be considered a site Class D. Refer to NYC Building Code for additional seismic-related criteria for foundation design.

#### **4.3 Liquefaction Potential**

The boring data suggest that the in-situ soil is considered liquefiable soil according to NYC Building Code. To minimize liquefaction potential, it is suggested that piles for support of the proposed building extend at least 20' below the liquefaction influence depth of 50'.

#### **4.4 Basement Slab and Walls**

##### **4.4.1 Design groundwater level**

Groundwater was observed in the borings at depths about 15' below existing grade. To account for seasonal variation and tidal effect, we suggest design groundwater level be assumed at a depth not lower than 11' below existing grade.



#### **4.4.2 Lateral Earth Pressures**

Permanent basement walls below grade should be designed to withstand long-term, at rest equivalent fluid pressures of 60 pounds per cubic foot (pcf) for wall above design groundwater level and 90 pcf for wall below design groundwater level.

Temporary walls, such as excavation shoring, if required, should be designed to withstand equivalent fluid pressure of 40 pcf for walls above groundwater level and 80 pcf below groundwater level.

Backfill against the basement wall should consist of sand and gravel with no more than 8% fines (minus No. 200 sieve size). The fill should be placed in horizontal lifts and each lift should be compacted to at least 95% of the maximum dry density as determined in accordance with ASTM D1557.

#### **4.4.3 Basement Floor Slabs**

The proposed basement floor slab should be designed and constructed as a structural slab supporting on piles.

#### **4.4.4 Foundation drainage and Under-slab drainage**

Foundation drainage is recommended for installation around the basement. Typical foundation drainage system should consist of 6" perforated and filter fabric-lined PVC pipe, covered with 6" crushed stone in all directions. Water collected in the foundation drainage system should be directed into ejector pits and/or sump pits where it can be pumped out and discharged into approved facilities.

Under-slab drainage system is optional but not required. Typical under-slab drainage system should consist of 12" of  $\frac{3}{4}$ " crushed stone with perforated and filter fabric-lined drain pipes looping within the crushed stone course at 15'-20' spacing. Water collected in the under-slab drainage system should be directed to ejector pit or sump pits where it can be pumped out and discharged into approved facilities.

#### **4.4.5 Dampproofing and Waterproofing**

In light of the site history (swamp or marshland) and the close proximity of prevailing groundwater table to the proposed basement level, it would be most prudent to waterproof the slab and portion of the basement wall. The basement wall should be waterproofed to a depth not lower than 3' above the design groundwater table.

### **4.5 Dewatering**

Dewatering shall be expected during the excavation of basement, pile caps and elevator pits. The extent of dewatering operation will depend upon the level of prevailing groundwater table at the time of construction. Keep in mind, groundwater table is known to fluctuate with seasonal, tidal and climatic conditions. In general, dewatering can be accomplished by means



of sump pump technique or well point method, depending upon the scope and extent of the dewatering requirement.

## **5. CONSTRUCTION MONITORING**

### **5.1 Protection of Adjacent Structures and Sidewalk**

The excavation and installation of the proposed foundation system will require shoring, bracing, and underpinning the adjacent structures and sidewalks, which should be designed by a professional structural engineer engaged by the contractor. The design drawings should be submitted to the project engineer for review and approval prior to installation. The underpinning and bracing work shall be subject to special inspection by a qualified professional engineer as required per NYC Code.

### **5.2 Pre-construction Survey**

It is strongly recommended that a pre-construction survey be conducted to document the existing conditions of the adjacent structures and sidewalks prior to commencement of any construction activities related to the new building. The conditions of the adjacent structures and sidewalk should be monitored periodically during the course of the project.

### **5.3 Filling and Backfilling**

Backfilling against pile caps and walls should utilize qualified fill materials meeting the grading requirements for control fill as per NYC Building Code. Control fill should be placed in 12-inch loose lifts and each lift should be compacted to at least 95% of its maximum dry density as determined in accordance with ASTM D1557.

## **6. LIMITATIONS**

The conclusions and recommendations contained in this report are based on the subsurface data obtained during this investigation and on the details stated in this report. Should conditions be encountered which differ specifically from those stated in this report, we should be notified immediately so that our recommendations may be reviewed and/or revised, if necessary.

## **7. CONSTRUCTION CONSULTATION AND INSPECTION**

Due to the nature of the soils and subsurface conditions at this site and the recommendations set forth herein, consultation and inspection services by a qualified soil engineer are recommended for the following:





1. Preparation of the site, including clearing, excavation of ground floor, and initial proofrolling and compaction of the in-situ soils.
2. Placement of all controlled backfill and/or fill, if any.
3. Site preparation.
4. Pile installation inspection.

We trust the above information will allow you to proceed with the design and construction of the proposed building.

We thank you for the opportunity of providing this service to you. Should you have any questions regarding this report, or if we can be of further assistance, please do not hesitate to contact us.

Respectfully Submitted  
Geo Tech Consultants LLC

Steve J. J. Lin, P.E.

Attachments:

Drawing G-001      Record of Boring Logs

