ARKANSAS DEPARTMENT OF TRANSPORTATION

SUBSURFACE INVESTIGATION

STATE JOB NO. 061472

FEDERAL AID PROJECT NO. 9040

HWY. 161 STR. & APPRS. (PULASKI & LONOKE COS.) (S)

STATE HIGHWAY 161 **SECTION** 5

IN LONOKE & PULASKI **COUNTY**

The information contained herein was obtained by the Department for design and estimating purposes only. It is being furnished with the express understanding that said information does not constitute a part of the Proposal or Contract and represents only the best knowledge of the Department as to the location, character and depth of the materials encountered. The information is only included and made available so that bidders may have access to subsurface information obtained by the Department and is not intended to be a substitute for personal investigation, interpretation and judgment of the bidder. The bidder should be cognizant of the possibility that conditions affecting the cost and/or quantities of work to be performed may differ from those indicated herein.

BAYOU METO CANAL 1000

HWY 161 BRIDGE

Geotechnical Design Report

2018 ADDENDUM

Prepared By:

US Army Corps of Engineers - Memphis District

Geotechnical Branch

November 2018

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TABLES

FIGURES

1. ADDENDUM BACKGROUND. The HWY 161 Bridge analysis and design was originally completed in June 2015. Subsurface lithology variations found during subsequent Bayou Meto Basin construction adjacent to the proposed bridge location suggested that the HWY 161 borings may also be affected. USACE Memphis authorized a re-drill at the three original boring locations to verify subsurface conditions and to address any design impacts resulting from the new borings.

2. SUBSURFACE INVESTIGATION. Borings 19-BMG-14, 20-BMU-14, and 21-BMU-14 were re-drilled by McCray Drilling, LLC. along the proposed centerline of the HWY 161 Bridge at positions directly adjacent to the original 2014 borings. USACE Memphis provided quality assurance (QA) personnel on-site to monitor drilling operations and to assist in sample field classifications. An "R" has been added to the end of each boring name (19-BMG-14R for example) to denote the 2017 re-drill. The re-drill boring logs and boring profile in relation to the bridge and canal are presented in the Appendix.

2.1. General Subsurface Conditions. Boring 19-BMG-14R was drilled to a 140-foot depth and borings 20 and 21-BMG-14R were drilled to 90 feet. The borings included disturbed (1.4-in I.D. split spoon) and/or undisturbed (5-in Shelby tube) sampling techniques. The first 20 feet of material included interbedded layers of fine grained silts (ML) and clays (CL, CL-ML, and CH). The above fine grained top blanket materials were generally underlain by medium dense to very dense poorly graded sands (SP) including interbedded layers containing a larger percentage of fines (CL, SP-SC, SP-SM, and SM) and transitioning to layers (GPs and GP-GC) containing various percentages of fine gravel starting at a depth of approximately 60 feet. In general, the re-drilled borings contained a slightly shallower blanket, a significant increase in the overall presence of gravels and fines within the underlying sands, and an increase in the average relative density within the coarse grained materials when compared to the original borings. The re-drilled boring 19-BMG-14R also noted tertiary below a depth of 137 ft (Approximate El. 110 ft), which was not picked up in the original 150-foot deep Boring 19-BMG-14.

2.2. Water Table. At the time of drilling, the water table was measured between NAVD88 elevations 221.9 feet and 235.7 feet. To be conservative for design, the ground water table was assumed at elevation 236 feet compared to a natural ground elevation of approximately 245 feet to 246 feet.

2.3. Laboratory Testing. McCray Drilling, LLC. performed laboratory testing of the bridge boring samples. Generally, unconfined compression tests were to be performed on Shelby

tube samples from the top 5-15 feet of fines and mechanical sieve analyses were performed on the remaining coarse-grained samples. Atterberg limits, moisture contents, dry unit weights, and fines content were also performed on Shelby tube samples. The condensed laboratory testing values are included in the boring logs.

3. GEOTECHNICAL RE-ANALYSIS. The following paragraphs will only highlight the findings of the re-analysis. Details on the methodologies used are further discussed in the June 2015 Bayou Meto Canal 1000 Hwy 161 Geotechnical Design Report. The original geotechnical report will be considered valid for anything not directly addressed below.

3.1. Liquefaction Potential & Residual Shear Strengths. The proposed bridge site class definition and design earthquake remain unchanged from the original report. However; liquefaction potential was re-evaluated due to the changes in lithology and relative densities related to the recorded standard penetration test (SPT) blow counts. Based on a global analysis and resulting Safety Factors <1, liquefaction may be induced for elevations and areas shown in Figure 1. The resulting design residual shear strengths within the liquefied zones are summarized in Table 1 below. The calculations for liquefaction and S_r can be found in the Appendix.

Table 1 - Residual Shear Strengths for Design

	Range of Residual Shear Strength, S_r (psf)
Zone 1	6 to 71
Zone 2	308 to 329

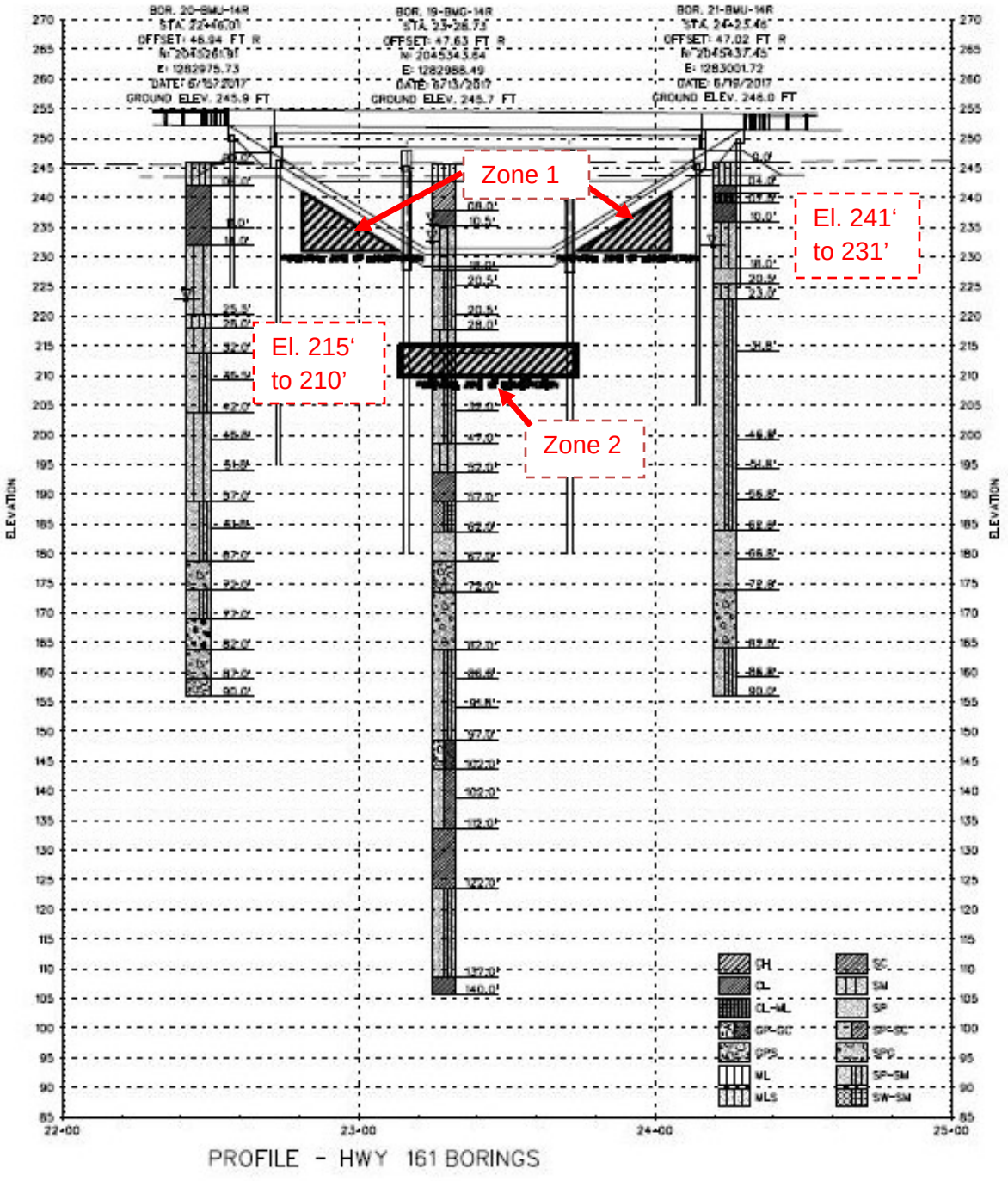

Figure 1 - Global Potential Zones of Liquefaction

3.2. Theoretical Axial Pile Capacity. General Design information for HWY 161 Bridge can be seen in Table 2. The minimum tip elevations listed in Table 2 combine the max factored axial structural loading per pile and the effects of a downdrag load for the compressive case only. Downdrag will only occur at and above the lowest liquefied layer (Zone 2) for the bents. Ultimate pile capacity curves can be found in the Appendix.

Table 2- General Theoretical Pile Capacity Information for Compression

Bent Type	Pile Diameter (in)	Loading Condition	Max Factored Axial Loading (Kips)	Downdrag Working Load (Kips)	Approx. Minimum Tip Elevation (ft)
Abutment 1	18	Static	118	0	195
Abutment 1	18	Extreme	113	0	223
Bents	24	Static	235	0	180
Bents	24	Extreme	205	22	194
Abutment 2	18	Static	118	0	207
Abutment 2	18	Extreme	113	0	223

3.3. Lateral Resistance. Changes to lateral resistance were considered negligible from the original calculations.

3.4. Channel Slope Stability. All slope stability F.S. met the minimum required F.S. for each scenario. A summary of the channel slope stability results are included in Table 3.

Table 3 – Slope Stability Results Summary

Location, Slope	Scenario	Target Min. F.S.	Spencer Critical F.S.
North Bank, LS	AC	1.30	3.31
	LT	1.25	2.49
	FP	1.40	3.31
	RD	1.20	2.49
North Bank, RS	AC	1.30	1.49
	LT	1.25	1.40
	FP	1.40	1.69
	RD	1.20	1.21
South Bank, LS	AC	1.30	3.09
	LT	1.25	2.21
	FP	1.40	3.09
	RD	1.20	2.21
South Bank, RS	AC	1.30	1.60
	LT	1.25	1.70
	FP	1.40	1.66
	RD	1.20	1.42

APPENDIX

Boring Designation 19-BMG-14(R)

DRILLING LOG

DIVISION: Mississippi Valley Division (MVD)

INSTALLATION: Memphis District (CEMVM)

SHEET 1 OF 4 SHEETS

1. PROJECT: Bayou Meto Bridge Design - HWY #161 & HWY #165 & Highway 161 and 165 Bridge Pavement Investigations

8. COORDINATE SYSTEM: HORIZONTAL: AR State Plane; VERTICAL: N.A.V.D 88

9. DRILLING METHOD: RM

2. HOLE NUMBER: 19-BMG-14(R); LOCATION COORDINATES: N 2045343.64 E 1282988.49

10. MANUFACTURER'S DESIGNATION OF DRILL: CME 750x, automatic hammer

3. DRILLING AGENCY: McCray Drilling

11. TOTAL SAMPLES: 34; DISTURBED: 34; UNDISTURBED: 0

4. NAME OF DRILLER: D. Dunn

12. DATE BORING: STARTED 6/13/17; COMPLETED 6/14/17

5. DIRECTION OF BORING: ☒ VERTICAL ☐ INCLINED; DEG FROM VERTICAL: ---; BEARING:

13. ELEVATION WATER TABLE (ft): AT DRILLING: 232.73; AFTER 24 HRS: 235.73

6. TOTAL DEPTH OF BORING: 140

7. ELEVATION TOP OF BORING: 245.73

ELEV	DEPTH	SAMPLE	Blows/0.5 ft	N_r	LEGEND	LAB CLASSIFICATION OF MATERIALS (Description)	% REC	Samp No.	Laboratory: % Gravel	% Sand	% Fines	D10	LL	PI	MC	DUW (pcf)	PPR (tsf)	Torvane (tsf)	C (psf)	REMARKS
			3 3 3	6		Silt (ML) - Brown	100	S-1						NP	13.3					
242.73	3																			
			0 0 0	0		Fat clay (CH) - Brown, Traces of Organic Matter	100	S-2					68	45	41.9					
			1 1 1	2			100	S-3					58	38	34.9					
237.73	8																			
			1 3 3	6		Lean clay (CL) - Brown, Silt Strata or Lenses	100	S-4					36	21	21.8					
235.23	10.5																			
			5 5 6	11		Silty sand (SM) - Brown, Fine	100	S-5			26				25.0					
			3 6 5	11			100	S-6			35				30.1					
			4 4 9	13			100	S-7	0	51	49									
227.73	18																			
			7 8 11	19		Poorly graded sand with silt (SP-SM) - Tan, Fine	100	S-8	0	92	8	0.084								
			6 10 14	24		Brown	100	S-9	0	91	9	0.077								
			9 10 13	23		Brown	100	S-10	0	90	10	0.076								
			11 7 9	16			100	S-11	0	93	7	0.081								
217.73	28																			
			10 13 17	30		Silty sand (SM) - Brown, Fine	100	S-12	0	81	19									
213.73	32																			
			9 15	15		Poorly graded sand with silt (SP-SM) - Tan, Fine	100	S-13	0	92	8	0.079								

0 5 10 15 20 25 30 35

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DRILLING LOG (Cont Sheet)

INSTALLATION: Memphis District (CEMVM)

SHEET 2 OF 4 SHEETS

PROJECT: Bayou Meto Bridge Design - HWY #161 & HWY #165 & Highway 161 and 165 Bridge Pavement Investigations

COORDINATE SYSTEM: HORIZONTAL: AR State Plane; VERTICAL: N.A.V.D 88

LOCATION COORDINATES: N 2045343.64 E 1282988.49

ELEVATION TOP OF BORING: 245.73

ELEV	DEPTH	SAMPLE	Blows/0.5 ft	N_f	LEGEND	LAB CLASSIFICATION OF MATERIALS (Description)	% REC	Samp No.	Laboratory: % Gravel	% Sand	% Fines	D10	LL	PI	MC	DUW (pcf)	PPR (tsf)	Torvane (tsf)	C (psf)	REMARKS
						Poorly graded sand with silt (SP-SM) - Tan, Fine *(continued)*														
		X	6 5 5	10			100	S-14	0	94	6	0.088								
		X	14 13 13	26			100	S-15	0	94	6	0.115								
198.73	47					Silty sand (SM) - Gray, Fine, Traces of Organic Matter														
		X	8 7 8	15			100	S-16	0	86	14									
193.73	52					Clayey sand (SC) - Tan, Fine, Clay Strata or Lenses														
		X	5 6 9	15			100	S-17	1	67	32		18	9	21.5					
188.73	57					Well graded sand with silt (SW-SM) - Brown, Fine to Coarse														
		X	7 9 6	15			100	S-18	29	65	6	0.171								
183.73	62					Poorly graded sand with silt (SP-SM) - Gray, Fine														
		X	29 39 24	63			100	S-19	2	91	7	0.101								
178.73	67					Poorly graded gravel with silt and sand (GP-GM) - Gray														
		X	5 4 8	12			100	S-20	61	33	6	0.422								
173.73	72					Poorly graded sand with gravel (SP) - Gray, Fine to Coarse														
		X	13 10 9	19			100	S-21	32	66	2	0.365								

DRILLING LOG (Cont Sheet)

INSTALLATION: Memphis District (CEMVM)

SHEET 3 OF 4 SHEETS

PROJECT: Bayou Meto Bridge Design - HWY #161 & HWY #165 & Highway 161 and 165 Bridge Pavement Investigations

COORDINATE SYSTEM: HORIZONTAL: AR State Plane; VERTICAL: N.A.V.D 88

LOCATION COORDINATES: N 2045343.64 E 1282988.49

ELEVATION TOP OF BORING: 245.73

ELEV	DEPTH	SAMPLE	Blows/0.5 ft	N_f	LEGEND	LAB CLASSIFICATION OF MATERIALS (Description)	% REC	Samp No.	Laboratory: % Gravel	% Sand	% Fines	D10	LL	PI	MC	DUW (pcf)	PPR (tsf)	Torvane (tsf)	C (psf)	REMARKS
			12 4 15	19		Poorly graded sand with gravel (SP) - Gray, Fine to Coarse *(continued)*	100	S-22	35	64	1	0.183								
163.73	82																			
			26 42 24	66		Poorly graded sand with silt and gravel (SP-SM) - Gray, Fine to Coarse	100	S-23	29	60	11									
			49 29 39	68		Tan	100	S-24	23	65	12									
			15 19 20	39		Brown, Clay Strata or Lenses	100	S-25	22	66	12									
148.73	97																			
			46 47 50	97		Poorly graded gravel with clay and sand (GP-GC) - Brown, Fine to Coarse, Clay Strata or Lenses	100	S-26	45	40	15									
143.73	102																			
			22 13 14	27		Poorly graded sand with clay (SP-SC) - Gray, Fine, Clay Strata or Lenses	100	S-27	0	87	13									
			26 28 26	54		Lignite Fragments	100	S-28												
133.73	112																			
			50 50	100+		Clayey sand (SC) - Gray, Fine	100	S-29			45		35	25	32.3					

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DRILLING LOG (Cont Sheet)

INSTALLATION: Memphis District (CEMVM)

SHEET 4 OF 4 SHEETS

PROJECT: Bayou Meto Bridge Design - HWY #161 & HWY #165 & Highway 161 and 165 Bridge Pavement Investigations

COORDINATE SYSTEM: HORIZONTAL: AR State Plane; VERTICAL: N.A.V.D 88

LOCATION COORDINATES: N 2045343.64 E 1282988.49

ELEVATION TOP OF BORING: 245.73

ELEV	DEPTH	SAMPLE	Blows/0.5 ft	N_f	LEGEND	LAB CLASSIFICATION OF MATERIALS (Description)	% REC	Samp No.	Laboratory: % Gravel	% Sand	% Fines	D10	LL	PI	MC	DUW (pcf)	PPR (tsf)	Torvane (tsf)	C (psf)	REMARKS
			50	100+		Clayey sand (SC) - Gray, Fine *(continued)*	100	S-30												
123.73	122																			
			8 23 47	70		Poorly graded sand with silt (SP-SM) - Gray, Fine	100	S-31	0	89	11									
			50	100+			100	S-32												
			43 50	100+			100	S-33												
108.73	137																			
			15 20 23	43		Lean clay (CL) - Gray, Hard	100	S-34					49	39	17.7					
105.73	140																			

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Boring Designation 20-BMU-14(R)

DRILLING LOG

DIVISION: Mississippi Valley Division (MVD)

INSTALLATION: Memphis District (CEMVM)

SHEET 1 OF 3 SHEETS

1. PROJECT: Bayou Meto Bridge Design - HWY #161 & HWY #165 & Highway 161 and 165 Bridge Pavement Investigations

8. COORDINATE SYSTEM: HORIZONTAL: AR State Plane; VERTICAL: N.A.V.D 88

9. DRILLING METHOD: RM

2. HOLE NUMBER: 20-BMU-14(R); LOCATION COORDINATES: N 2045261.91 E 1282975.73

10. MANUFACTURER'S DESIGNATION OF DRILL: CME 750x, automatic hammer

3. DRILLING AGENCY: McCray Drilling

11. TOTAL SAMPLES: 22; DISTURBED: 17; UNDISTURBED: 5

4. NAME OF DRILLER: D. Dunn

12. DATE BORING: STARTED 6/15/17; COMPLETED 6/15/17

5. DIRECTION OF BORING: ☒ VERTICAL ☐ INCLINED; DEG FROM VERTICAL: ---; BEARING:

13. ELEVATION WATER TABLE (ft): AT DRILLING: 222.92; AFTER 24 HRS:

6. TOTAL DEPTH OF BORING: 90

7. ELEVATION TOP OF BORING: 245.92

ELEV	DEPTH	SAMPLE	Blows/0.5 ft	N_f	LEGEND	LAB CLASSIFICATION OF MATERIALS (Description)	% REC	Samp No.	Laboratory: % Gravel	% Sand	% Fines	D10	LL	PI	MC	DUW (pcf)	PPR (tsf)	Torvane (tsf)	C (psf)	REMARKS
						Silt with sand (ML) - Brown, Rootlets														
											65				20.3					
241.92	4						100	ST-1												
						Lean clay (CL) - Brown, Soft, Oxidized														
							100	ST-2					45	31	39.0					
							100	ST-3												
													31	17	24.0	108	0.50	0.20	430	
							100	ST-4												
						Medium Stiff							28	13	24.6	97	3.00	0.30	540	UC - Side B broke while cutting
231.92	14												32	19	22.0	98	1.50	0.30	633	
						Silty sand (SM) - Brown, Fine	100	ST-5			43				19.6 20.9					
			8 7 8	15			100	S-6			19									
									0	86	14									
			6 6 7	13			100	S-7												
									0	86	14									
			9 8 10	18			100	S-8												
220.42	25.5																			
						Sandy silt (ML) - Brown, Fine			0	37	63									
			3 4 7	11			100	S-9												
217.92	28																			
						Silty sand (SM) - Brown, Fine			0	69	31									
			7 6 7	13			100	S-10												
213.92	32																			
						Poorly graded sand with silt (SP-SM) - Gray, Fine, Organic Matter			0	92	8	0.079								
			1 3	10			100	S-11												

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DRILLING LOG (Cont Sheet)

INSTALLATION: Memphis District (CEMVM)

SHEET 2 OF 3 SHEETS

PROJECT: Bayou Meto Bridge Design - HWY #161 & HWY #165 & Highway 161 and 165 Bridge Pavement Investigations

COORDINATE SYSTEM: HORIZONTAL: AR State Plane; VERTICAL: N.A.V.D 88

LOCATION COORDINATES: N 2045261.91 E 1282975.73

ELEVATION TOP OF BORING: 245.92

ELEV	DEPTH	SAMPLE	Blows/0.5 ft	N_f	LEGEND	LAB CLASSIFICATION OF MATERIALS (Description)	% REC	Samp No.	Laboratory: % Gravel	% Sand	% Fines	D10	LL	PI	MC	DUW (pcf)	PPR (tsf)	Torvane (tsf)	C (psf)	REMARKS
			7			Poorly graded sand with silt (SP-SM) - Gray, Fine, Organic Matter *(continued)*														
		X	13 12 13	25		Tan	100	S-12	0	95	5	0.136								
203.92	42																			
						Silty sand (SM) - Brown, Fine to Medium														
		X	6 5 6	11			100	S-13	0	86	14									
		X	5 6 7	13		Clay Strata or Lenses	100	S-14			30				21.5					Att. - Not enough sample to run test
		X	4 6 9	15		Gray, Organic Matter, Oxidized, Traces of Gravel	100	S-15	2	80	18									
188.92	57																			
						Poorly graded sand with silt (SP-SM) - Tan, Fine to Medium, Few Gravel														
		X	12 17 32	49			100	S-16	14	78	8	0.104								
		X	13 12 12	24			100	S-17	2	93	6	0.136								
178.92	67																			
						Poorly graded sand with gravel (SP) - Tan, Fine to Coarse														
		X	11 10 13	23			100	S-18	29	67	4	0.208								
173.92	72																			
						Poorly graded sand with silt and gravel (SP-SM) - Gray, Fine to Coarse														
		X	14 9 10	19			100	S-19	42	53	5	0.212								

DRILLING LOG (Cont Sheet)

INSTALLATION	SHEET
Memphis District (CEMVM)	3 OF 3 SHEETS

PROJECT	COORDINATE SYSTEM	HORIZONTAL	VERTICAL
Bayou Meto Bridge Design - HWY #161 & HWY #165 & Highway 161 and 165 Bridge Pavement Investigations		AR State Plane	N.A.V.D 88

LOCATION COORDINATES	ELEVATION TOP OF BORING
N 2045261.91 E 1282975.73	245.92

ELEV	DEPTH	SAMPLE	Blows/0.5 ft	N_c	LEGEND	LAB CLASSIFICATION OF MATERIALS (Description)	% REC	Samp No.	Laboratory: % Gravel	% Sand	% Fines	D10	LL	PI	MC	DUW (pcf)	PPR (tsf)	Torvane (tsf)	C (psf)	REMARKS
168.92	77																			
		X	12 14 18	32		Well graded gravel with sand (GW) - Gray, Fine	100	S-20	56	41	4	0.321								
163.92	82																			
		X	12 20 21	41		Poorly graded sand with gravel (SP) - Tan, Fine to Medium	100	S-21	23	69	8	0.108								
158.92	87																			
		X	7 12 13	25		Poorly graded gravel with sand (GP) - Brown, Fine	100	S-22	73	23	4	0.415								
155.92	90																			

-Water Level was not encountered

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Boring Designation 21-BMU-14 (R)

DRILLING LOG

DIVISION: Mississippi Valley Division (MVD)

INSTALLATION: Memphis District (CEMVM)

SHEET 1 OF 3 SHEETS

1. PROJECT: Bayou Meto Bridge Design - HWY #161 & HWY #165 & Highway 161 and 165 Bridge Pavement Investigations

8. COORDINATE SYSTEM: HORIZONTAL: AR State Plane; VERTICAL: N.A.V.D 88

9. DRILLING METHOD: RM

2. HOLE NUMBER: 21-BMU-14 (R)

LOCATION COORDINATES: N 2045437.45 E 1283001.72

10. MANUFACTURER'S DESIGNATION OF DRILL: CME 750x, automatic hammer

3. DRILLING AGENCY: McCray Drilling

11. TOTAL SAMPLES: 22; DISTURBED: 18; UNDISTURBED: 4

4. NAME OF DRILLER: D. Dunn

12. DATE BORING: STARTED 6/19/17; COMPLETED 6/20/17

5. DIRECTION OF BORING: ☒ VERTICAL ☐ INCLINED; DEG FROM VERTICAL: ---; BEARING:

13. ELEVATION WATER TABLE (ft): AT DRILLING: ; AFTER 24 HRS: 231.97

6. TOTAL DEPTH OF BORING: 90

7. ELEVATION TOP OF BORING: 245.97

ELEV	DEPTH	SAMPLE	Blows/0.5 ft	N_f	LEGEND	LAB CLASSIFICATION OF MATERIALS (Description)	% REC	Samp No.	Laboratory: % Gravel	% Sand	% Fines	D10	LL	PI	MC	DUW (pcf)	PPR (tsf)	Torvane (tsf)	C (psf)	REMARKS
						Silt with sand (ML) - Brown														
											76									
241.97	4						100	ST-1						NP	17.0					
240.72	5.25					Lean clay (CL) - Brown, Soft, Oxidized							31	16	22.7	101	1.00	0.75	384	
						Sandy silty clay (CL-ML) - Brown	100	ST-2			54		20	4	12.3					
238.97	7																			
						Sandy lean clay (CL) - Brown							23	9						
							100	ST-3												
235.97	10																			
						Silty sand (SM) - Brown, Fine														
							100	ST-4			35									
			6																	
			6						1	73	26									
			7	13			100	S-5												
227.97	18																			
			7			Poorly graded sand (SP) - Tan, Fine														
			10	22			100	S-6	0	96	4	0.132								
			12																	
225.47	20.5																			
			11			Silty sand (SM) - Brown, Fine														
			8	16			100	S-7	0	87	13									
222.97	23		8																	
			7			Poorly graded sand with silt (SP-SM) - Brown, Fine														
			8	16			100	S-8	0	92	8	0.078								
			8																	
			6																	
			6	16			100	S-9												
			10																	
			10																	
			5	14			100	S-10	0	88	12									
			9																	
			12			Tan														
			13	27			100	S-11	0	93	7	0.079								

GENERAL/UNDISTURBED - GINT STD US LAB.GDT - 11/21/18 09:25 - A:\GOSH\BAYOU_METO_HWY161_BRIDGE_DESIGN_2015\07_BORING_DATA\FINAL_BORING_DATA\FINAL_GINT\HWY161.GPJ

DRILLING LOG (Cont Sheet)

INSTALLATION: Memphis District (CEMVM)

SHEET 2 OF 3 SHEETS

PROJECT: Bayou Meto Bridge Design - HWY #161 & HWY #165 & Highway 161 and 165 Bridge Pavement Investigations

COORDINATE SYSTEM: HORIZONTAL: AR State Plane; VERTICAL: N.A.V.D 88

LOCATION COORDINATES: N 2045437.45 E 1283001.72

ELEVATION TOP OF BORING: 245.97

ELEV	DEPTH	SAMPLE	Blows/0.5 ft	N_f	LEGEND	LAB CLASSIFICATION OF MATERIALS (Description)	% REC	Samp No.	Laboratory: % Gravel	% Sand	% Fines	D10	LL	PI	MC	DUW (pcf)	PPR (tsf)	Torvane (tsf)	C (psf)	REMARKS
			14			Poorly graded sand with silt (SP-SM) - Brown, Fine *(continued)*														
		X	16 13 15	28		Tan	100	S-12	0	94	6	0.078								
		X	13 15 17	32		Tan	100	S-13	0	94	6	0.149								
		X	9 13 13	26		Traces of Gravel, Traces of Clay	100	S-14	1	90	10	0.079								
		X	9 14 16	30		Few Gravel, Traces of Clay	100	S-15	9	80	11									
		X	28 36 37	73		Tan	100	S-16	0	94	6	0.127								
183.97	62					Poorly graded sand (SP) - Gray, Fine to Medium, Traces of Gravel														
		X	10 10 9	19			100	S-17	1	95	4	0.158								
		X	12 16 16	32			100	S-18												
173.97	72					Poorly graded sand with gravel (SP) - Gray, Fine to Coarse														
		X	16 16 13	29			100	S-19	46	51	4	0.215								

GENERAL/UNDISTURBED - GINT STD US LAB.GDT - 11/21/18 09:25 - A:\GOSH\BAYOU_METO_HWY161_BRIDGE_DESIGN_2015\07_BORING_DATA\FINAL_BORING_DATA\FINAL_GINT\HWY161.GPJ

DRILLING LOG (Cont Sheet)

INSTALLATION	SHEET
Memphis District (CEMVM)	3 OF 3 SHEETS

PROJECT	COORDINATE SYSTEM	HORIZONTAL	VERTICAL
Bayou Meto Bridge Design - HWY #161 & HWY #165 & Highway 161 and 165 Bridge Pavement Investigations		AR State Plane	N.A.V.D 88

LOCATION COORDINATES	ELEVATION TOP OF BORING
N 2045437.45 E 1283001.72	245.97

ELEV	DEPTH	SAMPLE	Blows/ 0.5 ft	N_f	LEGEND	LAB CLASSIFICATION OF MATERIALS (Description)	% REC	Samp No.	Laboratory: % Gravel	% Sand	% Fines	D10	LL	PI	MC	DUW (pcf)	PPR (tsf)	Torvane (tsf)	C (psf)	REMARKS
			15 13 14	27		Poorly graded sand with gravel (SP) - Gray, Fine to Coarse *(continued)*	100	S-20												
163.97	82																			
			22 31 32	63		Poorly graded sand with silt and gravel (SP-SM) - Tan, Fine to Coarse	100	S-21	24	70	7	0.133								
			90	90		Gray	100	S-22	47	47	6	0.178								
155.97	90																			

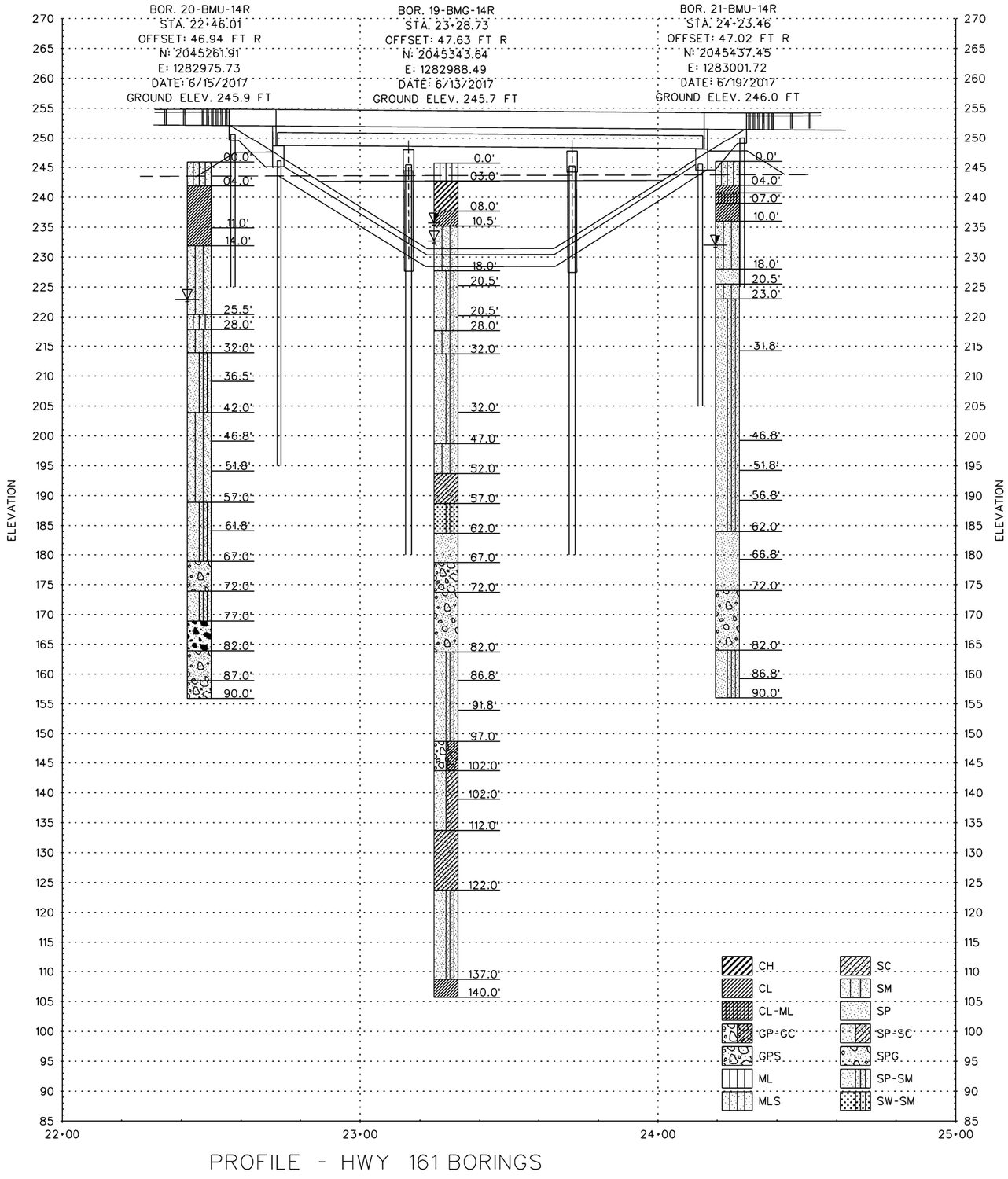
80

85

90

-Water Level was not encountered

GENERAL/UNDISTURBED - GINT STD US LAB.GDT - 11/21/18 09:25 - A:\GOSH\BAYOU_METO_HWY161_BRIDGE_DESIGN_2015\07_BORING_DATA\FINAL_BORING_DATA\FINAL_GINT\HWY161.GPJ



PROFILE - HWY 161 BORINGS

DATE REVISED	DATE FILMED	DATE REVISED	DATE FILMED	FED.RD. DIST.NO.	STATE	FED.RD PROJ.NO.	SHEET NO.	TOTAL SHEETS
				6	ARK.			
				JOB NO.		061472	30	101
				(2)	07386	LAYOUT	58589	

"N60" VALUES

20-BMU-14

18.5'-20.0', N=21
21.0'-22.5', N=18
23.5'-25.0', N=25
26.0'-27.5', N=15
28.5'-30.0', N=18
33.5'-35.0', N=14
38.5'-40.0', N=35
43.5'-45.0', N=15
48.5'-50.0', N=18
53.5'-55.0', N=21
58.5'-60.0', N=68
63.5'-65.0', N=33
68.5'-70.0', N=32
73.5'-75.0', N=26
78.5'-80.0', N=44
83.5'-85.0', N=57
88.5'-90.0', N=35

19-BMG-14

1.0'-2.5', N=8
3.5'-5.0', N=0
6.0'-7.5', N=2
8.5'-10.0', N=8
11.0'-12.5', N=15
13.5'-15.0', N=15
16.0'-17.5', N=18
18.5'-20.0', N=26
21.0'-22.5', N=33
23.5'-25.0', N=32
26.0'-27.5', N=22
28.5'-30.0', N=42
33.5'-35.0', N=21
38.5'-40.0', N=14
43.5'-45.0', N=36
48.5'-50.0', N=21
53.5'-55.0', N=21
58.5'-60.0', N=21
63.5'-65.0', N=88
68.5'-70.0', N=16
73.5'-75.0', N=26
78.5'-80.0', N=26
83.5'-85.0', N=92
88.5'-90.0', N=95
93.5'-95.0', N=54
98.5'-100.0', N=100+
103.5'-105.0', N=37
108.5'-110.0', N=75
113.5'-115.0', N=70
118.5'-120.0', N=70
123.5'-125.0', N=98
128.5'-130.0', N=70
133.5'-135.0', N=70
138.5'-140.0', N=60

21-BMU-14

16.0'-17.5', N=18
18.5'-20.0', N=30
21.0'-22.5', N=22
23.5'-25.0', N=22
26.0'-27.5', N=22
28.5'-30.0', N=19
33.5'-35.0', N=37
38.5'-40.0', N=39
43.5'-45.0', N=44
48.5'-50.0', N=36
53.5'-55.0', N=42
58.5'-60.0', N=100+
63.5'-65.0', N=26
68.5'-70.0', N=44
73.5'-75.0', N=40
78.5'-80.0', N=37
83.5'-85.0', N=88
88.5'-90.0', N=100+

NOTE: "N60" values were found by taking the observed field "N" values and multiplying by an energy correction factor of 1.4

BORING LEGEND

A1-Brown, SILT (ML) with sand, rootlets
B1-Soft, brown, lean CLAY (CL), oxidized
C1-Medium stiff, brown, lean CLAY (CL), oxidized
D1-Medium dense, brown, fine, silty SAND (SM)
E1-Stiff, brown, fine, sandy SILT (ML)
F1-Medium dense, gray, fine, poorly graded SAND with silt (SP-SM), organic matter
G1-Dense, tan, fine, poorly graded SAND with silt (SP-SM), organic matter
I11-Medium dense, brown, fine to medium, silty SAND (SM)
I1-Medium dense, brown, fine to medium, silty SAND (SM), clay strata or lenses
J1-Medium dense, gray, fine to medium, silty SAND (SM), organic matter, oxidized, traces of gravel
K1-Very dense, tan, fine to medium, poorly graded SAND with silt (SP-SM), few gravel
L1-Dense, tan, fine to medium, poorly graded SAND with silt (SP-SM), trace of gravel
M1-Dense, tan, fine to coarse, poorly graded SAND (SP) with gravel
N1-Medium dense, gray, fine to coarse, poorl graded SAND with silt (SP-SM)
O1-Dense, gray, fine, well graded Gravel (GW) with sand
P1-Very dens, tan, fine to medium, poorly graded SAND (SP) with gravel
Q1-Dense, brown, fine, poorly graded GRAVEL (GP) with sand
R1-Medium stiff, brown, SILT (ML)
S1-Very soft, brown, fat CLAY (CH), traces of organic matter
T1-Medium stiff, brown, lean CLAY (CL), silt strata or lenses
U1-Medium dense, tan, fine, poorly graded SAND with silt (SP-SM)
V1-Dens, brown, fine, poorly graded SAND with silt (SP-SM)
W1-Medium dense, tan, fine, poorly graded SAND with silt (SP-SM)
X1-Dense, tan, fine, poorly graded sand with silt (SP-SM)
Y1-Dense, tan, fine, poorly graded SAND with silt (SP-SM)
Z1-Medium dense, gray, fine, silty SAND (SM), traces of organic matter
A2-Medium dense, tan, fine, clayey SAND (SC), clay strata or lenses
B2-Medium dense, brown, fine to coarse, well graded SAND with silt (SW-SM)
C2-Very dense, gray, fine, poorly graded sand (SP)
D2-Medium dense, gray, poorly graded GRAVEL (GP) with sand
E2-Medium dense, gray, fine to coarse, poorly graded SAND (SP) with gravel
F2-Very dense, gray, fine to coarse, poorly graded SAND with silt (SP-SM)
G2-Very dense, tan, fine to coarse, poorly graded SAND with silt (SP-SM)
H2-Very dense, brown, fine to coarse, poorly graded SAND with silt (SP-SM), clay strata or lenses
I2-Very dense, brown, fine to coarse, poorly graded GRAVEL (GP-GC) with clay and sand, clay strata or lenses
J2-Dense, gray, fine, poorly graded SAND with clay (SP-SC), clay strata or lenses
K2-Very dense, gray, fine, poorly graded SAND with clay (SP-SC), clay strata or lenses, lignite fragments
L2-Very dense, gray, fine, clayey SAND (SC)
M2-Very dense, gray, fine, poorly graded SAND with silt (SP-SM)
N2-Hard, gray, lean CLAY (CL)
O2-Brown, sandy silty CLAY (CL-ML)
P2-Brown, sandy lean CLAY (CL)
Q2-Medium dense, tan, fine, poorly graded SAND (SP)
R2-Medium dense, brown, fine, poorly graded SAND with silt (SP-SM)
S2-Dense, brown, fine, poorly graded SAND with silt (SP-SM), traces of gravel, traces of clay
T2-S2-Dense, brown, fine, poorly graded SAND with silt (SP-SM), few gravel, traces of clay
U2-S2-Very dense, tan, fine, poorly graded SAND with silt (SP-SM)
V2-Medium dense, gray, fine to medium, poorly graded SAND (SP), traces of gravel
W2-Dense, gray, fine to coarse, poorly graded SAND (SP), traces of gravel
X2-Dense, gray, fine to coarse, poorly graded SAND (SP) with gravel

SHEET 2 OF 3
LAYOUT OF BRIDGE
HIGHWAY 161 OVER CANAL 1000
LONOKE & PULASKI COUNTIES
ROUTE 161 SEC. 5
ARKANSAS STATE HIGHWAY COMMISSION
LITTLE ROCK, ARK.

STATE OF ARKANSAS
LICENSED PROFESSIONAL ENGINEER
No. 15752
GORDY H. WILLIAMS

DRAWN BY: MJH DATE: OCT 2015
CHECKED BY: DATE: OCT 2015
DESIGNED BY: RL DATE: OCT 2015
FILENAME: b061472_b1.dgn
SCALE: NO SCALE

BRIDGE NO. 07386 DRAWING NO. 58589

$DATE$
$FILE$

2017 - REDONE BORINGS

Sample	N-Value				Material Type				Fines Content				Dry Unit Weight				Plastic Limit				Liquid Limit				Water Content				Shear Strength			
Depth (ft)	20	19	21	Avg	20	19	21	Avg	20	19	21	Avg	20	19	21	Avg	20	19	21	Avg	20	19	21	Avg	20	19	21	Avg	20	19	21	Avg
1		6		6	MLs	ML	MLs	MLs	65		76	71						0	0	0		0	0	0	20	13	17	17				
3.5		0		0	MLs	CH	MLs	MLs										23		23		68		68		42		42				
4					CL	CH	CL	CL							101	101	14		15	15	45		31	38	39		23	31			384	384
6		2		2	CL	CH	CL-ML	CL			54	54						20	16	18		58	20	39		35	12	24				
7					CL	CH	CLs	CL											14	14			23	23								
8.5		6		6	CL	CL	CL	CL										15		15		36		36		22		22				
10					CL	CL	SM	CL					108			108	14			14	31			31	24			24	430			430
11		11		11	CL	SM	SM	SM		26	35	31	97			97	15			15	28			28	22	25		24	540			540
13					CL	SM	SM	SM					98			98	13			13	32			32	22			22	633			633
13.5		11		11	CL	SM	SM	SM		35		35													20	30		25				
16		13	13	13	SM	SM	SM	SM	43	49	26	39																				
18.5	15	19	22	19	SM	SP-SM	SP	SP-SM	19	8	4	10																				
21	13	24	16	18	SM	SP-SM	SM	SM	14	9	13	12																				
23.5	18	23	16	19	SM	SP-SM	SP-SM	SP-SM	14	10	8	11																				
26	11	16	16	14	MLs	SP-SM	SP-SM	SP-SM	63	7		35																				
28.5	13	30	14	19	SM	SM	SP-SM	SM	31	19	12	21																				
33.5	10	15	27	17	SP-SM	SP-SM	SP-SM	SP-SM	8	8	7	8																				
38.5	25	10	28	21	SP-SM	SP-SM	SP-SM	SP-SM	5	6	6	6																				
43.5	11	26	32	23	SM	SP-SM	SP-SM	SP-SM	14	6	6	9																				
48.5	13	15	26	18	SM	SM	SP-SM	SM	30	14	10	18													22			22				
53.5	15	15	30	20	SM	SC	SP-SM	SM	18	32	11	20						9		9		18		18		21		21				
58.5	49	15	73	46	SP-SM	SW-SM	SP-SM	SP-SM	8	6	6	7																				
63.5	24	63	19	35	SP-SM	SP-SM	SP	SP-SM	6	7	4	6																				
68.5	23	12	32	22	SPg	GP-GM	SP	SPg	4	6		5																				
73.5	19	19	29	22	SP-SM	SPg	SPg	SPg	5	2	4	4																				
78.5	32	19	27	26	GWs	SPg	SPg	SPg	4	1		3																				
83.5	41	66	63	57	SPg	SP-SM	SP-SM	SP-SM	8	11	7	9																				
88.5	25	68	90	61	GP	SP-SM	SP-SM	SP-SM	4	12	6	7																				
93.5		39		39		SP-SM		SP-SM		12		12																				
98.5		97		97		GP-GC		GP-GC		15		15																				
103.5		27		27		SP-SC		SP-SC		13		13																				
108.5		54		54		SP-SC		SP-SC																								
113.5		100+		100		SC		SC		45		45						10		10		35		35		32		32				
118.5		100+		100		SC		SC																								
123.5		70		70		SP-SM		SP-SM		11		11																				
128.5		100+		100		SP-SM		SP-SM																								
133.5		100+		100		SP-SM		SP-SM																								
138.5		43		43		CL		CL										10		10		49		49		18		18				

2017 - REDONE BORINGS STEPPED LIQUEFACTION FACTOR OF SAFETY

Grade		229.8		231		232		233		234		235		236		237	
Wt ELE	243.1	-13.3		-12.1		-11.1		-10.1		-9.1		-8.1		-7.1		-6.1	
Sample	Elevation	F.S.	Occurance	F.S.	Occurance	F.S.	Occurance	F.S.	Occurance	F.S.	Occurance	F.S.	Occurance	F.S.	Occurance	F.S.	Occurance
1	244.9																
2	242.4																
3	239.9																
4	237.4																
5	234.9											0.03	Likely!	0.30	Likely!	0.53	Likely!
6	232.4							0.13	Likely!	0.31	Likely!	0.47	Likely!	0.61	Likely!	0.74	Likely!
7	229.9			2.00	Unlikely	2.00	Unlikely	2.00	Unlikely	2.00	Unlikely	2.00	Unlikely	2.00	Unlikely	2.00	Unlikely
8	227.4	2.00	Unlikely	2.00	Unlikely	2.00	Unlikely	2.00	Unlikely	2.00	Unlikely	2.00	Unlikely	2.00	Unlikely	2.00	Unlikely
9	224.9	2.00	Unlikely	2.00	Unlikely	2.00	Unlikely	2.00	Unlikely	2.00	Unlikely	2.00	Unlikely	2.00	Unlikely	2.00	Unlikely
10	222.4	2.00	Unlikely	2.00	Unlikely	2.00	Unlikely	2.00	Unlikely	2.00	Unlikely	2.00	Unlikely	2.00	Unlikely	2.00	Unlikely
11	219.9	2.00	Unlikely	2.00	Unlikely	2.00	Unlikely	2.00	Unlikely	2.00	Unlikely	2.00	Unlikely	2.00	Unlikely	2.00	Unlikely
12	217.4	2.00	Unlikely	2.00	Unlikely	2.00	Unlikely	2.00	Unlikely	2.00	Unlikely	2.00	Unlikely	2.00	Unlikely	2.00	Unlikely
13	212.4	0.95	Likely!	1.00	Likely!	1.03	Unlikely	1.07	Unlikely	1.10	Unlikely	1.13	Unlikely	1.16	Unlikely	1.20	Unlikely
14	207.4	2.00	Unlikely	2.00	Unlikely	2.00	Unlikely	2.00	Unlikely	2.00	Unlikely	2.00	Unlikely	2.00	Unlikely	2.00	Unlikely
15	202.4	2.00	Unlikely	2.00	Unlikely	2.00	Unlikely	2.00	Unlikely	2.00	Unlikely	2.00	Unlikely	2.00	Unlikely	2.00	Unlikely
16	197.4	1.34	Unlikely	1.36	Unlikely	1.41	Unlikely	1.43	Unlikely	1.47	Unlikely	1.50	Unlikely	1.54	Unlikely	1.56	Unlikely
17	192.4	2.00	Unlikely	2.00	Unlikely	2.00	Unlikely	2.00	Unlikely	2.00	Unlikely	2.00	Unlikely	2.00	Unlikely	2.00	Unlikely
18	187.4	2.00	Unlikely	2.00	Unlikely	2.00	Unlikely	2.00	Unlikely	2.00	Unlikely	2.00	Unlikely	2.00	Unlikely	2.00	Unlikely
19	182.4	2.00	Unlikely	2.00	Unlikely	2.00	Unlikely	2.00	Unlikely	2.00	Unlikely	2.00	Unlikely	2.00	Unlikely	2.00	Unlikely
20	177.4	1.29	Unlikely	1.31	Unlikely	1.36	Unlikely	1.37	Unlikely	1.42	Unlikely	1.43	Unlikely	1.49	Unlikely	1.50	Unlikely
21	172.4	1.30	Unlikely	1.35	Unlikely	1.36	Unlikely	1.41	Unlikely	1.42	Unlikely	1.47	Unlikely	1.48	Unlikely	1.53	Unlikely
22	167.4	1.73	Unlikely	1.74	Unlikely	1.80	Unlikely	1.81	Unlikely	1.87	Unlikely	1.88	Unlikely	1.93	Unlikely	1.95	Unlikely
23	162.4	2.00	Unlikely	2.00	Unlikely	2.00	Unlikely	2.00	Unlikely	2.00	Unlikely	2.00	Unlikely	2.00	Unlikely	2.00	Unlikely
24	157.4	2.00	Unlikely	2.00	Unlikely	2.00	Unlikely	2.00	Unlikely	2.00	Unlikely	2.00	Unlikely	2.00	Unlikely	2.00	Unlikely
25	152.4	2.00	Unlikely	2.00	Unlikely	2.00	Unlikely	2.00	Unlikely	2.00	Unlikely	2.00	Unlikely	2.00	Unlikely	2.00	Unlikely
26	145.9	2.00	Unlikely	2.00	Unlikely	2.00	Unlikely	2.00	Unlikely	2.00	Unlikely	2.00	Unlikely	2.00	Unlikely	2.00	Unlikely

														ound Surface		Under Abutment w/ fill	
Grade		238		239		240		241		242		243		245.9		252.48	
Wt ELE	243.1	-5.1		-4.1		-3.1		-2.1		-1.1		-0.1		2.8		9.38	
Sample	Elevation	F.S.	Occurance	F.S.	Occurance	F.S.	Occurance	F.S.	Occurance	F.S.	Occurance	F.S.	Occurance	F.S.	Occurance	F.S.	Occurance
1	244.9													Unsat	NO	Unsat	Unsat
2	242.4											Cohesive	Cohesive	Cohesive	Cohesive	Unsat	Unsat
3	239.9					0.13	Likely!	1.07	Unlikely	1.65	Unlikely	2.00	Unlikely	2.00	Unlikely	Cohesive	Cohesive
4	237.4	0.28	Likely!	0.64	Likely!	0.91	Likely!	1.12	Unlikely	1.29	Unlikely	1.42	Unlikely	1.87	Unlikely	2.00	Unlikely
5	234.9	0.73	Likely!	0.91	Likely!	1.06	Unlikely	1.20	Unlikely	1.31	Unlikely	1.40	Unlikely	1.76	Unlikely	2.00	Unlikely
6	232.4	0.86	Likely!	0.97	Likely!	1.07	Unlikely	1.16	Unlikely	1.24	Unlikely	1.31	Unlikely	1.59	Unlikely	2.00	Unlikely
7	229.9	2.00	Unlikely	2.00	Unlikely	2.00	Unlikely	2.00	Unlikely	2.00	Unlikely	2.00	Unlikely	2.00	Unlikely	1.92	Unlikely
8	227.4	2.00	Unlikely	2.00	Unlikely	2.00	Unlikely	2.00	Unlikely	2.00	Unlikely	2.00	Unlikely	2.00	Unlikely	2.00	Unlikely
9	224.9	2.00	Unlikely	2.00	Unlikely	2.00	Unlikely	2.00	Unlikely	2.00	Unlikely	2.00	Unlikely	2.00	Unlikely	2.00	Unlikely
10	222.4	2.00	Unlikely	2.00	Unlikely	2.00	Unlikely	2.00	Unlikely	2.00	Unlikely	2.00	Unlikely	2.00	Unlikely	2.00	Unlikely
11	219.9	2.00	Unlikely	2.00	Unlikely	2.00	Unlikely	2.00	Unlikely	2.00	Unlikely	2.00	Unlikely	2.00	Unlikely	2.00	Unlikely
12	217.4	2.00	Unlikely	2.00	Unlikely	2.00	Unlikely	2.00	Unlikely	2.00	Unlikely	2.00	Unlikely	2.00	Unlikely	2.00	Unlikely
13	212.4	1.23	Unlikely	1.27	Unlikely	1.29	Unlikely	1.33	Unlikely	1.36	Unlikely	1.40	Unlikely	1.54	Unlikely	2.00	Unlikely
14	207.4	2.00	Unlikely	2.00	Unlikely	2.00	Unlikely	2.00	Unlikely	2.00	Unlikely	2.00	Unlikely	2.00	Unlikely	1.82	Unlikely
15	202.4	2.00	Unlikely	2.00	Unlikely	2.00	Unlikely	2.00	Unlikely	2.00	Unlikely	2.00	Unlikely	2.00	Unlikely	2.00	Unlikely
16	197.4	1.62	Unlikely	1.64	Unlikely	1.70	Unlikely	1.73	Unlikely	1.79	Unlikely	1.81	Unlikely	2.00	Unlikely	2.00	Unlikely
17	192.4	2.00	Unlikely	2.00	Unlikely	2.00	Unlikely	2.00	Unlikely	2.00	Unlikely	2.00	Unlikely	2.00	Unlikely	2.00	Unlikely
18	187.4	2.00	Unlikely	2.00	Unlikely	2.00	Unlikely	2.00	Unlikely	2.00	Unlikely	2.00	Unlikely	2.00	Unlikely	2.00	Unlikely
19	182.4	2.00	Unlikely	2.00	Unlikely	2.00	Unlikely	2.00	Unlikely	2.00	Unlikely	2.00	Unlikely	2.00	Unlikely	2.00	Unlikely
20	177.4	1.55	Unlikely	1.57	Unlikely	1.62	Unlikely	1.63	Unlikely	1.69	Unlikely	1.70	Unlikely	1.85	Unlikely	2.00	Unlikely
21	172.4	1.54	Unlikely	1.59	Unlikely	1.60	Unlikely	1.65	Unlikely	1.66	Unlikely	1.71	Unlikely	1.80	Unlikely	2.00	Unlikely
22	167.4	2.00	Unlikely	2.00	Unlikely	2.00	Unlikely	2.00	Unlikely	2.00	Unlikely	2.00	Unlikely	2.00	Unlikely	2.00	Unlikely
23	162.4	2.00	Unlikely	2.00	Unlikely	2.00	Unlikely	2.00	Unlikely	2.00	Unlikely	2.00	Unlikely	2.00	Unlikely	2.00	Unlikely
24	157.4	2.00	Unlikely	2.00	Unlikely	2.00	Unlikely	2.00	Unlikely	2.00	Unlikely	2.00	Unlikely	2.00	Unlikely	2.00	Unlikely
25	152.4	2.00	Unlikely	2.00	Unlikely	2.00	Unlikely	2.00	Unlikely	2.00	Unlikely	2.00	Unlikely	2.00	Unlikely	2.00	Unlikely
26	145.9	2.00	Unlikely	2.00	Unlikely	2.00	Unlikely	2.00	Unlikely	2.00	Unlikely	2.00	Unlikely	2.00	Unlikely	2.00	Unlikely

WITH CYCLIC SOFTENING

2017 - REDONE BORINGS RESIDUAL SHEAR STRENGTHS

1 atm =2116 psf

Design Grade EL =229.8'

In-Situ Data									Design Stress	Mitchell and Soga (2005)				Idriss & Boulanger (2008)			
MATERIAL	El_{top}	$(N_1)_{60\ Youd}$	fines	PL	LL	PI	WC	S_u	σ'_{v0}	σ'_{v0}	Liquidity	S_s	S_r	$\Delta(N1)_{60\text{-}Sr}$ (Seed-Harder)	$(N_1)_{60CS\text{-}Sr}$	S_r/σ'_{v0} (void redist. significant)	S_r
TYPE	ft	bpf	%				%	psf	psf	atm	Index	(From Figure)	psf	bpf	bpf		psf
SP-SM	212.4	26.4	8						1027	0.49				1	27.4	0.3	308

Design Grade EL =231'

In-Situ Data									Design Stress	Mitchell and Soga (2005)				Idriss & Boulanger (2008)			
MATERIAL	El_{top}	$(N_1)_{60\ Youd}$	fines	PL	LL	PI	WC	S_u	σ'_{v0}	σ'_{v0}	Liquidity	S_s	S_r	$\Delta(N1)_{60\text{-}Sr}$ (Seed-Harder)	$(N_1)_{60CS\text{-}Sr}$	S_r/σ'_{v0} (void redist. significant)	S_r
TYPE	ft	bpf	%				%	psf	psf	atm	Index	(From Figure)	psf	bpf	bpf		psf
SP-SM	212.4	26.4	8						1096	0.52				1	27.4	0.3	329

Design Grade EL =233'

In-Situ Data									Design Stress	Mitchell and Soga (2005)				Idriss & Boulanger (2008)			
MATERIAL	El_{top}	$(N_1)_{60\ Youd}$	fines	PL	LL	PI	WC	S_u	σ'_{v0}	σ'_{v0}	Liquidity Index	S_s	S_r	N_{corr} (Seed-Harder)	$(N_1)_{60CS\text{-}Sr}$	S_r/σ'_{v0} (void redist. significant)	S_r
TYPE	ft	bpf	%				%	psf	psf	atm		(From Figure)	psf	bpf	bpf		psf
SM	232.4	18.4	31			0	24		35	0.02				2.48	20.9	0.18	6

Design Grade EL =234'

In-Situ Data									Design Stress	Mitchell and Soga (2005)				Idriss & Boulanger (2008)			
MATERIAL	El_{top}	$(N_1)_{60\ Youd}$	fines	PL	LL	PI	WC	S_u	σ'_{v0}	σ'_{v0}	Liquidity Index	S_s	S_r	N_{corr} (Seed-Harder)	$(N_1)_{60CS\text{-}Sr}$	S_r/σ'_{v0} (void redist. significant)	S_r
TYPE	ft	bpf	%				%	psf	psf	atm		(From Figure)	psf	bpf	bpf		psf
SM	232.4	18.4	31			0	24		92	0.04				2.48	20.9	0.18	17

Design Grade EL =235'

In-Situ Data									Design Stress	Mitchell and Soga (2005)				Idriss & Boulanger (2008)			
MATERIAL	El_{top}	$(N_1)_{60\ Youd}$	fines	PL	LL	PI	WC	S_u	σ'_{v0}	σ'_{v0}	Liquidity Index	S_s	S_r	N_{corr} (Seed-Harder)	$(N_1)_{60CS\text{-}Sr}$	S_r/σ'_{v0} (void redist. significant)	S_r
TYPE	ft	bpf	%				%	psf	psf	atm		(From Figure)	psf	bpf	bpf		psf
SM	234.9	19.0	31			0	24		6	0.00				2.48	21.5	0.19	1
SM	232.4	18.4	31			0	24		150	0.07				2.48	20.9	0.18	27

Design Grade EL =237'

In-Situ Data									Design Stress	Mitchell and Soga (2005)				Idriss & Boulanger (2008)			
MATERIAL	El_{top}	$(N_1)_{60\ Youd}$	fines	PL	LL	PI	WC	S_u	σ'_{v0}	σ'_{v0}	Liquidity Index	S_s	S_r	N_{corr} (Seed-Harder)	$(N_1)_{60CS\text{-}Sr}$	S_r/σ'_{v0} (void redist. significant)	S_r
TYPE	ft	bpf	%				%	psf	psf	atm		(From Figure)	psf	bpf	bpf		psf
SM	234.9	19.0	31			0	24		121	0.06				2.48	21.5	0.19	23
SM	232.4	18.4	31			0	24		265	0.13				2.48	20.9	0.18	48

Design Grade EL =238'

In-Situ Data									Design Stress	Mitchell and Soga (2005)				Idriss & Boulanger (2008)			
MATERIAL	El_{top}	$(N_1)_{60\ Youd}$	fines	PL	LL	PI	WC	S_u	σ'_{v0}	σ'_{v0}	Liquidity Index	S_s	S_r	N_{corr} (Seed-Harder)	$(N_1)_{60CS\text{-}Sr}$	S_r/σ'_{v0} (void redist. significant)	S_r
TYPE	ft	bpf	%				%	psf	psf	atm		(From Figure)	psf	bpf	bpf		psf
CL	237.4	10.4	54	15	33	18	25	500	41	0.02	0.56	1.0	500	4	14.4	0.12	5
SM	234.9	19.0	31			0			185	0.09				2.48	21.5	0.19	35
SM	232.4	18.4	31			0			329	0.16				2.48	20.9	0.18	59

Design Grade EL =239'

In-Situ Data									Design Stress	Mitchell and Soga (2005)				Idriss & Boulanger (2008)			
MATERIAL	El_{top}	$(N_1)_{60\ Youd}$	fines	PL	LL	PI	WC	S_u	σ'_{v0}	σ'_{v0}	Liquidity Index	S_s	S_r	N_{corr} (Seed-Harder)	$(N_1)_{60CS\text{-}Sr}$	S_r/σ'_{v0} (void redist. significant)	S_r
TYPE	ft	bpf	%				%	psf	psf	atm		(From Figure)	psf	bpf	bpf		psf
CL	237.4	10.4	54	15	33	18	25	500	108	0.05	0.56	1.0	500	4	14.4	0.12	13
SM	234.9	19.0	31				24		252	0.12				2.48	21.5	0.19	48
SM	232.4	18.4	31				24		396	0.19				2.48	20.9	0.18	71

Design Grade EL =240'

In-Situ Data									Design Stress	Mitchell and Soga (2005)				Idriss & Boulanger (2008)			
MATERIAL	El_{top}	$(N_1)_{60\ Youd}$	fines	PL	LL	PI	WC	S_u	σ'_{v0}	σ'_{v0}	Liquidity Index	S_s	S_r	N_{corr} (Seed-Harder)	$(N_1)_{60CS\text{-}Sr}$	S_r/σ'_{v0} (void redist. significant)	S_r
TYPE	ft	bpf	%				%	psf	psf	atm		(From Figure)	psf	bpf	bpf		psf
CL	239.9	3.8	54	15	33	18	25	500	7	0.00	0.56	1.0	500	4	7.8	0.7	5
CL	237.4	10.4	54	15	33	18	25	500	176	0.08	0.56	1.0	500	4	14.4	0.12	21

Zone	MATERIAL	EL_{top}	GRADE EL. S_u PROFILE								
#	TYPE	ft	EL=229.8'	EL=231'	EL=233'	EL=234'	EL=235'	EL=237'	EL=238'	EL=239'	EL=240'
1	CL	239.9									5
	CL	237.4							5	13	21
2	SM	234.9					1	23	35	48	
	SM	232.4			6	17	27	48	59	71	
3	CL-ML	212.4	308	329							

2017- Redone Settlement & Downdrag Potential Due to Liquefaction/Cyclic Softening

	In-Situ Data				Tokimatsu-Seed (1987)						FHWA Criteria	
Layer bottom	MATERIAL TYPE	EL_{top} ft	$(N_1)_{60\ Youd}$ bpf	fines %	$CSR_{7.16\ Bent}$ Youd	$CSR_{7.16}/CSR_{7.5}$* Correction Factor	$CSR_{7.5}$ Bent	ε_v* Bent (%)	Specimen H ft	ΔH Bent ft	ΔH Bent Zone (in)	≥.5 (in)
	CL	241	3.8	54	4.21	1.06	3.97	10.00	2.3	0.230	**6.000**	**Yes**
236	CL	237.4	10.4	54	1.35	1.06	1.27	10.00	2.7	0.270		
	SM	236	19.0	31	12.38	1.06	11.68	10.00	2.6	0.260	**6.120**	**Yes**
231	SM	232.4	18.4	31	2.80	1.06	2.64	10.00	2.5	0.250		
210	SP-SM	215	26.4	8	0.38	1.06	0.36	1.10	5	0.055	**0.660**	**Yes**

*$CSR_{7.16\ Bent}$= Taken at the lowest depth of initiation. CSR will decrease based on applied vertical stress increase.

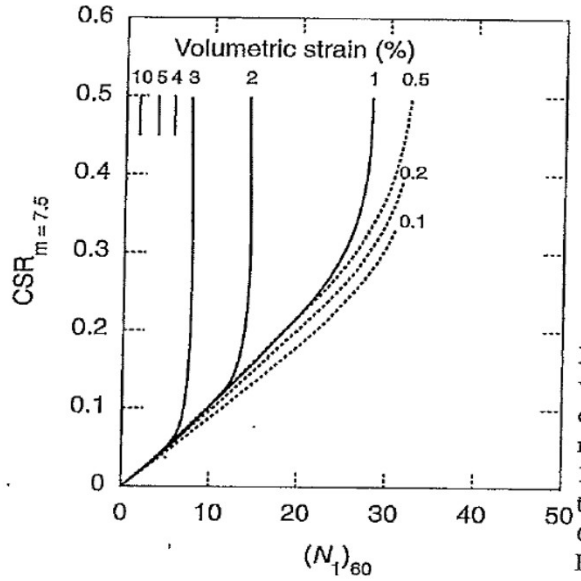
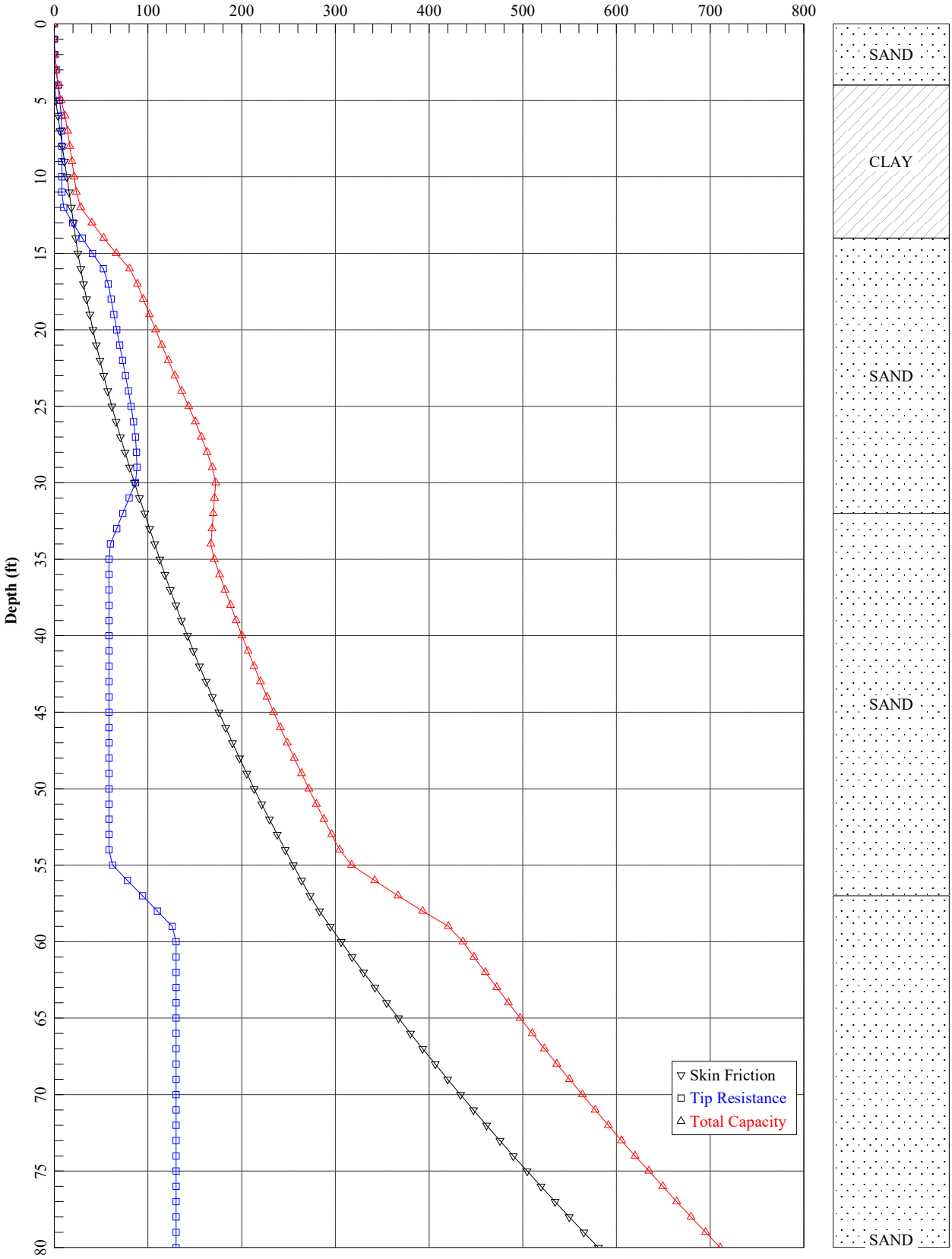


Figure 9.53 Chart for estimation of volumetric strain in saturated sands from cyclic stress ratio and standard penetration resistance. (After Tokimatsu and Seed, 1987. Evaluation of settlements in sand due to earthquake shaking, *Journal of Geotechnical Engineering*, Vol. 113, No. 8. Reprinted by permission of ASCE.)

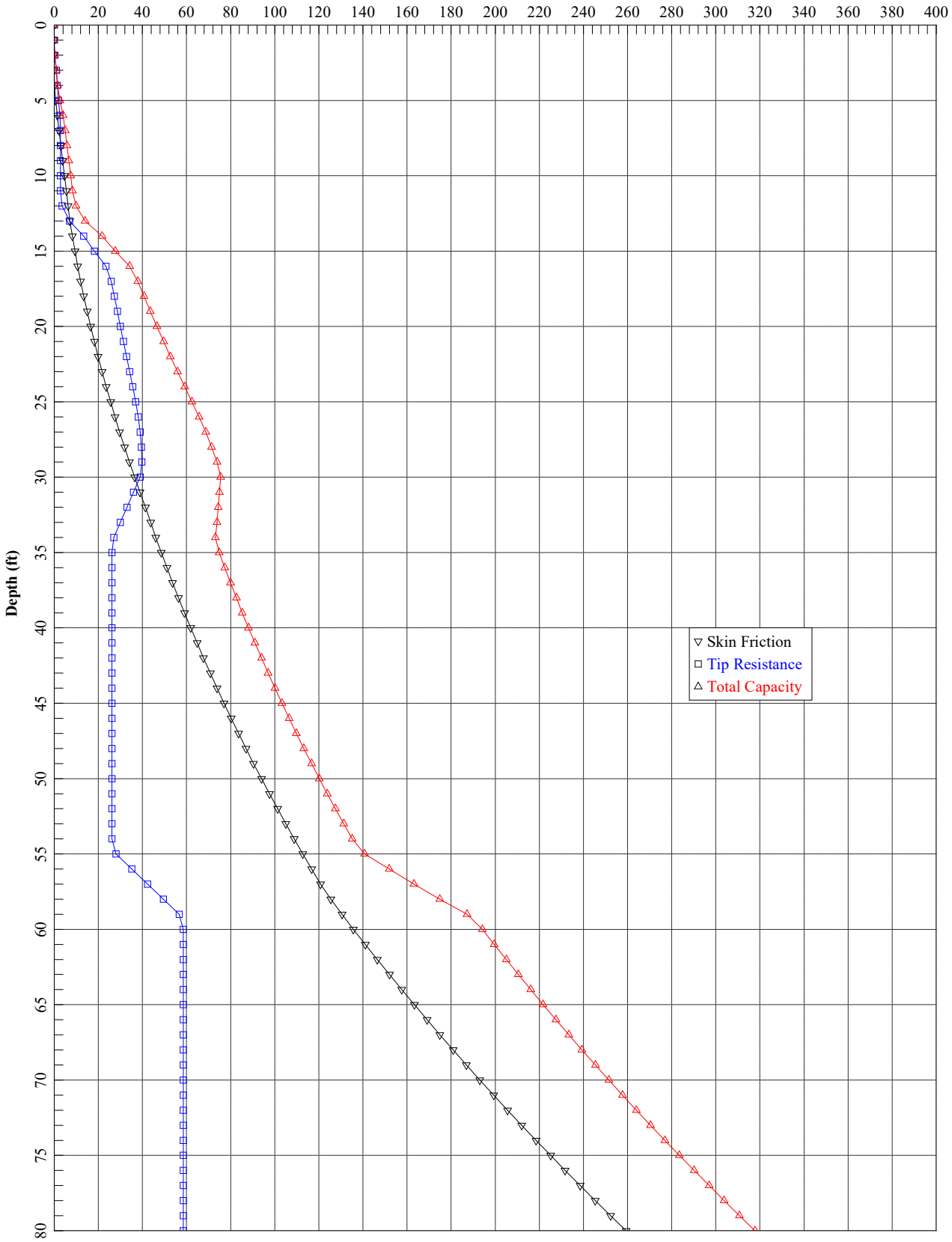
Table 9-2 Magnitude Correction Factors for Cyclic Stress Approach

Magnitude, M	$CSR_M/CSR_{M=7.5}$
$5\frac{1}{4}$	1.50
6	1.32
$6\frac{3}{4}$	1.13
$7\frac{1}{2}$	1.00
$8\frac{1}{2}$	0.89

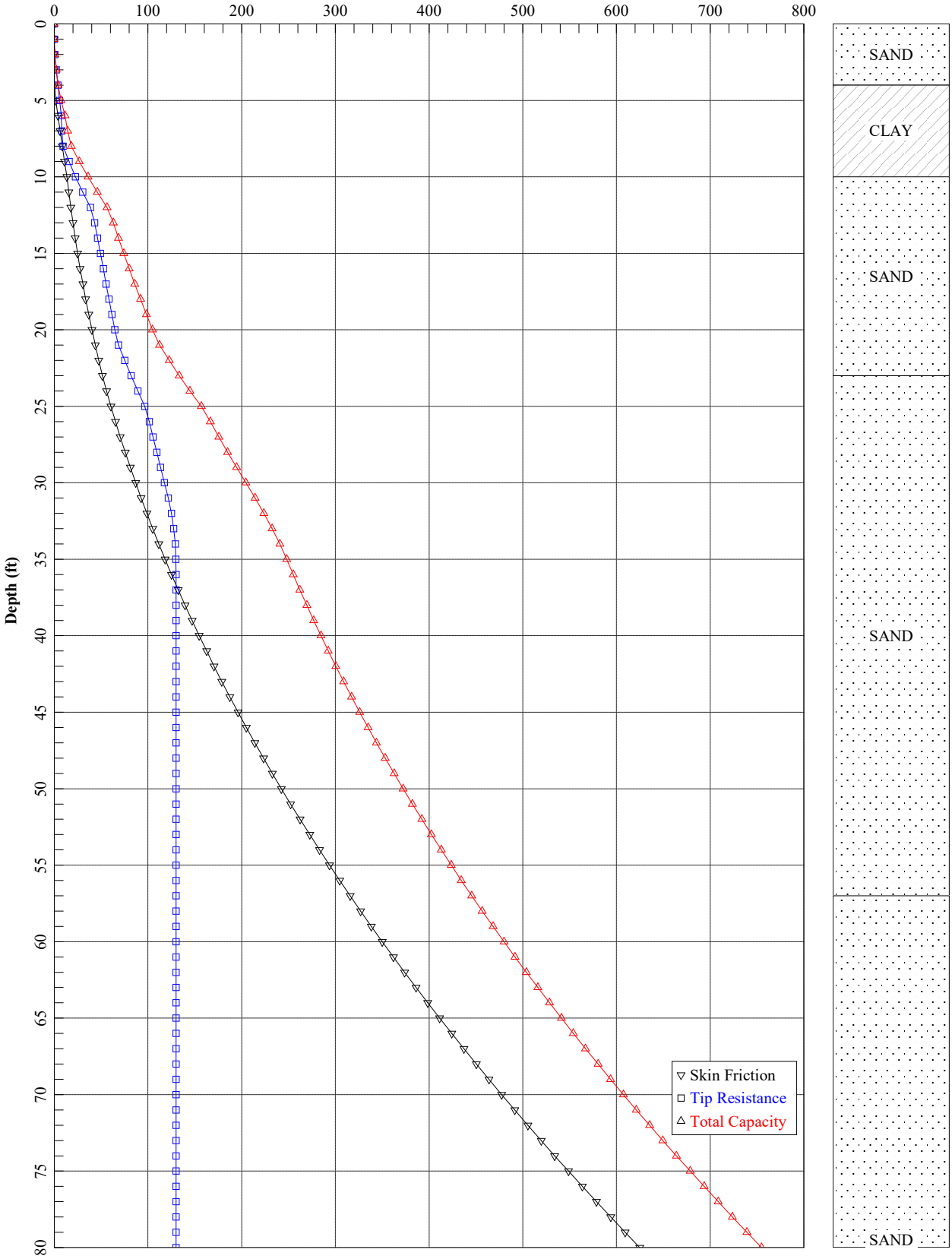
HWY 161 - 18in Diameter Abutment 1 Extreme Axial Capacity (Approx. Bridge Station 22+75)
Axial Capacity (kips)



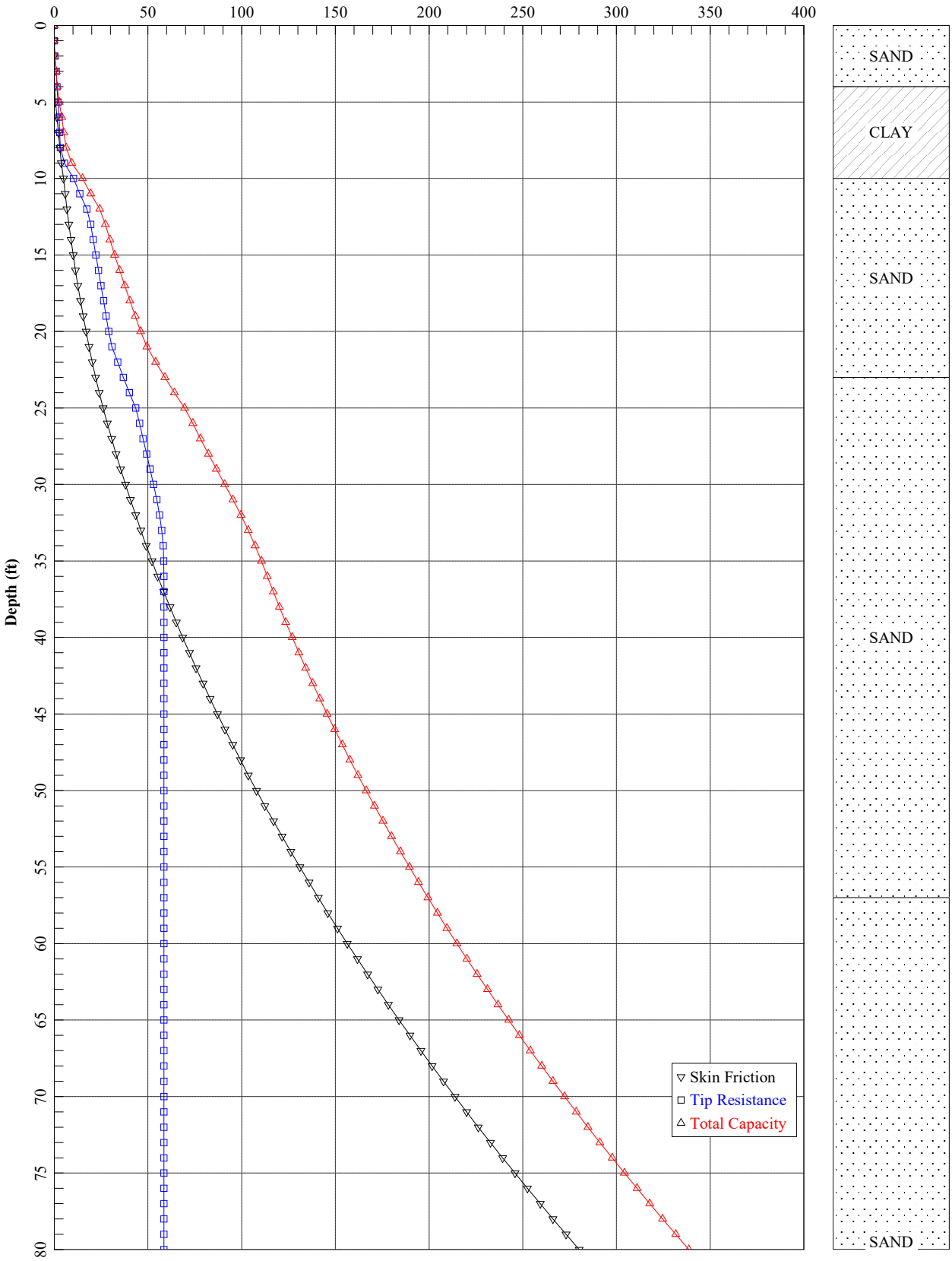
HWY 161 - 18in Diameter Abutment 1 Static Axial Capacity (Approx. Bridge Station 22+75)



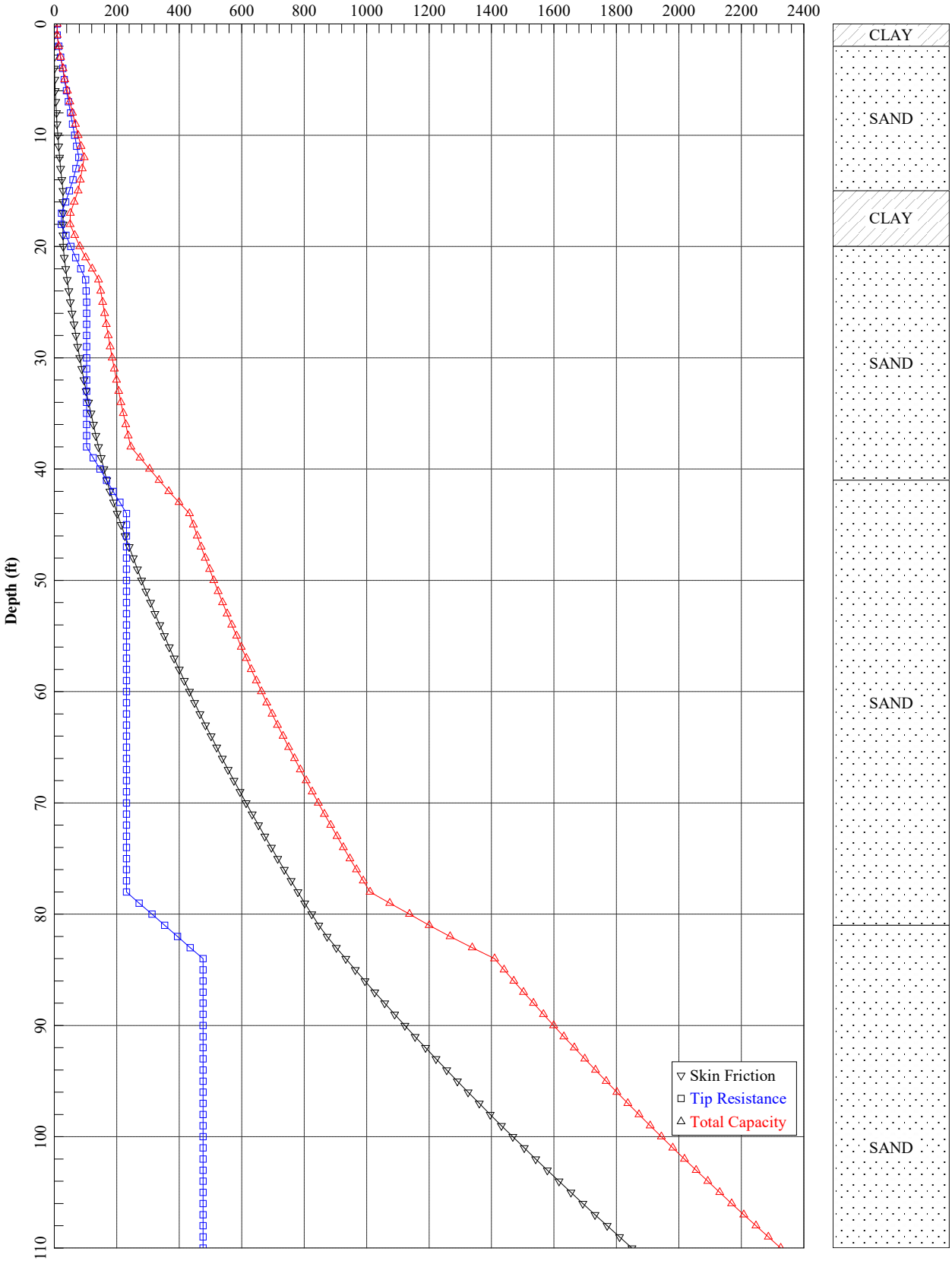
HWY 161 - 18in Diameter Abutment 2 Extreme Axial Capacity (Approx. Bridge Station 24+25)
Axial Capacity (kips)



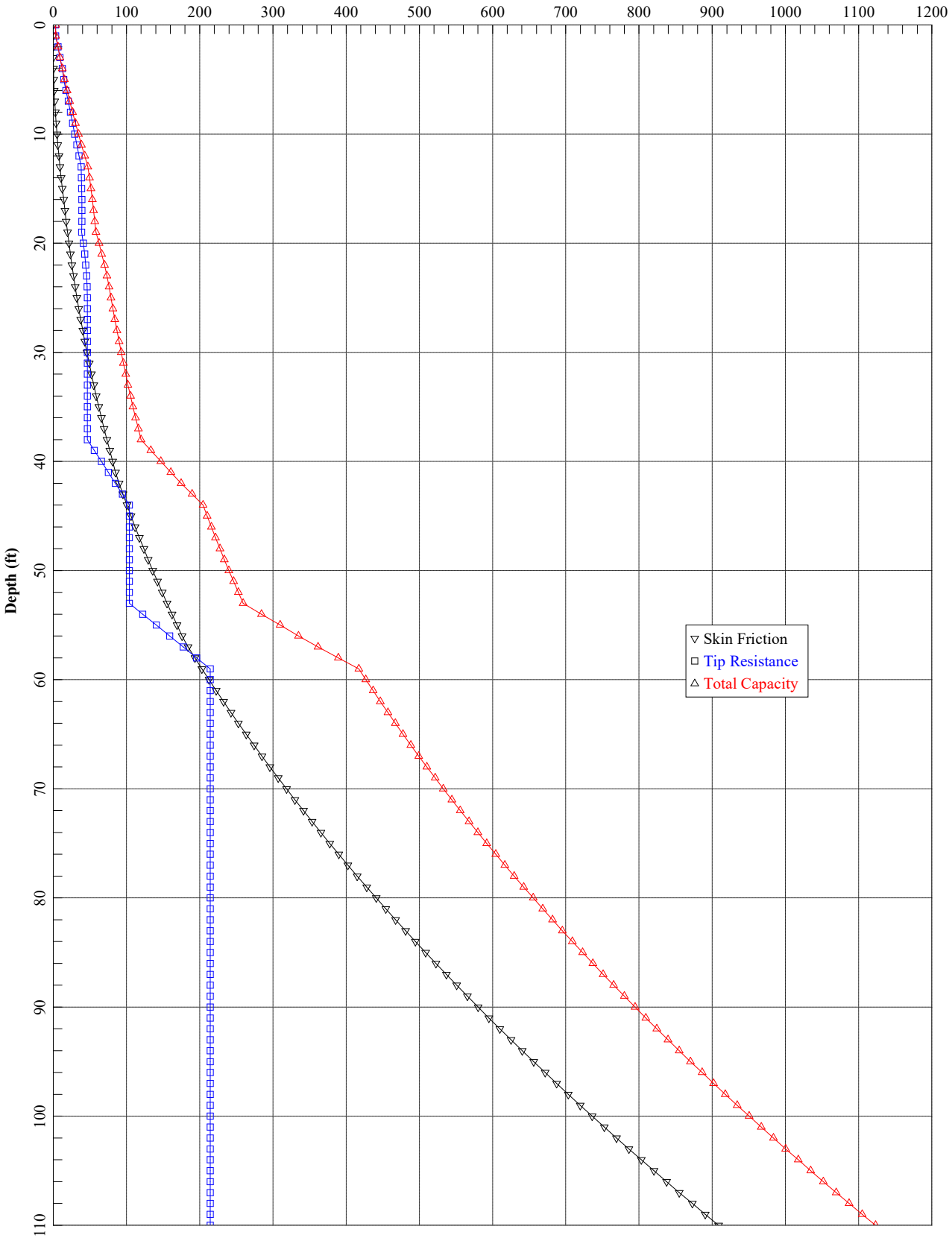
HWY 161 - 18in Diameter Abutment 2 Static Axial Capacity (Approx. Bridge Station 24+25)



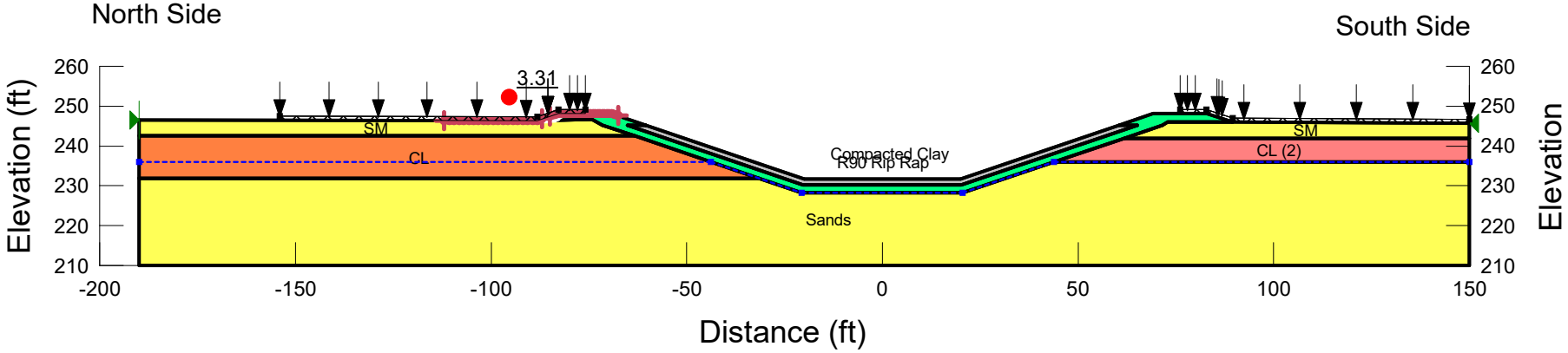
HWY 161 - 24in Diameter Bent Extreme
Axial Capacity (kips)



HWY 161 - 24in Diameter Bent Static
Axial Capacity (kips)



Name: HWY 161_North_LS_AC
Method: Spencer
Slip Surface Option: Entry and Exit
Minimum Slip Surface Depth: 1.5 ft
PWP Conditions Source: Piezometric Line



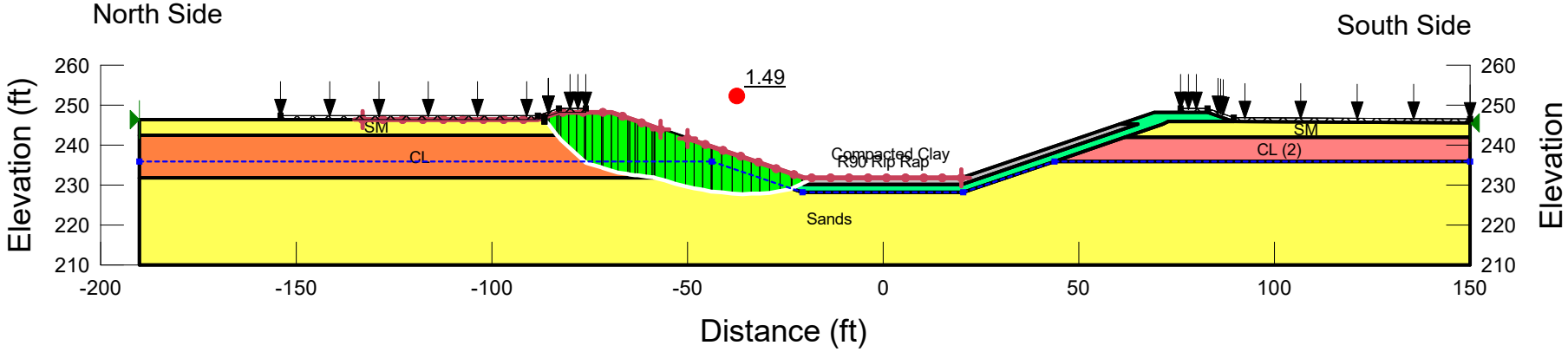
Name: R90 Rip Rap Model: Mohr-Coulomb Unit Weight: 122 pcf Cohesion': 0 psf Phi': 38 ° Piezometric Line: 1
Name: Compacted Clay Model: Mohr-Coulomb Unit Weight: 115 pcf Cohesion': 750 psf Phi': 0 ° Piezometric Line: 1
Name: CL Model: Mohr-Coulomb Unit Weight: 125 pcf Cohesion': 500 psf Phi': 0 ° Piezometric Line: 1
Name: Sands Model: Mohr-Coulomb Unit Weight: 125 pcf Cohesion': 0 psf Phi': 28 ° Piezometric Line: 1
Name: CL (2) Model: Mohr-Coulomb Unit Weight: 124 pcf Cohesion': 380 psf Phi': 0 ° Piezometric Line: 1
Name: SM Model: Mohr-Coulomb Unit Weight: 125 pcf Cohesion': 0 psf Phi': 28 ° Piezometric Line: 1

GENERAL NOTES:

Classification, stratifications, shear strengths, and unit weights of the soil were based on the results of undisturbed/disturbed data. See Appendix A for boring information. Shear strengths were assumed constant through each layer.

BAYOU METO - CANAL 1000
HWY 161 BRIDGE
C1000 CL STATION 106+35
PULASKI COUNTY, ARKANSAS

Name: HWY 161_North_RS_AC
Method: Spencer
Slip Surface Option: Entry and Exit
Minimum Slip Surface Depth: 1.5 ft
PWP Conditions Source: Piezometric Line



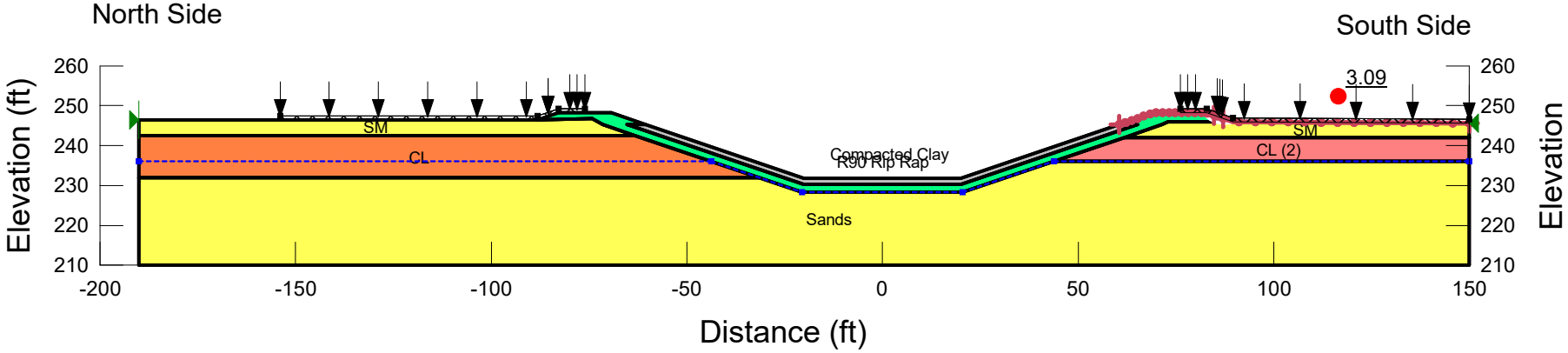
Name: R90 Rip Rap Model: Mohr-Coulomb Unit Weight: 122 pcf Cohesion': 0 psf Phi': 38 ° Piezometric Line: 1
Name: Compacted Clay Model: Mohr-Coulomb Unit Weight: 115 pcf Cohesion': 750 psf Phi': 0 ° Piezometric Line: 1
Name: CL Model: Mohr-Coulomb Unit Weight: 125 pcf Cohesion': 500 psf Phi': 0 ° Piezometric Line: 1
Name: Sands Model: Mohr-Coulomb Unit Weight: 125 pcf Cohesion': 0 psf Phi': 28 ° Piezometric Line: 1
Name: CL (2) Model: Mohr-Coulomb Unit Weight: 124 pcf Cohesion': 380 psf Phi': 0 ° Piezometric Line: 1
Name: SM Model: Mohr-Coulomb Unit Weight: 125 pcf Cohesion': 0 psf Phi': 28 ° Piezometric Line: 1

GENERAL NOTES:

Classification, stratifications, shear strengths, and unit weights of the soil were based on the results of undisturbed/disturbed data. See Appendix A for boring information. Shear strengths were assumed constant through each layer.

BAYOU METO - CANAL 1000
HWY 161 BRIDGE
C1000 CL STATION 106+35
PULASKI COUNTY, ARKANSAS

Name: HWY 161_South_LS_AC
Method: Spencer
Slip Surface Option: Entry and Exit
Minimum Slip Surface Depth: 1.5 ft
PWP Conditions Source: Piezometric Line



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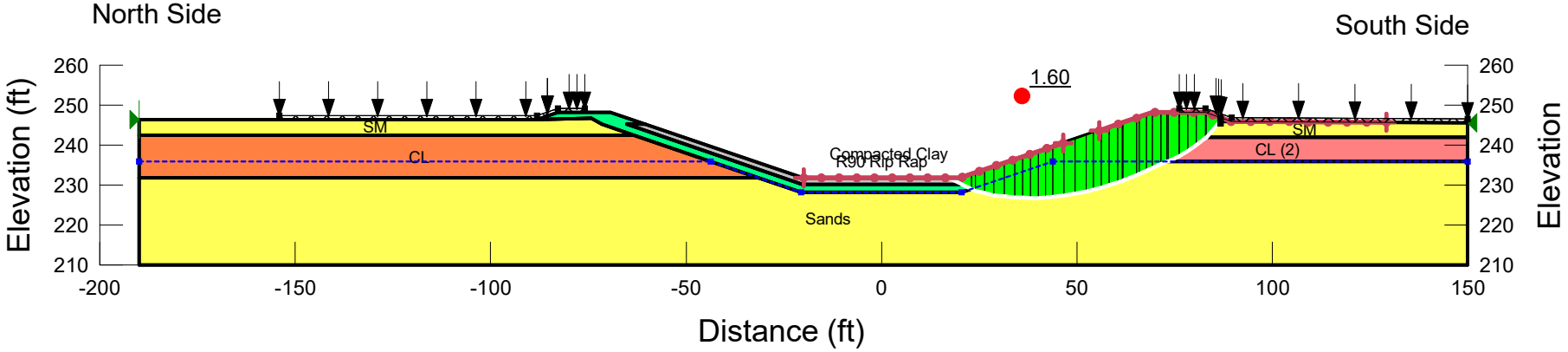
Name: Compacted Clay Model: Mohr-Coulomb Unit Weight: 115 pcf Cohesion': 750 psf Phi': 0 ° Piezometric Line: 1
Name: CL Model: Mohr-Coulomb Unit Weight: 125 pcf Cohesion': 500 psf Phi': 0 ° Piezometric Line: 1
Name: Sands Model: Mohr-Coulomb Unit Weight: 125 pcf Cohesion': 0 psf Phi': 28 ° Piezometric Line: 1
Name: CL (2) Model: Mohr-Coulomb Unit Weight: 124 pcf Cohesion': 380 psf Phi': 0 ° Piezometric Line: 1
Name: SM Model: Mohr-Coulomb Unit Weight: 125 pcf Cohesion': 0 psf Phi': 28 ° Piezometric Line: 1

GENERAL NOTES:

Classification, stratifications, shear strengths, and unit weights of the soil were based on the results of undisturbed/disturbed data. See Appendix A for boring information. Shear strengths were assumed constant through each layer.

BAYOU METO - CANAL 1000
HWY 161 BRIDGE
C1000 CL STATION 106+35
PULASKI COUNTY, ARKANSAS

Name: HWY 161_South_RS_AC
Method: Spencer
Slip Surface Option: Entry and Exit
Minimum Slip Surface Depth: 1.5 ft
PWP Conditions Source: Piezometric Line



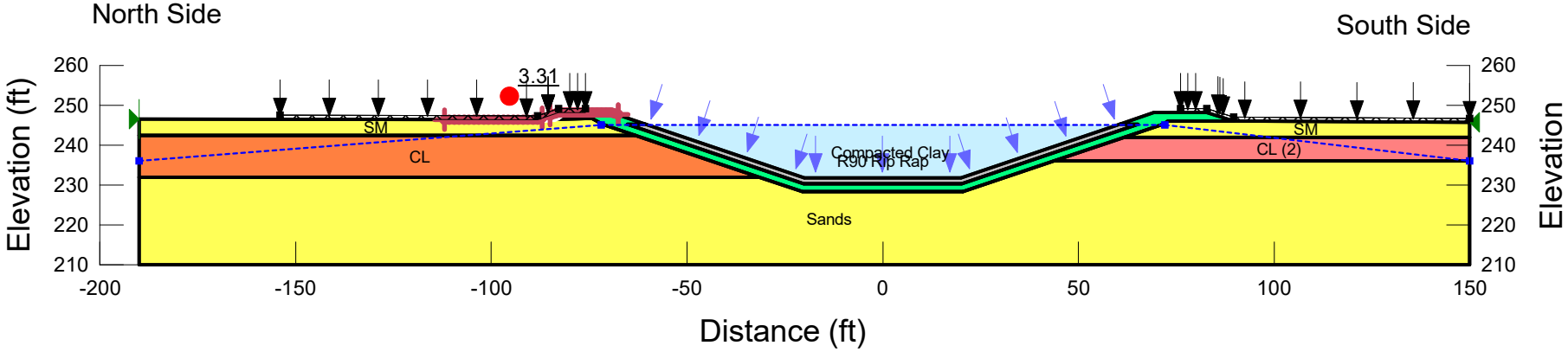
Name: R90 Rip Rap Model: Mohr-Coulomb Unit Weight: 122 pcf Cohesion': 0 psf Phi': 38 ° Piezometric Line: 1
Name: Compacted Clay Model: Mohr-Coulomb Unit Weight: 115 pcf Cohesion': 750 psf Phi': 0 ° Piezometric Line: 1
Name: CL Model: Mohr-Coulomb Unit Weight: 125 pcf Cohesion': 500 psf Phi': 0 ° Piezometric Line: 1
Name: Sands Model: Mohr-Coulomb Unit Weight: 125 pcf Cohesion': 0 psf Phi': 28 ° Piezometric Line: 1
Name: CL (2) Model: Mohr-Coulomb Unit Weight: 124 pcf Cohesion': 380 psf Phi': 0 ° Piezometric Line: 1
Name: SM Model: Mohr-Coulomb Unit Weight: 125 pcf Cohesion': 0 psf Phi': 28 ° Piezometric Line: 1

GENERAL NOTES:

Classification, stratifications, shear strengths, and unit weights of the soil were based on the results of undisturbed/disturbed data. See Appendix A for boring information. Shear strengths were assumed constant through each layer.

BAYOU METO - CANAL 1000
HWY 161 BRIDGE
C1000 CL STATION 106+35
PULASKI COUNTY, ARKANSAS

Name: HWY 161_North_LS_AC
Method: Spencer
Slip Surface Option: Entry and Exit
Minimum Slip Surface Depth: 1.5 ft
PWP Conditions Source: Piezometric Line



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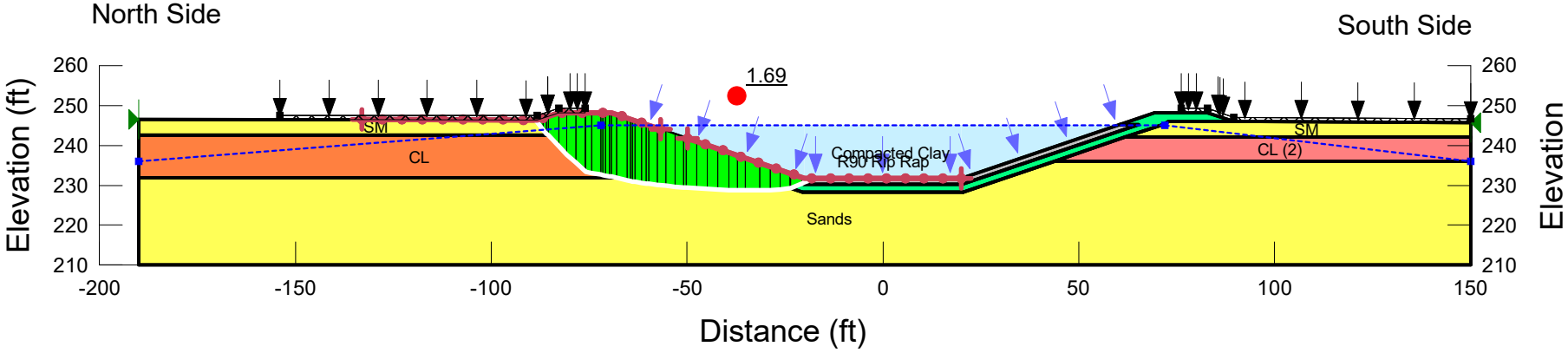
Name: Compacted Clay Model: Mohr-Coulomb Unit Weight: 115 pcf Cohesion': 750 psf Phi': 0 ° Piezometric Line: 1
Name: CL Model: Mohr-Coulomb Unit Weight: 125 pcf Cohesion': 500 psf Phi': 0 ° Piezometric Line: 1
Name: Sands Model: Mohr-Coulomb Unit Weight: 125 pcf Cohesion': 0 psf Phi': 28 ° Piezometric Line: 1
Name: CL (2) Model: Mohr-Coulomb Unit Weight: 124 pcf Cohesion': 380 psf Phi': 0 ° Piezometric Line: 1
Name: SM Model: Mohr-Coulomb Unit Weight: 125 pcf Cohesion': 0 psf Phi': 28 ° Piezometric Line: 1

GENERAL NOTES:

Classification, stratifications, shear strengths, and unit weights of the soil were based on the results of undisturbed/disturbed data. See Appendix A for boring information. Shear strengths were assumed constant through each layer.

BAYOU METO - CANAL 1000
HWY 161 BRIDGE
C1000 CL STATION 106+35
PULASKI COUNTY, ARKANSAS

Name: HWY 161_North_RS_AC
Method: Spencer
Slip Surface Option: Entry and Exit
Minimum Slip Surface Depth: 1.5 ft
PWP Conditions Source: Piezometric Line



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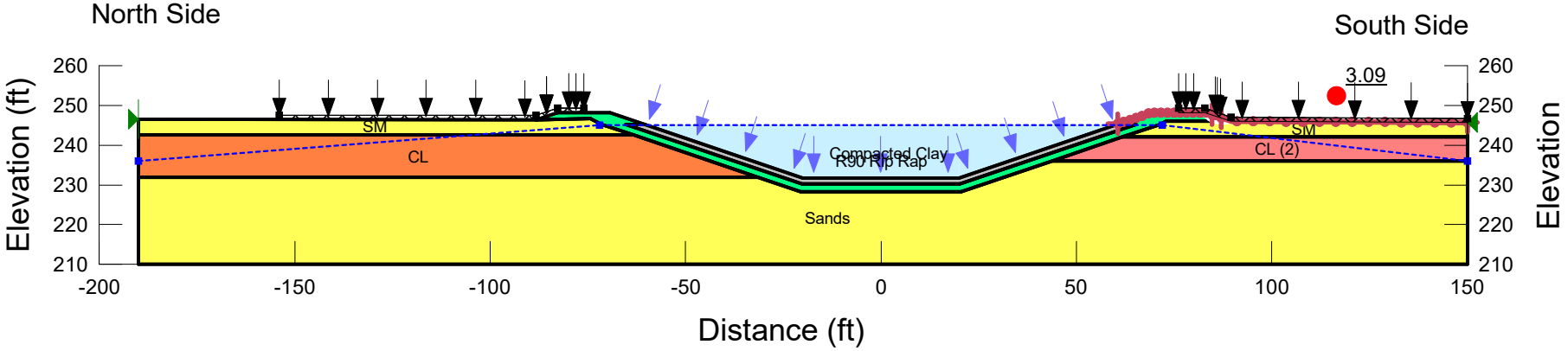
Name: Compacted Clay Model: Mohr-Coulomb Unit Weight: 115 pcf Cohesion': 750 psf Phi': 0 ° Piezometric Line: 1
Name: CL Model: Mohr-Coulomb Unit Weight: 125 pcf Cohesion': 500 psf Phi': 0 ° Piezometric Line: 1
Name: Sands Model: Mohr-Coulomb Unit Weight: 125 pcf Cohesion': 0 psf Phi': 28 ° Piezometric Line: 1
Name: CL (2) Model: Mohr-Coulomb Unit Weight: 124 pcf Cohesion': 380 psf Phi': 0 ° Piezometric Line: 1
Name: SM Model: Mohr-Coulomb Unit Weight: 125 pcf Cohesion': 0 psf Phi': 28 ° Piezometric Line: 1

GENERAL NOTES:

Classification, stratifications, shear strengths, and unit weights of the soil were based on the results of undisturbed/disturbed data. See Appendix A for boring information. Shear strengths were assumed constant through each layer.

BAYOU METO - CANAL 1000
HWY 161 BRIDGE
C1000 CL STATION 106+35
PULASKI COUNTY, ARKANSAS

Name: HWY 161_South_LS_AC
Method: Spencer
Slip Surface Option: Entry and Exit
Minimum Slip Surface Depth: 1.5 ft
PWP Conditions Source: Piezometric Line



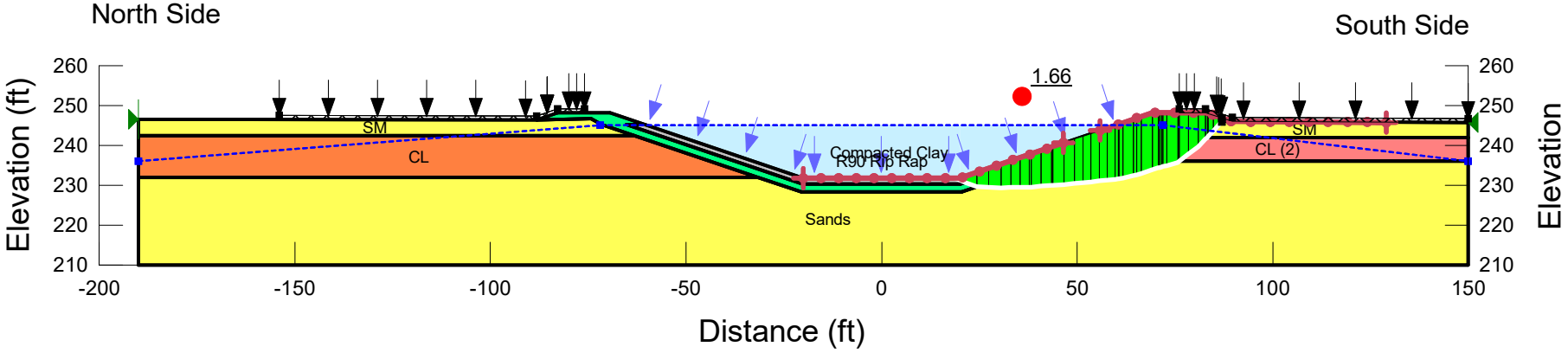
Name: R90 Rip Rap Model: Mohr-Coulomb Unit Weight: 122 pcf Cohesion': 0 psf Phi': 38 ° Piezometric Line: 1
Name: Compacted Clay Model: Mohr-Coulomb Unit Weight: 115 pcf Cohesion': 750 psf Phi': 0 ° Piezometric Line: 1
Name: CL Model: Mohr-Coulomb Unit Weight: 125 pcf Cohesion': 500 psf Phi': 0 ° Piezometric Line: 1
Name: Sands Model: Mohr-Coulomb Unit Weight: 125 pcf Cohesion': 0 psf Phi': 28 ° Piezometric Line: 1
Name: CL (2) Model: Mohr-Coulomb Unit Weight: 124 pcf Cohesion': 380 psf Phi': 0 ° Piezometric Line: 1
Name: SM Model: Mohr-Coulomb Unit Weight: 125 pcf Cohesion': 0 psf Phi': 28 ° Piezometric Line: 1

GENERAL NOTES:

Classification, stratifications, shear strengths, and unit weights of the soil were based on the results of undisturbed/disturbed data. See Appendix A for boring information. Shear strengths were assumed constant through each layer.

BAYOU METO - CANAL 1000
HWY 161 BRIDGE
C1000 CL STATION 106+35
PULASKI COUNTY, ARKANSAS

Name: HWY 161_South_RS_AC
Method: Spencer
Slip Surface Option: Entry and Exit
Minimum Slip Surface Depth: 1.5 ft
PWP Conditions Source: Piezometric Line



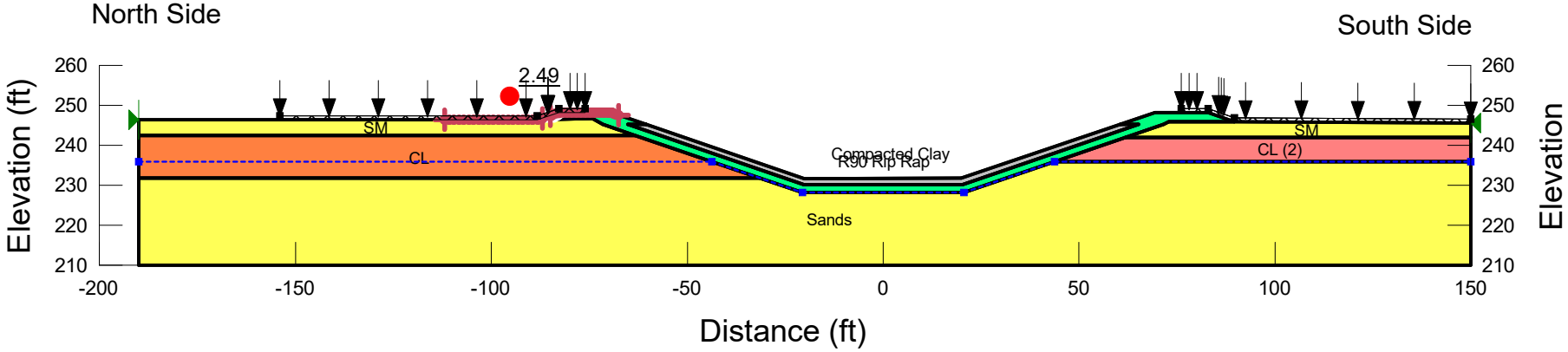
Name: R90 Rip Rap Model: Mohr-Coulomb Unit Weight: 122 pcf Cohesion': 0 psf Phi': 38 ° Piezometric Line: 1
Name: Compacted Clay Model: Mohr-Coulomb Unit Weight: 115 pcf Cohesion': 750 psf Phi': 0 ° Piezometric Line: 1
Name: CL Model: Mohr-Coulomb Unit Weight: 125 pcf Cohesion': 500 psf Phi': 0 ° Piezometric Line: 1
Name: Sands Model: Mohr-Coulomb Unit Weight: 125 pcf Cohesion': 0 psf Phi': 28 ° Piezometric Line: 1
Name: CL (2) Model: Mohr-Coulomb Unit Weight: 124 pcf Cohesion': 380 psf Phi': 0 ° Piezometric Line: 1
Name: SM Model: Mohr-Coulomb Unit Weight: 125 pcf Cohesion': 0 psf Phi': 28 ° Piezometric Line: 1

GENERAL NOTES:

Classification, stratifications, shear strengths, and unit weights of the soil were based on the results of undisturbed/disturbed data. See Appendix A for boring information. Shear strengths were assumed constant through each layer.

BAYOU METO - CANAL 1000
HWY 161 BRIDGE
C1000 CL STATION 106+35
PULASKI COUNTY, ARKANSAS

Name: HWY 161_North_LS_AC
Method: Spencer
Slip Surface Option: Entry and Exit
Minimum Slip Surface Depth: 1.5 ft
PWP Conditions Source: Piezometric Line



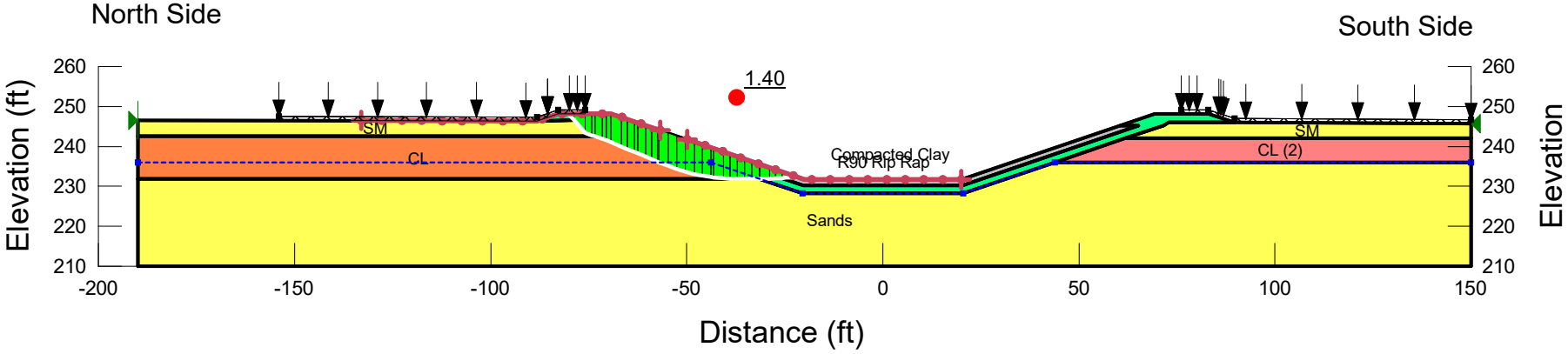
Name: R90 Rip Rap Model: Mohr-Coulomb Unit Weight: 122 pcf Cohesion': 0 psf Phi': 38 ° Piezometric Line: 1
Name: Compacted Clay Model: Mohr-Coulomb Unit Weight: 115 pcf Cohesion': 50 psf Phi': 23 ° Piezometric Line: 1
Name: CL Model: Mohr-Coulomb Unit Weight: 125 pcf Cohesion': 0 psf Phi': 24 ° Piezometric Line: 1
Name: Sands Model: Mohr-Coulomb Unit Weight: 125 pcf Cohesion': 0 psf Phi': 30 ° Piezometric Line: 1
Name: CL (2) Model: Mohr-Coulomb Unit Weight: 124 pcf Cohesion': 0 psf Phi': 28 ° Piezometric Line: 1
Name: SM Model: Mohr-Coulomb Unit Weight: 125 pcf Cohesion': 0 psf Phi': 28 ° Piezometric Line: 1

GENERAL NOTES:

Classification, stratifications, shear strengths, and unit weights of the soil were based on the results of undisturbed/disturbed data. See Appendix A for boring information. Shear strengths were assumed constant through each layer.

BAYOU METO - CANAL 1000
HWY 161 BRIDGE
C1000 CL STATION 106+35
PULASKI COUNTY, ARKANSAS

Name: HWY 161_North_RS_AC
Method: Spencer
Slip Surface Option: Entry and Exit
Minimum Slip Surface Depth: 1.5 ft
PWP Conditions Source: Piezometric Line



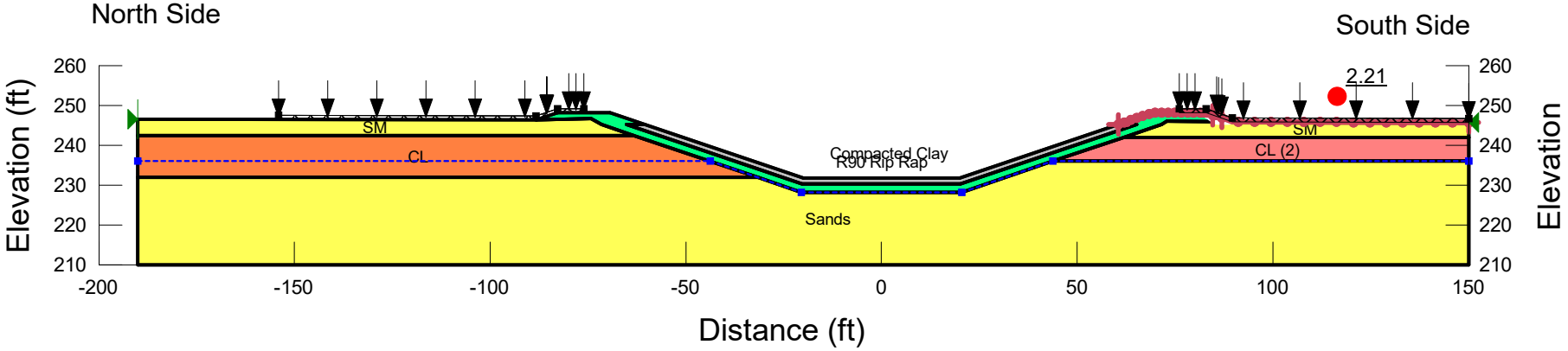
Name: R90 Rip Rap Model: Mohr-Coulomb Unit Weight: 122 pcf Cohesion': 0 psf Phi': 38 ° Piezometric Line: 1
Name: Compacted Clay Model: Mohr-Coulomb Unit Weight: 115 pcf Cohesion': 50 psf Phi': 23 ° Piezometric Line: 1
Name: CL Model: Mohr-Coulomb Unit Weight: 125 pcf Cohesion': 0 psf Phi': 24 ° Piezometric Line: 1
Name: Sands Model: Mohr-Coulomb Unit Weight: 125 pcf Cohesion': 0 psf Phi': 30 ° Piezometric Line: 1
Name: CL (2) Model: Mohr-Coulomb Unit Weight: 124 pcf Cohesion': 0 psf Phi': 28 ° Piezometric Line: 1
Name: SM Model: Mohr-Coulomb Unit Weight: 125 pcf Cohesion': 0 psf Phi': 28 ° Piezometric Line: 1

GENERAL NOTES:

Classification, stratifications, shear strengths, and unit weights of the soil were based on the results of undisturbed/disturbed data. See Appendix A for boring information. Shear strengths were assumed constant through each layer.

BAYOU METO - CANAL 1000
HWY 161 BRIDGE
C1000 CL STATION 106+35
PULASKI COUNTY, ARKANSAS

Name: HWY 161_South_LS_AC
Method: Spencer
Slip Surface Option: Entry and Exit
Minimum Slip Surface Depth: 1.5 ft
PWP Conditions Source: Piezometric Line



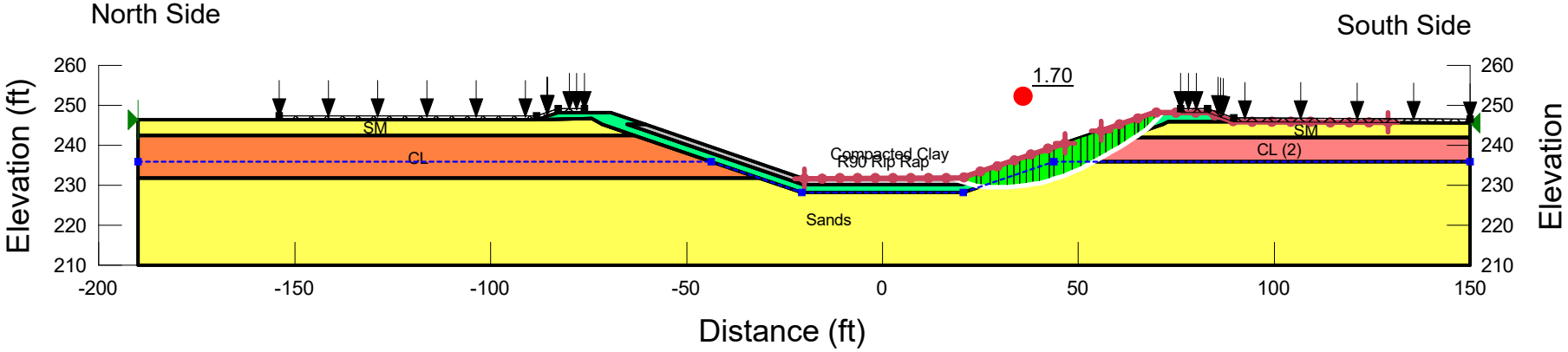
Name: R90 Rip Rap Model: Mohr-Coulomb Unit Weight: 122 pcf Cohesion': 0 psf Phi': 38 ° Piezometric Line: 1
Name: Compacted Clay Model: Mohr-Coulomb Unit Weight: 115 pcf Cohesion': 50 psf Phi': 23 ° Piezometric Line: 1
Name: CL Model: Mohr-Coulomb Unit Weight: 125 pcf Cohesion': 0 psf Phi': 24 ° Piezometric Line: 1
Name: Sands Model: Mohr-Coulomb Unit Weight: 125 pcf Cohesion': 0 psf Phi': 30 ° Piezometric Line: 1
Name: CL (2) Model: Mohr-Coulomb Unit Weight: 124 pcf Cohesion': 0 psf Phi': 28 ° Piezometric Line: 1
Name: SM Model: Mohr-Coulomb Unit Weight: 125 pcf Cohesion': 0 psf Phi': 28 ° Piezometric Line: 1

GENERAL NOTES:

Classification, stratifications, shear strengths, and unit weights of the soil were based on the results of undisturbed/disturbed data. See Appendix A for boring information. Shear strengths were assumed constant through each layer.

BAYOU METO - CANAL 1000
HWY 161 BRIDGE
C1000 CL STATION 106+35
PULASKI COUNTY, ARKANSAS

Name: HWY 161_South_RS_AC
Method: Spencer
Slip Surface Option: Entry and Exit
Minimum Slip Surface Depth: 1.5 ft
PWP Conditions Source: Piezometric Line



Name: R90 Rip Rap Model: Mohr-Coulomb Unit Weight: 122 pcf Cohesion': 0 psf Phi': 38 ° Piezometric Line: 1
Name: Compacted Clay Model: Mohr-Coulomb Unit Weight: 115 pcf Cohesion': 50 psf Phi': 23 ° Piezometric Line: 1
Name: CL Model: Mohr-Coulomb Unit Weight: 125 pcf Cohesion': 0 psf Phi': 24 ° Piezometric Line: 1
Name: Sands Model: Mohr-Coulomb Unit Weight: 125 pcf Cohesion': 0 psf Phi': 30 ° Piezometric Line: 1
Name: CL (2) Model: Mohr-Coulomb Unit Weight: 124 pcf Cohesion': 0 psf Phi': 28 ° Piezometric Line: 1
Name: SM Model: Mohr-Coulomb Unit Weight: 125 pcf Cohesion': 0 psf Phi': 28 ° Piezometric Line: 1

GENERAL NOTES:

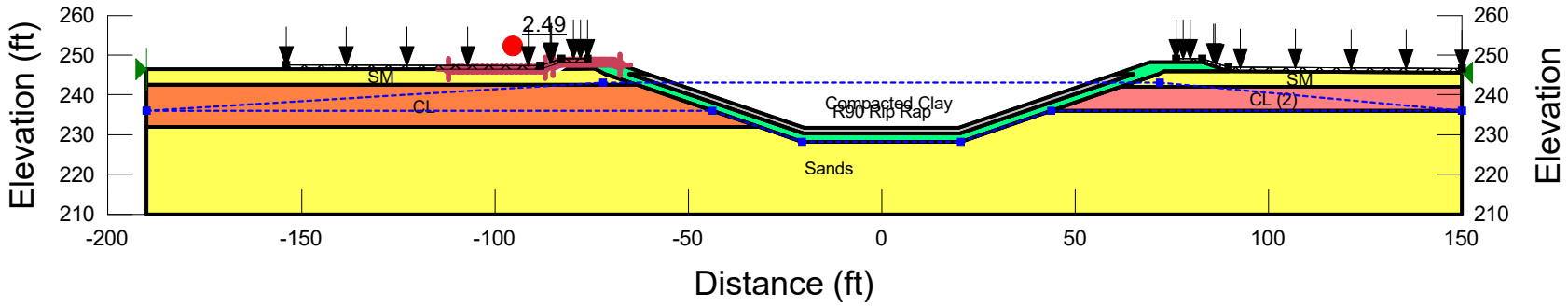
Classification, stratifications, shear strengths, and unit weights of the soil were based on the results of undisturbed/disturbed data. See Appendix A for boring information. Shear strengths were assumed constant through each layer.

BAYOU METO - CANAL 1000
HWY 161 BRIDGE
C1000 CL STATION 106+35
PULASKI COUNTY, ARKANSAS

Name: HWY 161_North_LS_AC
Method: Spencer
Slip Surface Option: Entry and Exit
Minimum Slip Surface Depth: 1.5 ft
PWP Conditions Source: Piezometric Line

North Side

South Side



Name: R90 Rip Rap Model: Mohr-Coulomb Unit Weight: 122 pcf Cohesion': 0 psf Phi': 38 ° Cohesion R: 0 psf Phi R: 38 ° Piezometric Line: 1 Piezometric Line After Drawdown: 2
Name: Compacted Clay Model: Mohr-Coulomb Unit Weight: 115 pcf Cohesion': 50 psf Phi': 23 ° Cohesion R: 375 psf Phi R: 11 ° Piezometric Line: 1 Piezometric Line After Drawdown: 2
Name: CL Model: Mohr-Coulomb Unit Weight: 125 pcf Cohesion': 0 psf Phi': 24 ° Cohesion R: 300 psf Phi R: 12 ° Piezometric Line: 1 Piezometric Line After Drawdown: 2
Name: Sands Model: Mohr-Coulomb Unit Weight: 125 pcf Cohesion': 0 psf Phi': 30 ° Cohesion R: 0 psf Phi R: 30 ° Piezometric Line: 1 Piezometric Line After Drawdown: 2
Name: CL (2) Model: Mohr-Coulomb Unit Weight: 124 pcf Cohesion': 0 psf Phi': 28 ° Cohesion R: 190 psf Phi R: 14 ° Piezometric Line: 1 Piezometric Line After Drawdown: 2
Name: SM Model: Mohr-Coulomb Unit Weight: 125 pcf Cohesion': 0 psf Phi': 28 ° Cohesion R: 0 psf Phi R: 28 ° Piezometric Line: 1 Piezometric Line After Drawdown: 2

GENERAL NOTES:

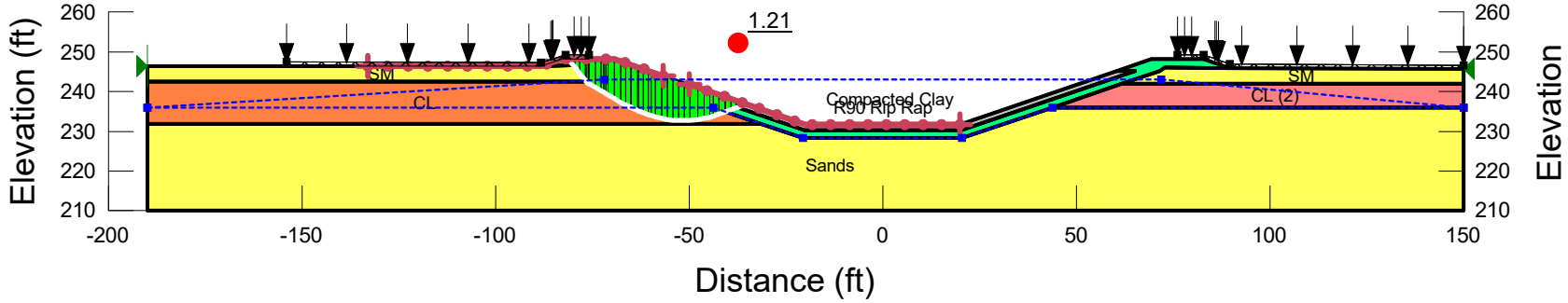
Classification, stratifications, shear strengths, and unit weights of the soil were based on the results of undisturbed/disturbed data. See Appendix A for boring information. Shear strengths were assumed constant through each layer.

BAYOU METO - CANAL 1000
HWY 161 BRIDGE
C1000 CL STATION 106+35
PULASKI COUNTY, ARKANSAS

Name: HWY 161_North_RS_AC
Method: Spencer
Slip Surface Option: Entry and Exit
Minimum Slip Surface Depth: 1.5 ft
PWP Conditions Source: Piezometric Line

North Side

South Side



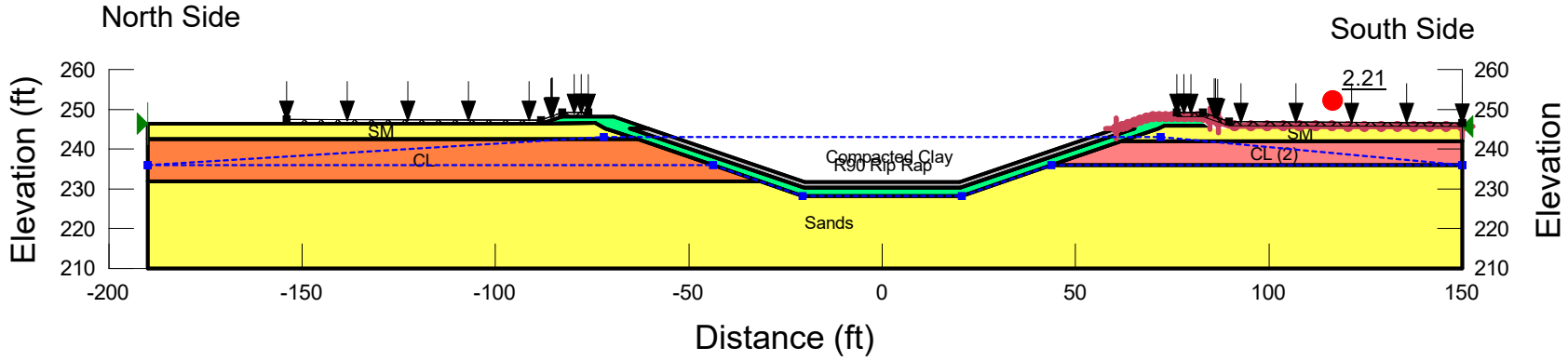
Name: R90 Rip Rap Model: Mohr-Coulomb Unit Weight: 122 pcf Cohesion': 0 psf Phi': 38 ° Cohesion R: 0 psf Phi R: 38 ° Piezometric Line: 1 Piezometric Line After Drawdown: 2
Name: Compacted Clay Model: Mohr-Coulomb Unit Weight: 115 pcf Cohesion': 50 psf Phi': 23 ° Cohesion R: 375 psf Phi R: 11 ° Piezometric Line: 1 Piezometric Line After Drawdown: 2
Name: CL Model: Mohr-Coulomb Unit Weight: 125 pcf Cohesion': 0 psf Phi': 24 ° Cohesion R: 300 psf Phi R: 12 ° Piezometric Line: 1 Piezometric Line After Drawdown: 2
Name: Sands Model: Mohr-Coulomb Unit Weight: 125 pcf Cohesion': 0 psf Phi': 30 ° Cohesion R: 0 psf Phi R: 30 ° Piezometric Line: 1 Piezometric Line After Drawdown: 2
Name: CL (2) Model: Mohr-Coulomb Unit Weight: 124 pcf Cohesion': 0 psf Phi': 28 ° Cohesion R: 190 psf Phi R: 14 ° Piezometric Line: 1 Piezometric Line After Drawdown: 2
Name: SM Model: Mohr-Coulomb Unit Weight: 125 pcf Cohesion': 0 psf Phi': 28 ° Cohesion R: 0 psf Phi R: 28 ° Piezometric Line: 1 Piezometric Line After Drawdown: 2

GENERAL NOTES:

Classification, stratifications, shear strengths, and unit weights of the soil were based on the results of undisturbed/disturbed data. See Appendix A for boring information. Shear strengths were assumed constant through each layer.

BAYOU METO - CANAL 1000
HWY 161 BRIDGE
C1000 CL STATION 106+35
PULASKI COUNTY, ARKANSAS

Name: HWY 161_South_LS_AC
Method: Spencer
Slip Surface Option: Entry and Exit
Minimum Slip Surface Depth: 1.5 ft
PWP Conditions Source: Piezometric Line



Name: R90 Rip Rap Model: Mohr-Coulomb Unit Weight: 122 pcf Cohesion': 0 psf Phi': 38 ° Cohesion R: 0 psf Phi R: 38 ° Piezometric Line: 1 Piezometric Line After Drawdown: 2
Name: Compacted Clay Model: Mohr-Coulomb Unit Weight: 115 pcf Cohesion': 50 psf Phi': 23 ° Cohesion R: 375 psf Phi R: 11 ° Piezometric Line: 1 Piezometric Line After Drawdown: 2
Name: CL Model: Mohr-Coulomb Unit Weight: 125 pcf Cohesion': 0 psf Phi': 24 ° Cohesion R: 300 psf Phi R: 12 ° Piezometric Line: 1 Piezometric Line After Drawdown: 2
Name: Sands Model: Mohr-Coulomb Unit Weight: 125 pcf Cohesion': 0 psf Phi': 30 ° Cohesion R: 0 psf Phi R: 30 ° Piezometric Line: 1 Piezometric Line After Drawdown: 2
Name: CL (2) Model: Mohr-Coulomb Unit Weight: 124 pcf Cohesion': 0 psf Phi': 28 ° Cohesion R: 190 psf Phi R: 14 ° Piezometric Line: 1 Piezometric Line After Drawdown: 2
Name: SM Model: Mohr-Coulomb Unit Weight: 125 pcf Cohesion': 0 psf Phi': 28 ° Cohesion R: 0 psf Phi R: 28 ° Piezometric Line: 1 Piezometric Line After Drawdown: 2

GENERAL NOTES:

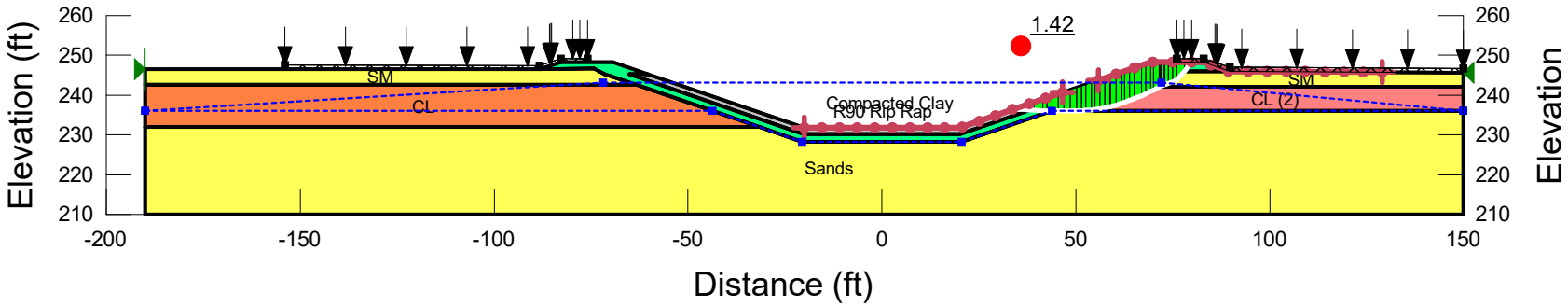
Classification, stratifications, shear strengths, and unit weights of the soil were based on the results of undisturbed/disturbed data. See Appendix A for boring information. Shear strengths were assumed constant through each layer.

BAYOU METO - CANAL 1000
HWY 161 BRIDGE
C1000 CL STATION 106+35
PULASKI COUNTY, ARKANSAS

Name: HWY 161_South_RS_AC
Method: Spencer
Slip Surface Option: Entry and Exit
Minimum Slip Surface Depth: 1.5 ft
PWP Conditions Source: Piezometric Line

North Side

South Side



Name: R90 Rip Rap Model: Mohr-Coulomb Unit Weight: 122 pcf Cohesion': 0 psf Phi': 38 ° Cohesion R: 0 psf Phi R: 38 ° Piezometric Line: 1 Piezometric Line After Drawdown: 2
Name: Compacted Clay Model: Mohr-Coulomb Unit Weight: 115 pcf Cohesion': 50 psf Phi': 23 ° Cohesion R: 375 psf Phi R: 11 ° Piezometric Line: 1 Piezometric Line After Drawdown: 2
Name: CL Model: Mohr-Coulomb Unit Weight: 125 pcf Cohesion': 0 psf Phi': 24 ° Cohesion R: 300 psf Phi R: 12 ° Piezometric Line: 1 Piezometric Line After Drawdown: 2
Name: Sands Model: Mohr-Coulomb Unit Weight: 125 pcf Cohesion': 0 psf Phi': 30 ° Cohesion R: 0 psf Phi R: 30 ° Piezometric Line: 1 Piezometric Line After Drawdown: 2
Name: CL (2) Model: Mohr-Coulomb Unit Weight: 124 pcf Cohesion': 0 psf Phi': 28 ° Cohesion R: 190 psf Phi R: 14 ° Piezometric Line: 1 Piezometric Line After Drawdown: 2
Name: SM Model: Mohr-Coulomb Unit Weight: 125 pcf Cohesion': 0 psf Phi': 28 ° Cohesion R: 0 psf Phi R: 28 ° Piezometric Line: 1 Piezometric Line After Drawdown: 2

GENERAL NOTES:

Classification, stratifications, shear strengths, and unit weights of the soil were based on the results of undisturbed/disturbed data. See Appendix A for boring information. Shear strengths were assumed constant through each layer.

BAYOU METO - CANAL 1000
HWY 161 BRIDGE
C1000 CL STATION 106+35
PULASKI COUNTY, ARKANSAS