Memo

Date:        April 5, 2018

To:          Eric Peterson, North Area Signing Engineer
             Metro District Traffic Engineering

From:        Rich Lamb, Foundations Engineer
             Geotechnical Engineering Section

Subject:     SP 0207-105 TH 65 Overhead Sign (OH MN65-010)
             Located at the intersection of TH 65 and CSAH 10 in Coon Rapids
             Foundation Analysis and Design Recommendations

1.0 Project Description
This report summarizes results of a subsurface investigation and foundation analysis and provides foundation recommendations for the construction of an overhead sign (OH MN65-010) located on southbound TH 65 at the exit to CSAH 10 westbound in Coon Rapids.

1.1 Proposed Structure and Foundation Support
The new structure will be a cantilever sign post type 1-4 and will be supported with a spread footing or drilled shaft foundation.

2.0 Subsurface Investigations
One Standard Penetration Test (SPT) boring was drilled in March 2018 near the proposed sign location. Please refer to the attached investigation plan for more details on this location.

2.1 Subsurface Conditions
The SPT boring encountered an upper 12 ft. layer of loose to medium dense Sand followed by dense to very dense sand. Water was measured 10 ft. below the surface during normal drilling operations. This depth matches well with top of the saturated sands. Please refer to the attached boring log for a more complete description of the foundation soils.

3.0 Foundation Analysis
As part of the overhead sign standard design (developed in the 1970’s), standard foundations were developed to support the signs. These standard foundations consist of spread footing and drilled shaft designs to be used on different sign pole sizes (see Drawing ST-3, Standard Overhead Sign Supports Interim Design B). In addition, the standard foundation notes state the following requirements:
• All spread footings have an allowable design bearing pressure of 1 ¼ tons per square foot

• The drilled shafts have an allowable design lateral bearing pressure of 250 lbs. per square foot per foot of depth

These requirements will be met in all but the weakest mineral type soils and therefore represent a very conservative design. Having said that, and in lieu of new foundation designs, we proceeded to check the foundation soils to see if they met these requirements.

For this sign location, we determined that both the spread footing and drilled shaft standard foundation sizes/depth will be adequate for safely supported the overhead sign.

4.0 Foundation Recommendations
Based on review of the existing subsurface conditions and proposed construction, we recommend the following:

1. The proposed overhead sign structure should be supported with either a spread footing or drilled shaft foundation as detailed on the attached Standard Overhead Sign Supports Interim Design B sheet ST-3.

2. This office should be contacted if soils different than those described in this report are encountered during construction of the sign foundation.

Attachments:
Boring Plan
OH Sign Foundation Detail Sheet
SPT Boring Log

cc:
Brad Skow
T. Clyne
This boring was made by ordinary and conventional methods and with care deemed adequate for the Department's design purposes. Since this boring was not taken to gather information relating to the construction of the project, the data noted in the field and recorded may not necessarily be the same as that which a contractor would desire. While the Department believes that the information as to the conditions and materials reported is accurate, it does not warrant that the information is necessarily complete. This information has been edited or abridged and may not reveal all the information which might be useful or of interest to the contractor. Consequently, the Department will make available at its offices, the field logs related to this boring.

Since subsurface conditions outside each borehole are unknown, and soil, rock and water conditions cannot be relied upon to be consistent or uniform, no warrant is made that conditions adjacent to this boring will necessarily be the same as or similar to those shown on this log. Furthermore, the Department will not be responsible for any interpretations, assumptions, projections or interpolations made by contractors, or other users of this log.

Water levels recorded on this log should be used with discretion since the use of drilling fluids in borings may seriously distort the true field conditions. Also, water levels in cohesive soils often take extended periods of time to reach equilibrium and thus relect their true field level. Water levels can be expected to vary both seasonally and yearly. The absence of notations of this log regarding water does not necessarily mean that this boring was dry or that the contractor will not encounter subsurface water during the course of construction.

**DRILLING OPERATIONS**

- AUG .......... Augered
- CD .......... Core Drilled
- DBD .......... Disturbed by Drilling
- DBJ .......... Disturbed by Jetting
- PD .......... Plug Drilled
- ST .......... Split Tube (SPT Test)
- TW .......... Thinwall (3" Shelby Tube)
- WS .......... Wash Sample
- AB .......... After Bailing
- NSR .......... No Sample Retrieved
- WH .......... Weight of Hammer
- WR .......... Weight of Rod
- Mud .......... Drilling Fluids in Sample
- CS .......... Continuous Sample

**SOIL / ROCK CORE TESTS**

- SPT N60  
  ASTM D1586 Modified Blows per foot with 140 lb. hammer and a standard energy of 210 ft-lbs. This energy represents 60% of the potential energy of the system and is the average energy provided by a Rope & Cathead system.
- MC .......... Moisture Content
- COH .......... Cohesion
  (equivalent to 1/2 Unconfined Compression Strength)
- Y .......... Sample Unit Weight
- LL .......... Liquid Limit
- PI .......... Plasticity Index
- φ .......... Angle of Internal Friction
- REC ......... Percent Core Recovered
- RQD ......... Rock Quality Description
- ACL ......... Average Core Length
  (Average length of core that is greater than 4" long)
- Core Breaks .... Number of natural core breaks per 2 foot interval

**DISCONTINUITY SPACING**

- Fractures  Distance  Bedding
  Very Close .... < 2 inches .... Very Thin
  Close .......... 2-12 inches .... Thin
  Mod. Close .... 12-36 inches .... Medium
  Wide .......... > 36 inches .... Thick

**RELATIVE DENSITY**

<table>
<thead>
<tr>
<th>Compactness - Granular Soils</th>
<th>BPF</th>
</tr>
</thead>
<tbody>
<tr>
<td>very loose ..................</td>
<td>0-4</td>
</tr>
<tr>
<td>loose ........................</td>
<td>5-10</td>
</tr>
<tr>
<td>medium dense ................</td>
<td>11-24</td>
</tr>
<tr>
<td>dense ........................</td>
<td>25-50</td>
</tr>
<tr>
<td>very dense ...................</td>
<td>&gt; 50</td>
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<table>
<thead>
<tr>
<th>Consistency - Cohesive Soils</th>
<th>BPF</th>
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<tbody>
<tr>
<td>very soft ....................</td>
<td>0-1</td>
</tr>
<tr>
<td>soft .........................</td>
<td>2-4</td>
</tr>
<tr>
<td>firm ..........................</td>
<td>5-8</td>
</tr>
<tr>
<td>stiff ..........................</td>
<td>9-15</td>
</tr>
<tr>
<td>very stiff ....................</td>
<td>16-30</td>
</tr>
<tr>
<td>hard .........................</td>
<td>31-60</td>
</tr>
<tr>
<td>very hard ....................</td>
<td>&gt; 60</td>
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</table>

**GRAIN SIZE / PLASTICITY**

- VF ... Very Fine
- F ... Fine
- Slp ... Slightly Plastic
- Cr ... Coarse

**SOIL / ROCK TERMS**

- C ... Clay
- Lmst ... Limestone
- L ... Loam
- Sst ... Sandstone
- Si ... Sand
- Dolo ... Dolostone
- Si ... Silt
- Wx ... weathered
- G ... Gravel (No. 10 Sieve to 3")
- Bldr ... Boulder (>3" dia.)
- T ... Till (unsorted, non stratified glacial deposits)

**MnDOT Triangular Textural Classification System**

G:\geotech\Scot Larson\Lab-Office\Boring Log Descriptive Terminology.xlsx
### Laboratory Log & Test Results - Subsurface Exploration

**UNIQUE NUMBER 82969**

<table>
<thead>
<tr>
<th>Depth (ft)</th>
<th>Classification</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.0</td>
<td>Very Fine Sand, light-brown, moist</td>
<td>smooth drilling 0.0' to 29.0'</td>
</tr>
<tr>
<td>6.5</td>
<td>Loamy Very Fine Sand with IOS and a seam of Silt at 8.5', browns, saturated</td>
<td></td>
</tr>
<tr>
<td>9.0</td>
<td>Very Fine Sand, brown, saturated</td>
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</tr>
<tr>
<td>10.0</td>
<td>Fine Sand, brown to gray-brown, saturated</td>
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</tr>
<tr>
<td>31.0</td>
<td>Bottom of Hole -31.0'</td>
<td></td>
</tr>
</tbody>
</table>

**Location**

Anoka County Coordinate System

Latitude (North)=45°07'23.75"  Longitude (West)=93°14'10.26"

**Drill Machine**

211304 CME Fat Tire

**Drill Rig**

CME Automatic Calibrated

**Drill Operation**

Smooth drilling 0.0' to 29.0'

**Other Tests Or Remarks**

Water measured at 10.5' with auger