



Memo

Date: April 6, 2021

To: Curt Kobilarcsik, Project Manager
District Metro

From: Chelsey A. Brummer, Graduate Engineer
Geotechnical Section 

Concur: Rich Lamb, Foundations Engineer
Geotechnical Section

Subject: S.P. 2724-124, Overhead Sign 35W-570
TH 55 at TH 35W North and 7th Street
Foundations Analysis and Design Recommendations

1.0 Project Description

This letter provides a foundation analysis and set of recommendations for replacing the in-place overhead sign on Trunk Highway 55 at Trunk Highway 35W North and 7th Street.

2.0 Field Investigation and Foundation Conditions

Two Cone Penetration Tests (CPT Soundings) were advanced in March of 2021 at the location the overhead sign will be placed by MnDOT staff. A copy of the CPT Sounding results is attached to this report.

The soils encountered at the overhead sign location generally consists of dense to very dense sandy soils with hard to very hard silt seams. The CPT Soundings (c01a and c02) were terminated at approximately 21 and 28 feet respectively.

3.0 Foundation Analysis

Based on review of preliminary plans, the proposed overhead sign will be replacing an existing overhead sign of approximately the same dimensions and in approximately the same location.

The foundation analysis consisted of verifying that the foundation soil properties met the minimum values as required by MnDOT standard plan 5-297.763. The standard assumes the foundations soils have a friction angle of 30°, a unit weight of 125pcf, a maximum coefficient of friction of 0.70 and groundwater elevation at or below the bottom of a spread footing or at least 1.5 ft below finished grade for drilled shafts.

Based on review of the existing subsurface conditions at the proposed overhead sign footing locations, it has been determined that the soils meet the minimum requirements of 30° friction angle, a unit weight of 125pcf, and a maximum coefficient of friction of 0.70. Groundwater was not measured during the subsurface investigation.

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3.1 Settlement

The estimated settlement of the new overhead sign was based on the following assumptions:

- A. The roadway profile will not be raised

We estimate the new overhead sign may settle between ½ inch and 1 inch over the life of the sign. Differential settlements between the signposts is expected to be less than ½ inch.

4.0 Foundation Recommendations

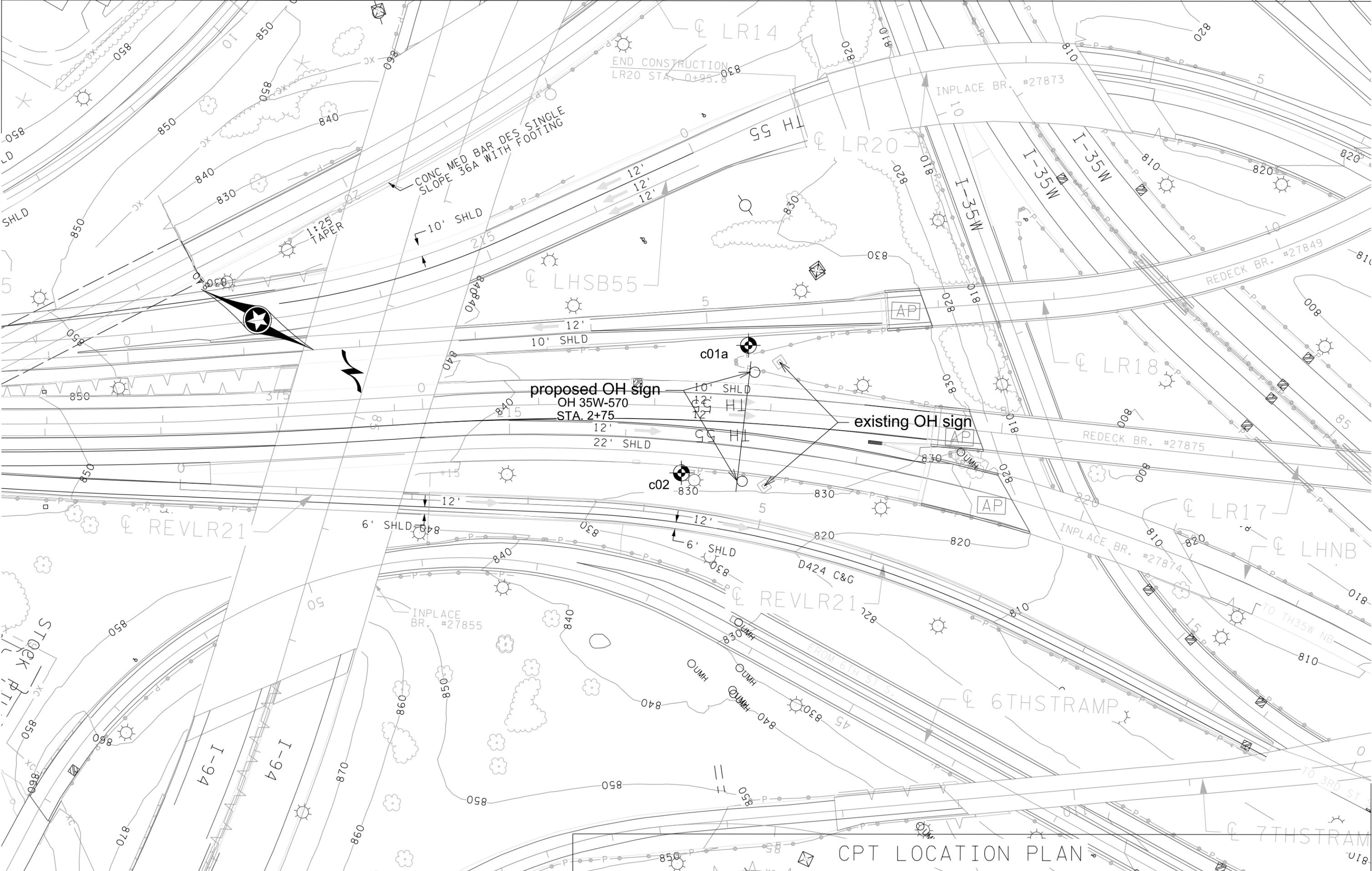
Based on the existing conditions along with an analysis of the project soils, we recommend that:

1. The overhead sign be constructed in accordance with MnDOT standard plan 5-297.763.
2. This office be contacted for revised foundation recommendations if the foundation soils or groundwater elevations differ from those described in this report.

Attachments: CPT Location Plan
CPT Index
CPT Sounding Logs

cc: Dave VanDeusen
Brad Skow





END CONSTRUCTION
LR20 STA. 0+95.8

CONC MED BAR DES SINGLE
SLOPE 36A WITH FOOTING

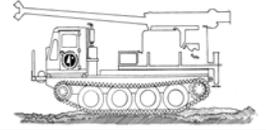
proposed OH sign
OH 35W-570
STA. 2+75

existing OH sign

CPT LOCATION PLAN



Minnesota Department of Transportation Geotechnical Section Cone Penetration Test Index Sheet 1.0 (CPT 1.0)



USER NOTES, ABBREVIATIONS AND DEFINITIONS

This Index sheet accompanies Cone Penetration Test Data. Please refer to the Boring Log Descriptive Terminology Sheet for information relevant to conventional boring logs.

This Cone Penetration Test (CPT) Sounding follows ASTM D 5778 and was made by ordinary and conventional methods and with care deemed adequate for the Department's design purposes. Since this sounding 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 relating to this sounding.

Since subsurface conditions outside each CPT Sounding 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 sounding 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 pressure measurements and subsequent interpreted water levels shown on this log should be used with discretion since they represent dynamic conditions. Dynamic Pore water pressure measurements may deviate substantially from hydrostatic conditions, especially in cohesive soils. In cohesive soils, water pressures often take extended periods of time to reach equilibrium and thus reflect their true field level. Water levels can be expected to vary both seasonally and yearly. The absence of notations on 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.

CPT Terminology

- CPT Cone Penetration Test
- CPTU Cone Penetration Test with Pore Pressure measurements
- SCPTU Cone Penetration Test with Pore Pressure and Seismic measurements
- Piezocone... Common name for CPTU test

(Note: This test is not related to the Dynamic Cone Penetrometer DCP)

qt TIP RESISTANCE

The resistance at the cone corrected for water pressure. Data is from cone with 60 degree apex angle and a 10 cm² end area.

fs SLEEVE FRICTION RESISTANCE

The resistance along the sleeve of the penetrometer.

FR Friction Ratio

Ratio of sleeve friction over corrected tip resistance.

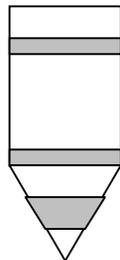
$$FR = f_s / q_t$$

Vs Shear Wave Velocity

A measure of the speed at which a seismic wave travels through soil/rock.

PORE WATER MEASUREMENTS

Pore water measurements reported on CPT Log are representative of water pressures measured at the U2 location, just behind the cone tip, prior to the sleeve, as shown in the figure below. These measurements are considered to be dynamic water pressures due to the local disturbance caused by the cone tip. Dynamic water pressure decay and Static water pressure measurements are reported on a Pore Water Pressure Dissipation Graph.



U2

SBT SOIL BEHAVIOR TYPE

Soil Classification methods for the Cone Penetration Test are based on correlation charts developed from observations of CPT data and conventional borings. Please note that these classification charts are meant to provide a guide to Soil Behavior Type and should not be used to infer a soil classification based on grain size distribution.

The numbers corresponding to different regions on the charts represent the following soil behavior types:

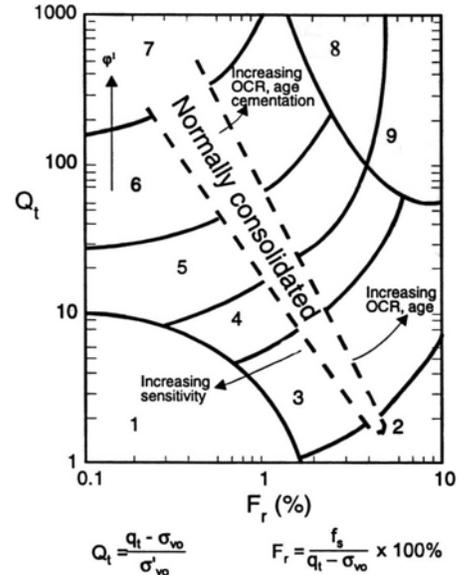
1. Sensitive, Fine Grained
2. Organic Soils - Peats
3. Clays - Clay to Silty Clay
4. Silt Mixtures - Clayey Silt to Silty Clay
5. Sand Mixtures - Silty Sand to Sandy Silt
6. Sands - Clean Sand to Silty Sand
7. Gravelly Sand to Sand
8. Very Stiff Sand to Clayey Sand
9. Very Stiff, Fine Grained

Note that engineering judgment, and comparison with conventional borings is especially important in the proper interpretation of CPT data in certain geo-materials.

The following charts are used to provide a Soil Behavior Type for the CPT Data.

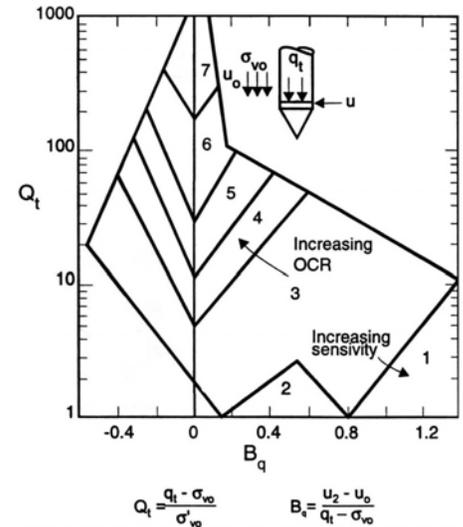
Robertson CPT 1990

Soil Behavior type based on friction ratio



Robertson CPTU 1990

Soil Behavior type based on pore pressure



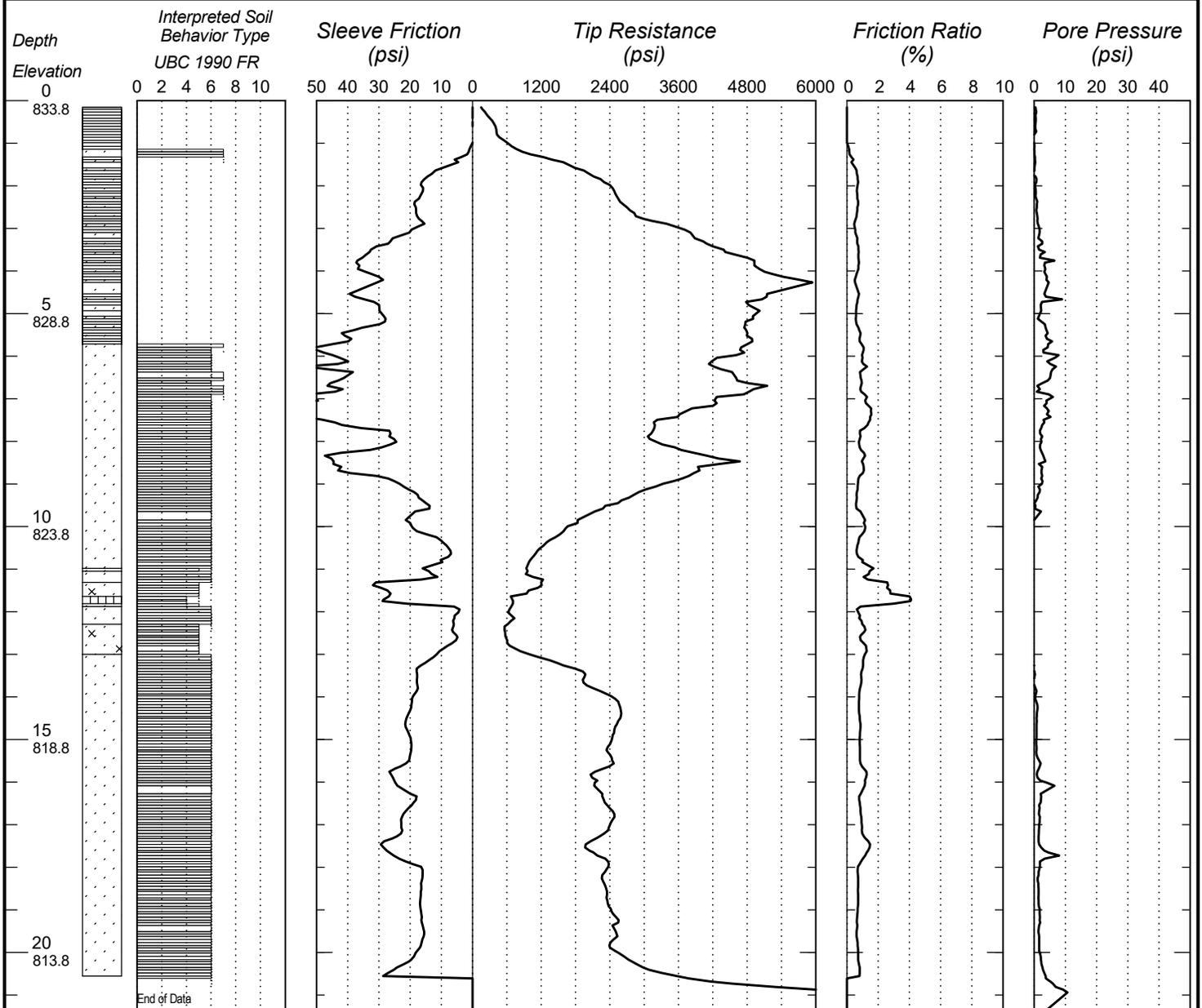
where ...

- QT normalized cone resistance
- Bq pore pressure ratio
- Fr Normalized friction ratio
- σvo overburden pressure
- σ'vo effective over burden pressure
- u2 measured pore pressure
- u0 equilibrium pore pressure

CONE PENETRATION TEST RESULTS

UNIQUE NUMBER 85851

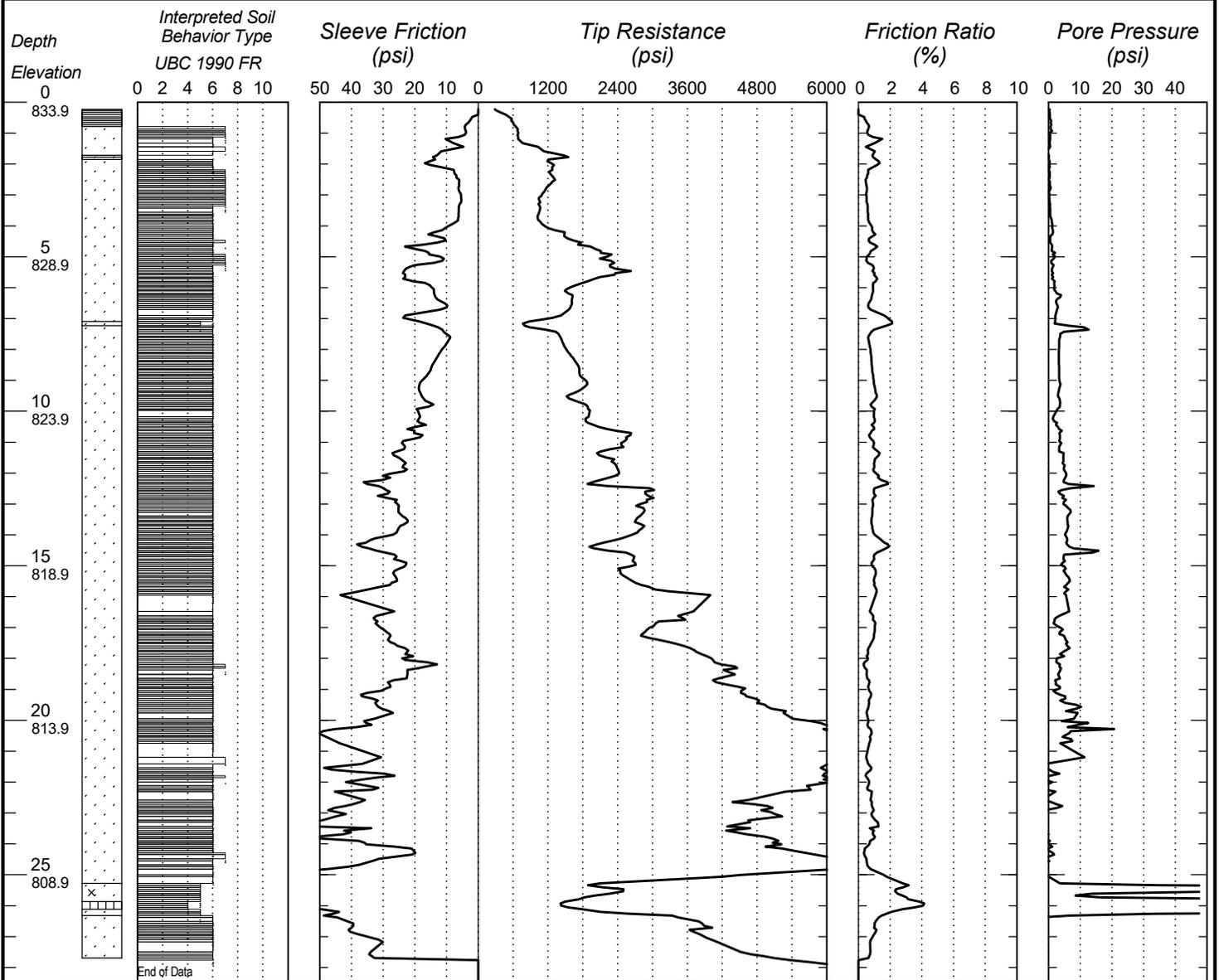
State Project 2724-124	Bridge No. or Job Desc. Over Head Sign	Trunk Highway/Location MN Trunk Highway 55	Sounding No. c01a	Ground Elevation 833.8 (DTM)
Location Hennepin County Coordinate System X=533754 Y=164099		CPT Machine 205146 CPT Truck (H)	SHEET 1 of 1	
Latitude (North)=44°58'00.61" Longitude (West)=93°15'10.55"		CPT Operator ODonnell	Date Completed 3/22/21	
		Hole Type CPT-STD		



Bottom of Hole 21.33

CONE PENETRATION TEST RESULTS
UNIQUE NUMBER 85852

State Project 2724-124	Bridge No. or Job Desc. Over Head Sign	Trunk Highway/Location MN Trunk Highway 55	Sounding No. c02	Ground Elevation 833.9 (DTM)
Location Hennepin County Coordinate System X=533878 Y=164101		CPT Machine 205146 CPT Truck (H)	SHEET 1 of 1	
Latitude (North)=44°58'00.63" Longitude (West)=93°15'08.82"		CPT Operator ODonnell	Date Completed 3/22/21	
		Hole Type CPT-STD		



Bottom of Hole 28.48