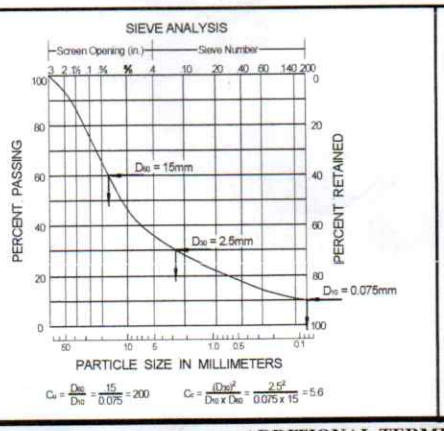
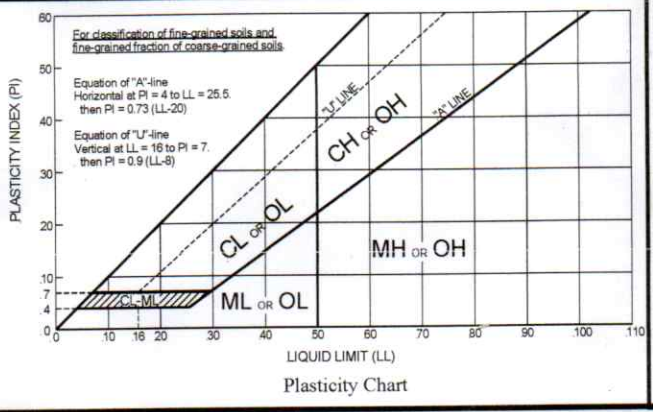
UNIFIED SOIL CLASSIFICATION SYSTEM
ASTM Designations: D 2487, D2488

AMERICAN ENGINEERING TESTING, INC.

Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests[A]				Soil Classification: Group Symbol	Soil Classification: Group Name[B]
Coarse-Grained Soils More than 50% retained on No. 200 sieve	Gravels More than 50% coarse fraction retained on No. 4 sieve	Clean Gravels Less than 5% fines[C]	$Cu \geq 4$ and $1 \leq Cc \leq 3^E$	GW	Well graded gravel[F]
			$Cu < 4$ and/or $1 > Cc > 3^E$	GP	Poorly graded gravel[F]
		Gravels with Fines more than 12% fines[C]	Fines classify as ML or MH	GM	Silty gravel[F,G,H]
			Fines classify as CL or CH	GC	Clayey gravel[F,G,H]
	Sands 50% or more of coarse fraction passes No. 4 sieve	Clean Sands Less than 5% fines[D]	$Cu \geq 6$ and $1 \leq Cc \leq 3^E$	SW	Well-graded sand[I]
			$Cu < 6$ and/or $1 > Cc > 3^E$	SP	Poorly-graded sand[I]
		Sands with Fines more than 12% fines[D]	Fines classify as ML or MH	SM	Silty sand[G,H,I]
			Fines classify as CL or CH	SC	Clayey sand[G,H,I]
Fine-Grained Soils 50% or more passes the No. 200 sieve (see Plasticity Chart below)	Silts and Clays Liquid limit less than 50	inorganic	PI>7 and plots on or above "A" line[J]	CL	Lean clay[K,L,M]
			PI<4 or plots below "A" line[J]	ML	Silt[K,L,M]
		organic	Liquid limit–oven dried / Liquid limit – not dried < 0.75	OL	Organic clay[K,L,M,N] / Organic silt[K,L,M,O]
	Silts and Clays Liquid limit 50 or more	inorganic	PI plots on or above "A" line	CH	Fat clay[K,L,M]
			PI plots below "A" line	MH	Elastic silt[K,L,M]
		organic	Liquid limit–oven dried / Liquid limit – not dried < 0.75	OH	Organic clay[K,L,M,P] / Organic silt[K,L,M,Q]
Highly organic soil			Primarily organic matter, dark in color, and organic in odor	PT	Peat[R]





Plasticity Chart

Notes

[A]Based on the material passing the 3-in (75-mm) sieve.

[B]If field sample contained cobbles or boulders, or both, add "with cobbles or boulders, or both" to group name.

[C]Gravels with 5 to 12% fines require dual symbols:
GW-GM well-graded gravel with silt
GW-GC well-graded gravel with clay
GP-GM poorly graded gravel with silt
GP-GC poorly graded gravel with clay

[D]Sands with 5 to 12% fines require dual symbols:
SW-SM well-graded sand with silt
SW-SC well-graded sand with clay
SP-SM poorly graded sand with silt
SP-SC poorly graded sand with clay

[E]$Cu = D_{60} / D_{10}$, $Cc = \frac{(D_{30})^2}{D_{10} \times D_{60}}$

[F]If soil contains ≥15% sand, add "with sand" to group name.

[G]If fines classify as CL-ML, use dual symbol GC-GM, or SC-SM.

[H]If fines are organic, add "with organic fines" to group name.

[I]If soil contains ≥15% gravel, add "with gravel" to group name.

[J]If Atterberg limits plot is hatched area, soil is a CL-ML silty clay.

[K]If soil contains 15 to 29% plus No. 200 add "with sand" or "with gravel", whichever is predominant.

[L]If soil contains ≥30% plus No. 200, predominantly sand, add "sandy" to group name.

[M]If soil contains ≥30% plus No. 200, predominantly gravel, add "gravelly" to group name.

[N]PI≥4 and plots on or above "A" line.

[O]PI<4 or plots below "A" line.

[P]PI plots on or above "A" line.

[Q]PI plots below "A" line.

[R]Fiber Content description shown below.

ADDITIONAL TERMINOLOGY NOTES USED BY AET FOR SOIL IDENTIFICATION AND DESCRIPTION

Grain Size

Term	Particle Size
Boulders	Over 12"
Cobbles	3" to 12"
Gravel	#4 sieve to 3"
Sand	#200 to #4 sieve
Fines (silt & clay)	Pass #200 sieve

Gravel Percentages

Term	Percent
A Little Gravel	3% - 14%
With Gravel	15% - 29%
Gravelly	30% - 50%

Consistency of Plastic Soils

Term	N-Value, BPF
Very Soft	less than 2
Soft	2 - 4
Firm	5 - 8
Stiff	9 - 15
Very Stiff	16 - 30
Hard	Greater than 30

Relative Density of Non-Plastic Soils

Term	N-Value, BPF
Very Loose	0 - 4
Loose	5 - 10
Medium Dense	11 - 30
Dense	31 - 50
Very Dense	Greater than 50

Moisture/Frost Condition (MC Column)

D (Dry): Absence of moisture, dusty, dry to touch.

M (Moist): Damp, although free water not visible. Soil may still have a high water content (over "optimum").

W (Wet/ Waterbearing): Free water visible, intended to describe non-plastic soils. Waterbearing usually relates to sands and sand with silt.

F (Frozen): Soil frozen

Layering Notes

Laminations: Layers less than ½" thick of differing material or color.

Lenses: Pockets or layers greater than ½" thick of differing material or color.

Peat Description

Term	Fiber Content (Visual Estimate)
Fibric Peat:	Greater than 67%
Hemic Peat:	33 – 67%
Sapric Peat:	Less than 33%

Organic Description (if no lab tests)

Soils are described as *organic*, if soil is not peat and is judged to have sufficient organic fines content to influence the Liquid Limit properties. *Slightly organic* used for borderline cases.

Root Inclusions

With roots: Judged to have sufficient quantity of roots to influence the soil properties.

Trace roots: Small roots present, but not judged to be in sufficient quantity to significantly affect soil properties.

AMERICAN ENGINEERING TESTING	**Long Birch Lodge Boy River Bridge** **Longville, Minnesota**			AET Project No. P-0015185
	Boring Location Map			
	Scale: Shown	Drawn by: TE	Reviewed by: MJLH	**Date:** September 9, 2022

AMERICAN ENGINEERING TESTING

SUBSURFACE BORING LOG

AET No: **P-0015185** Log of Boring No. **B-1 (p. 1 of 2)**

Project: **Long Birch Lodge Boy River Bridge; Longville, Minnesota**

Surface Elevation **1327.7**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS WC	qp	LL	PL	%-#200
1	FILL, sand, a little gravel, trace roots, brown and grayish brown	FILL	11	M	SS	19	3				
3			4	M	SS	12	4				
5	SAND WITH GRAVEL, fine to medium grained, trace roots, grayish brown, wet, very loose to medium dense to loose (SP) (possible fill)	COARSE ALLUVIUM OR FILL	4	M	SS	12	3 17				
8			12	W	SS	0					
10			16	W	SS	3	35				
13			6	W	SS	3	26				
15	LEAN TO FAT CLAY, gray, stiff (CL/CH)	FINE ALLUVIUM	9	W	SS	14	27 30	2.50			
18	SAND, fine to medium grained, a little gravel, grayish brown, waterbearing, medium dense (SP)	COARSE ALLUVIUM	14	W	SS	14	34 22				
20			15	W	SS	14	21				
23	SAND, fine grained, grayish brown, waterbearing, medium dense (SP)		18	W	SS	12	12 24				
25	SAND WITH GRAVEL, coarse grained, grayish brown, waterbearing, medium dense (SP)		27	W	SS	10	11 15				
27	SAND, fine to medium grained, grayish brown, waterbearing, medium dense to very dense, lenses of gravel with sand (SP)		22	W	SS	16	18 10				

DEPTH: DRILLING METHOD	WATER LEVEL MEASUREMENTS						
	DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
0-14½' 4.25" HSA							
14½'-59½' RD w/DM	**8/15/22**	**10:25**	**14.0**	**12.0**	**11.8**	**None**	**9.4**
	8/15/22	**10:35**	**14.0**	**12.0**	**11.7**	**None**	**9.3**
BORING COMPLETED: **8/15/22**							
DR: **JA** LG: **LC** Rig: **85**							

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

AET_CORP P-0015185.GPJ AET+CPT+WELL.GDT 9/23/22

AMERICAN ENGINEERING TESTING

SUBSURFACE BORING LOG

AET No: P-0015185 Log of Boring No. B-1 (p. 2 of 2)

Project: Long Birch Lodge Boy River Bridge; Longville, Minnesota

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS WC	qp	LL	PL	%-#200
31	SAND, fine to medium grained, grayish brown, waterbearing, medium dense to very dense, lenses of gravel with sand (SP) *(continued)*	COARSE ALLUVIUM *(continued)*	22	W	SS	16	17 16				
32											
33			17	W	SS	10	15				
34							16				
35			32	W	SS	18	16				
36											
37											
38			15	W	SS	10	17				
39											
40			28	W	SS	12	21				
41											
42											
43			42	W	SS	12	18				
44											
45			27	W	SS	14	19				
46											
47							18				
48			72	W	SS	16	11				
49											
50	SILTY SAND, fine to medium grained, brown, wet, very dense to dense, lenses of gravel (SM)		58	W	SS	14	15 17				
51											
52							15				
53			32	W	SS	16	19				
54											
55	SAND WITH GRAVEL, fine to coarse grained, grayish brown, waterbearing, dense (SP)		37	W	SS	24	16 18				
56	SILTY SAND, fine grained, grayish brown, wet, dense (SM)										
57											
58			34	W	SS	24	20				
59											
60			46	W	SS	18	18				
61											
	END OF BORING AT 61.5 FEET *Boring backfilled with bentonite grout*										

AET_CORP P-0015185.GPJ AET+CPT+WELL.GDT 9/23/22

AMERICAN ENGINEERING TESTING

SUBSURFACE BORING LOG

AET No: **P-0015185** Log of Boring No. **B-2 (p. 1 of 2)**

Project: **Long Birch Lodge Boy River Bridge; Longville, Minnesota**

Surface Elevation **1327.4**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS WC	DEN	LL	PL	%-#200
1	FILL, gravelly sand with silt	FILL	12	M	SS	10	4				
3			6	W	SS	1	10				
4	FILL, silty sand with gravel, brown										
6			7	W	SS	8	10				
7	SILTY SAND, grayish brown, wet, very loose to medium dense, lenses of sand (SM) (possible fill)	COARSE ALLUVIUM OR FILL	3	W	SS	12	18				
10	GRAVEL, with sand, trace roots and pieces of wood, brown and dark brown, wet, medium dense to loose (GP) (possible fill)		25	W	SS	10	32				
13			10	W	SS	1	52				
15	LEAN CLAY, gray, very stiff, lenses of gravel and sand (CL)	FINE ALLUVIUM			TW	20	25	95			
18			25	W	SS	8	21				
19	SAND, fine to medium grained, a little gravel, grayish brown, waterbearing, medium dense (SP)	COARSE ALLUVIUM			TW	16					
23			22	W	SS	10	22				
25			14	W	SS	12	16				
27	SAND, fine to medium grained, grayish brown, waterbearing, medium dense to dense, lenses of gravel with sand (SP)		27	W	SS	12	8 17				
29											

DEPTH:	DRILLING METHOD	WATER LEVEL MEASUREMENTS						
		DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL
0-14½'	4.25" HSA							
14½'-59½'	RD w/DM	8/16/22	9:15	11.5	9.5	9.6	None	7.2
		8/16/22	9:45	11.5	9.5	9.4	None	6.3
BORING COMPLETED:	8/16/22							
DR: JA	LG: LC Rig: 85							

NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG

AET_CORP P-0015185.GPJ AET+CPT+WELL.GDT 9/23/22

AMERICAN ENGINEERING TESTING

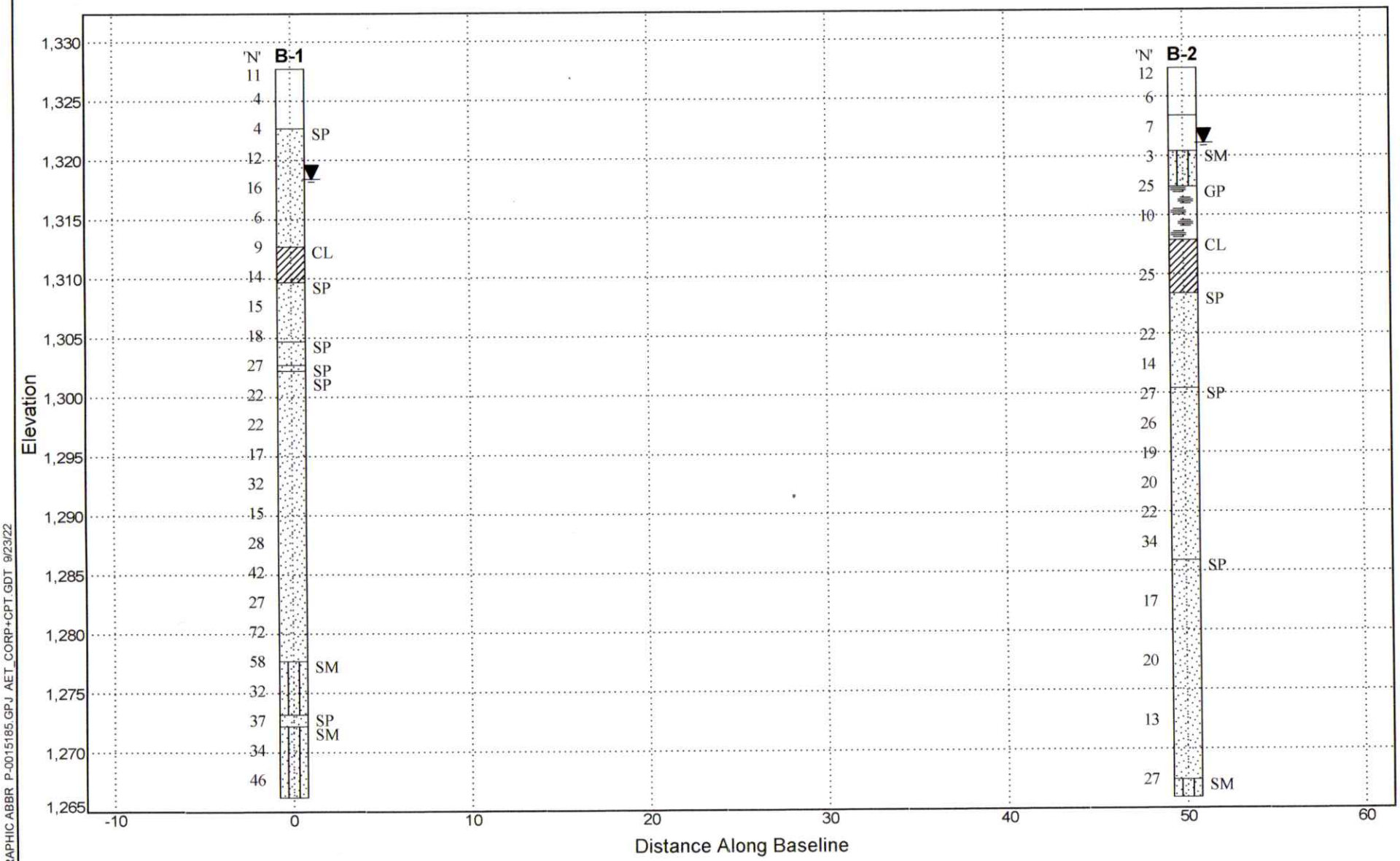
SUBSURFACE BORING LOG

AET No: **P-0015185** Log of Boring No. **B-2 (p. 2 of 2)**

Project: **Long Birch Lodge Boy River Bridge; Longville, Minnesota**

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS WC	DEN	LL	PL	%-#200
31	SAND, fine to medium grained, grayish brown, waterbearing, medium dense to dense, lenses of gravel with sand (SP) *(continued)*	COARSE ALLUVIUM *(continued)*	26	W	SS	12	18				
32											
33			19	W	SS	12	13, 18				
34											
35			20	W	SS	12	18				
36											
37											
38			22	W	SS	12	11, 15				
39											
40			34	W	SS	14	11, 20				
41											
42	SAND, fine to medium grained, grayish brown, waterbearing, medium dense (SP)										
43											
44											
45			17	W	SS	10	19				
46											
47											
48											
49											
50			20	W	SS	12	19				
51											
52											
53											
54											
55			13	W	SS	10	22				
56											
57											
58											
59											
60	SILTY SAND, fine grained, gray, wet, medium dense (SM)		27	W	SS	18	14, 17				
61	**END OF BORING AT 61.5 FEET** *Boring backfilled with bentonite grout*										

AET_CORP P-0015185.GPJ AET+CPT+WELL.GDT 9/23/22



AET
550 Cleveland Avenue North
St. Paul, MN 55114
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Long Birch Lodge Boy River Bridge
Longville, Minnesota
AET No: P-0015185

AET 8.5 X 11 N-VALUES & GRAPHIC ABBR P-0015185.GPJ AET_CORP+CPT.GDT 9/23/22

Figure 1: B-1, West Abutment, 7" x 0.317" CIP Pile
Axial Capacity (kips)

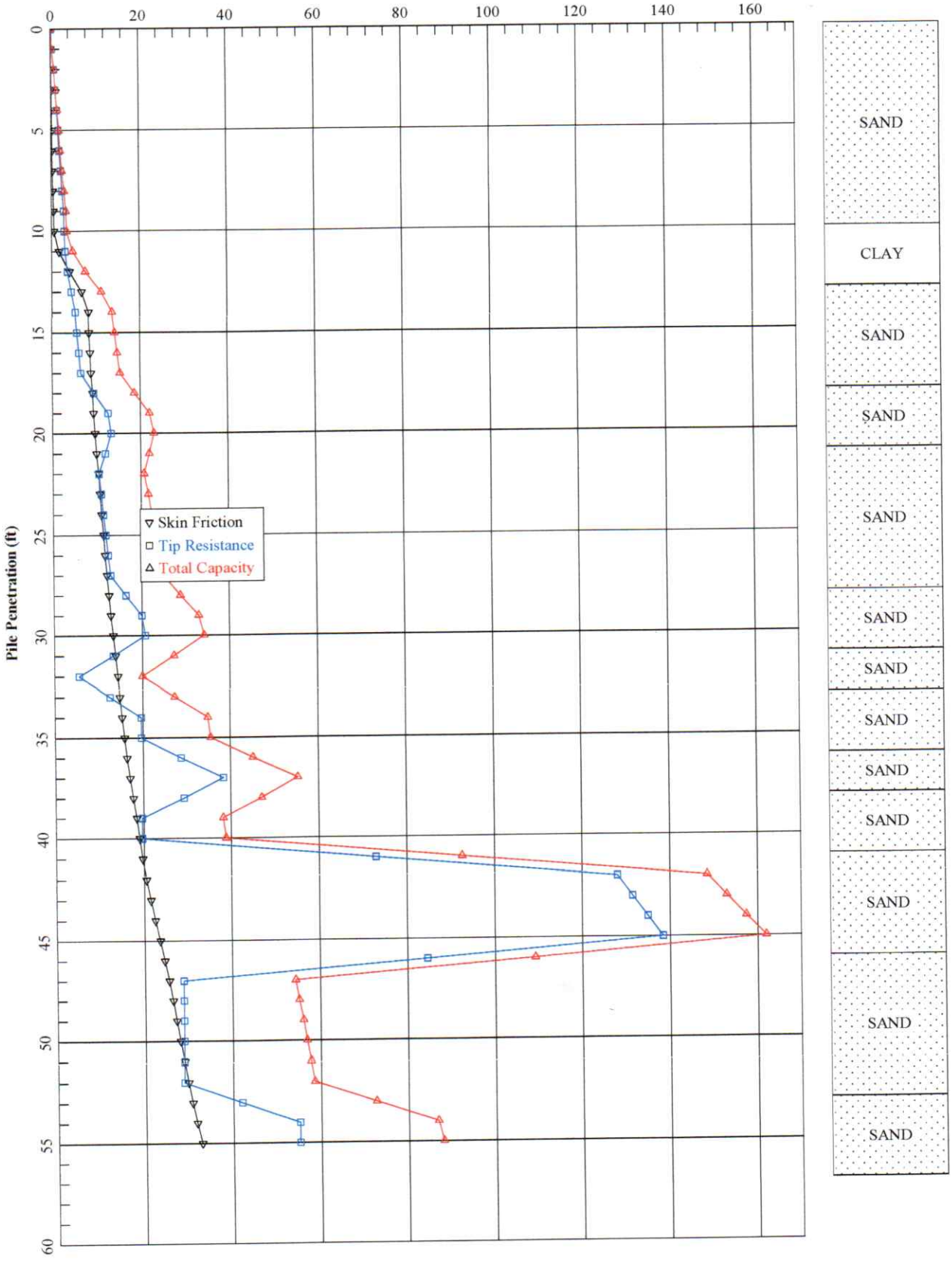
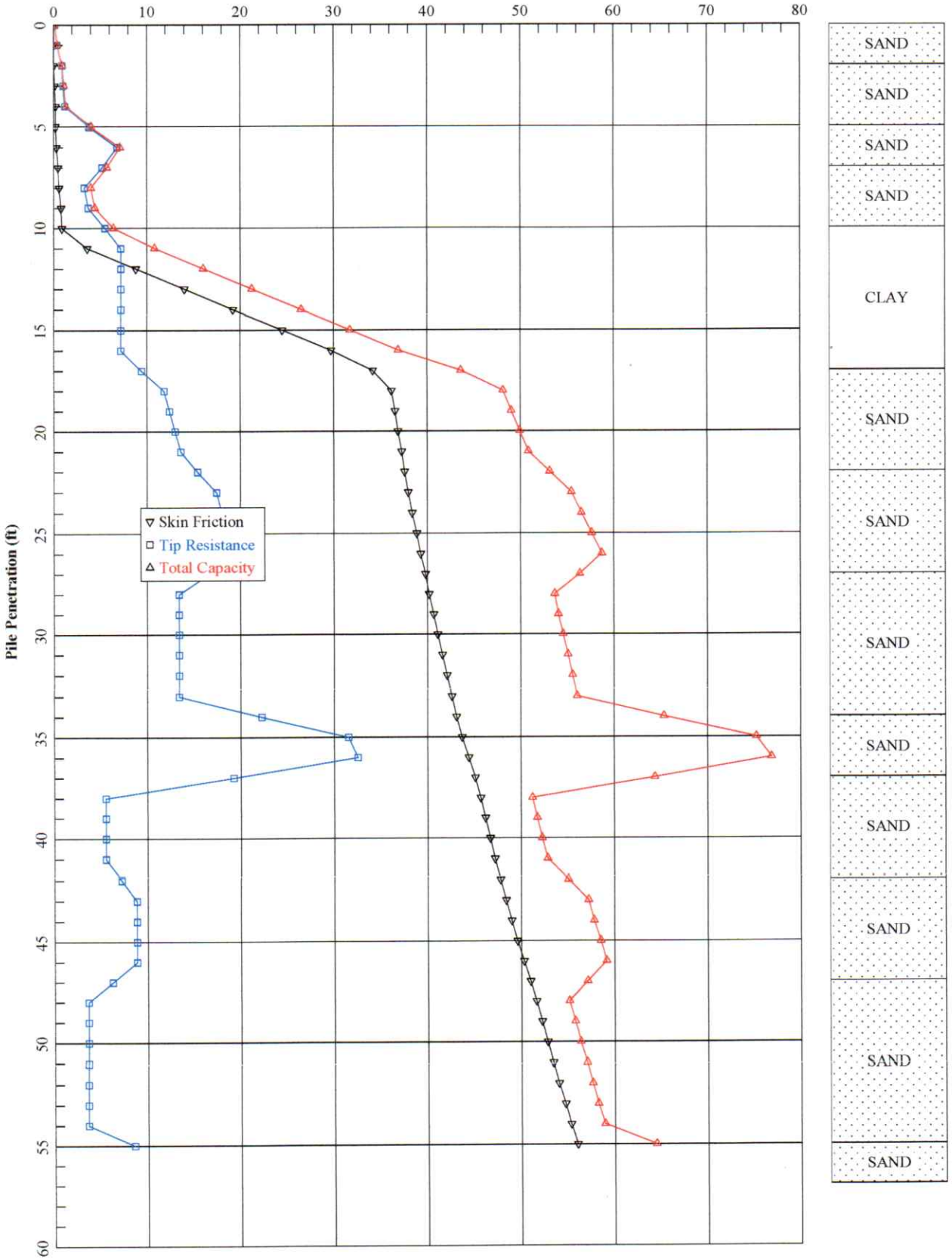
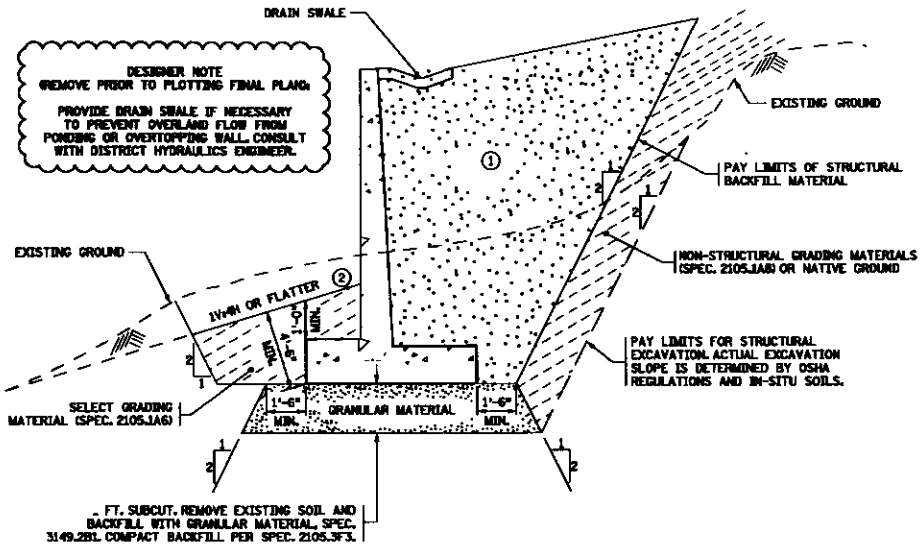
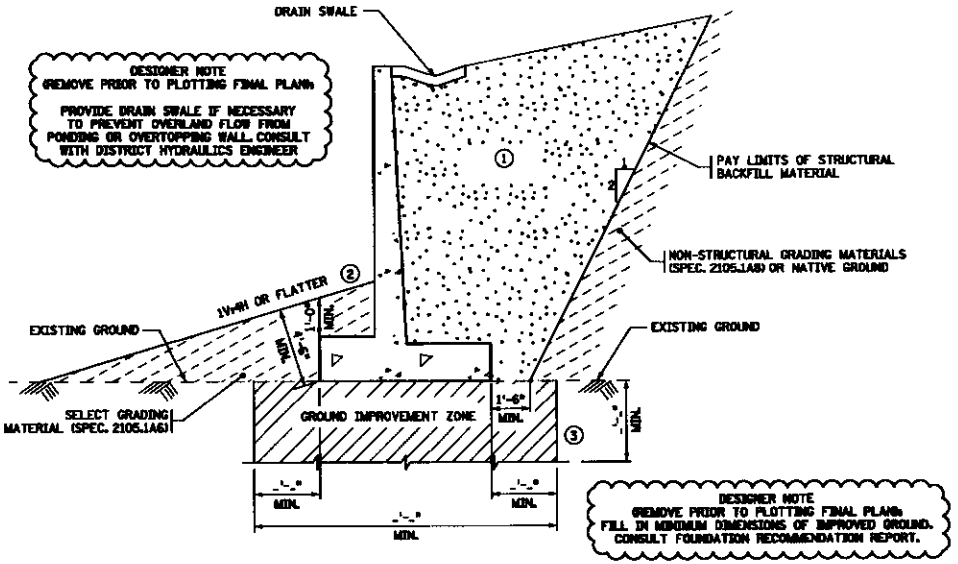


Figure 2: B-2, East Abutment, 7" x 0.317" CIP Pile
Axial Capacity (kips)



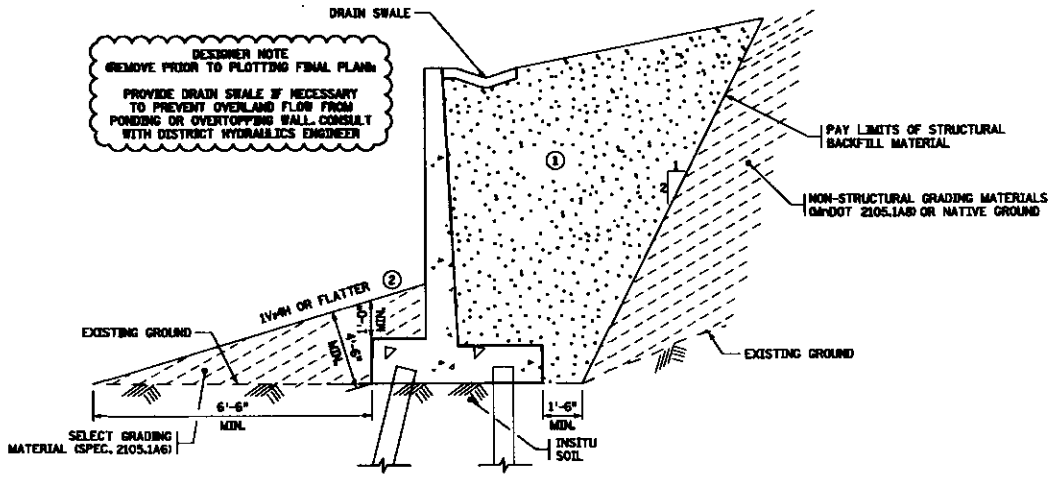


SPREAD FOOTING WITH SOIL SUBCUT
(NOT DRAWN TO SCALE)



SPREAD FOOTING PLACED OVER GROUND IMPROVEMENT
(NOT DRAWN TO SCALE)

DESIGNER NOTE
(REMOVE PRIOR TO PLOTTING FINAL PLANS)
FILL IN SUBCUT DEPTH FROM FOUNDATION RECOMMENDATION REPORT



PILE FOUNDATION
2-PILE SYSTEM SHOWN, OTHER SIMILAR
(NOT DRAWN TO SCALE)

DESIGNER NOTES
(REMOVE PRIOR TO PLOTTING FINAL PLANS)

ALTER BACKFILL AND FINAL GRADE SECTIONS SHOWN IN THIS STANDARD TO MATCH PROJECT SPECIFIC CONDITIONS.

CHECK THE FOUNDATIONS REPORT FOR ADDITIONAL NOTES AND RECOMMENDATIONS THAT SHOULD BE INCLUDED IN PROJECT PLANS.

IF GROUND WATER IS ENCOUNTERED WITHIN TWICE THE FOOTING WIDTH BELOW THE FOOTING, CONTACT THE GEOTECHNICAL ENGINEER TO EVALUATE IF THE STANDARD CAN BE USED OR A REDESIGN IS NEEDED.

① BACKFILL WITH STRUCTURAL BACKFILL SPEC. 3149.2D2 COMPACT BACKFILL PER SPEC. 2105.3F3.

② PROVIDE SLOPE OF 1V:24H TO 1V:4H FOR PROPER DRAINAGE.

③ PROVIDE SUFFICIENT COVERAGE AREA AND TREATMENT VOLUME TO GIVE GENERALLY UNIFORM SUPPORT TO THE FOUNDATION. IMPROVED GROUND OR SURFACE PREPARATIONS PLACED TO IMPROVE GROUND SUPPORT ARE TO BE IN IMMEDIATE CONTACT WITH THE FOOTING AND FOUNDATION MATERIAL.

REVISION:	MODIFIED				
APPROVED: AUGUST 27, 2014	DATE	DESCRIPTION	CERTIFIED BY	STANDARD SHEET NO. 5-297.624 (6 OF 6)	TITLE: RETAINING WALL MISCELLANEOUS DETAILS (GEOTECHNICAL DETAILS)
Nancy Daubenberger			LICENSED PROFESSIONAL ENGINEER — DATE	STANDARD APPROVED: AUGUST 27, 2014	
STATE BRIDGE ENGINEER			NAME: LIC. NO.	STATE PROJ. NO. (TH) SHEET NO. OF SHEETS	