PRELIMINARY GEOTECHNICAL SUMMARY
FOR
PROPOSED PARKING FACILITY
SCHOOL STREET LOT
DOVER, NH
CITY OF DOVER
OFFICE OF THE FINANCE DIRECTOR
288 CENTRAL AVENUE
DOVER, NH 03820-4169
ATTN: DANIEL BARUFALDI

JTC Project # 11-GEO-005
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<table>
<thead>
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<th>Section</th>
</tr>
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</tr>
<tr>
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</tr>
<tr>
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</tr>
</tbody>
</table>
JOHN TURNER CONSULTING, INC
19 DOVER STREET
DOVER, NEW HAMPSHIRE
603-749-1841 (p) / 603-516-6851 (f)
NH-MA-ME-VT
consultUIN.com

MEMORANDUM

TO: City of Dover
    Office of the Finance Director
    288 Central Avenue
    Dover, NH 03820-4169

FROM: Kyle Urso
      Field Engineer
      Kevin Martin, P.E.
      Geotechnical Engineer

DATE: February 24, 2011

RE: PRELIMINARY GEOTECHNICAL SUMMARY
    PROPOSED PARKING FACILITY
    SCHOOL STREET LOT
    DOVER, NEW HAMPSHIRE

Project No. 11-GEO-005

This memorandum report presents the findings of a subsurface exploration program and a preliminary evaluation of the conditions encountered as they relate to the feasibility of a proposed parking facility. The contents of this report are subject to the attached Limitations.

BACKGROUND

The purpose of this preliminary geotechnical study is to review the subgrade conditions and feasibility for potential re-use of city owned lots. Future development is uncertain but may include a parking lot or parking garage. A parking garage may be up to 4-7 stories with considerable load.

SITE & PROJECT DESCRIPTION

The project site is presently utilized as a parking lot. The site is relatively level based on visual estimate. A Site Plan is in the process of being complied for the project. Recent survey of the test bores indicates site grades to vary from elevation =61-67 ft possessing a gradual downward slope to the east. An Environmental Site Assessment (ESA) is also being completed for the project. This ESA report was not completed at the time of this study. It is noted that the site was prior used for residential development. Prior Sanborn Fire Maps show several dwellings throughout the property.
SUBSURFACE EXPLORATIONS

Test Borings

The subgrade conditions were reviewed with the completion of four (4) test borings throughout the lot. The test borings (identified as B1 to B4) were advanced to refusal depths of about ≈3-25 ft utilizing continuous flight solid stem augers. Soil samples were typically retrieved at no greater than 5 ft intervals with a 2-inch diameter split-spoon sampler. Standard Penetration Tests (SPTs) were performed at the sampling intervals in general accordance with ASTM-D1586 (Standard Method for Penetration Test and Split-Barrel Sampling of Soils). Field descriptions and penetration resistance of the soils encountered, observed depth to groundwater, depth to apparent bedrock refusal and other pertinent data are contained on the attached Test Boring Logs. The test borings were located by survey as shown on the Test Boring Location Plan.

SUBGRADE CONDITIONS

The subgrade conditions, in general, consist of (1) shallow granular Fill underlain by (2) a stiff Silt & Clay then (3) Refusal. The refusal was variable being met at depths of ≈3-25 ft below grade.

A shallow, granular Fill was encountered throughout the site to shallow depths of ≈2-3 ft. This fill is expected to be the pavement gravel base. Other fill should be expected being associated with intersecting utilities and past construction. The predominate overburden consists of a grey-brown, stiff to hard, Silt & Clay, trace fine sand. The Silt & Clay is typically stiff to hard at shallower depths (≈10 ft) becoming progressively softer (medium to stiff) with depth. The Silt & Clay is expected to be encountered throughout most of the construction. The Silt & Clay is moisture sensitive, poor-draining and frost susceptible.

Test boring refusal, presumably bedrock, was met in all the test borings at depths of ≈3-25 ft below grade. There was about ≈2-3 ft of weathered ledge prior to refusal at most locations. The refusals were deepest at B1 & B2 (≈25 ft) towards the east. The shallowest refusal (≈3-5 ft) was met at B3 where four (4) attempts resulted in similar shallow refusal suggesting a large obstruction or ledge. The variable depth to refusal suggests a sloping and/or undulating bedrock contour. The USGS Bedrock Geologic Map of New Hampshire (1996) depicts bedrock in the area to include biotite granofels, mica schist, quartzite and/or phyllite. Such rock types are characteristically hard and of sound quality.

Groundwater was encountered in the test borings about ≈13-18 ft below grade. It should be noted that fluctuations in the level of the groundwater may occur due to variations in rainfall, temperature, and other factors differing from the time of the measurements. The study was completed at a time of seasonally low groundwater.
PRELIMINARY GEOTECHNICAL EVALUATION

The subgrade conditions are generally suitable for support of a spread footing foundation. The Silt & Clay is stable and consolidated which is favorable for shallow foundation support. The Silt & Clay can provide bearing strength of about 4.5 ksf while maintaining settlement less than 1 inch.

The subsurface conditions were reviewed with respect to seismic criteria set forth in the *International Building Code (2009).* Based on the stability and fine-grained composition of the site soils (silt and clay), the site is not susceptible to liquefaction (complete loss of shear resistance) in the event of an earthquake. Based on interpretation of the *Building Code* together with the project and site conditions, the *Site Classification* (Table 1613.5.2) is “D” (Stable Soil).

We trust the contents of this memorandum report are responsive to your needs at this time. Should you have any questions or require additional assistance, please do not hesitate to contact our office.
LIMITATIONS

Explorations

1. The analyses, recommendations and designs submitted in this report are based in part upon the data obtained from preliminary subsurface explorations. The nature and extent of variations between these explorations may not become evident until construction. If variations then appear evident, it will be necessary to re-evaluate the recommendations of this report.

2. The generalized soil profile described in the text is intended to convey trends in subsurface conditions. The boundaries between strata are approximate and idealized and have been developed by interpretation of widely spaced explorations and samples; actual soil transitions are probably more gradual. For specific information, refer to the individual test pit and/or boring logs.

3. Water level readings have been made in the test pits and/or test borings under conditions stated on the logs. These data have been reviewed and interpretations have been made in the text of this report. However, it must be noted that fluctuations in the level of the groundwater may occur due to variations in rainfall, temperature, and other factors differing from the time the measurements were made.

Review

4. It is recommended that this firm be given the opportunity to review final design drawings and specifications to evaluate the appropriate implementation of the recommendations provided herein.

5. In the event that any changes in the nature, design, or location of the proposed areas are planned, the conclusions and recommendations contained in this report shall not be considered valid unless the changes are reviewed and conclusions of the report modified or verified in writing by John Turner Consulting, Inc.

Construction

6. It is recommended that this firm be retained to provide geotechnical engineering services during the earthwork phases of the work. This is to observe compliance with the design concepts, specifications, and recommendations and to allow design changes in the event that subsurface conditions differ from those anticipated prior to the start of construction.

Use of Report

7. This report has been prepared for the exclusive use of the City of Dover in accordance with generally accepted soil and foundation engineering practices. No other warranty, expressed or implied, is made.

8. This report has been prepared for this project by John Turner Consulting, Inc. This report was completed for preliminary design purposes and may be limited in its scope to complete an accurate bid. Contractors wishing a copy of the report may secure it with the understanding that its scope is limited to geotechnical design considerations.
# Boring Log

**Client:** City of Dover  
**Project:** Geo-Analysis: 4 City Parking Lots  
School Street Parking Lot  
**Project No:** 11-GEO-005  
**Boring #:** B1  
**Location:** See Plan  
**Surface Elevation:** 63.7  
**Date:** 04-Feb-11  

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<th>Type of Boring</th>
<th>2.25&quot; H.S.A.</th>
</tr>
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<tbody>
<tr>
<td>Drilling Co.</td>
<td>Great Works Test Boring</td>
</tr>
<tr>
<td>Driller</td>
<td>Jeff Lee</td>
</tr>
<tr>
<td>JTC Rep.</td>
<td>Kyle Uso</td>
</tr>
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<thead>
<tr>
<th>FT</th>
<th>NO.</th>
<th>Sample Depth (Ft.)</th>
<th>REC. (IN.)</th>
<th>Soil &amp; Rock Classification-Description</th>
<th>U.S. Corps of Engineers System (Soil)</th>
<th>Stratum Change (Ft.)</th>
<th>Blows Per 6 Inches</th>
<th>Pen (N)</th>
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<td>1.25</td>
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<td>S-1b</td>
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<td>5-6-7-9</td>
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<td>S-7</td>
<td>20-22</td>
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<td>3-3-4-5</td>
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Auger refusal @ 24.5" in Probable Intact Bedrock

**Remarks:** Cat Head Hammer, 4.25" Internal Diameter Hollow Stem Auger

Standard Penetration Test (SPT) = 140# hammer falling 30" (ASTM D1586)  
Blows are per 6 inches with a 24" long by 2" O.D. by 1 3/8" I.D. split spoon sampler unless otherwise noted  
S = split-spoon sample; C = rock core sample; U = undisturbed

**Remarks:** The stratification lines represent the approximate boundary between soil types and the transition may be gradual. Water level readings have been made in the test borings at times and under conditions stated in the test boring logs. Fluctuations in the level of the groundwater may occur due to other factors than those present at the time measurements were made. Proportions used: trace (0-10%), little (10-20%), some (20-35%), and (35-50%)
# Boring Log

**John Turner Consulting, Inc.**  
19 Dover Street  
Dover, NH 03820  

**Client:** City of Dover  
**Project:** Geo-Analysis: 4 City Parking Lots  
School Street Parking Lot  
**Project No:** 11-GEO-005  

**Boring #:** B2  
**Location:** See Plan  
**Surface Elevation:** 61.3  
**Date:** 04-Feb-11  

**Type of Boring:** 2.25" H.S.A.  
**Drilling Co:** Great Works Test Boring  
**Driller:** Jeff Lee  
**Jtc Rep:** Kyle Urso  

<table>
<thead>
<tr>
<th>FT</th>
<th>NO.</th>
<th>Sample Depth (Ft.)</th>
<th>Rec. (In.)</th>
<th>Soil &amp; Rock Classification-Description</th>
<th>Burmeister System (Soil)</th>
<th>U.S. Corps of Engineers System (Rock)</th>
<th>Stratum Change (Ft.)</th>
<th>Bows Per 6 Inches</th>
<th>Pen (N)</th>
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<td>1</td>
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<td>3</td>
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<td></td>
<td>25</td>
<td>50/0&quot;</td>
<td>50+</td>
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**Remarks:**  
Cat Head Hammer, 4.25" Internal Diameter Hollow Stem Auger  

**Standard Penetration Tests (SPT) = 140# hammer falling 30" (ASTM D1586)**  
Blows are per 6 inches with a 24" long by 2" O.D. by 1 3/8" I.D. split spoon sampler unless otherwise noted  
S = Split-spoon sample; C = rock core sample; U = undisturbed

**Remarks:** The stratification lines represent the approximate boundary between soil types and the transition may be gradual. Water level readings have been made in the test borings at times and under conditions stated in the test boring logs. Fluctuations in the level of the groundwater may occur due to other factors than those present at the time measurements were made.  
Proportions noted: trace (0-10%), little (10-20%), some (20-35%), and (35-50%)
# BORING LOG

**JOHN TURNER CONSULTING, INC.**

**19 DOVER STREET**

**DOVER, NH 03820**

**PHONE:** 603-749-1841

**FAX:** 603-516-6851

### CLIENT:
City of Dover

### PROJECT:
- Geo-Analysis: 4 City Parking Lots
- School Street Parking Lot

### PROJECT NO:
11-GEO-005

### BORING #:
B3

### LOCATION:
See Plan

### SURFACE ELEVATION:
64.5

### DATE:
04-Feb-11

### TYPE OF BORING:
2.25" H.S.A.

### DRILLING CO:
Great Works Test Boring

### DATE:
4-Feb-11

### DEPTH:

### TIME:
None Encountered

### JTC REP.:
Kyle Urso

### SOIL & ROCK CLASSIFICATION-DESCRIPTION

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<th>NO.</th>
<th>SAMPLE</th>
<th>REC. (IN.)</th>
<th>SOIL &amp; ROCK CLASSIFICATION-DESCRIPTION</th>
<th>BURMEISTER SYSTEM (SOIL)</th>
<th>U.S. CORPS OF ENGINEERS SYSTEM (ROCK)</th>
<th>STRATUM CHANGE (FT.)</th>
<th>BLOWS PER 6 INCHES</th>
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<td>No Recovery</td>
<td></td>
<td></td>
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<td>50/5*</td>
<td>50+</td>
</tr>
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**Auger Refusal @ 3.5'-Probable Boulder Obstruction**

- Move 3' W-Auger Refusal @ 4.3'
- Move 6' E-Auger Refusal @ 3.3'
- Move 3' North-Auger Refusal @ 4.5'

### REMARKS:
- Cat Head Hammer, 4.25" Internal Diameter Hollow Stem Auger

**Standard Penetration Tests (SPT) = 140# hammer falling 30" (ASTM D1586)**

- Blows are per 6 inches with a 24" long by 2" O.D. by 1 3/8" I.D. split spoon sampler unless otherwise noted
- S = split-spoon sample; C = rock core sample; U = undisturbed

**REMARKS:** The stratification lines represent the approximate boundary between soil types and the transition may be gradual. Water level readings have been made in the test borings at times and under conditions stated in the test boring logs. Fluctuations in the level of the groundwater may occur due to other factors than those present at the time measurements were made.

- Proportions used: trace (0-10%), little (10-20%), some (20-35%), and (35-50%)
### BORING LOG

**CLIENT:** City of Dover  
**PROJECT:** Geo-Analysis: 4 City Parking Lots  
**LOCATION:** See Plan  
**SURFACE ELEVATION:** 67.1  
**DATE:** 04-Feb-11  
**BOYNG #:** B4  
**GROUNDWATER OBSERVATIONS**

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<tr>
<td>4-Feb-11</td>
<td>13.0'</td>
<td>During Drilling</td>
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**DRILLER:** Jeff Lee  
**JTC REP.:** Kyle Unso

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<tr>
<th>FT</th>
<th>NO.</th>
<th>SAMPLE DEPTH (FT.)</th>
<th>REC. (IN.)</th>
<th>SOIL &amp; ROCK CLASSIFICATION-DESCRIPTION</th>
<th>BURMEISTER SYSTEM (SOIL)</th>
<th>U.S. CORPS OF ENGINEERS SYSTEM (ROCK)</th>
<th>STRATUM CHANGE (FT.)</th>
<th>BLOWS PER 6 INCHES</th>
<th>PEN (N)</th>
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</tr>
<tr>
<td>5</td>
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<td>3-5</td>
<td>14</td>
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<tr>
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<td>15-17</td>
<td>24</td>
<td>Auger Refusal @ 15.0'</td>
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<td>50/4'</td>
<td>50+</td>
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<td>Spoon Refusal @ 15.3' in Probable Intact Bedrock</td>
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**REMARKS:** Acker Drill Rig, 2.25" Internal Diameter Hollow Stem Auger

Standard Penetration Tests (SPT) = 140# hammer falling 30" (ASTM D1586)
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