DEPARTMENT OF TRANSPORTATION
Office of Materials & Road Research
1400 Gervais Avenue, Maplewood, MN 55109

Memo

DATE: March 29th, 2022

TO: Dan Prather, Preliminary Bridge Engineer
Office of Bridges & Structures

FROM: Hossana Teklyes, Asst. Foundations Engineer HWT
Geotechnical Engineering Section

CONCUR: Rich Lamb, Foundations Engineer RAL
Geotechnical Engineering Section

SUBJECT: S.P. 2772-124, New Bridge 27317 (Metro District)
TH 169 Under 63rd Ave. N, 0.9 miles S. of the JCT. of TH 94 in Maple Grove
Foundations Analysis and Design Recommendations

1.0 Project Description

This report provides a Foundation Analysis and Design Recommendations for constructing Bridge 27317 that will replace old bridge 27534. The new bridge will be a two-span bridge and will use 45" prestressed concrete beams with a cast in place deck of 38 feet wide with approximately 209 feet length. The abutments and pier will be supported on Spread Footings.

2.0 Field Investigation and Foundation Conditions

Two Standard Penetration Tests (SPT), two Cone Penetration Tests (CPT) and two Seismic Cone Penetration Tests (SCPT) were taken in February and March of 2022 by MnDOT close to the bridge abutments and pier. Copies of the logs are attached with this report.

The SPT borings taken at proximity to the abutments show predominantly dense to very dense sandy soils with some seams of slightly plastic sandy loam soils. Water was encountered at an approximate elevation ranging from 872-874 ft. Bedrock wasn't encountered during the drilling of these two borings. The drillings were terminated at elevations ranging from 820-830 ft.

It is important to note that the SPTs were taken approximately 60 ft. from the abutments due to access problem. We have taken additional Seismic CPTs (close to the abutments) that we used for our analysis.

The CPT/SCPT soundings were interpreted for a general soil behavior type and blow count. They were broken into significant soil layers by depth. No soil samples were taken, so the soil behavior type may not match exactly what soil is present but should indicate how it behaves if compared to standard soil.

Seismic CPT tests were performed in soundings cs03 & cs04 to measure the shear wave velocities of the soils based on ASTM D5778-20 and D&400. The results showed that the dense to very dense sands below the proposed footings have shear wave velocities (V_s) ranging from 242-3714 ft/s.

Table 1: Measurements of Shear Wave Velocity from Seismic CPT.

SCPT Sounding	Test Depth (ft)	Arrival Time (ms)	V_s (ft/s)
cs03	3.28	14.36	-
	6.53	21.84	434
	9.71	25	1006
	13.06	28.28	1021
	16.4	34	584
	19.72	37.2	1038
	23.03	40.68	951
	26.31	43.2	1302
	29.56	46.04	1144
	32.68	46.88	3714
	35.99	50.08	1034
	39.37	52.16	1625
	42.68	55.48	997
	45.9	59.44	813
	49.9	63.16	721
cs04	3.02	5.96	-
	6.33	10.76	690
	9.55	12.8	1578
	16.21	17.28	394
	19.46	20.48	1016
	22.83	34.4	242
	26.12	37	1265
	29.43	40.2	1034
	32.68	43.08	1128
	35.99	46.68	919
	39.34	49.92	1034
	42.59	53.32	956
	45.9	57.12	871
	49.11	61.52	730
	49.93	62.76	661

3.0 Foundation Analysis

Approximate roadway and footing elevations were determined from a Preliminary Bridge Plan provided by MnDOT's Bridge Office.

3.1 Substructure Foundations

Due to the dense and sandy nature of the soils present, shallow foundations are proposed and have been analyzed for use at the abutments and pier.

Table 2: Recommended Foundation Types and Assumed Footing Elevations.

Location	***West Abutment***	***Pier***	***East Abutment***
Foundation	Spread Footing	Spread Footing	Spread Footing
SPT/CPT/SCPT used for the analysis	cs03 & T01	c01a & c02	cs04 & T02
Assumed bottom of Footing Elevation	902 ft.	892 ft.	902 ft.

3.2 Shallow Foundation – Service Limit State

CPT and seismic CPT data were used to predict the settlement (service limit state). This model uses the Westegaard stress distribution method and uses CPT N-interpreted sounding data and shear wave velocity respectively. CPT tip resistance was used to calculate the Nominal Bearing Resistance (Strength Limit State). The results from the analyses are presented on the attached graphs.

One settlement graph with 1 inch settlement was developed for each abutment. The settlement at the time of setting the beams may be less than 1 inch since it is estimated that at least 50% of the total load will have already been applied to the soil due to the construction of the footing and stem itself.

To further minimize differential settlement directly underneath the footing and further reduce possible settlement, it is recommended that a 2-foot subcut be constructed, backfilled, and compacted with Coarse Filter Aggregate bedding beneath the footings.

3.3 Shallow Foundation – Strength Limit State

The strength limit state of the soil's nominal bearing capacity was computed for varying footing widths.

The following are the resistance factors for evaluation of the strength limit state performance limits based on the latest LRFD code.

Bearing Resistance, using CPT = 0.5
Sliding, Cast-in-Place Concrete on Sand = 0.80

Refer to the following figures in the appendix for the nominal bearing resistance and service limit state for the substructures on this project.

Figure 1: West Abutment……1-inch settlement
Figure 2: East Abutment……1-inch settlement
Figure 3: Pier……1-inch settlement

4.0 Project Specific Recommendations:

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

1. Topsoil and other organic material be removed from areas where fill is to be placed. These soils be excavated and replaced with Granular Borrow (Mn/DOT spec. 3149.2B.1) and compacted to 95% to 100% Standard Proctor density.

2. The bridge be supported on spread footing foundations with capacities defined in the nominal bearing resistance graphs (Figures 1 to 3). The graphs show predicted available geotechnical resistance based on footing width for the strength/extreme-event limit states and service limit state at each abutment and pier locations; each graph is presented for 1.0 inch of deflection. Recent studies have shown that most of the settlement at bridge abutments built on granular soils occurs during the construction of the foundations and placement of the soil backfill.

   The service limits state (Green line in the graph) is expected to control the design. Strength/extreme-event limit state (Red line in the graph) information is presented on the same charts **Note that the scales are different for the service limit state [left side] and strength/extreme-event limit state [right side] data.**

3. A 2-foot subcut is required beneath footings to be located on or in native soils. Backfill subcut with Coarse Filter Aggregate (MnDOT Spec. 3149.2H1) and compact to 95% to 100 % Standard Proctor density.

4. Please contact our office if there is interest in monitoring the loads and settlements for the foundations at this bridge during construction so improved correlations can be developed for the **geotechnical prediction methods based on observed field behavior.**

4.1 General Recommendations:

5. The footings be buried a minimum of 4.5 feet below the final ground line for frost protection.

6. Drainage shall be installed as appropriate at the footing locations to ensure that the bearing soils and soils behind the abutment are free draining. Drainage be provided from the base of the footing subcut

soils and from the rear of the abutment walls, similar to retaining wall drainage plans as used on recent projects.

7. Drainage from the bridge deck and the roadway areas shall not be directed onto unprotected embankment slopes to prevent erosion.

8. Any pipes (water mains or drainage culverts) be appropriately gasketed or cased to minimize risk of erosion from pipe leakage or breakage. Refer to section **2.4.1.6.2** buried utilities of **MnDOT LRFD Bridge Design Manual** on any buried utilities or drainage pipes installed near footings.

9. Embankment slopes are recommended to be constructed at 2H : 1V slopes, or flatter, for stability and to reduce erosion from overland flow. Vegetation be established as quickly as possible after construction to minimize the potential for erosion.

Attachments:

Spread Footing Bearing Resistance Graphs (Figures 1 to 3)
SPT/CPT/SCPT Plan & Profile
SPT/CPT index sheet
SPT Logs (T01 & T02)
CPT Logs (c01a & c02)
SCPT Logs (cs03 & cs04)

cc:

Brad Skow…….. (C.O. Geotechnical Section Manager)
Dave VanDeusen……(Metro Materials Engineer)
Ashley Grzbowski……..(C.O. Bridge Office)
Michael Kronzer…….(Metro Project Engineer)
Jason Hedeen……...(C.O Asset Management)

Figure 1: West Abutment - LRFD 1.0 Inch Settlement.

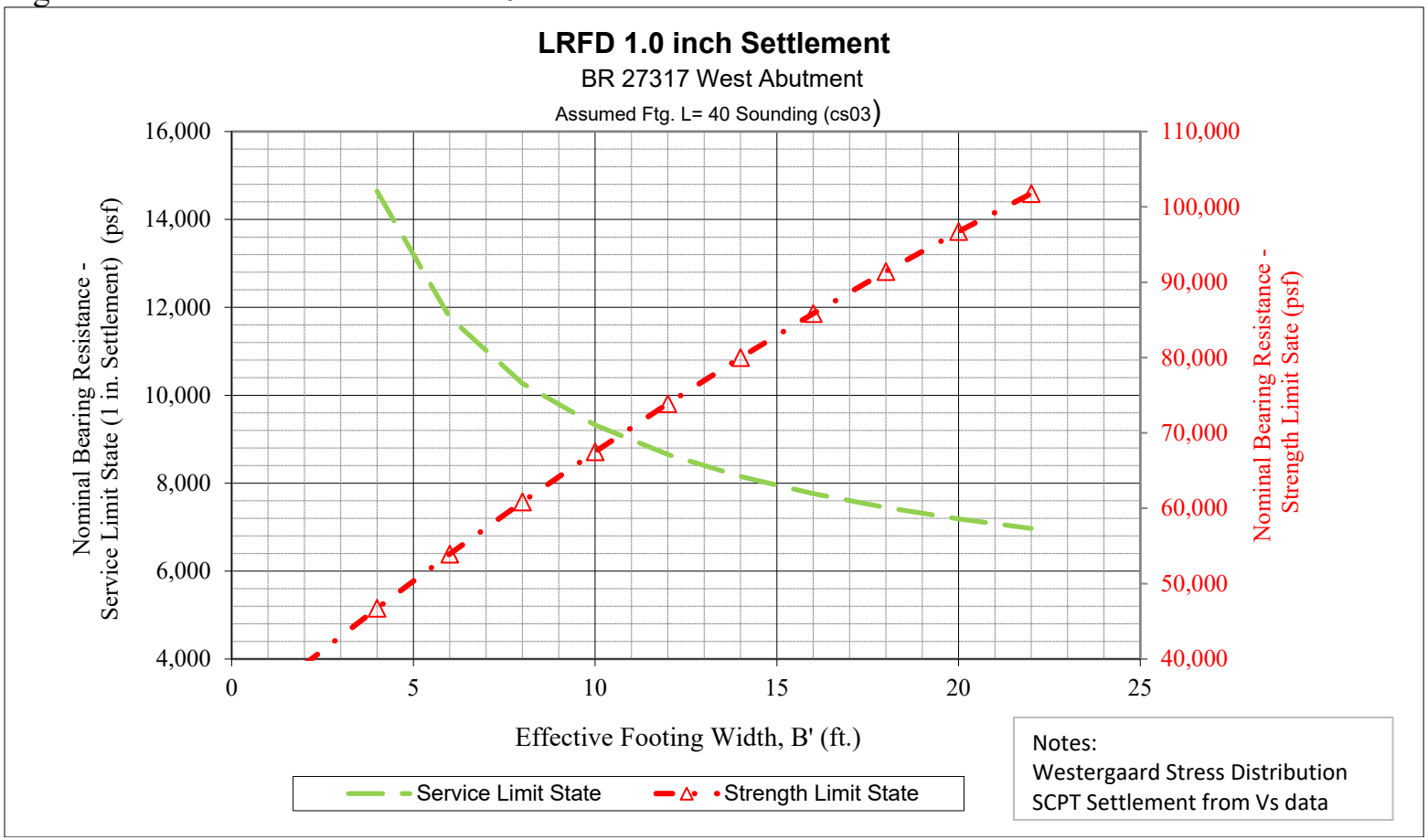


Figure 2: East Abutment - LRFD 1.0 Inch Settlement.

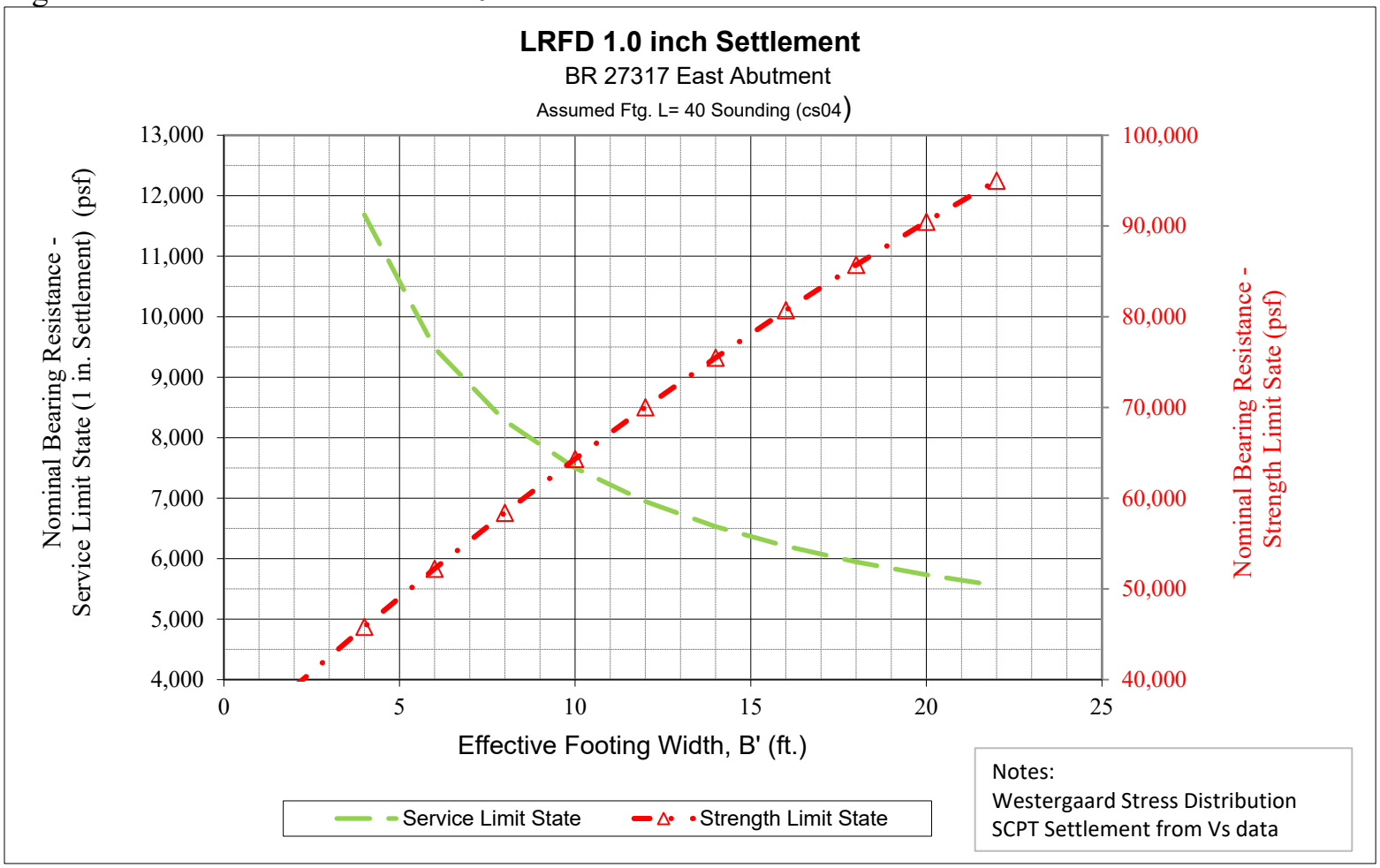


Figure 3: Pier - LRFD 1.0 Inch Settlement.

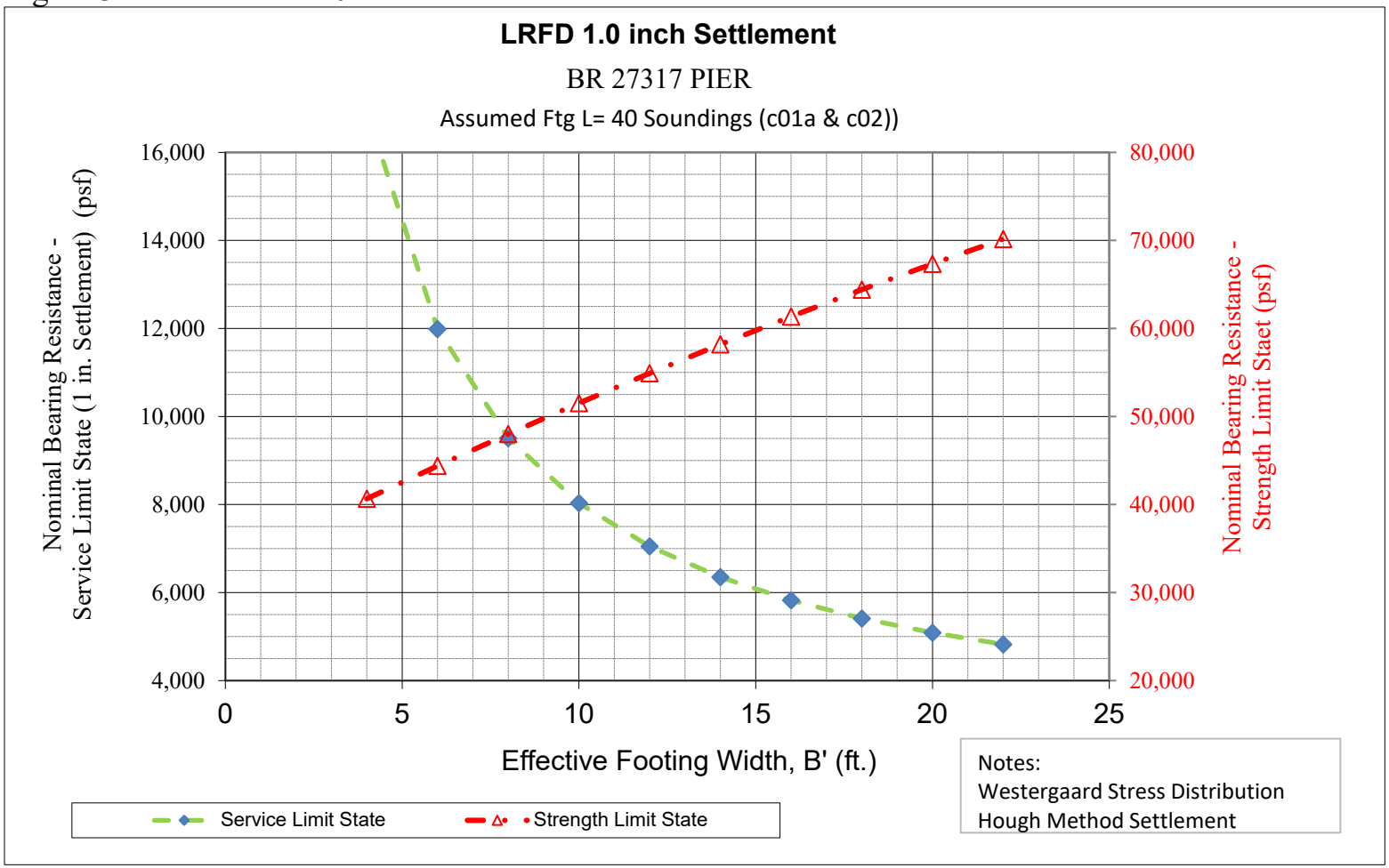


Figure 1: West Abutment - LRFD 1.0 Inch Settlement.

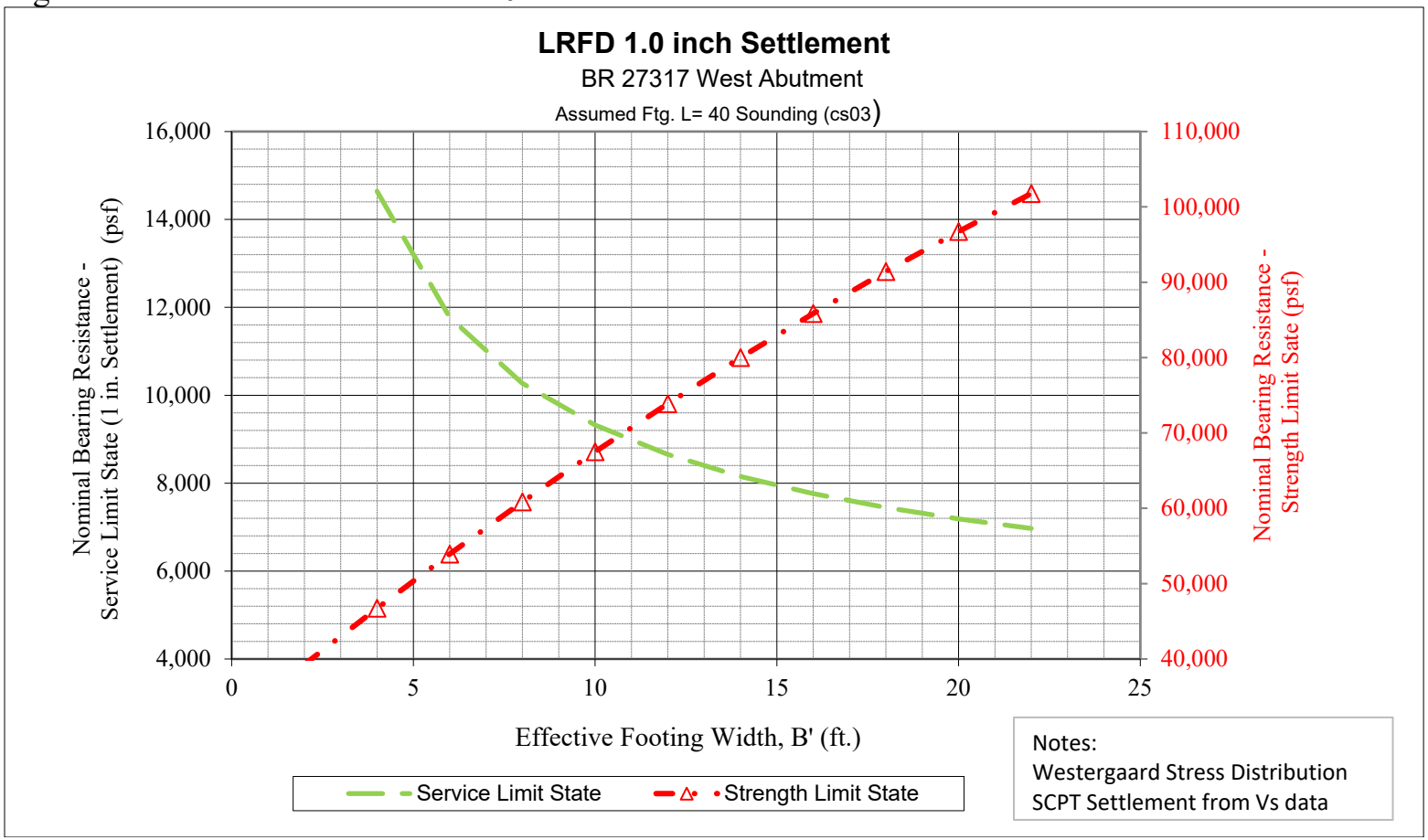


Figure 2: East Abutment - LRFD 1.0 Inch Settlement.

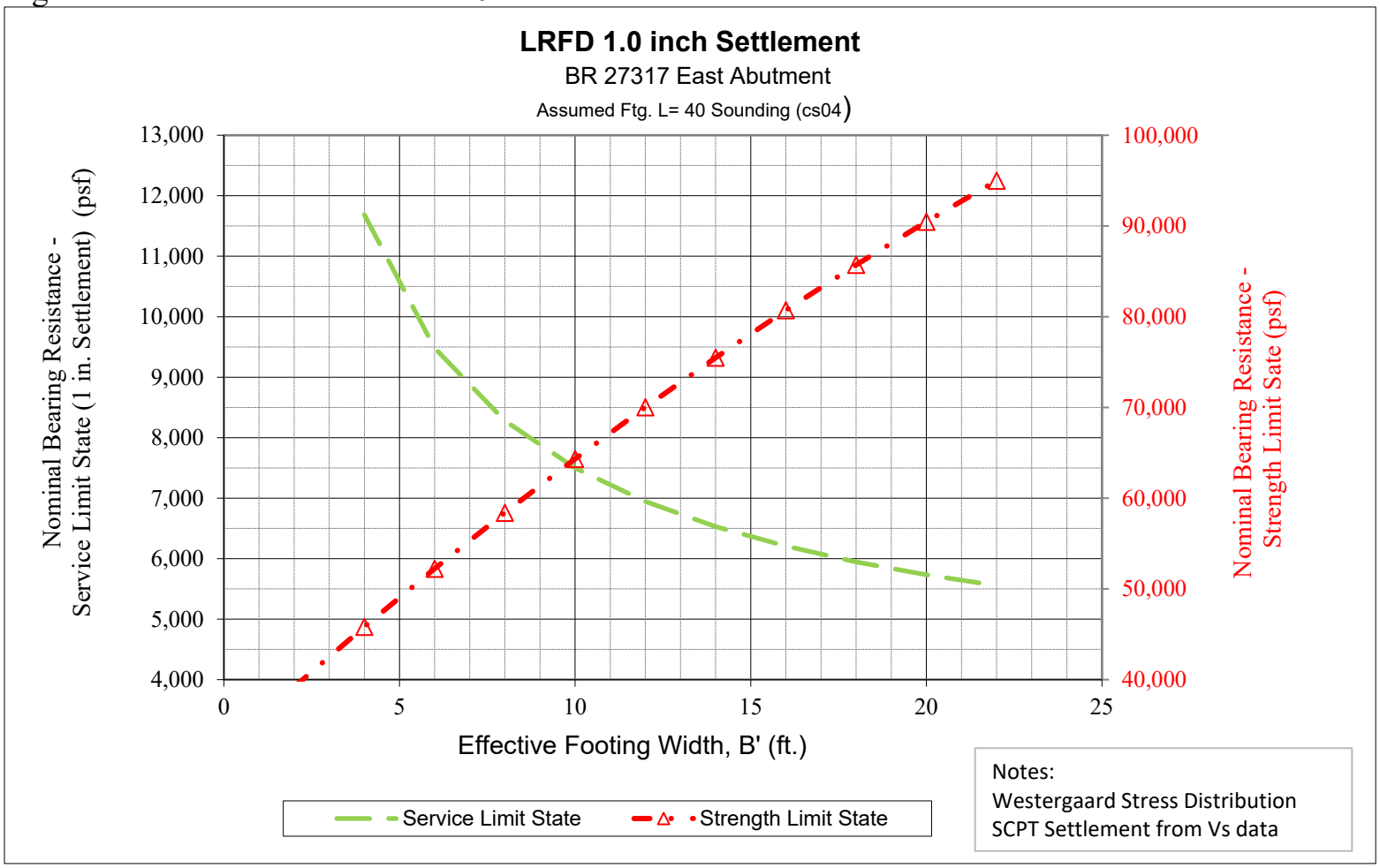
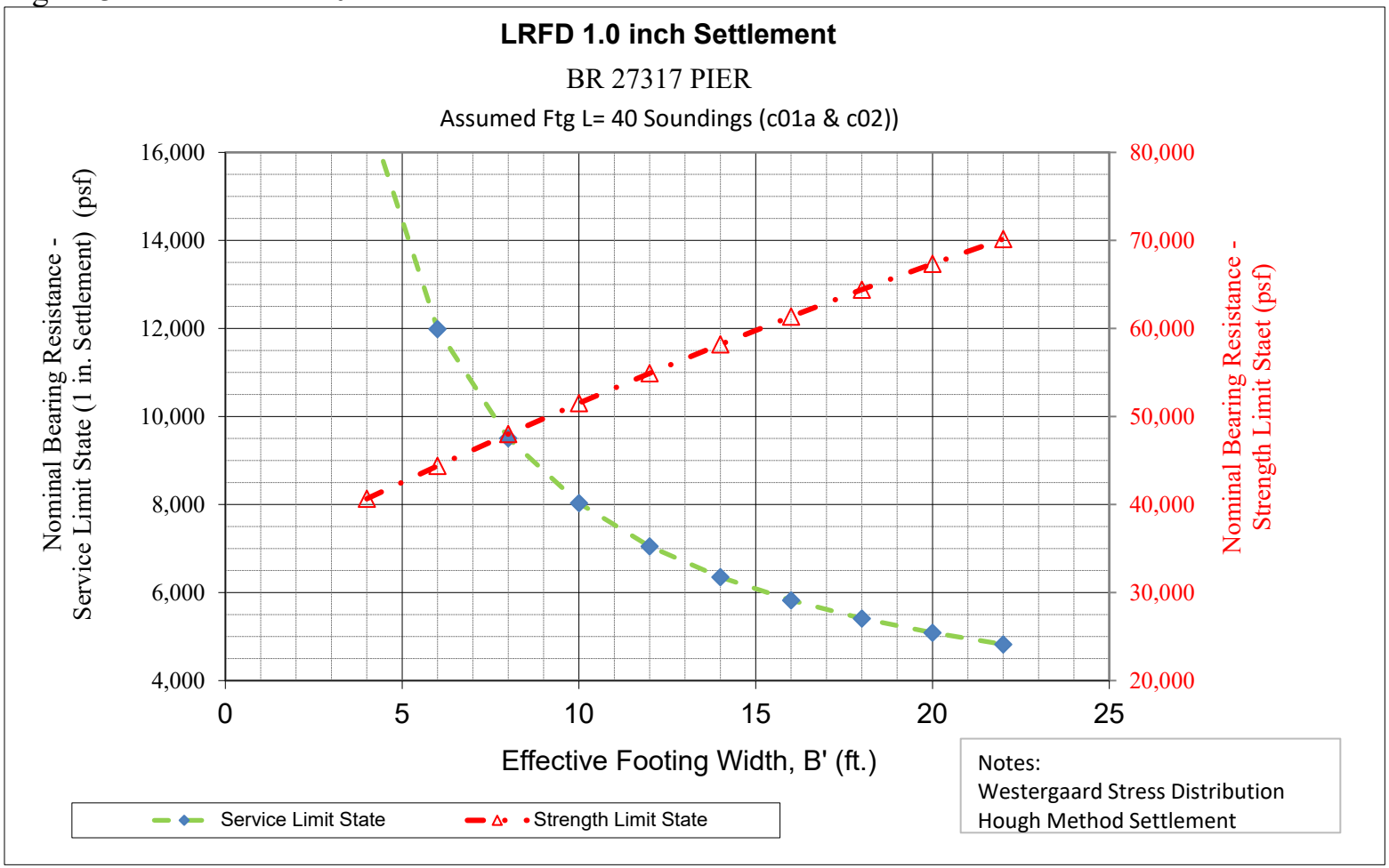
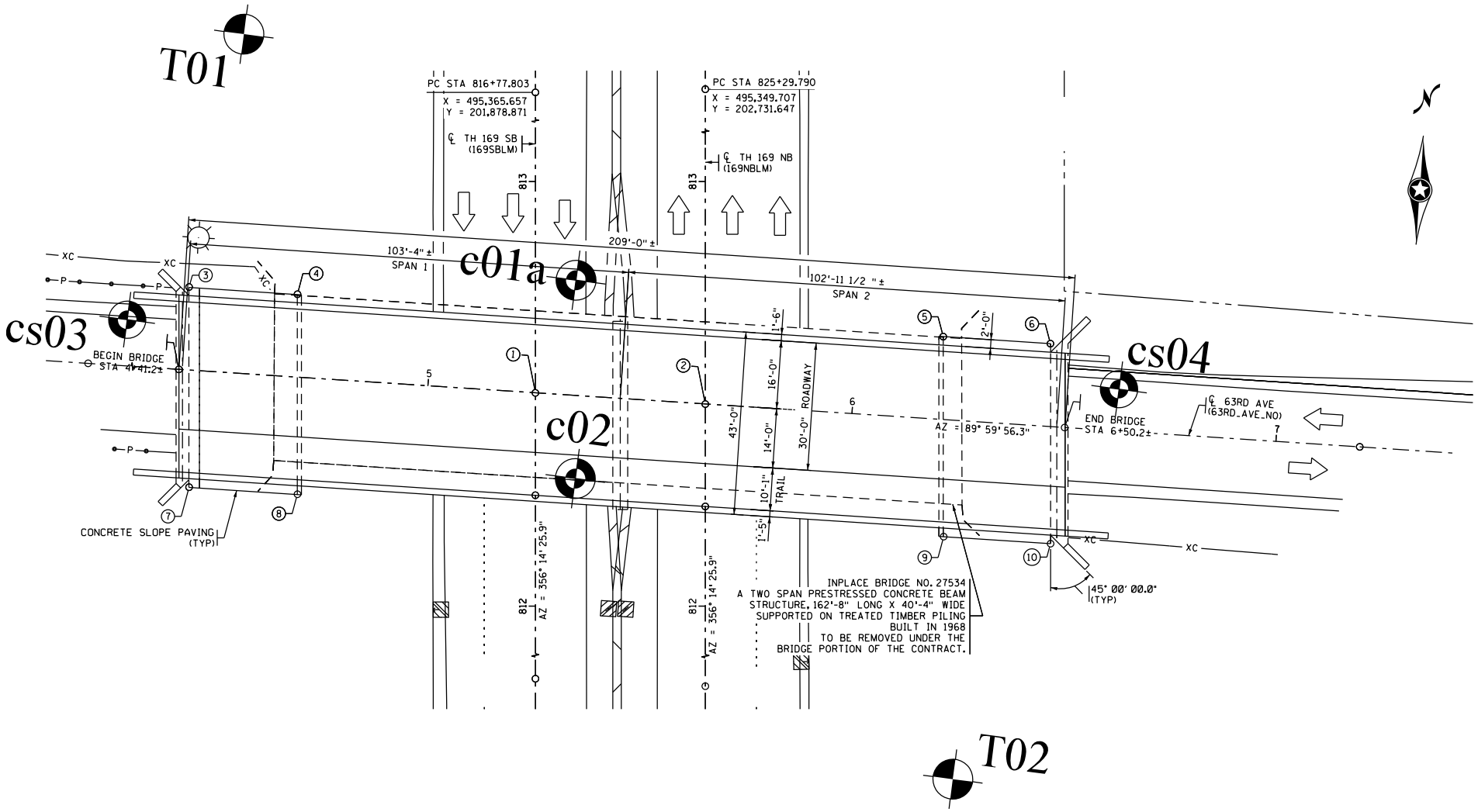
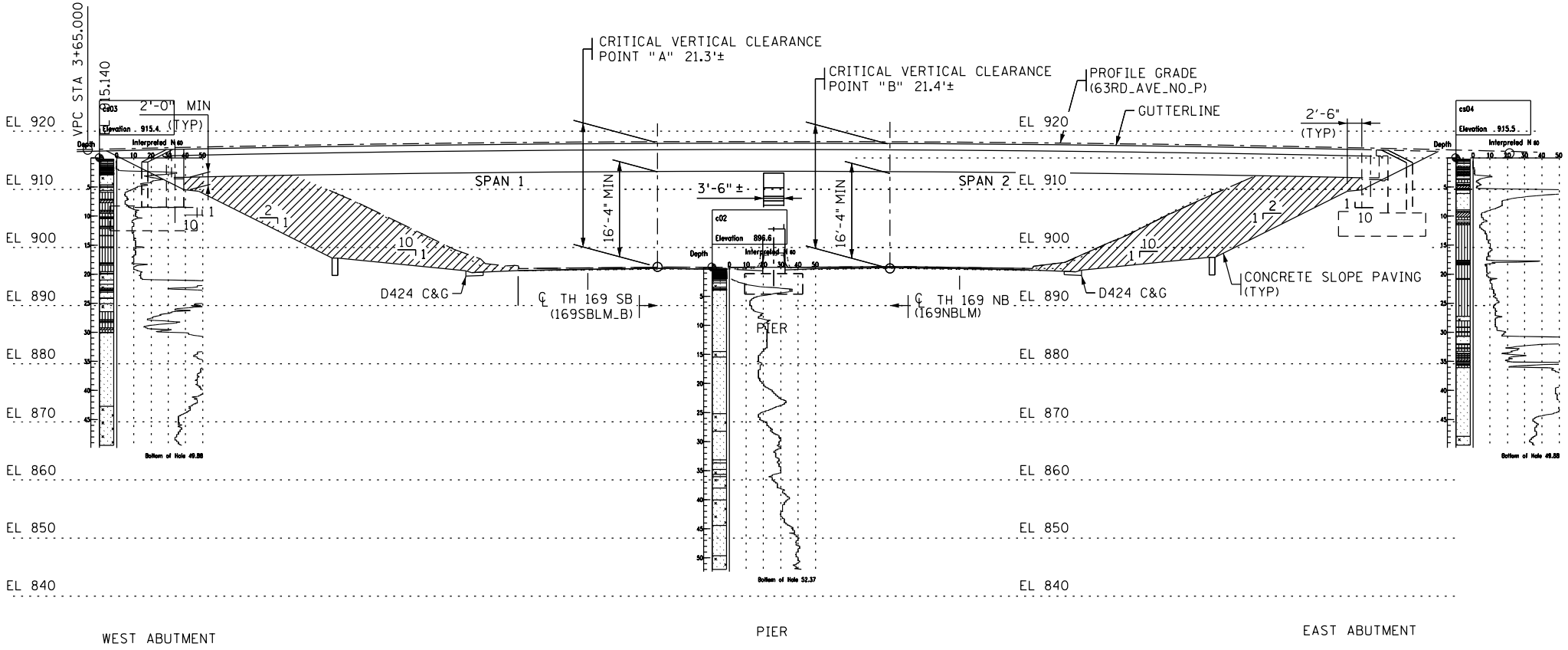


Figure 3: Pier - LRFD 1.0 Inch Settlement.

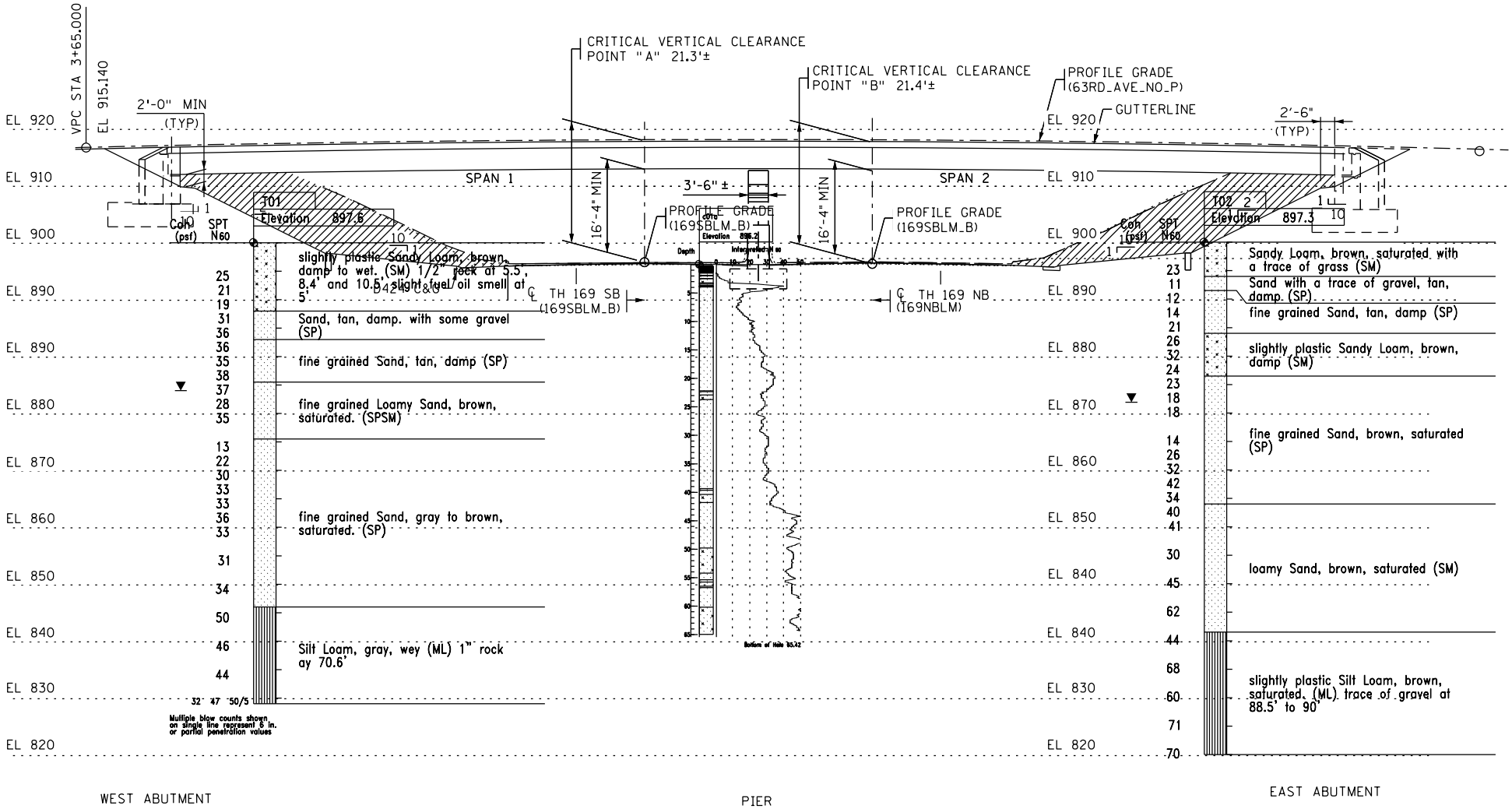




BRIDGE 27317 BORINGS/SOUNDINGS PLAN



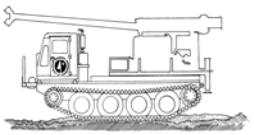
BRIDGE 27317 BORINGS/SOUNDINGS PROFILE



BRIDGE 27317 BORINGS/SOUNDINGS PROFILE

Minnesota Department of Transportation Geotechnical Section

Boring Log Descriptive Terminology (English Units)



USER NOTES, ABBREVIATIONS AND DEFINITIONS - Additional information available in Geotechnical Manual.

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 relating 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 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.

WH ..... Weight of Hammer
WR ..... Weight of Rod
Mud..... Drilling Fluids in Sample
CS ..... Continuous Sample

SOIL/CORE TESTS

SPT N_{60} ..... 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
γ ..... Sample Density
LL..... Liquid Limit
PI..... Plasticity Index
Φ ..... Phi Angle
REC..... Percent Core Recovered
RQD ..... Rock Quality Description (Percent of total core interval consisting of unbroken pieces 4 inches or longer)
ACL..... Average Core Length (Average length of core that is greater than 4 inches 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

Consistency - Cohesive Soils	BPF
very soft	0-1
soft	2-4
firm	5-8
stiff	9-15
very stiff	16-30
hard	31-60
very hard	> 60

COLOR

blk..... Black
grn ..... Green
orng ..... Orange
dk..... Dark
IOS..... Iron Oxide Stained
wht .....White
brn.....Brown
yel.....Yellow
lt .....Light

GRAIN SIZE /PLASTICITY

VF..... Very Fine
F ..... Fine
Cr..... Coarse
pl .....Plastic
slpl .....Slightly Plastic

SOIL/ROCK TERMS

C..... Clay
L..... Loam
S..... Sand
Si..... Silt
G ..... Gravel (No. 10 Sieve to 3 inches)
Bldr..... Boulder (over 3 inches)
T..... till (unsorted, nonstratified glacial deposits)
Lmst.....Limestone
Sst.....Sandstone
Dolo.....Dolostone
wx.....weathered

WATER MEASUREMENT

AB ..... After Bailing
AC ..... After Completion
AF..... After Flushing
w/C..... with Casing
w/M ..... with Mud
WSD..... While Sampling/Drilling
w/AUG..... with Hollow Stem Auger

MISCELLANEOUS

NA..... Not Applicable
w/ ..... with
w/o ..... with out
sat..... saturated

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 (Shelby Tube)
WS..... Wash Sample
NSR..... No Sample Retrieved

DRILLING SYMBOLS

Vane Shear Test

WS — Washed Sample (Collected during plug drilling)

Augered

PD — Plug Drilled

Split Tube Sample (SPT N_{60} 2 in. spilt tube with liners)

Thin Wall Sample (3 in. Shelby Tube)

Core Drilled (NV Core Barrel unless otherwise noted)

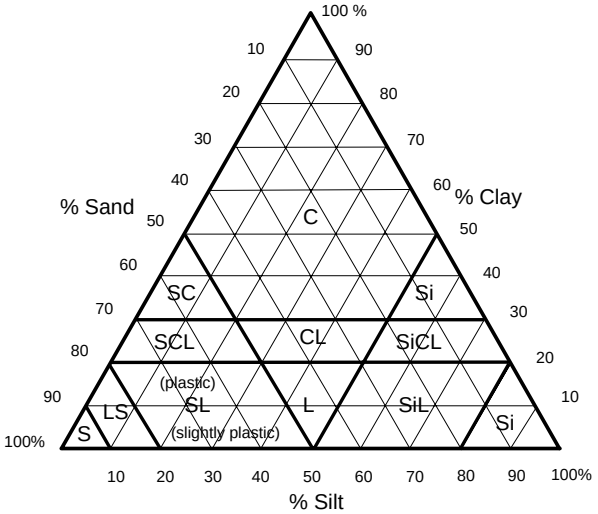
CS — Continuous Soil Sample

A/J — Augered & Jetted

Jet — Jetted

A/P — Augered & Plug Drilled

Mn/DOT Triangular Textural Soil Classification System



RELATIVE DENSITY

Compactness - Granular Soils	BPF
very loose	0-4
loose	5-10
medium dense	11-24
dense	25-50
very dense	>50

DEPARTMENT OF TRANSPORTATION

MINNESOTA DEPARTMENT OF TRANSPORTATION - GEOTECHNICAL SECTION

LABORATORY LOG & TEST RESULTS - SUBSURFACE EXPLORATION

UNIQUE NUMBER 86311

State Project	Bridge No. or Job Desc.	Trunk Highway/Location	Boring No.	Ground Elevation
2772-124	**BRIDGE # 27534**	**US Highway 169**	**T01**	**897.6** *(DTM)*

Location Hennepin County Coordinate System
X=495320 Y=201532
Latitude (North)=45°04'10.46" Longitude (West)=93°24'05.21"

Drill Machine **217270 CME 55 Track**
Hammer **CME Automatic Calibrated**

SHEET 1 of 1
Drilling Completed **2/1/22**

DEPTH	Depth / Elev.	Lithology	Classification	Drilling Operation	SPT N_{60} (%) REC	MC (%) RQD	COH (psf) ACL (ft)	γ (pcf) Core Breaks	Soil / Rock	Other Tests Or Remarks / Formation or Member
5			slightly plastic Sandy Loam, brown, damp to wet. (SM) 1/2" rock at 5.5', 8.4' and 10.5' slight fuel oil smell at 5'		25	9				smooth drilling
					21	10				
10					19	12				
	12.0 / 885.6				31	2				
15			Sand, tan, damp. with some gravel (SP)		36	2				
	17.0 / 880.6				36	4				
20			fine grained Sand, tan, damp (SP)		35	3				
					38	6				
▼25	24.5 / 873.1				37	20				
					28	23				
30			fine grained Loamy Sand, brown, saturated. (SPSM)		35	21				
				PD						1' of heave after sample
35	34.5 / 863.1				13	26				7' of heave change to mud drilling
				PD	22	25				
40				PD	30	25				
				PD	33	24				
45				PD	33	25				Smooth drilling
				PD	36	25				
50			fine grained Sand, gray to brown, saturated. (SP)	PD	33	24				
				PD						
55					31	23				
				PD						
60					34	24				
	64.0			PD						
65	833.6				50	21				
				PD						
70					46	22				rougher drilling 68'-69'
			Silt Loam, gray, wey (ML) 1" rock ay 70.6'	PD						rough drilling 71'-73'
75					44	22				
				PD						
80	81.0				32 / 47 / 50/5	22				
	816.6		Bottom of Hole - 81.0'							
			Water measured at 26.0' with auger							

Field Crew Chief: Dan Gunderson Soil Class: Rock Class: Edit: Date: 2/16/22

DEPARTMENT OF TRANSPORTATION

MINNESOTA DEPARTMENT OF TRANSPORTATION - GEOTECHNICAL SECTION

LABORATORY LOG & TEST RESULTS - SUBSURFACE EXPLORATION

UNIQUE NUMBER 86322

State Project	Bridge No. or Job Desc.	Trunk Highway/Location	Boring No.	Ground Elevation
2772-124	**BRIDGE # 27534**	**US Highway 169**	**T02**	**897.3** *(DTM)*

Location Hennepin County Coordinate System
X=495498 Y=201368
Latitude (North)=45°04'08.84" Longitude (West)=93°24'02.73"

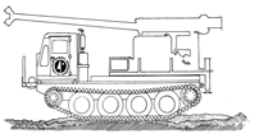
Drill Machine **217270 CME 55 Track**
Hammer **CME Automatic Calibrated**

SHEET 1 of 1
Drilling Completed **2/9/22**

DEPTH	Depth / Elev.	Lithology	Classification	Drilling Operation	SPT N_{60} (%) REC	MC (%) RQD	COH (psf) ACL (ft)	γ (pcf) Core Breaks	Soil / Rock	Other Tests Or Remarks / Formation or Member
5	6.0 / 891.3		Sandy Loam, brown, saturated with a trace of grass (SM)		23	19				
			Sand with a trace of gravel, tan, damp (SP)		11	3				
10	8.5 / 888.8		fine grained Sand, tan, damp (SP)		12	1				
					14	-32				Smooth drilling
15	16.0 / 881.3				21	2				
			slightly plastic Sandy Loam, brown, damp (SM)		26	20				
20					32	13				
	23.5 / 873.8				24	19				
25					23	2				
					18	23				
30					18	23				1' of heave
			fine grained Sand, brown, saturated (SP)		14	22				
35				PD	26	24				
				PD	32	24				
40				PD	42	23				
				PD	34	27				
45	46.0 / 851.3			PD	40	23				smooth drilling
				PD	41	22				
50				PD						
					30	25				
55			loamy Sand, brown, saturated (SM)	PD						
					45	22				
60				PD						
					62	19				
65				PD						
	68.5 / 828.8				44	27				
70				PD						rough drilling 71' to 72.5'
					68	22				
75				PD						rough drilling 75'-77'
			slightly plastic Silt Loam, brown, saturated. (ML) trace of gravel at 88.5' to 90'		60	6				
80				PD						
					71	38				
85				PD						stiffer and rough drilling 85' to 88.5'
	90.0 / 807.3				70	22				
90			Bottom of Hole - 90.0'							
			Water measured at 28.1 with auger							

Field Crew Chief: Dan Gunderson Soil Class: Rock Class: Edit: Date: 2/16/22

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)

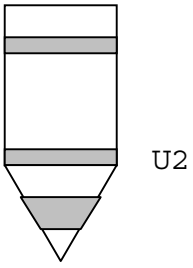
q_T TIP RESISTANCE
The resistance at the cone corrected for water pressure. Data is from cone with 60 degree apex angle and a 10 cm^2 end area.

f_s SLEEVE FRICTION RESISTANCE
The resistance along the sleeve of the penetrometer.

FR Friction Ratio
Ratio of sleeve friction over corrected tip resistance.
FR = fs/qt

V_s Shear Wave Velocity
A measure of the speed at which a siesmic 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.



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.

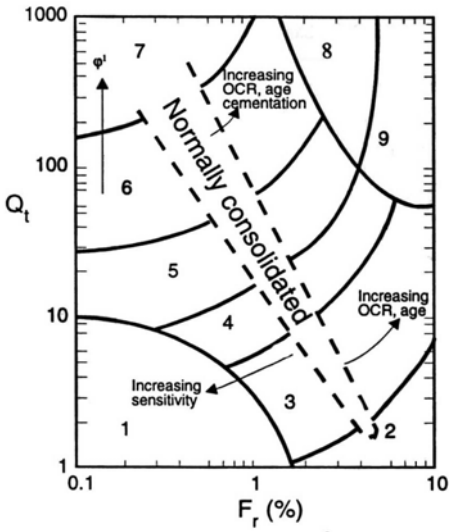
The numbers corresponding to different regions on the charts represent the following soil behavior types:

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

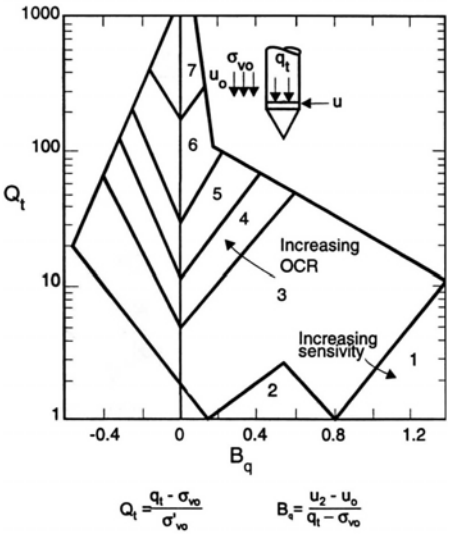
Note that engineering judgment, and comparison with conventional borings is especially important in the proper interpretation of CPT data in certain geo-materials.

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 ...
Q_T ..... normalized cone resistance
B_q ..... pore pressure ratio
F_r ..... Normalized friction ratio
σ_{vo} ..... overburden pressure
σ'_{vo} ..... effective over burden pressure
u_2 ..... measured pore pressure
u_0 ..... equilibrium pore pressure

DEPARTMENT OF TRANSPORTATION

MINNESOTA DEPARTMENT OF TRANSPORTATION - GEOTECHNICAL SECTION

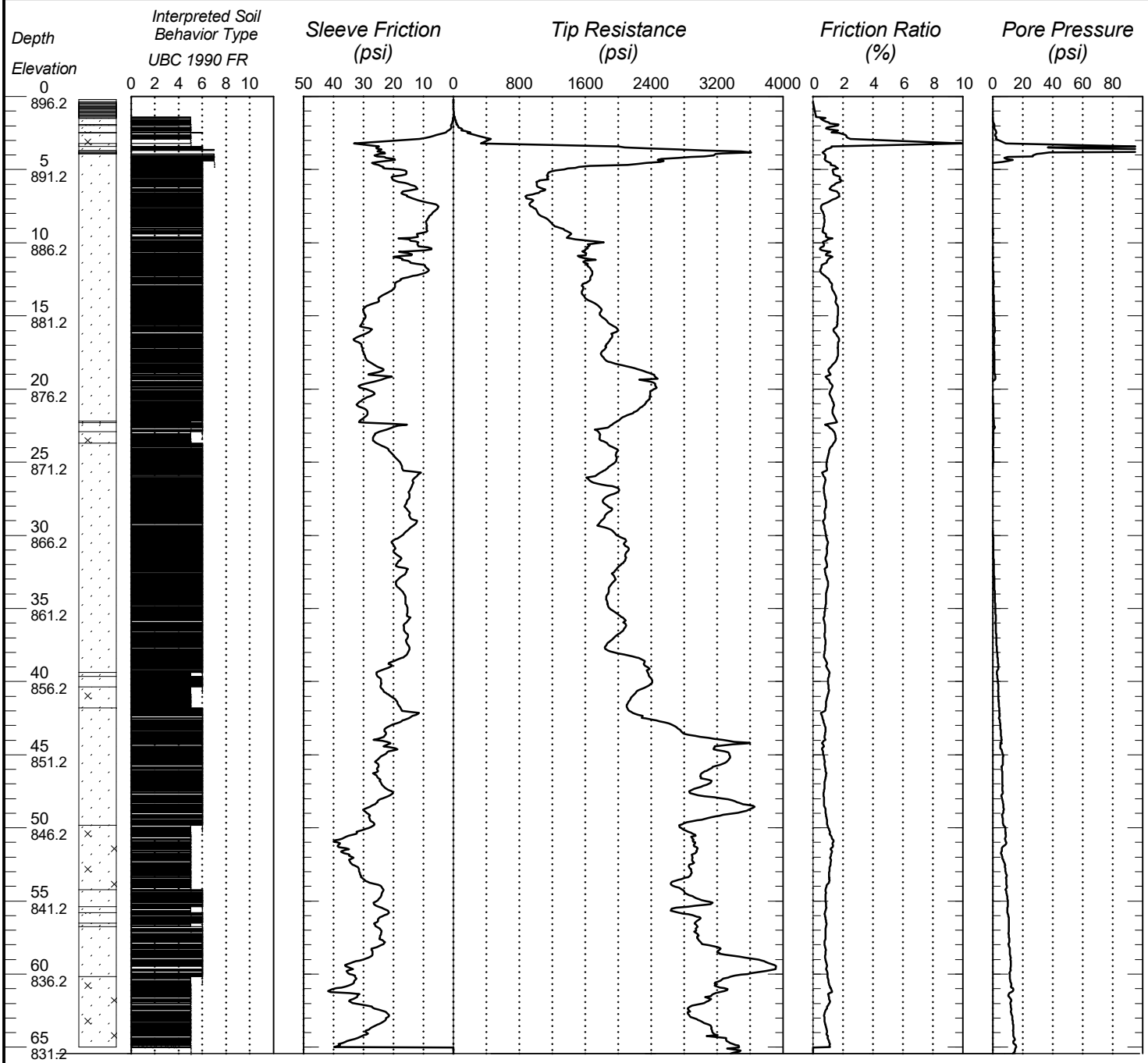
CONE PENETRATION TEST RESULTS

UNIQUE NUMBER 86323

(MDH H390906)

State Project	Bridge No. or Job Desc.	Trunk Highway/Location	Sounding No.	Ground Elevation
2772-124	**BRIDGE # 27534**	**US Highway 169**	**c01a**	**896.2** *(DTM)*

Location Hennepin County Coordinate System	*CPT Machine* **219328 CPT Western Star**	*SHEET 1 of 1*
X=495402 Y=201479	*CPT Operator* **ODonnel**	*Date Completed*
Latitude (North)=45°04'09.94" *Longitude (West)=93°24'04.07"*	*Hole Type* **CPT-STD**	**2/24/22**



Bottom of Hole 65.42

DEPARTMENT OF TRANSPORTATION

MINNESOTA DEPARTMENT OF TRANSPORTATION - GEOTECHNICAL SECTION

CONE PENETRATION TEST RESULTS

UNIQUE NUMBER 86324

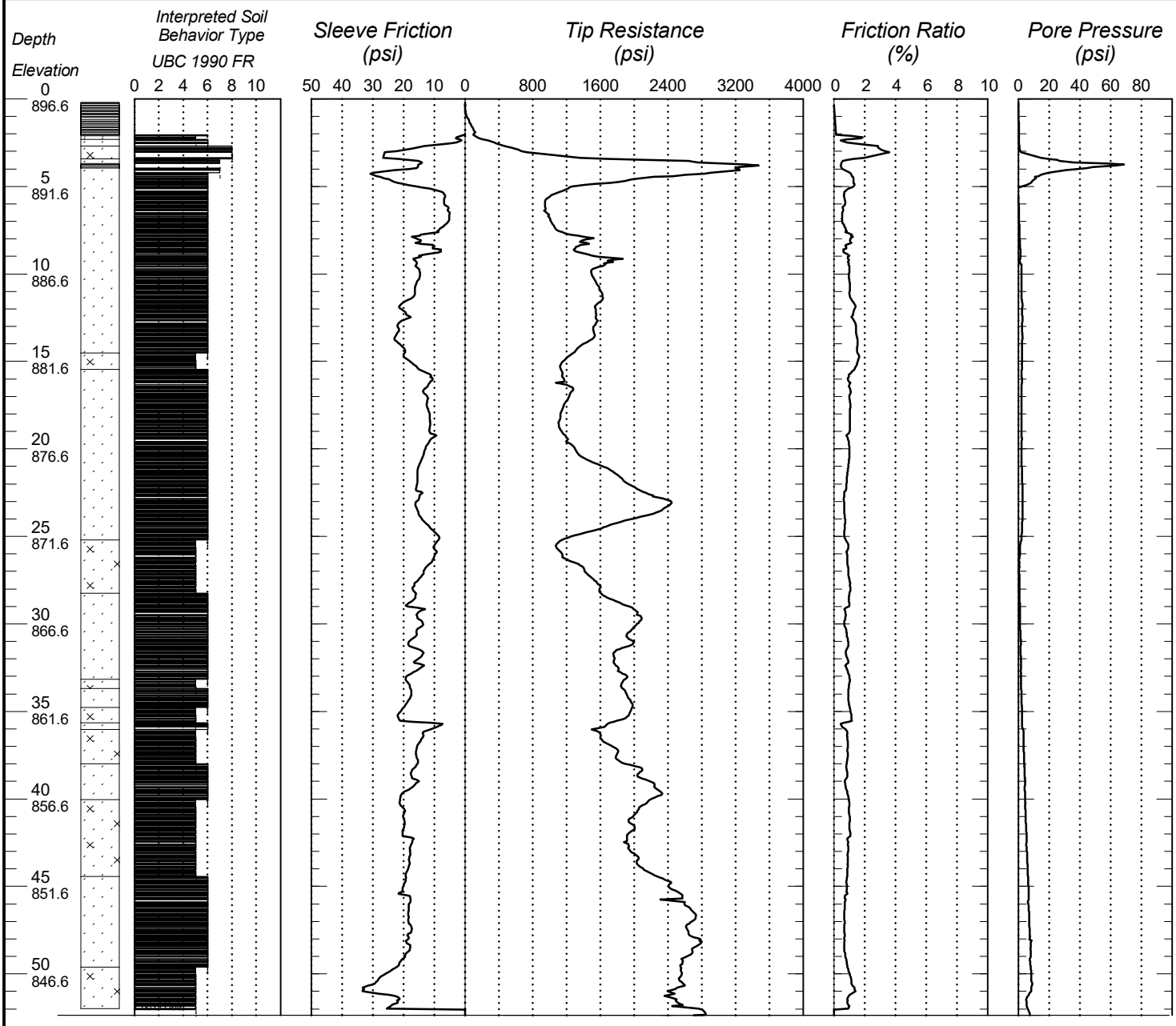
(MDH H390906)

State Project	Bridge No. or Job Desc.	Trunk Highway/Location	Sounding No.	Ground Elevation
2772-124	**BRIDGE # 27534**	**US Highway 169**	**c02**	**896.6** *(DTM)*

Location Hennepin County Coordinate System
X=495404 Y=201433
Latitude (North)=45°04'09.48" *Longitude (West)=93°24'04.03"*

CPT Machine **219328 CPT Western Star**
CPT Operator **ODonnel**
Hole Type **CPT-STD**

SHEET 1 of 1
Date Completed **2/24/22**



Bottom of Hole 52.37

DEPARTMENT OF TRANSPORTATION

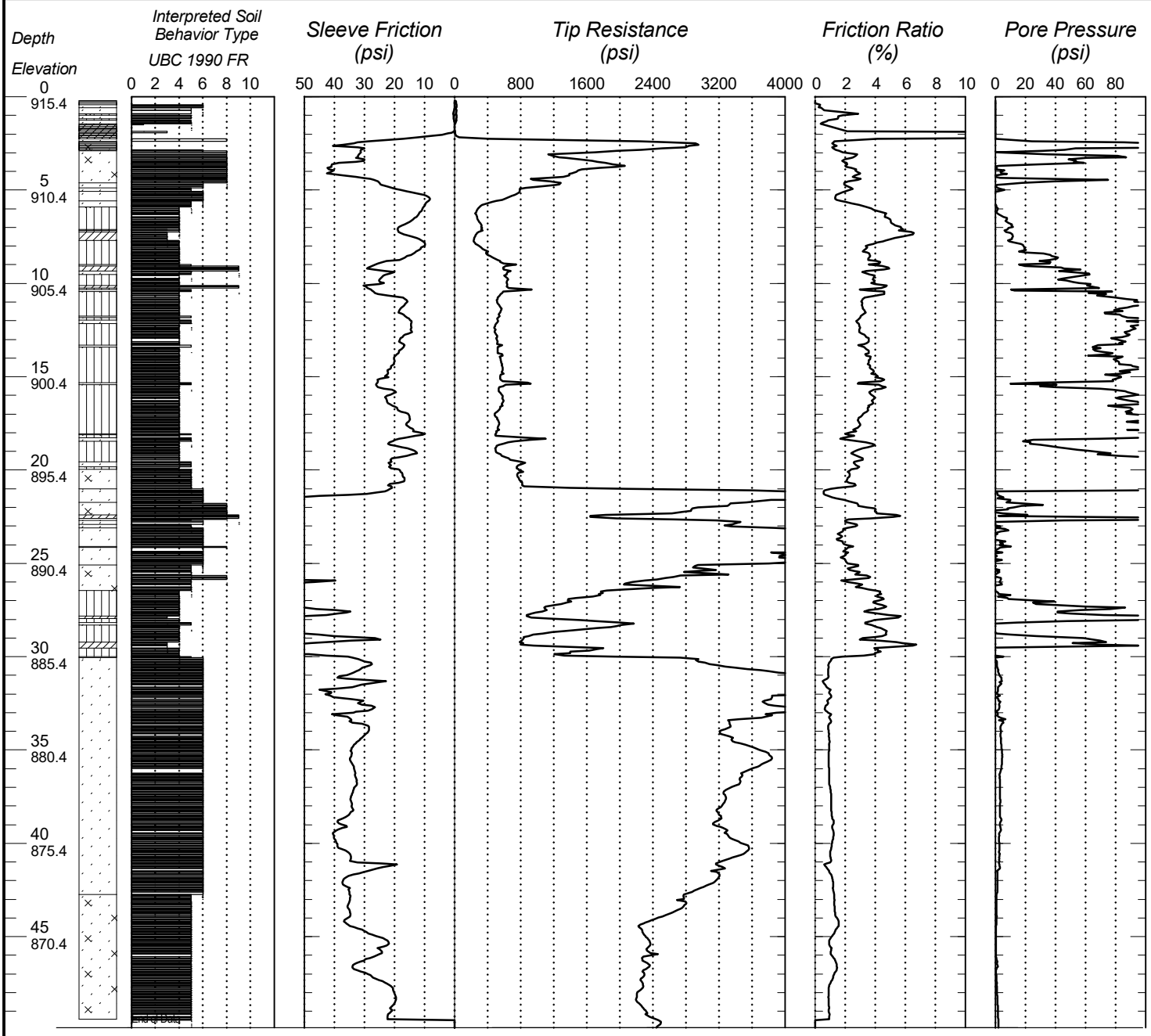
MINNESOTA DEPARTMENT OF TRANSPORTATION - GEOTECHNICAL SECTION

CONE PENETRATION TEST RESULTS

UNIQUE NUMBER 87269

State Project	Bridge No. or Job Desc.	Trunk Highway/Location	Sounding No.	Ground Elevation
2772-124	**BRIDGE # 27534**	**US Highway 169**	**cs03**	**915.4** *(DTM)*

Location	CPT Machine	SHEET 1 of 1
Hennepin County Coordinate System	**219328 CPT Western Star**	
X=495297 Y=201463	CPT Operator **ODonnel**	Date Completed
Latitude (North)=45°04'09.78" *Longitude (West)=93°24'05.53"*	Hole Type **CPT-SEISMIC**	**3/16/22**



Bottom of Hole 49.88

DEPARTMENT OF TRANSPORTATION

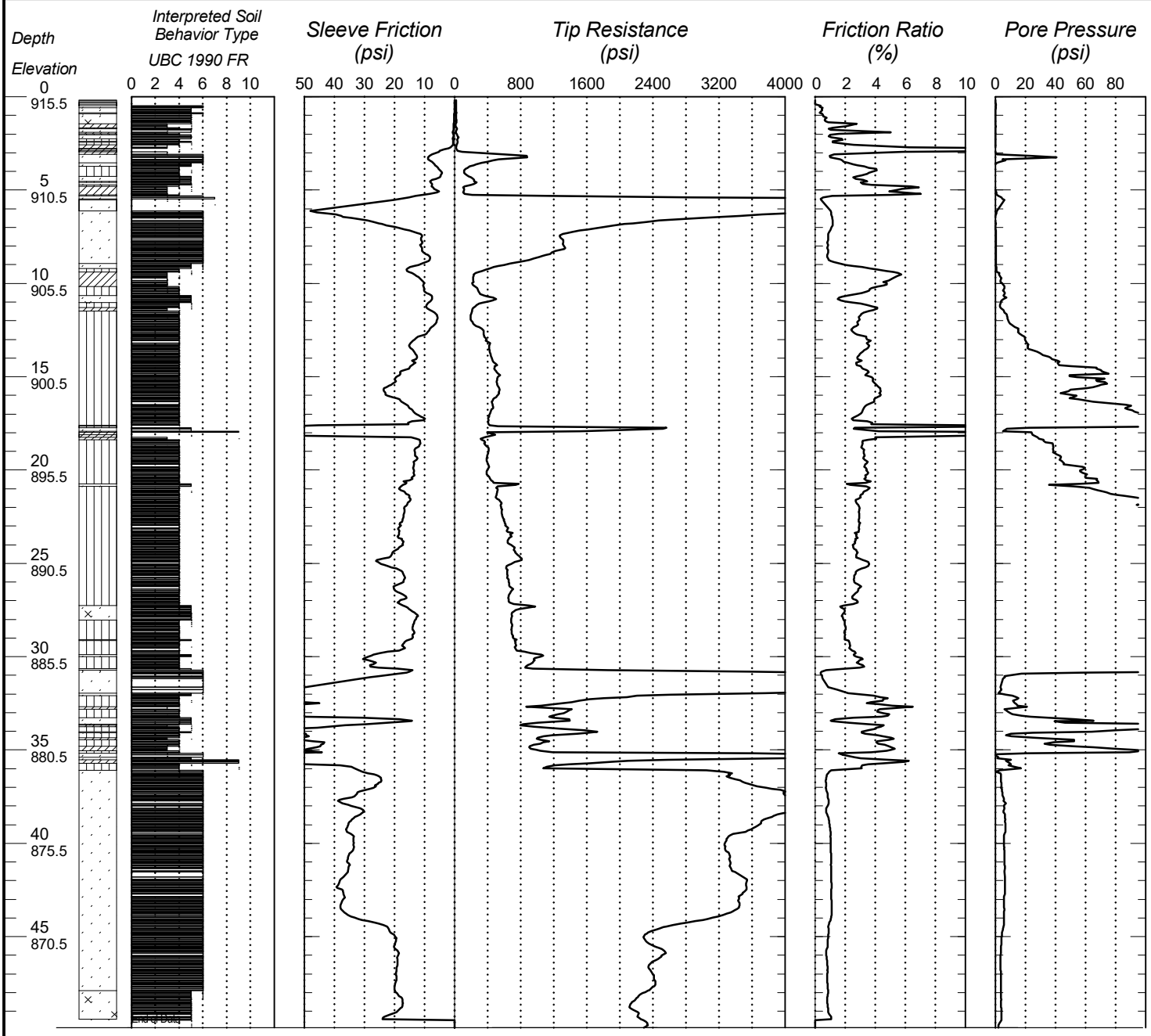
MINNESOTA DEPARTMENT OF TRANSPORTATION - GEOTECHNICAL SECTION

CONE PENETRATION TEST RESULTS

UNIQUE NUMBER 87270

State Project	Bridge No. or Job Desc.	Trunk Highway/Location	Sounding No.	Ground Elevation
2772-124	**BRIDGE # 27534**	**US Highway 169**	**cs04**	**915.5** *(DTM)*

Location	CPT Machine	SHEET 1 of 1
Hennepin County Coordinate System	**219328 CPT Western Star**	
X=495531 Y=201462	CPT Operator **ODonnel**	Date Completed
Latitude (North)=45°04'09.77" *Longitude (West)=93°24'02.27"*	Hole Type **CPT-SEISMIC**	**3/16/22**



Bottom of Hole 49.88