11 Executive Drive, Suite 12, Fairview Heights, Illinois 62208 618-624-8610

Structural Geotechnical Report

IL Rte. 145 over Bay Creek (FAP Rte 132)
Section 103 (B-2)
Pope County, Illinois
PTB190-035
IDOT Job Number D-99-028-19
Existing Structure 076-0024
Proposed Structure 076-0033

Prepared For:
Oates Associates, Inc.
100 Lanter Court, Suite 1
Collinsville, Illinois 62234
618-345-2200

Prepared By:
Millennia Professional Services of Illinois, Ltd.
11 Executive Drive, Suite 12
Fairview Heights, Illinois 62208
618-624-8610

Authored By:
Jacob A. Schaeffer, PE
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Millennia Project Number MG19034.09
August 17, 2021

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2.0 Subsurface Exploration and Laboratory Testing

2.1 Subsurface Exploration

M 30 d r 18 2019 D d d r r r r r r d 1 d 2 145 29 d 30 2021 M d d r r r r r r r r d r d 3 d 4 M r d d d d d d r r d d r d d r r r d 2021 d d d r r 2 D r d d M r d D r r r d r r r r r r r r

4.0 Geotechnical Evaluations

4.1 Earthwork and Slope Stability

d M d r d r d M d r r d d d

dd d r r r d d r r d r r r M d d d

22 0 37 5 316 0 301 0 d 27 0 40 0 312 0 299 5 r 3 d 4 r 2019 r d r r 33 5 48 5 318 9 301 4 d 31 36 319 1 314 1 r 1 d 2 r d r 58 5 291 6 r 2 d 60 2019 d 2021 r r d r D r d r r r r d r d r d r r 1979 r r d d r r r d r r 326 d 308 r 1 1979 r r r r d r d r r r d r r 310 0 304 0 r 2 1979 M d r r r r d r r r r d r r 319 294 5 r 3 1979

d r r r r r d d d r r r d r r d r r d r r r r d r r r d r r d d d d d r d r r d r r r d r r d r r d

5.0 Foundation Evaluations and Design Recommendations

5.1 Drilled Shaft Foundations

M d d r d d d

Unfactored Side Resistance and Tip Resistance Values for Boring 1-S (2019) North Abutment Station 898+26.00

Elevation (ft)	Material Classification	Nominal Unit Side Resistance (psf)	Nominal Tip* Resistance (psf)	Nominal Liquefaction Downdrag Unit Values (psf)**
350 341				230
341 336.5		385		360
336.5 334		55		55
334 331.5	r	500		400
331.5 326.5	r	220		400
326.5 324		660		1,200
324 321.5	r	385		700
321.5 314		190		350
314 296.5	d r	1,310		200
296.5 276.5	d r	2,000	36,000	
276.5 255	d r	1,970	36,000	

d r r r r 5 r r d r
r d r d r d
d r d

Unfactored Side Resistance and Tip Resistance Values for Boring 2-S (2019) South Abutment Station 895+06.00

Elevation (ft)	Material Classification	Nominal Unit Side Resistance (psf)	Nominal Tip* Resistance (psf)	Nominal Liquefaction Downdrag Unit Values (psf)**
350 to 344				130
344 to 336.5		275		445
336.5 to 334		110		200
334 to 324	r	430		670
324 to 321.5		385		690
321.5 to 316.5		220		400
316.5 to 311.5	d	730		200
311.5 to 298	d	2,025	36,000	
298 to 291.5	d	1,600	28,800	
291.5 to 260	d	1,925	28,800	

d r r r 5 r
r d r d r d

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145 r r M r r d

R r r d dr d d r r r d

Resistance Factors

Method and Soil Type	Resistance Factor
d R r	0.45
d R r	0.55
R r	0.35
R r	0.45
R r	0.40
R r	0.50
d d D dr	1.0

r d r d r R D 9 d

r d d r d r d r d d r 0.60 dd R D r r d r r d r r d r r r r r d r r d d r d d r r d d d r r r r r d d r d r d dr d d d d r d r d d r M d dr dr r r d

r d r r r d r r r r r r d r d r r d r r d r r r d r r d d d r r d d r r d r r r d d d r d r d r r d d r r D r d r d r d r dr r d M r d d

r r r r d r d r r d r r r r d r r r r d r r d r r d r r d r d r r d r d r r d r r d r r d r d d r r r d d r r D r d r d r d r dr r d M r d d

Estimated Pile Length Table – North Abutment (Boring 1-S 2019)
(Estimated Pile Cutoff Elevation: 345.18)

Pile Type and Size	Nominal Required Bearing (kips)	Factored Resistance Available (kips)	Estimated Pile Length (ft.)
MS 12” w/0.25” walls	201	110	49
	375	206	90
MS 14” w/0.25” walls	254	139	49
	451	248	90
MS 14” w/0.312” walls	252	139	49
	451	248	90
MS 16” w/0.312” walls	312	171	49
	531	292	90
MS 16” w/0.375” walls	312	171	49
	531	292	90
8 36	92	50	90
10 42	116	64	90
10 57	119	66	90
12 53	146	80	90
12 63	147	81	90
12 74	149	82	90
12 84	152	83	90
14 73	180	99	90
14 89	183	100	90
14 102	185	102	90
14 117	187	103	90

***= maximum nominal bearing and maximum estimated pile length below existing boring depth**

Estimated Pile Length Table – South Abutment (Boring 2-S 2019)
(Estimated Pile Cutoff Elevation: 345.18)

Pile Type and Size	Nominal Required Bearing (kips)	Factored Resistance Available (kips)	Estimated Pile Length (ft.)
MS 12” w/0.25” walls	213	117	49
	392	213	82
MS 14” w/0.25” walls	259	143	49
	459	251	80
MS 14” w/0.312” walls	259	143	49
	479*	263	84*
MS 16” w/0.312” walls	308	169	49
	564	310	84*
MS 16” w/0.375” walls	308	170	49
	564*	310	84*
8 36	93*	51	84*
10 42	119*	66	84*
10 57	122*	67	84*
12 53	150*	82	84*
12 63	152*	83	84*
12 74	154*	84	84*
12 84	156*	86	84*
14 73	186*	102	84*
14 89	189*	104	84*
14 102	191*	105	84*
14 117	194*	107	84*

***= maximum nominal bearing and maximum estimated pile length below existing boring depth**

Estimated Pile Length Table – Pier 1 (Boring 4-S 2021)
(Pile Cutoff Elevation: 336.3)

Pile Type and Size	Nominal Required Bearing (kips)	Factored Resistance Available (kips)	Estimated Pile Length (ft.)
MS 12” w/0.25” walls	230	125	47
	363	198	86
MS 14” w/0.25” walls	289	157	47
	435	237	91
MS 14” w/0.312” walls	289	157	47
	445	237	86
MS 16” w/0.312” walls	353	192	47
	510	279	86
MS 16” w/0.375” walls	353	192	47
	510	279	86
8 36	75	40	86
10 42	96	52	86
10 57	98	53	86
12 53	120	65	86
12 63	121	65	86
12 74	123	66	86
12 84	125	67	86
14 73	148	80	86
14 89	150	81	86
14 102	153	82	86
14 117	155	84	86

***= maximum nominal bearing and maximum estimated pile length below existing boring depth**

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Estimated Pile Length Table – Pier 3 (Boring 3-S 2021)
(Pile Cutoff Elevation: 333.3)

Pile Type and Size	Nominal Required Bearing (kips)	Factored Resistance Available (kips)	Estimated Pile Length (ft.)
MS 12” w/0.25” walls	320	174	50
	392	208	80
MS 14” w/0.25” walls	406	220	50
	459	231	79
MS 14” w/0.312” walls	406	220	50
	570	286	94
MS 16” w/0.312” walls	500	272	50
	654	333	94
M 16” w/0.375” walls	500	272	50
	782	409	101
8 36	286	156	107
10 42	335	183	106
10 57	454*	250	108*
12 53	418	228	106
12 63	497	271	107
12 74	589*	324	108*
12 84	664*	365	108*
14 73	578	316	107
14 89	705*	388	108*
14 102	810*	445	108*
14 117	929*	511	108*

***= maximum nominal bearing and maximum estimated pile length below existing boring depth**

5.3 Lateral Load Capacity Considerations

r d r d d d r d r d d d d d d R d d d d d r d r d d d d d d

Parameters for Use in LPILE Analysis at Boring 2-S (2019)
South Abutment at Station 895+06.00

Elevation (ft)	LPILE Soil Type	Effective Unit Weight (pcf)	Undrained Cohesion (psf)	Strain at 50% Maximum Stress	Angle of Internal Friction (degrees)	p-y Soil Modulus K_{static} (pci)
350 344	r	125	900	0 009		350
344 336 5	r	58	600	0 010		100
336 5 334	M	58	200	0 020		30
334 324	r	58	780	0 010		100
324 321 5	r	58	700	0 010		100
321 5 316 5	M	53	400	0 020		30
316 5 311 5	d R	58			28	13
311 5 298	d R	58			36	97
298 291 5	d R	58			32	51
291 5 260 0	d R	58			33	60

d r d r r d r d

Parameters for Use in LPILE Analysis at Boring 4-S (2021)
Pier 1 at Station 895+76.00 □

Elevation (ft)	LPILE Soil Type	Effective Unit Weight (pcf)	Undrained Cohesion (psf)	Strain at 50% Maximum Stress	Angle of Internal Friction (degrees)	p-y Soil Modulus K_{static} (pci)
339□329□	□□□□□□□ □□□□□ □M□□□□□□□□□	58□□	500□	0□020□	□□□□	30□
329□324□	□□□□□□□ □□□□□ □M□□□□□□□□□	58□□	400□	0□020□	□□□□	30□
324□312□	□□□□□□□ □□□□□ □M□□□□□□□□□	58□□	300□	0□012□	□□□□	75□
312□300□	□□□d□□R□□□□□□	58□□	□□□□	□□□□	30□	13□
300□249□5□	□□□d□□R□□□□□□	58□□	□□□□	□□□□	33□	60□

□□□□□□□□□□□d□□□□r□□□□□□□□□□□□□□□□□□□

Parameters for Use in LPILE Analysis of Liquefiable Layers at Boring 1-S (2019) North Abutment at Station 898+26.00

Elevation (ft)	LPILE Soil Type	Effective Unit Weight (pcf)	Undrained Cohesion (psf)	Strain at 50% Maximum Stress	Angle of Internal Friction (degrees)	p-y Soil Modulus K_{static} (pci)
318 to 301.4	M	58	240	0.02		30

Parameters for Use in LPILE Analysis of Liquefiable Layers at Boring 2-S (2019) South Abutment at Station 895+06.00

Elevation (ft)	LPILE Soil Type	Effective Unit Weight (pcf)	Undrained Cohesion (psf)	Strain at 50% Maximum Stress	Angle of Internal Friction (degrees)	p-y Soil Modulus K_{static} (pci)
319.1 to 314.1	M	58	160	0.02		30

Parameters for Use in LPILE Analysis of Liquefiable Layers at Boring 4-S (2021) Pier 1 at Station 895+76.00

Elevation (ft)	LPILE Soil Type	Effective Unit Weight (pcf)	Undrained Cohesion (psf)	Strain at 50% Maximum Stress	Angle of Internal Friction (degrees)	p-y Soil Modulus K_{static} (pci)
312 to 299.5	M	58	300	0.02		30

Parameters for Use in LPILE Analysis of Liquefiable Layers at Boring 3-S (2021) Pier 2 Station 896+66.00 and Pier 3 at Station 897+56.00

Elevation (ft)	LPILE Soil Type	Effective Unit Weight (pcf)	Undrained Cohesion (psf)	Strain at 50% Maximum Stress	Angle of Internal Friction (degrees)	p-y Soil Modulus K_{static} (pci)
316 to 301	M	58	100	0.02		30

6.0 Construction Considerations

6.1 Temporary Sheeting and Soil Retention

r d r d r d r R d d r d r r r d r r d r r d r d r r d r d r r r d r d r r d r d r r r d r d r r d r d r

rr r d rr d r d d d

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6439 Plymouth Avenue, Suite W-129, St. Louis, Missouri 63133 314-531-3981

Appendix A:

Figure 1: Vicinity Map
Figure 2: TS&L Plan
Figure 3: Subsurface Profile

Millennia Professional Services

11 [illegible] Dr [illegible] 12 [illegible] r [illegible]

[illegible] 618 624 8610

[illegible] 618 624 8611

r [illegible] M 19034 09

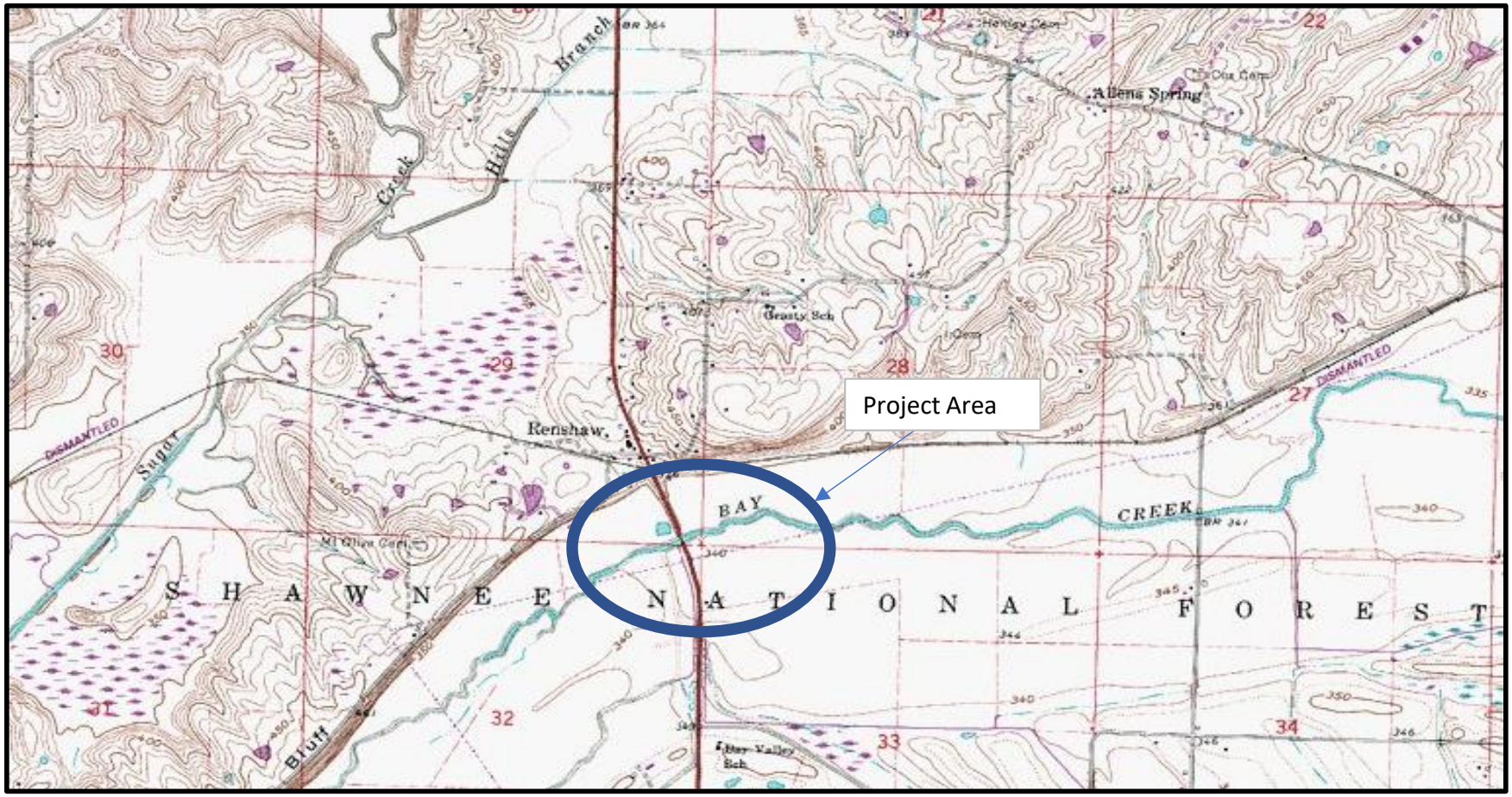


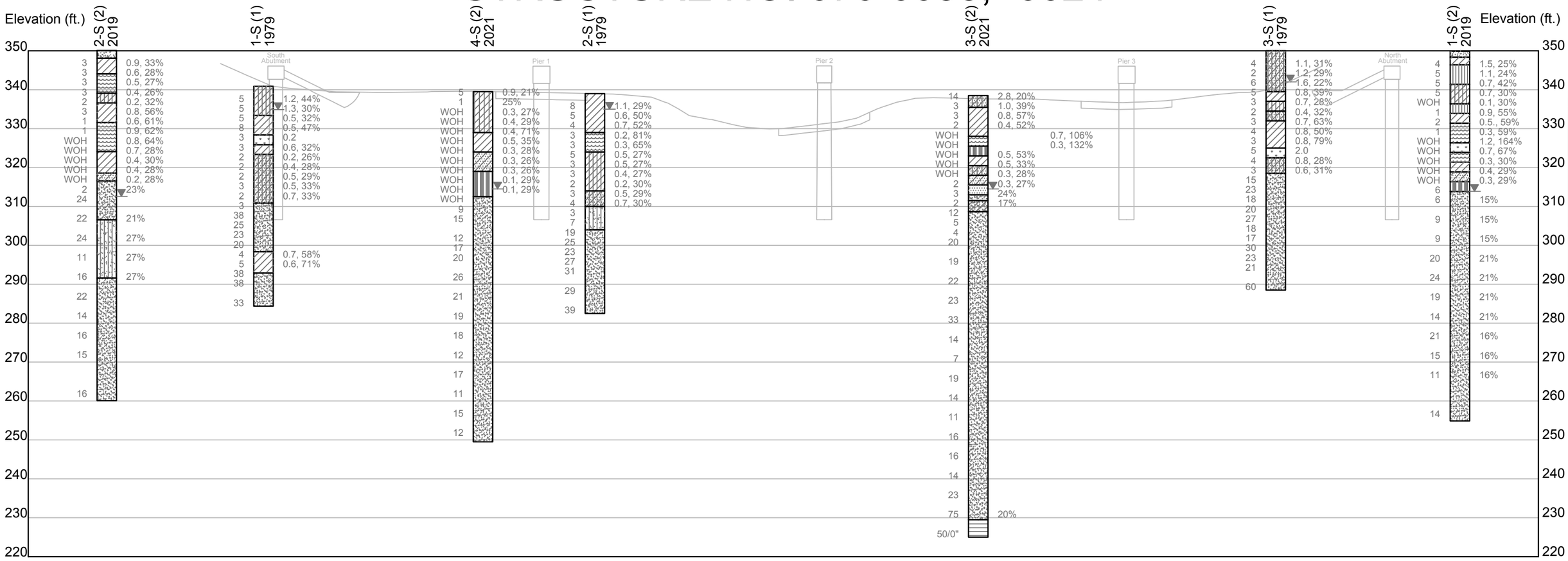
FIGURE 1: VICINITY MAP

[illegible] 145 [illegible] r [illegible] r [illegible]

[illegible]

[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	M 19034 09	[illegible]	8 14 2020

STRUCTURE NO. 076-0033, -0024



Note: Elevations are approximate. Actual conditions between borings are unknown, and are subject to change. Drilled shaft depths shown are only for reference.

STRATIGRAPHY

CLAY	LOAM	SHALE
CLAY LOAM	PEAT	SILT
CLAY WITH ORGANICS	SAND	SILTY CLAY
CONCRETE	SANDY CLAY	SILTY CLAY LOAM
	SANDY LOAM	SILTY LOAM

BORING DATA KEY:

Boring ID

N-Value (bpf) | Stratigraphy

Rimac Value (tsf) , Moisture Content (%)

Groundwater level encountered at boring

Vertical Scale: Approx. 1" = 25'
Horizontal Scale: IGNORE

FIGURE 3:

SUBSURFACE PROFILE

PROJECT NAME:	PROJECT No.:	DRAWN BY:	CHECKED BY:
Work Order No. 9 IL 145 over Bay Creek	MG19034.09	B. FISHER	J. SCHAEFFER
		08/05/2021	08/05/2021

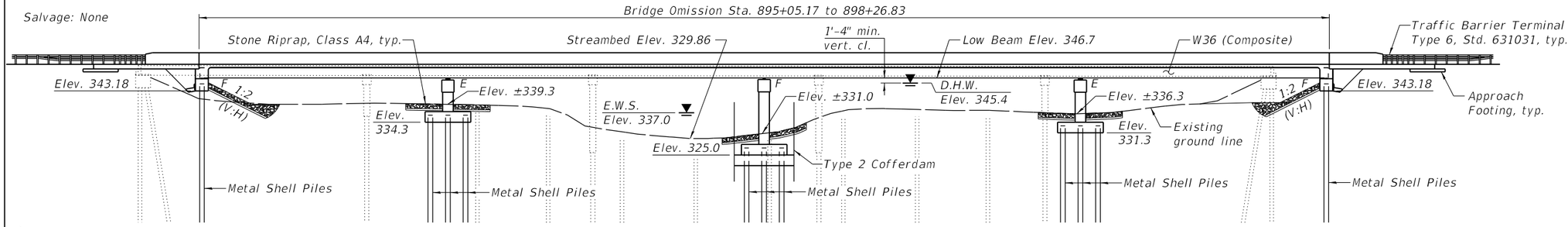
MILLENNIA PROFESSIONAL SERVICES

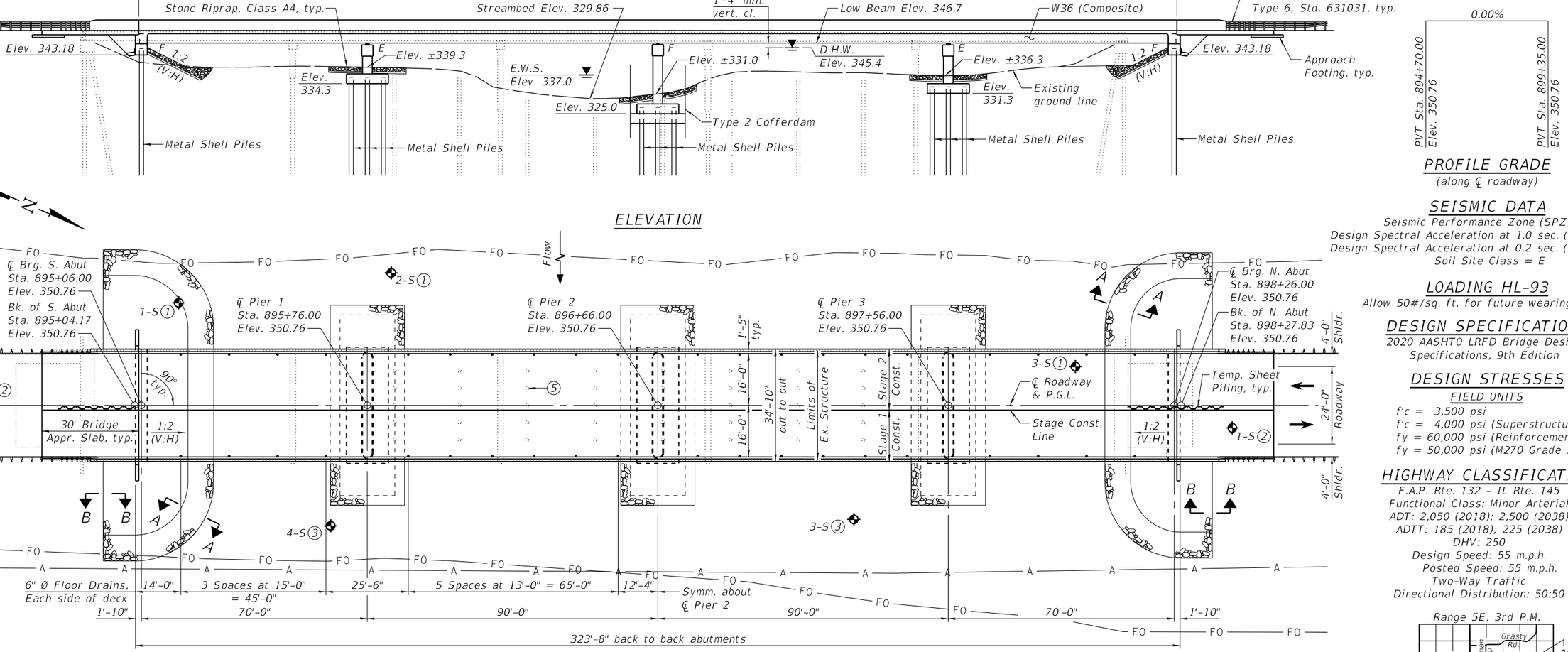
Bench Mark: BM 804 – Chiseled square on northeast wingwall, Sta. 898+11, 17' RT., Elev. 350.05.

Existing Structure: S.N. 076-0024 was originally built in 1983 as F.A. Route 132, Section 103A-B. The back to back abutment length is 324'-7" and the out to out deck width is 34'-0". The existing structure consists of a five span 27" PPC deck beam superstructure supported by concrete stub abutments founded on concrete piles and concrete pile bent piers founded on concrete piles. Structure is to be removed and replaced.

Traffic Control: One lane of traffic will be maintained by utilizing staged construction.

Salvage: None





PLAN

0.00%

PVT Sta. 894+70.00 Elev. 350.76

PVT Sta. 899+35.00 Elev. 350.76

PROFILE GRADE

(along ℄ roadway)

SEISMIC DATA

Seismic Performance Zone (SPZ) = 4
Design Spectral Acceleration at 1.0 sec. (SD1) = 0.701g
Design Spectral Acceleration at 0.2 sec. (SDS) = 0.918g
Soil Site Class = E

LOADING HL-93

Allow 50#/sq. ft. for future wearing surface.

DESIGN SPECIFICATIONS

2020 AASHTO LRFD Bridge Design Specifications, 9th Edition

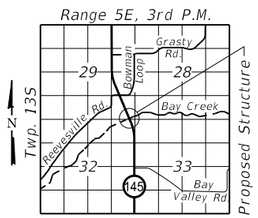
DESIGN STRESSES

FIELD UNITS

f'c = 3,500 psi
f'c = 4,000 psi (Superstructure concrete)
fy = 60,000 psi (Reinforcement)
fy = 50,000 psi (M270 Grade 50)

HIGHWAY CLASSIFICATION

F.A.P. Rte. 132 – IL Rte. 145
Functional Class: Minor Arterial
ADT: 2,050 (2018); 2,500 (2038)
ADTT: 185 (2018); 225 (2038)
DHV: 250
Design Speed: 55 m.p.h.
Posted Speed: 55 m.p.h.
Two-Way Traffic
Directional Distribution: 50:50



LOCATION SKETCH

WATERWAY INFORMATION

Drainage Area = 169.6 sq. mi.
Exist. Low Grade Elev. 348.8 at Sta. 890+00
Prop. Low Grade Elev. 348.9 at Sta. 890+00

Flood		Freq Yr.	Q C.F.S. Exist.	Q C.F.S. Prop.	Opening Ft² Exist.	Opening Ft² Prop.	Nat. H.W.E.	Head – Ft. Exist.	Head – Ft. Prop.	Headwater El. Exist.	Headwater El. Prop.
	Main Channel		6,502	6,489	2,448	2,460					
	Relief Str.	10	3,498	3,511	1,344	1,344	345.4	0.2	0.2	345.6	345.6
	Total		10,000	10,000	3,792	3,804					
Design	Main Channel		9,008	8,959	2,448	2,460					
	Relief Str.	50	5,092	5,141	1,344	1,344	345.4	0.4	0.4	345.8	345.8
	Total		14,100	14,100	3,792	3,804					
Base	Main Channel		10,096	10,074	2,448	2,460					
	Relief Str.	100	5,704	5,726	1,344	1,344	345.4	0.5	0.5	345.9	345.9
	Total		15,800	15,800	3,792	3,804					
Check	Main Channel		11,418	11,287	2,448	2,460					
	Relief Str.	200	6,282	6,413	1,344	1,344	345.4	0.6	0.6	346.0	346.0
	Total		17,700	17,700	3,792	3,804					
Max Calc.	Main Channel		12,865	12,835	2,448	2,460					
	Relief Str.	500	7,235	7,265	1,344	1,344	345.4	0.7	0.7	346.1	346.1
	Total		20,100	20,100	3,792	3,804					

PRELIMINARY PLANS

NOT FOR REVIEW

DESIGN SCOUR ELEVATION TABLE

Event / Limit State	Design Scour Elevations (ft.) S. Abut.	Pier 1	Pier 2	Pier 3	N. Abut.	Item 113
Q100	343.2	331.6	319.9	328.9	343.2	5
Q200	343.2	331.3	319.4	328.6	343.2	
Design	343.2	331.6	319.9	328.9	343.2	
Check	343.2	331.3	319.4	328.6	343.2	

Notes:
(1) 1979 Boring.
(2) 2019 Boring.
(3) 2021 Boring.
(4) For Sections A-A and B-B, and Riprap Protection at Piers, see sheet 2 of 2.
(5) Timber piles from 1959 bridge construction, typical.

GENERAL PLAN & ELEVATION
IL RTE. 145 OVER BAY CREEK
F.A.P. RTE. 132 – SEC. 103B-2
POPE COUNTY
STA. 896+66.00
STRUCTURE NO. 076-0033

OATES ASSOCIATES
www.oatesassociates.com
ILLINOIS DESIGN FIRM LICENSE NO.: 184.001115

USER NAME =		DESIGNED - JAD	REVISED -
		CHECKED - ETH	REVISED -
PLOT SCALE =		DRAWN - JAD	REVISED -
PLOT DATE =	8/16/2021	CHECKED - ETH	REVISED -

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

SHEET 1 OF 2 SHEETS

F.A.P. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
132	103B-2	POPE		
		CONTRACT NO. 78719		
	ILLINOIS	FED. AID PROJECT		

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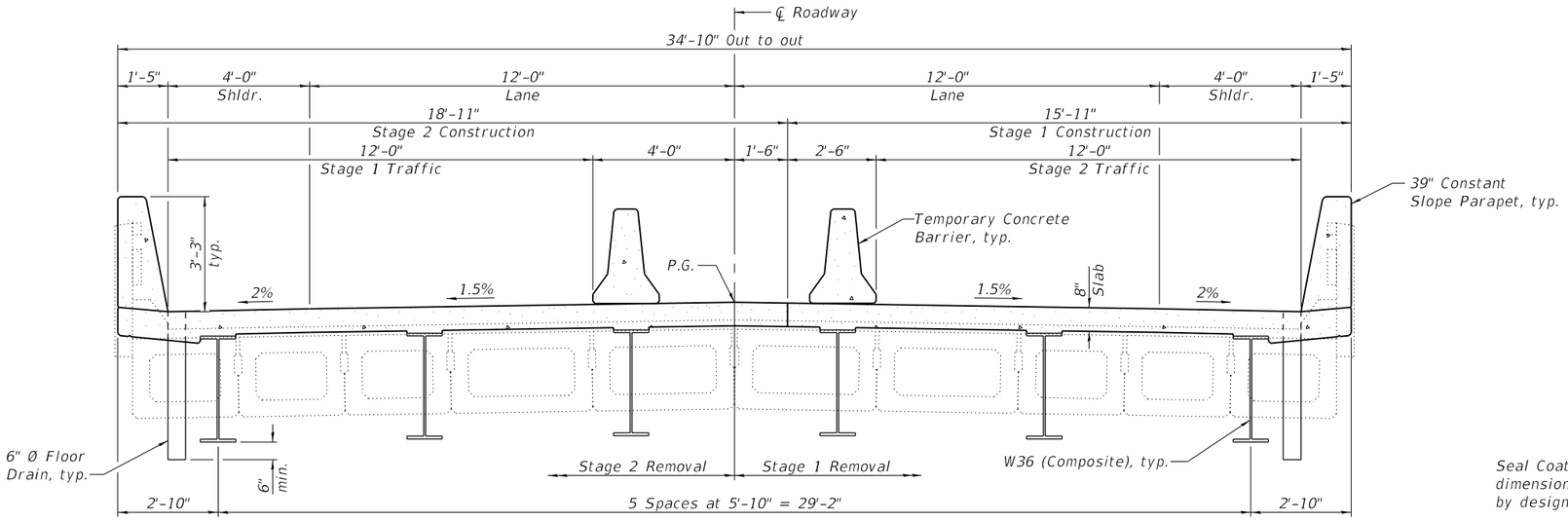
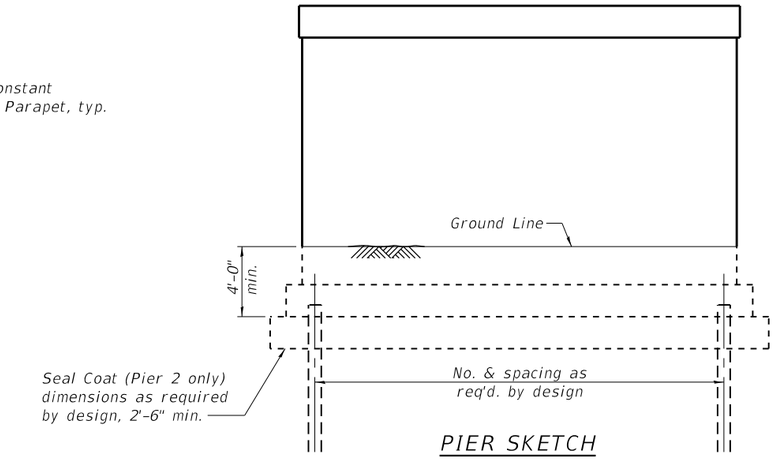
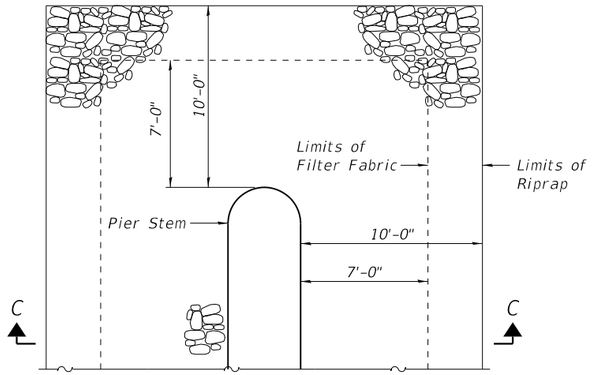


CROSS SECTION
(Looking North)

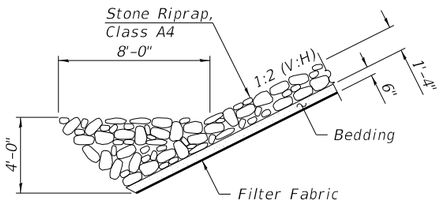


PIER SKETCH

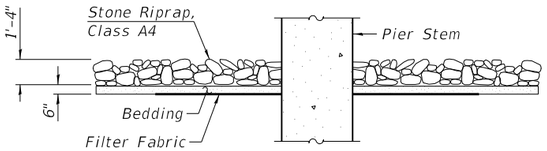
PRELIMINARY PLANS
NOT FOR REVIEW



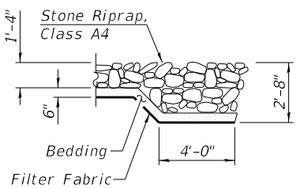
RIPRAP PROTECTION AT PIERS



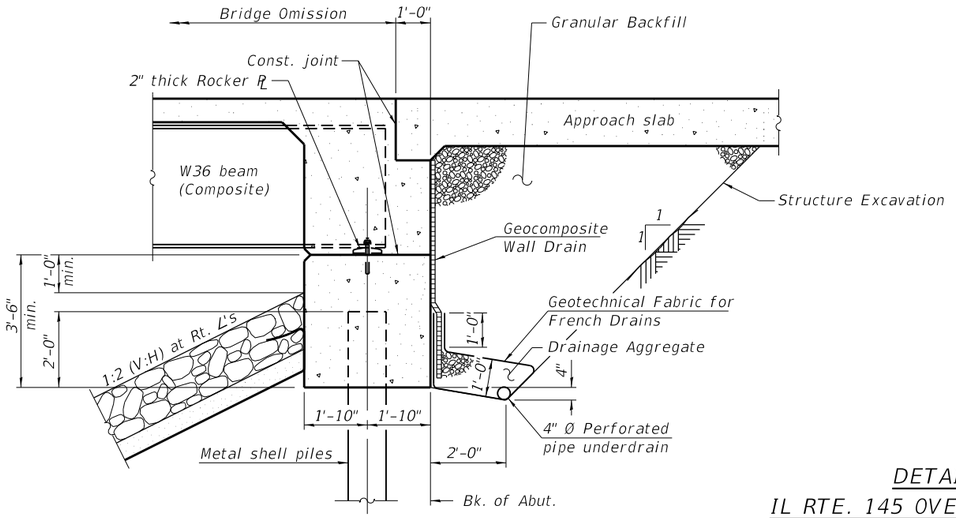
SECTION A-A



SECTION C-C



SECTION B-B



SECTION THRU INTEGRAL ABUTMENT

DETAILS
IL RTE. 145 OVER BAY CREEK
F.A.P. RTE. 132 - SEC. 103B-2
POPE COUNTY
STA. 896+66.00
STRUCTURE NO. 076-0033

FILE NAME: H:\P118120\118120.009\BridgeTSL\Microstation\0760033-78719-002-TSL.dgn

OATES ASSOCIATES
www.oatesassociates.com
ILLINOIS DESIGN FIRM LICENSE NO.: 184.001115

USER NAME =	DESIGNED - JAD	REVISED -	
	CHECKED - ETH	REVISED -	
PLOT SCALE =	DRAWN - JAD	REVISED -	
PLOT DATE = 8/16/2021	CHECKED - ETH	REVISED -	

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

SHEET 2 OF 2 SHEETS

F.A.P. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
132	103B-2	POPE		
		CONTRACT NO. 78719		
		ILLINOIS	FED. AID PROJECT	

11 Executive Drive, Suite 12 Fairview Heights, Illinois 62208 618-624-8610

Appendix B:

Boring Logs

MILLENNIA PROFESSIONAL SERVICES
www.millennia.pro

3-S
SOIL BORING LOG

Sheet 1 of 3

COUNTY Pope
SECTION 103(B-2)
ROUTE 132
MPS PROJECT NO. 076-0024
DATE 6/30/2021

DESCRIPTION IL-145 over Bay Creek
LOCATION 2.3 miles South of IL 146 (North Abut.)
DRILLED BY Geotechnology
DRILLING METHOD Hollow Stem Auger
DISTRICT 9
CONSULTANT Millennia Professional Services
LOGGED BY P. Adhikari
HAMMER TYPE Automatic
RIG TYPE CME 550X
EFFICIENCY 75%

BORING NO. 3-S
Station 897+25
Offset 35 ft RT
Northing
Easting
Ground Surface Elev. 338.5 ft

Surface Water Elev. ft
Stream Bed Elev. ft
Groundwater Elev.:
First Encounter 314.5 ft ▼
Upon Completion ft
After ____ Hrs. ft

LITHOLOGY	ELEV (ft)	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
Topsoil (2.0")	338.30				
FILL: Brown, very stiff, SILTY CLAY LOAM			2		
			7	2.8	20
			7	S	
	335.50				
Gray, soft to medium-stiff, moist, CLAY			WOH		
			1	1.0	39
		-5	2	S	
			WOH		
- trace organics below 6.5 ft.			2	0.8	57
- Atterberg Limits: LL= 95, PI = 61			1	S	
			WOH		
			1	0.4	52
		-10	1	S	
	328.00				
Black, medium-stiff, moist, ORGANIC CLAY			1		
			WOH	0.7	106
			WOH	S	
	325.50				
Brownish gray, soft, moist, ORGANIC SILTY LOAM			WOH		
			WOH	0.3	132
		-15	WOH	P	
	323.00				
Gray, soft, moist, CLAY, trace organics			WOH		
			WOH	0.5	53
			WOH	B	
	320.50				
Gray, soft, moist, SILTY CLAY LOAM			WOH		
- Atterberg Limits: LL = 41, PI = 20			WOH	0.5	33
		-20	WOH	B	

LITHOLOGY	ELEV (ft)	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
Gray, soft, moist, SILTY CLAY LOAM *(continued)*	318.00				
Gray, soft, moist, CLAY LOAM			WOH		
			WOH	0.3	28
			WOH	B	
	315.50				
Gray, soft, moist, LOAM			WOH		
- Atterberg Limits: LL = 23, PI = 7 ▼			1	0.3	27
		-25	1	B	
	313.00				
Gray, loose, SAND, fine- to medium-grained			2		
	311.50		1		24
Gray, soft, SANDY CLAY, trace organics			2		
			1		
- Atterberg Limits: LL = 23, PI = 8			WOH		17
	308.70	-30	2		
Gray, loose to medium-dense, SAND, medium- to coarse-grained, with fine gravel			5		
- 4.1% passing No. 200 sieve, 15.0% retained on No. 4 sieve			5		
			7		
			1		
			1		
		-35	4		
- 6.5% passing No. 200 sieve, 28.5% retained on No. 4 sieve			1		
			2		
			2		
			4		
			8		
		-40	12		

The Unconfined Compressive Strength (UCS) Qu column represents either the IDOT Rimac or AASHTO T 208 Test Procedure. The Qu failure mode is indicated by B for Bulge or S for Shear. P is a Pocket Penetrometer test. The Standard Penetration Test (SPT) N value is the sum of the second and third Blows /6 in. values in each sample using AASHTO T 206.

Printed 8/17/2021

MILLENNIA PROFESSIONAL SERVICES
www.millennia.pro

3-S
SOIL BORING LOG

Sheet 2 of 3

COUNTY: Pope
SECTION: 103(B-2)
ROUTE: 132
MPS PROJECT NO.: 076-0024
DATE: 6/30/2021

DESCRIPTION: IL-145 over Bay Creek
LOCATION: 2.3 miles South of IL 146 (North Abut.)
DRILLED BY: Geotechnology
DRILLING METHOD: Hollow Stem Auger
DISTRICT: 9
CONSULTANT: Millennia Professional Services
LOGGED BY: P. Adhikari
HAMMER TYPE: Automatic
RIG TYPE: CME 550X
EFFICIENCY: 75%

BORING NO. 3-S
Station 897+25
Offset 35 ft RT
Northing
Easting
Ground Surface Elev. 338.5 ft

Surface Water Elev. ft
Stream Bed Elev. ft
Groundwater Elev.:
First Encounter 314.5 ft ▼
Upon Completion ft
After ____ Hrs. ft

LITHOLOGY	ELEV (ft)	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
Gray, loose to medium-dense, SAND, medium- to coarse-grained, with fine gravel *(continued)*					
- fine- to medium-grained below 43.5 ft.			5		
		-45	7 12		
			8		
- 6.8% passing No. 200 sieve			11 11		
		-50			
			6		
			10 13		
		-55			
			6		
			15 18		
		-60			

LITHOLOGY	ELEV (ft)	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
Gray, loose to medium-dense, SAND, medium- to coarse-grained, with fine gravel *(continued)*					
- medium- to coarse-grained below 63.5 ft.			6		
			6 8		
		-65			
			3		
			3 4		
		-70			
			7		
			10 9		
		-75			
			5		
- fine- to medium-grained below 78.5 ft.			7 7		
		-80			

The Unconfined Compressive Strength (UCS) Qu column represents either the IDOT Rimac or AASHTO T 208 Test Procedure. The Qu failure mode is indicated by B for Bulge or S for Shear. P is a Pocket Penetrometer test. The Standard Penetration Test (SPT) N value is the sum of the second and third Blows /6 in. values in each sample using AASHTO T 206.

MILLENNIA PROFESSIONAL SERVICES
www.millennia.pro

3-S
SOIL BORING LOG

Sheet 3 of 3

COUNTY: Pope
SECTION: 103(B-2)
ROUTE: 132
MPS PROJECT NO.: 076-0024
DATE: 6/30/2021

DESCRIPTION: IL-145 over Bay Creek
LOCATION: 2.3 miles South of IL 146 (North Abut.)
DRILLED BY: Geotechnology
DRILLING METHOD: Hollow Stem Auger
DISTRICT: 9
CONSULTANT: Millennia Professional Services
LOGGED BY: P. Adhikari
HAMMER TYPE: Automatic
RIG TYPE: CME 550X
EFFICIENCY: 75%

BORING NO. 3-S
Station 897+25
Offset 35 ft RT
Northing
Easting
Ground Surface Elev. 338.5 ft

Surface Water Elev. ft
Stream Bed Elev. ft
Groundwater Elev.:
First Encounter 314.5 ft ▼
Upon Completion ft
After ____ Hrs. ft

LITHOLOGY	ELEV (ft)	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
Gray, loose to medium-dense, SAND, medium- to coarse-grained, with fine gravel *(continued)*					
			6		
- medium- to coarse-grained below 83.5 ft.			6		
		-85	5		
			7		
- with gravel below 88.5 ft.			7		
		-90	9		
			11		
			9		
		-95	7		
			6		
			7		
		-100	7		

LITHOLOGY	ELEV (ft)	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
Gray, loose to medium-dense, SAND, medium- to coarse-grained, with fine gravel *(continued)*					
			4		
			9		
		-105	14		
	229.50		32		
Gray SHALE, weathered			25		20
		-110	50		
	225.00				
- no recovery at 113.5 ft.			50/0"		
End of Boring		-115			
		-120			

The Unconfined Compressive Strength (UCS) Qu column represents either the IDOT Rimac or AASHTO T 208 Test Procedure. The Qu failure mode is indicated by B for Bulge or S for Shear. P is a Pocket Penetrometer test. The Standard Penetration Test (SPT) N value is the sum of the second and third Blows /6 in. values in each sample using AASHTO T 206.

Printed 8/17/2021

MILLENNIA PROFESSIONAL SERVICES
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4-S
SOIL BORING LOG

Sheet 1 of 3

COUNTY: Pope
SECTION: 103(B-2)
ROUTE: 132
MPS PROJECT NO.: 076-0024
DATE: 6/29/2021

DESCRIPTION: IL-145 over Bay Creek
LOCATION: 2.3 miles South of IL 146 (South Abut.)
DRILLED BY: Geotechnology
DRILLING METHOD: Hollow Stem Auger
DISTRICT: 9
CONSULTANT: Millennia Professional Services
LOGGED BY: P. Adhikari
HAMMER TYPE: Automatic
RIG TYPE: CME 550X
EFFICIENCY: 75%

BORING NO. 4-S
Station 895+65
Offset 37 ft RT
Northing
Easting
Ground Surface Elev. 339.5 ft

Surface Water Elev. ft
Stream Bed Elev. ft
Groundwater Elev.:
First Encounter 314.5 ft ▼
Upon Completion ft
After ____ Hrs. ft

LITHOLOGY	ELEV (ft)	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
Topsoil (2.0")	339.25				
Brown, soft to medium-stiff, SILTY CLAY			2		
			3	0.9	21
			2	S	
- gray, soft, moist below 3.5 ft.			WOH		
			WOH		25
		-5	1		
			WOH		
			WOH	0.3	27
			WOH	B	
- trace organics below 8.5 ft.			WOH		
			WOH	0.4	29
		-10	WOH	B	
	329.00				
Gray, soft, moist, CLAY, trace organics			WOH		
			WOH	0.4	71
			WOH	B	
			WOH		
			WOH	0.5	35
		-15	WOH	B	
	324.00				
Gray, soft, moist, CLAY LOAM, trace organics			WOH		
			WOH	0.3	28
			WOH	B	
			WOH		
			WOH	0.3	26
		-20	WOH	B	

LITHOLOGY	ELEV (ft)	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
	319.00				
Gray, very soft to soft, moist, SILT LOAM			WOH		
			WOH	0.3	26
			WOH	B	
			WOH		
- Atterberg Limits: LL = 31, PI = 12			WOH	0.1	29
		▼-25	WOH	B	
			WOH		
	312.50				
Gray, very loose to medium-dense, SAND, fine- to medium-grained, trace gravel			WOH	0.1	29
			WOH	B	
			WOH		
			WOH		
		-30	WOH		
- with gravel below 31.0 ft.			3		
- 4.4% passing No. 200 sieve, 24.7% retained on No. 4 seive			4		
			5		
- trace gravel below 33.5 ft.			3		
			6		
		-35	9		
- fine- to coarse-grained below 38.5 ft.			6		
			6		
		-40	6		

The Unconfined Compressive Strength (UCS) Qu column represents either the IDOT Rimac or AASHTO T 208 Test Procedure. The Qu failure mode is indicated by B for Bulge or S for Shear. P is a Pocket Penetrometer test. The Standard Penetration Test (SPT) N value is the sum of the second and third Blows /6 in. values in each sample using AASHTO T 206.

Printed 8/17/2021

MILLENNIA PROFESSIONAL SERVICES
www.millennia.pro

4-S
SOIL BORING LOG

Sheet 2 of 3

COUNTY: Pope
SECTION: 103(B-2)
ROUTE: 132
MPS PROJECT NO.: 076-0024
DATE: 6/29/2021

DESCRIPTION: IL-145 over Bay Creek
LOCATION: 2.3 miles South of IL 146 (South Abut.)
DRILLED BY: Geotechnology
DRILLING METHOD: Hollow Stem Auger
DISTRICT: 9
CONSULTANT: Millennia Professional Services
LOGGED BY: P. Adhikari
HAMMER TYPE: Automatic
RIG TYPE: CME 550X
EFFICIENCY: 75%

BORING NO. 4-S
Station 895+65
Offset 37 ft RT
Northing
Easting
Ground Surface Elev. 339.5 ft

Surface Water Elev. ft
Stream Bed Elev. ft
Groundwater Elev.:
First Encounter 314.5 ft ▼
Upon Completion ft
After ____ Hrs. ft

LITHOLOGY	ELEV (ft)	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
Gray, very loose to medium-dense, SAND, fine- to medium-grained, trace gravel *(continued)*			5		
			8		
- with gravel below 41.0 ft.			9		
			7		
- fine- to medium-grained below 43.5 ft.			10		
- 3.5% passing No. 200 sieve		-45	10		
			10		
			13		
		-50	13		
- fine- to coarse-grained below 53.5 ft.			8		
			9		
		-55	12		
			12		
			9		
		-60	10		

LITHOLOGY	ELEV (ft)	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
Gray, very loose to medium-dense, SAND, fine- to medium-grained, trace gravel *(continued)*					
			7		
			9		
		-65	9		
			3		
- medium- to coarse-grained below 68.5 ft.			6		
		-70	6		
			7		
			8		
		-75	9		
			6		
- fine- to medium-grained below 78.5 ft.			5		
		-80	6		

The Unconfined Compressive Strength (UCS) Qu column represents either the IDOT Rimac or AASHTO T 208 Test Procedure. The Qu failure mode is indicated by B for Bulge or S for Shear. P is a Pocket Penetrometer test. The Standard Penetration Test (SPT) N value is the sum of the second and third Blows /6 in. values in each sample using AASHTO T 206.

Printed 8/17/2021

MILLENNIA PROFESSIONAL SERVICES
www.millennia.pro

4-S
SOIL BORING LOG

Sheet 3 of 3

COUNTY: Pope
SECTION: 103(B-2)
ROUTE: 132
MPS PROJECT NO.: 076-0024
DATE: 6/29/2021

DESCRIPTION: IL-145 over Bay Creek
DISTRICT: 9
LOCATION: 2.3 miles South of IL 146 (South Abut.)
CONSULTANT: Millennia Professional Services
DRILLED BY: Geotechnology
LOGGED BY: P. Adhikari
RIG TYPE: CME 550X
DRILLING METHOD: Hollow Stem Auger
HAMMER TYPE: Automatic
EFFICIENCY: 75%

BORING NO. 4-S
Station 895+65
Offset 37 ft RT
Northing
Easting
Ground Surface Elev. 339.5 ft

Surface Water Elev. ft
Stream Bed Elev. ft
Groundwater Elev.:
First Encounter 314.5 ft ▼
Upon Completion ft
After ____ Hrs. ft

LITHOLOGY	ELEV (ft)	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
Gray, very loose to medium-dense, SAND, fine- to medium-grained, trace gravel *(continued)*			6		
		-85	7 8		
- medium- to coarse-grained below 88.5 ft.			10		
			6 6		
	249.50	-90			
End of Boring					
		-95			
		-100			

LITHOLOGY	ELEV (ft)	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
		-105			
		-110			
		-115			
		-120			

The Unconfined Compressive Strength (UCS) Qu column represents either the IDOT Rimac or AASHTO T 208 Test Procedure. The Qu failure mode is indicated by B for Bulge or S for Shear. P is a Pocket Penetrometer test. The Standard Penetration Test (SPT) N value is the sum of the second and third Blows /6 in. values in each sample using AASHTO T 206.

Printed 8/17/2021

Illinois Department of Transportation

Memorandum

To:	Carrie Nelsen	Attn: Dave Piche
From:	Keith Roberts	By: Aaron Hayes
Subject:	Boring Logs	
Date:	November 22, 2019	

IL 145 over Bay Creek
Structure 076-0024 (Ex.)
Section 103(B-2)
Pope County

Foundation boring logs have been obtained for the above listed structure and are attached. Please note the borings were completed on two separate occasions.

Rock was not encountered in the two borings completed for this project. The borings were drilled to a depth that will achieve a minimum nominal driven bearing capacity for a 14 in. diameter metal shell pile of 435 kips at Boring 1-S and 500 kips at Boring 2-S. Boring 1-S, near the north abutment, shows a layer of potentially liquefiable soils at a depth of 33.5 to 53.5 feet. Boring 2-S, near the south abutment, shows layers of potentially liquefiable soils at depths of 33.5 to 43.5 feet and 53.5 to 58.5 feet. A liquefaction analysis should be completed once the proposed structure's final dimensions are determined.

Borings completed in 1979 before the existing structure was constructed have been attached for additional subsurface information. Also attached is a General Plan and Elevation sheet from the 1979 plans showing the old boring locations.

Attachments
AWH:ah

cc: Materials Geotechnical Unit\Boring Logs using gINT\State Structures\Pope

Illinois Department of Transportation
Division of Highways
District 9

SOIL BORING LOG

Date 5/30/19

ROUTE IL 145 **DESCRIPTION** Structure over Bay Creek **LOGGED BY** L. Estel

SECTION 103(B-2) **LOCATION** 2.3 miles South of IL 146 (North Abut.), **SEC.** 29, **TWP.** 13S, **RNG.** 5E, **PM**

COUNTY Pope **DRILLING METHOD** Hollow stem auger (8" O.D., 3.25" I.D.) **HAMMER TYPE** Auto SPT 140 lb

STRUCT. NO. 076-0024
Station 896+49

BORING NO. 1-S
Station 898+44
Offset 7.0ft Rt
Ground Surface Elev. 349.9 ft

Surface Water Elev. 333.6 ft
Stream Bed Elev. 330.1 ft

Groundwater Elev.:
▽ **First Encounter** 313.9 ft
▽ **Upon Completion** ft
▼ **After** Hrs. ft

DEPTH (ft)	BLOWS	UCS Qu (tsf)	MOIST (%)	Description
				Cored pavement, 9" HMA over 9" CONCRETE
348.40				
				Grey, Moist CLAY (visual ID from auger cuttings)
346.40				
	1			Stiff Grey, Moist SILT
	2	1.5	25	
-5	2	B		
	1			
	2	1.1	24	
	3	B		
341.40				
	1			M. Stiff Grey, Moist SILTY CLAY with chunks of WOOD
	2	0.7	42	
-10	3	B		
	1			
	2	0.7	30	
	3	B		
336.40				
	WOH			V. Soft Grey, Moist SILT A-6(11) 0% SAND, 83% SILT, 17% CLAY, LL = 32, PI = 10 (Lab 41)
	WOH	0.1	30	
-15	WOH	B		
333.90				
	WOH			M. Stiff Grey, V. Moist CLAY N.L. PI > 11 (Est.)
	WOH	0.9	55	
	1	B		
331.40				
	WOH			Soft Grey, V. Moist CLAY with ORGANICS N.L. PI > 11 (Est.)
	1	0.5	59	
-20	1	B		

DEPTH (ft)	BLOWS	UCS Qu (tsf)	MOIST (%)	Description
				Soft Grey, V. Moist CLAY with ORGANICS N.L. PI > 11 (Est.) *(continued)*
	WOH			
	WOH	0.3	59	
	1	B		
326.40				
	WOH			Stiff Dark Brown and Black, V. Moist CLAYEY PEAT
	WOH	1.2	164	
-25	WOH	B		
323.90				
	WOH			M. Stiff Grey, V. Moist CLAY with specks of ORGANICS N.L. PI > 11 (Est.)
	WOH	0.7	67	
	WOH	B		
321.40				
	WOH			Soft Grey, Moist CLAY N.L. PI > 11 (Est.)
	WOH	0.3	30	
-30	WOH	B		
318.90				
	WOH			Soft Grey, Moist CLAY LOAM with ORGANICS (medium plasticity) and a 12 inch layer of Grey, m. to c. SAND
	WOH	0.4	29	
	WOH	B		
316.40				
	WOH			Soft Grey, Moist SILTY LOAM A-4(4) 25% m. SAND, 60% SILT, 15% CLAY, LL = 27, PI = 8 (Lab 42)
	WOH	0.3	29	
-35	WOH	B		
▽ 313.90				
	4			Loose Grey m. and c. SAND with f. GRAVEL 40% f. GRAVEL and c. SAND, 58% m. SAND, 1% SILT, 1% CLAY (based on visual ID and Lab 43) (washed)
	3			
	3			
311.40				
	2			
	3		15	
-40	3			

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer, E-Estimated)
Abbreviations W.O.H - Sampler Advanced By Weight of Hammer, W.O.P - Advanced by Weight of Pipe, B.S. - Before Seating
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206) BBS, from 137 (Rev. 8-99)

File Name S:\MATERIALS GEOTECHNICAL UNIT\BORING LOGS USING GINT\STATE STRUCTURES\POPE\076-0024 IL 145 OVER BAY CREEK 2019.GPJ Data Template D6TEMPLT.GDT Date Printed 11/22/19
Latitude 37.351721 Longitude -88.676114 Datum NAD83 Job Number

Illinois Department of Transportation
Division of Highways
District 9

SOIL BORING LOG

Date 5/30/19

ROUTE IL 145 **DESCRIPTION** Structure over Bay Creek **LOGGED BY** L. Estel

SECTION 103(B-2) **LOCATION** 2.3 miles South of IL 146 (North Abut.), **SEC.** 29, **TWP.** 13S, **RNG.** 5E, **PM**

COUNTY Pope **DRILLING METHOD** Hollow stem auger (8" O.D., 3.25" I.D.) **HAMMER TYPE** Auto SPT 140 lb

STRUCT. NO. 076-0024
Station 896+49

BORING NO. 1-S
Station 898+44
Offset 7.0ft Rt
Ground Surface Elev. 349.9 ft

Surface Water Elev. 333.6 ft
Stream Bed Elev. 330.1 ft

Groundwater Elev.:
▽ **First Encounter** 313.9 ft
▽ **Upon Completion** ft
▼ **After** Hrs. ft

DEPTH (ft)	BLOWS	UCS Qu (tsf)	MOIST (%)	DEPTH (ft)	BLOWS	UCS Qu (tsf)	MOIST (%)
Loose Grey, Moist m. and c. SAND with f. GRAVEL (non-plastic) 40% f. GRAVEL and c. SAND, 58% m. SAND, 1% SILT, 1% CLAY (Lab 43) *(continued)*				M. Dense Grey, Moist m. and c. SAND with f. GRAVEL (non-plastic) 14% c. SAND and f. GRAVEL, 82% m. SAND, 3% SILT, 1% CLAY (Lab 44) *(continued)*			
	4				3		
	4		15		8		21
-45	5			-65	11		
	2				5		
	5		15		5		21
-50	4			-70	9		
296.40				276.40			
M. Dense Grey, Moist m. and c. SAND with f. GRAVEL (non-plastic) 14% c. SAND and f. GRAVEL, 82% m. SAND, 3% SILT, 1% CLAY (Lab 44)	4			M. Dense Grey, Moist m. and c. SAND with f. GRAVEL (non-plastic) 29% c. SAND and f. GRAVEL, 69% m. SAND, 1% SILT, 1% CLAY (Lab 45)	5		
	8		21		12		16
-55	12			-75	9		
	7				4		
	13		21		7		16
-60	11			-80	8		

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer, E-Estimated)
Abbreviations W.O.H - Sampler Advanced By Weight of Hammer, W.O.P - Advanced by Weight of Pipe, B.S. - Before Seating
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206) BBS, from 137 (Rev. 8-99)

File Name S:\MATERIALS GEOTECHNICAL UNIT\BORING LOGS USING GINT\STATE STRUCTURES\POPE\076-0024 IL 145 OVER BAY CREEK 2019.GPJ Data Template D6TEMPLT.GDT Date Printed 11/22/19
Latitude 37.351721 Longitude -88.676114 Datum NAD83 Job Number

Illinois Department of Transportation
Division of Highways
District 9

SOIL BORING LOG

Date 5/30/19

ROUTE IL 145 **DESCRIPTION** Structure over Bay Creek **LOGGED BY** L. Estel

SECTION 103(B-2) **LOCATION** 2.3 miles South of IL 146 (North Abut.), **SEC.** 29, **TWP.** 13S, **RNG.** 5E, **PM**

COUNTY Pope **DRILLING METHOD** Hollow stem auger (8" O.D., 3.25" I.D.) **HAMMER TYPE** Auto SPT 140 lb

STRUCT. NO. 076-0024
Station 896+49

BORING NO. 1-S
Station 898+44
Offset 7.0ft Rt
Ground Surface Elev. 349.9 ft

Surface Water Elev. 333.6 ft
Stream Bed Elev. 330.1 ft

Groundwater Elev.:
▽ **First Encounter** 313.9 ft
▽ **Upon Completion** ft
▼ **After** Hrs. ft

DEPTH (ft)	BLOWS	UCS Qu (tsf)	MOIST (%)
M. Dense Grey, Moist m. and c. SAND with f. GRAVEL (non-plastic) 29% c. SAND and f. GRAVEL, 69% m. SAND, 1% SILT, 1% CLAY (Lab 45) *(continued)*			
	3		
	5		16
-85	6		
-90			
	4		
	7		
254.90 -95	7		
(end of boring)			
Bottom of hole @ 95 ft			
N.L. = Not Liquefiable			
Elevation referenced to BM 804, Chiseled Square on the NE wingwall of SN 076-0024; EL. 350.05			
-100			

To convert "N" values to "N60", multiply by 1.5

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer, E-Estimated)
Abbreviations W.O.H - Sampler Advanced By Weight of Hammer, W.O.P - Advanced by Weight of Pipe, B.S. - Before Seating
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206) BBS, from 137 (Rev. 8-99)

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Latitude 37.351721 Longitude -88.676114 Datum NAD83 Job Number

Illinois Department of Transportation
Division of Highways
District 9

SOIL BORING LOG

Date 10/18/19

ROUTE IL 145 **DESCRIPTION** Structure over Bay Creek **LOGGED BY** L. Estel

SECTION 103(B-2) **LOCATION** 2.3 miles South of IL 146 (South Abut.), **SEC.** 29, **TWP.** 13S, **RNG.** 5E, **PM**

COUNTY Pope **DRILLING METHOD** Hollow stem auger (8" O.D., 3.25" I.D.) **HAMMER TYPE** Auto SPT 140 lb

STRUCT. NO. 076-0024
Station 896+49

BORING NO. 2-S
Station 894+54
Offset 7.0ft Lt
Ground Surface Elev. 350.1 ft

Surface Water Elev. 333.3 ft
Stream Bed Elev. 330.3 ft

Groundwater Elev.:
▽ **First Encounter** 312.6 ft
▽ **Upon Completion** ft
▽ **After** Hrs. ft

DEPTH (ft)	BLOWS	UCS Qu (tsf)	MOIST (%)	Description
				Cored pavement, 13" HMA over 9" CONCRETE
348.10				
				Grey, Moist CLAY (visual ID from auger cuttings)
346.60				
	WOH			M. Stiff Grey, Moist CLAY
	1	0.9	33	
-5	2	B		
344.10				
	WOH			M. Stiff Grey, Moist CLAY with thin layers of ORGANICS
	1	0.6	28	
	2	B		
	WOH			
	1	0.5	27	
-10	2	B		
339.10				
	WOH			Soft Grey, Moist SILTY CLAY
	1	0.4	26	
	2	B		
336.60				
	WOH			V. Soft Grey, Moist CLAY N.L. PI > 11 (Est.)
	1	0.2	32	
-15	1	B		
334.10				
	WOH			M. Stiff Grey, V. Moist CLAY N.L. PI > 11 (Est.)
	1	0.8	56	
	2	B		
331.60				
	WOH			M. Stiff Grey with specks of Brown, V. Moist CLAY with ORGANICS
	WOH	0.6	61	
-20	1	B		

DEPTH (ft)	BLOWS	UCS Qu (tsf)	MOIST (%)	Description
				N.L. PI > 11 (Est.)
				Dark Grey
	WOH			
	WOH	0.9	62	
	1	B		
	WOH			
	WOH	0.8	64	
-25	WOH	B		
324.10				
	WOH			M. Stiff Grey, Moist CLAY N.L. PI > 11 (Est.)
	WOH	0.7	28	
	WOH	B		
321.60				
	WOH			Soft Grey, Moist CLAY N.L. PI > 11 (Est.)
	WOH	0.4	30	
-30	WOH	B		
318.60				
	WOH			V. Soft Grey, Moist CLAY LOAM N.L. PI > 11 (Est.)
	WOH	0.4	28	
	WOH	B		
316.60				
	WOH			V. Loose Grey, Moist well graded f. SAND
	WOH	0.2	28	
-35	WOH	B		
	WOH			Non-plastic, 18% c. SAND, 62% f. SAND, 16% SILT, 4% CLAY (Lab 59)
	WOH		23	
	2			
311.60				
	8			M. Dense (No sample)
	12			
-40	12			(washed)

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer, E-Estimated)
Abbreviations W.O.H - Sampler Advanced By Weight of Hammer, W.O.P - Advanced by Weight of Pipe, B.S. - Before Seating
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Latitude 37.350817 Longitude -88.675664 Datum NAD83 Job Number

Illinois Department of Transportation
Division of Highways
District 9

SOIL BORING LOG

Date 10/18/19

ROUTE IL 145 **DESCRIPTION** Structure over Bay Creek **LOGGED BY** L. Estel

SECTION 103(B-2) **LOCATION** 2.3 miles South of IL 146 (South Abut.), **SEC.** 29, **TWP.** 13S, **RNG.** 5E, **PM**

COUNTY Pope **DRILLING METHOD** Hollow stem auger (8" O.D., 3.25" I.D.) **HAMMER TYPE** Auto SPT 140 lb

STRUCT. NO. 076-0024
Station 896+49

BORING NO. 2-S
Station 894+54
Offset 7.0ft Lt
Ground Surface Elev. 350.1 ft

Surface Water Elev. 333.3 ft
Stream Bed Elev. 330.3 ft

Groundwater Elev.:
▽ **First Encounter** 312.6 ft
▽ **Upon Completion** ft
▼ **After** Hrs. ft

DEPTH (ft)	BLOWS	UCS Qu (tsf)	MOIST (%)	Description
				M. Dense (No sample)
				(washed) *(continued)*
306.60				
	5			M. Dense Grey, Moist c. SANDY LOAM with rounded f. GRAVEL
	10		21	Non-plastic, 19% f. GRAVEL to c.
-45	12			SAND, 19% m. SAND, 25% f.
				SAND, 30% SILT, 7% CLAY (Lab 60)
				(washed)
301.60				
	6			M. Dense Grey, Wet SANDY LOAM A-6(1)
	12		27	LL = 28, PI = 14, 21% c. SAND to
-50	12			f. GRAVEL, 24% m. SAND, 27%
				f. SAND, 16% SILT, 12% CLAY
				(Lab 61)
				(washed)
	4			
	8		27	
-55	3			
				(washed)
291.60				
	5			
	8		27	
-60	8			

DEPTH (ft)	BLOWS	UCS Qu (tsf)	MOIST (%)	Description
				M. Dense Grey, Moist f. and m. SAND
				(washed) *(continued)*
	17			
	8			
-65	14			
281.60				
	10			M. Dense Grey, Moist m. and c.
	7			SAND with rounded f. GRAVEL
-70	7			and 1" COAL seam
276.60				
	4			M. Dense Grey, Moist m. and c.
	8			SAND with rounded GRAVEL
-75	8			Non-plastic, 29% c. SAND and f.
				GRAVEL, 69% m. SAND, 1%
				SILT, 1% CLAY (based on visual
				ID and Lab 45)
				(washed)
	5			
	6			
-80	9			

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer, E-Estimated)
Abbreviations W.O.H - Sampler Advanced By Weight of Hammer, W.O.P - Advanced by Weight of Pipe, B.S. - Before Seating
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Latitude 37.350817 Longitude -88.675664 Datum NAD83 Job Number

Illinois Department of Transportation
Division of Highways
District 9

SOIL BORING LOG

Date 10/18/19

ROUTE IL 145 **DESCRIPTION** Structure over Bay Creek **LOGGED BY** L. Estel

SECTION 103(B-2) **LOCATION** 2.3 miles South of IL 146 (South Abut.), **SEC.** 29, **TWP.** 13S, **RNG.** 5E, **PM**

COUNTY Pope **DRILLING METHOD** Hollow stem auger (8" O.D., 3.25" I.D.) **HAMMER TYPE** Auto SPT 140 lb

STRUCT. NO. 076-0024
Station 896+49

BORING NO. 2-S
Station 894+54
Offset 7.0ft Lt
Ground Surface Elev. 350.1 ft

Surface Water Elev. 333.3 ft
Stream Bed Elev. 330.3 ft

Groundwater Elev.:
▽ **First Encounter** 312.6 ft
▽ **Upon Completion** ft
▼ **After** ____ **Hrs.** ft

DEPTH (ft)	BLOWS	UCS Qu (tsf)	MOIST (%)	
				M. Dense Grey, Moist m. and c. SAND with rounded GRAVEL Non-plastic, 29% c. SAND and f. GRAVEL, 69% m. SAND, 1% SILT, 1% CLAY (based on visual ID and Lab 45) (washed) *(continued)*
-85				
	7			
	6			
260.10 -90	10			
				Bottom of hole @ 90.0 ft N.L. = Not Liquefiable Elevation referenced to BM 804, Chiseled Square on the NE wingwall of SN 076-0024; EL. 350.05 To convert "N" values to "N60", multiply by 1.5
-95				
-100				

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer, E-Estimated)
Abbreviations W.O.H - Sampler Advanced By Weight of Hammer, W.O.P - Advanced by Weight of Pipe, B.S. - Before Seating
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B.M. "□" Cut in N. end of East hubguard 10'-6" Rt Sta. 897+37 Elev. 351.36

Existing Structure: #076-0017 Built 1934 at Sta. 896+56 Section 103 A on S. B. L. Rte. 145 Seven I-bm spans with 4" Timber planks superstructure and timber pile bents substructure. Timber planks replaced with 6" concrete slab in 1959. Existing structure is 147'-3½" long by 22'-0" wide Stage Construction shall be utilized so as to maintain one way traffic during reconstruction.

No Salvage

ROUTE	SECTION	COUNTY	TOTAL SHEETS	SHEET
FA 132	103A-B	POPE	25	13
STA.		TO STA.		
F.A.P.R.A. RTE. NO. 4	ILLINOIS	FED. AID PROJECT-		

1 of 13

GENERAL NOTES

See Proposal for Boring Data.

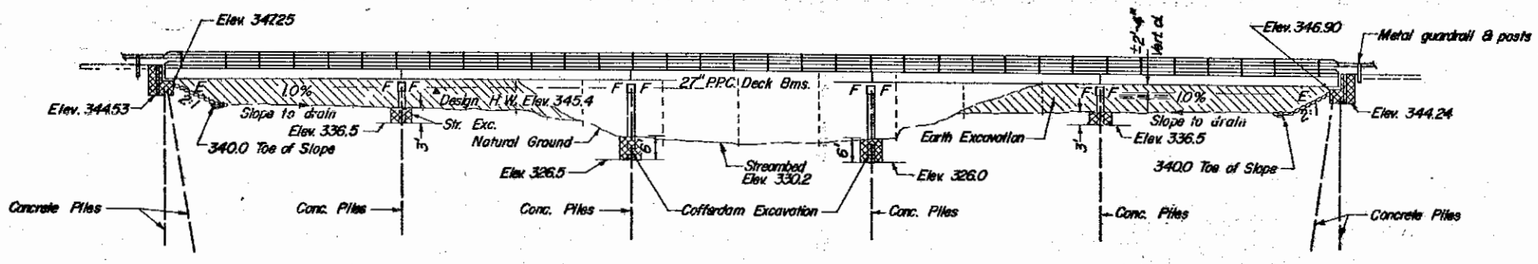
The top surface of the beams shall be finished in accordance with Article 505.06 of the Standard Specification except that the surface shall not be roughened by brooming. The finished surface shall be free of depressions or high spots with sharp corners.

Protective Coat shall not be applied to surfaces to which Waterproofing Membrane System is applied.

Reinforcement bars shall conform to the requirements of AASHTO M-31 or M-53 Grade 60, unless otherwise indicated.

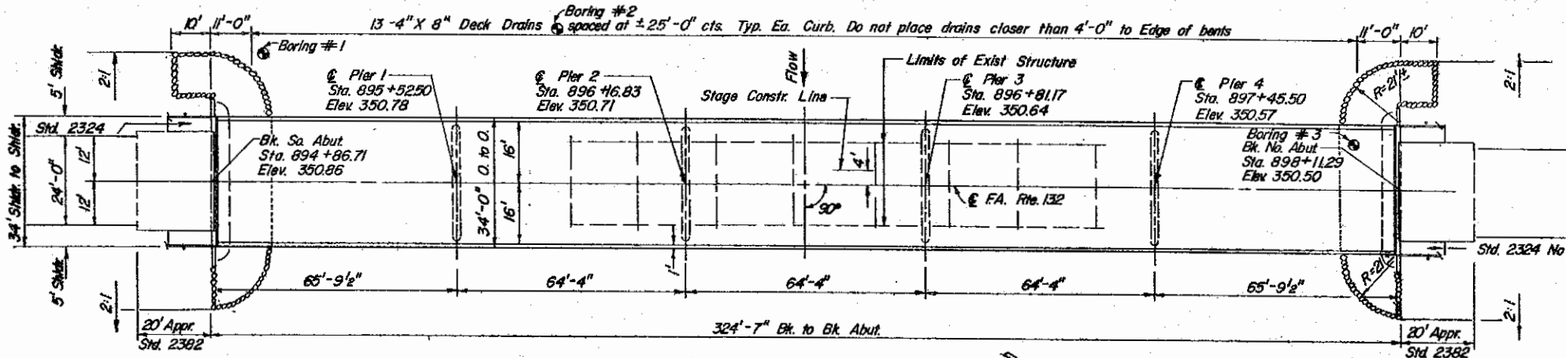
The Contractor shall drive one precast concrete test pile in a permanent location at Pier 2 and at Pier 4 as directed by the Engineer.

Bars designated "Grade 40" shall have a minimum yield strength of 33,000 psi and maximum yield strength of 45,000 psi.

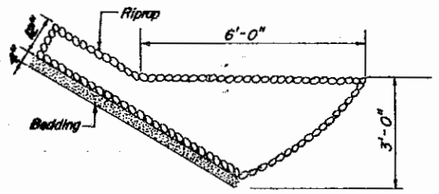


ELEVATION

NOTE: Hatched Area shows Earth Excavation which is included in the Earth work balances in the road plans.



PLAN



RIPRAP ANCHOR DETAIL

STATION 896+49
BUILT 198 BY
STATE OF ILLINOIS
F.A. RT. 132 SEC. 103A-B
F.A. PROJECT BR-F-132(49)
LOADING HS20
*STR. NO.

NAME PLATE

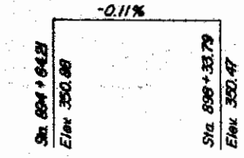
See Std. 2113

*Structure Number to be supplied by District.

APPROVED
FOR STRUCTURAL ADEQUACY ONLY
Engineer of Bridge & Traffic Structures

TOTAL BILL OF MATERIAL

ITEM	UNIT	SUPER	SUB	TOTAL
Structure Excavation	Cu. Yd.		195	195
Portland Cement Mortar Fairing Course	Lin. Ft.	2890		2890
Waterproofing Membrane System	Sq. Yd.	1145		1145
Protective Coat	Sq. Yd.	110		110
Bituminous Conc. Surf. Crse. Mixture D Class I	Ton	134		134
Concrete Piles	Lin. Ft.	1078		1078
Precast Concrete Piles, 14"	Lin. Ft.		2357	2357
Test Pile, Precast Concrete	Ea.		2	2
Neoprene Expansion Jt. 2"	Lin. Ft.	64		64
Precast Prestressed Concrete Deck Beams (27" Depth)	Sq. Ft.	10,923		10,923
Steel Railing, Type T	Lin. Ft.	644		644
Untreated Timber	FBM		624	624
Hardware	Pound		105	105
Name Plates	Ea.	1		1
Stone Riprap	Sq. Yd.		330	330
Removal of Existing Structures	Ea.			1
Class X Concrete	Cu. Yd.	18.2	181.0	199.2
Reinforcement Bars	Pound	1250	18,580	19,830
Temporary Bridge Rail	Lin. Ft.	365		365
Steel Sheet Piling, Temporary	Sq. Ft.		4750	4750
Cofferdam (Pier 2)	Ea.		1	1
Cofferdam (Pier 3)	Ea.		1	1
Cofferdam Excavation	Cu. Yds.		105	105



PROFILE GRADE

℄ ROADWAY

WATERWAY INFORMATION

Drainage Area 164.66 sq. mi. Low Grade Elev. 349.16' at Sta. 890+00

Flood	Freq. Yr.	Q. C.F.S.	Opening Sq. Ft. Exist.	Opening Sq. Ft. Prop.	Nat. H.W.E.	Head-Ft. Exist.	Head-Ft. Prop.	Headwater Exist.	Headwater Prop.
Design	50	9900	1398	2360	345.4	2.0	0.47	347.4	345.9
Base	100	11700	1478	2528	346.0	2.5	0.60	348.5	346.6
Overtopping	—	—	—	—	—	—	—	—	—
Max. Calc.	500	15515	1627	2842	347.12	3.0	0.75	350.1	347.9

DESIGN STRESSES

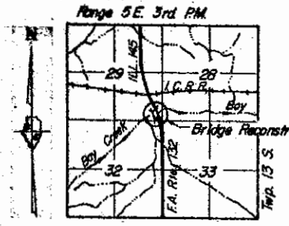
FIELD UNITS
f'_c = 3,500 psi
f_y = 60,000 psi Reinforcement

PRECAST PRESTRESSED UNITS
f'_c = 5,000 psi
f_{ci} = 4,000 psi
f_s = 270,000 psi (f'_s ½" ø Strands)
f'_s = 189,000 psi (f'_s ½" ø Strands)

Design Specifications 1977 AASHTO & 1978, 1979 & 1980 Interims as applicable

Allow for 25 #/sq. ft. Future Wearing Surface

LOADING HS20-44



LOCATION SKETCH

STATE OF ILLINOIS
ROBERT BRADFORD WILLIAMS
REGISTERED
STRUCTURAL ENGINEER

GENERAL PLAN AND ELEVATION

F.A. Rte. 132 (ILL. 145) Over BAY CREEK
F.A. Rte. 132 SECTION 103A-B
POPE COUNTY Sta. 896+49.00

GREENE & ELLIOTT, Ltd.
CONSULTING ENGINEERS
1819 STEVENSON DR. · 217/529-6681 · SPRINGFIELD, ILL.

DRAWN L.V.	REVISED	DATE	PROJECT
CHECKED R.B.J.		OCT. 1980	

Revised

BRIDGE FOUNDATION BORING LOG

PROJECT

ROUTE F.A. 132

SEC. 103A-B

COUNTY POPE

Boring No. 1-S

Station 895+05

Offset 34' LT. CL

BRIDGE STRUCTURE CARRYING F.A. ROUTE 132 OVER BAY CREEK

STA. 896+46

Date OCTOBER, 1979

Bored By JOHN R. HAYDEN

Checked By GARY L. PULLEY

Surface Water El. NONE

Groundwater El. at Completion 334.9

After — Hours —

Elevation		N	Qu t/s.f.	w (%)
Ground Surface 340.9	0			
MEDIUM TO STIFF MOIST TO VERY MOIST BROWN MOTTLED GREY CLAY TO SILTY CLAY A-6				
		5	1.2S	44
	-5			
		5	1.3S	30
333.4				
SOFT VERY MOIST GREY CLAY A-6 TO A-7-6		5	0.5B	32
	-10			
		8	0.5S	47
328.4				
VERY SOFT VERY MOIST BROWN & GREY PEAT		3	0.2B	-
325.9	-15			
MEDIUM VERY MOIST GREY CLAY A-6 TO A-7-6		3	0.6B	32
323.4				
VERY SOFT VERY MOIST GREY SILTY CLAY TO CLAY LOAM A-6		2	0.2B	26
320.9	-20			
SOFT VERY MOIST GREY SILTY CLAY TO CLAY LOAM A-6 WITH SAND SEAMS		2	0.4B	28
SEE NEXT COLUMN				

Elevation		N	Qu t/s.f.	w (%)
		2	0.5B	29
	-25			
		3	0.5B	33
313.4				
MEDIUM VERY MOIST GREY SILTY CLAY A-6 WITH SAND SEAMS		2	0.7B	33
310.9	-30			
VERY LOOSE WET GREY COARSE GRAINED SAND WITH SOME GRAVEL		3	-	-
308.4				
DENSE TO MEDIUM WET GREY FINE TO COARSE GRAINED SAND		38	-	-
	-35			
		25	-	-
		23	-	-
	-40			
		20	-	-
298.4				
MEDIUM VERY MOIST GREY CLAY A-7-6		4	0.7S	58
SEE NEXT SHEET	-45			

N – Standard Penetration Test – Blows per foot to drive 2" O.D. Split Spoon Sampler 12" with 140# hammer falling 30".

Qu – Unconfined Compressive Strength – t/sf

w – Water Content – percentage of oven dry weight – %.

Type failure:
B – Bulge Failure
S – Shear Failure
E – Estimated Value
P – Penetrometer

BRIDGE FOUNDATION BORING LOG

STRUCTURE CARRYING F.A. ROUTE 132 OVER BAY CREEK
SEC. 103A-B
POPE COUNTY
BORING NO. 1-S

Elevation	N	Qu t/s.f.	w (%)	Description
-45				SEE PREVIOUS SHEET
	5	0.6S	71	
292.9				
	38		-	DENSE WET GREY COARSE GRAINED SAND & SOME SMALL GRAVEL
-50				
	38	-	-	
-55				
284.4	33	-	-	
				BOTTOM OF HOLE = 56.5'.
				DURING DRILLING OPERATIONS IT APPEARED THAT FREE WATER WAS ENCOUNTERED AT 30.0'.
-60				DURING DRILLING OPERATIONS WASH OUT PROCEDURES USED FROM 29.0' TO 56.5'.
				STRUCTURE LOCATION: SE 1/4, SE 1/4, SECTION 29, T13S, R5E, 3RD P.M., POPE COUNTY, ILLINOIS.
-65				
-70				
-75				
-80				
-85				
-90				
-95				

BRIDGE FOUNDATION BORING LOG

PROJECT -
ROUTE F.A. 132
SEC. 103A-B
COUNTY POPE

BRIDGE STRUCTURE CARRYING F.A. ROUTE 132 OVER BAY CREEK
STA. 896+46

Date OCTOBER, 1979
Bored By JOEL CONGIARDO
Checked By GARY L. PULLEY

Boring No. 2-S
Station 895+83
Offset 41' LT. CL

Surface Water El. NONE
Groundwater El. at Completion 333.0
After 24 Hours 335.0

Elevation		N	Qu t/s.f.	w (%)
Ground Surface 339.0	0			
STIFF MOIST TO VERY MOIST BROWN CLAY A-7-6				
		8	1.1B	29
334.0	-5			
MEDIUM VERY MOIST GREY CLAY A-6 TO A-7-6		5	0.6B	50
		4	0.7B	52
329.0	-10			
SOFT TO VERY SOFT VERY MOIST GREY CLAY A-6 WITH ROTTEN WOOD MIXED		3	0.2B	81
		3	0.3B	65
324.0	-15			
MEDIUM VERY MOIST GREY SILTY CLAY TO CLAY A-6 TO A-7-6		5	0.5B	27
		3	0.5B	27
319.0	-20			
SOFT TO VERY SOFT VERY MOIST GREY SILTY CLAY A-6		3	0.4B	27
SEE NEXT COLUMN				

Elevation		N	Qu t/s.f.	w (%)
		2	0.2B	30
314.0	-25			
MEDIUM VERY MOIST GREY TO DARK GREY SILTY CLAY TO CLAY LOAM A-6 WITH SAND SEAMS		3	0.5B	29
310.0		4	0.7B	30
LOOSE TO VERY LOOSE WET GREY FINE TO COARSE GRAINED SAND WITH SILTY CLAY SEAMS	-30	3	-	-
		7	-	-
304.0	-35			
MEDIUM WET GREY COARSE GRAINED SAND & SOME SMALL GRAVEL		19	-	-
		25	-	-
	-40			
		23	-	-
		27	-	-
294.0	-45			
SEE NEXT SHEET				

N – Standard Penetration Test – Blows per foot to drive 2" O.D. Split Spoon Sampler 12" with 140# hammer falling 30".

Qu – Unconfined Compressive Strength – t/sf

w – Water Content – percentage of oven dry weight – %.

Type failure:
B – Bulge Failure
S – Shear Failure
E – Estimated Value
P – Penetrometer

FORM NO B-D 137 REV. 9-66

BRIDGE FOUNDATION BORING LOG

STRUCTURE CARRYING F.A. ROUTE 138 OVER BAY CREEK
SECTION 103A-B
POPE COUNTY
BORING NO. 2-S

Elevation	N	Qu t/s.f.	w (%)	Elevation	N	Qu t/s.f.	w (%)
-45				-75			
DENSE TO MEDIUM WET GREY COARSE GRAINED SAND	31	-	-				
-50				-80			
	29	-	-				
-55				-85			
282.5	39	-	-				
BOTTOM OF HOLE = 56.5'.				-90			
DURING DRILLING OPERATIONS IT APPEARED THAT FREE WATER WAS ENCOUNTERED AT 25.5'.							
-60				-95			
DURING DRILLING OPERATIONS WASH OUT PROCEDURES USED FROM 29.0' TO 56.5'.							
-65							
-70							

BRIDGE FOUNDATION BORING LOG

PROJECT -
ROUTE F.A. 132
SEC. 103A-B
COUNTY POPE

BRIDGE STRUCTURE CARRYING F.A. ROUTE 132 OVER BAY CREEK
STA. 896+46

Date OCTOBER, 1979
Bored By JOHN R. HAYDEN
Checked By GARY L. PULLEY

Boring No. 3-S
Station 897+95
Offset 12' LT. CL

Surface Water El. NONE
Groundwater El. at Completion 342.0
After - Hours -

	Elevation	N	Qu t/s.f.	w (%)
Ground Surface	350.0 0			
MEDIUM VERY MOIST BROWN MOTTLED GREY SILTY CLAY LOAM A-4 & GRAVEL				
		4	1.1S	31
	344.5 -5			
MEDIUM TO STIFF VERY MOIST GREY SILTY CLAY TO SILTY CLAY LOAM A-6		2	1.2S	29
		6	1.6S	22
	339.5 -10			
MEDIUM VERY MOIST GREY CLAY A-7-6		5	0.8S	39
	337.0			
MEDIUM VERY MOIST GREY SILTY CLAY A-6		3	0.7B	28
	-15 334.5			
SOFT VERY MOIST GREY SILTY CLAY LOAM A-4		2	0.4B	32
	332.0			
MEDIUM VERY MOIST DARK GREY CLAY A-7-6		3	0.7S	63
	-20 329.5			
MEDIUM VERY MOIST GREY STREAKED BLACK & BROWN CLAY A-7-6		4	0.8S	50
SEE NEXT COLUMN				

	Elevation	N	Qu t/s.f.	w (%)
		3	0.8S	79
	325.0 -25			
STIFF MOIST BLACK, BROWN & GREY PEAT		5	2.0S	-
	322.5			
MEDIUM VERY MOIST GREY SILTY CLAY TO SILTY CLAY LOAM A-6		4	0.8B	28
	-30			
	318.5	3	0.6B	31
MEDIUM WET GREY COARSE GRAINED SAND & GRAVEL		15	-	-
	-35			
		23	-	-
		18	-	-
	-40			
		20	-	-
		27	-	-
SEE NEXT SHEET	-45			

N – Standard Penetration Test – Blows per foot to drive 2" O.D. Split Spoon Sampler 12" with 140# hammer falling 30".

Qu – Unconfined Compressive Strength – t/sf

w – Water Content – percentage of oven dry weight – %.

Type failure:
B – Bulge Failure
S – Shear Failure
E – Estimated Value
P – Penetrometer

BRIDGE FOUNDATION BORING LOG

STRUCTURE CARRYING F.A. ROUTE 132 OVER BAY CREEK
SECTION 103A-B
POPE COUNTY
BORING NO. 3-S

Elevation	N	Qu t/s.f.	w (%)
-45			
	18	-	-
	17	-	-
-50			
	30	-	-
	23	-	-
-55			
	21	-	-
-60			
289.5			
VERY DENSE WET GREY COARSE GRAINED SAND 288.5	60	-	-
BOTTOM OF HOLE = 61.5'.			
DURING DRILLING OPERATIONS IT APPEARED THAT FREE WATER WAS ENCOUNTERED AT 31.5'.			
DURING DRILLING OPERATIONS WASH OUT PROCEDURE USED FROM 31.5' TO 60.0'.			
-65			
-70			

SEE PREVIOUS SHEET

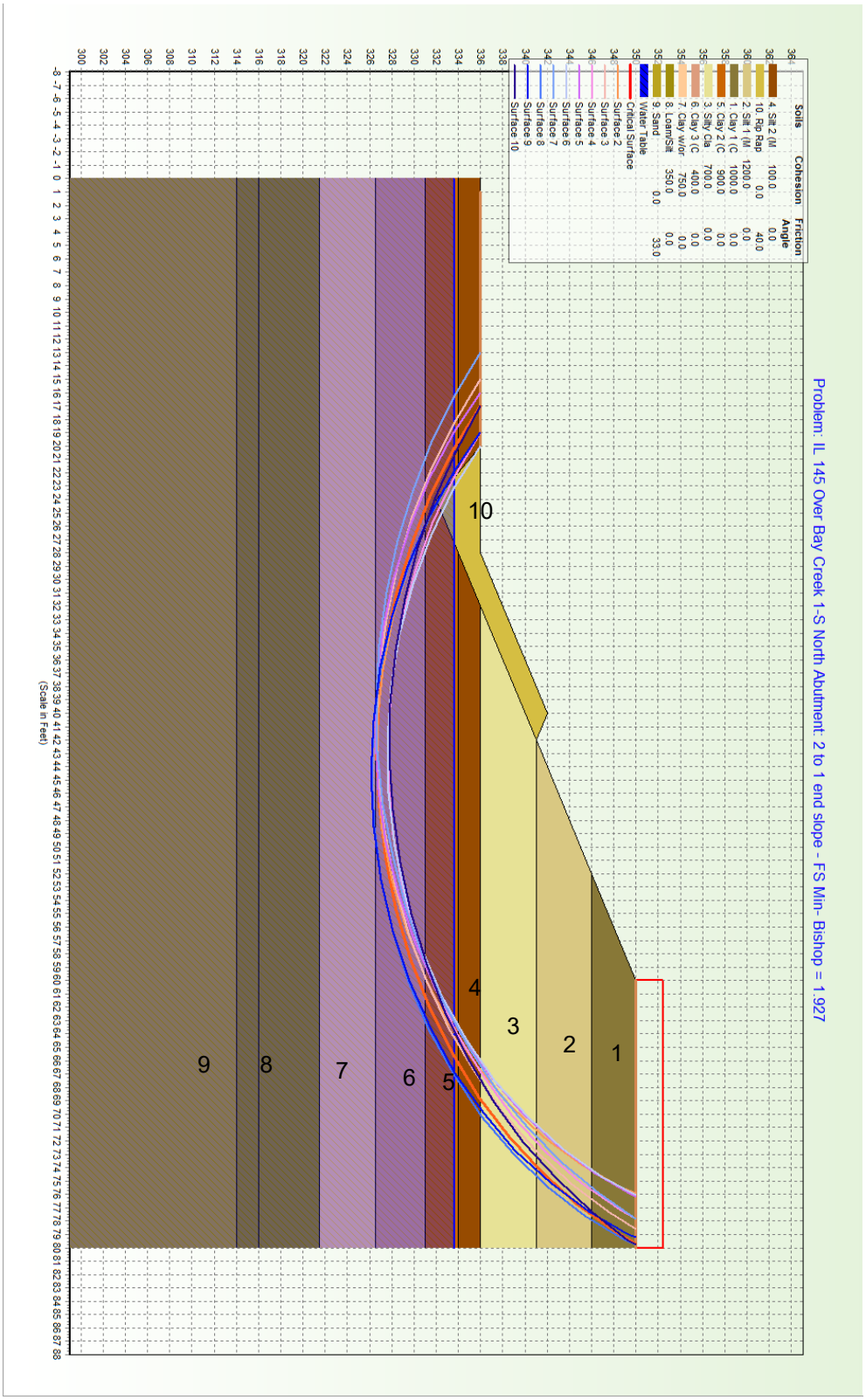
Elevation	N	Qu t/s.f.	w (%)
-75			
-80			
-85			
-90			
-95			

11 Executive Drive, Suite 12 Fairview Heights, Illinois 62208 618-624-8610

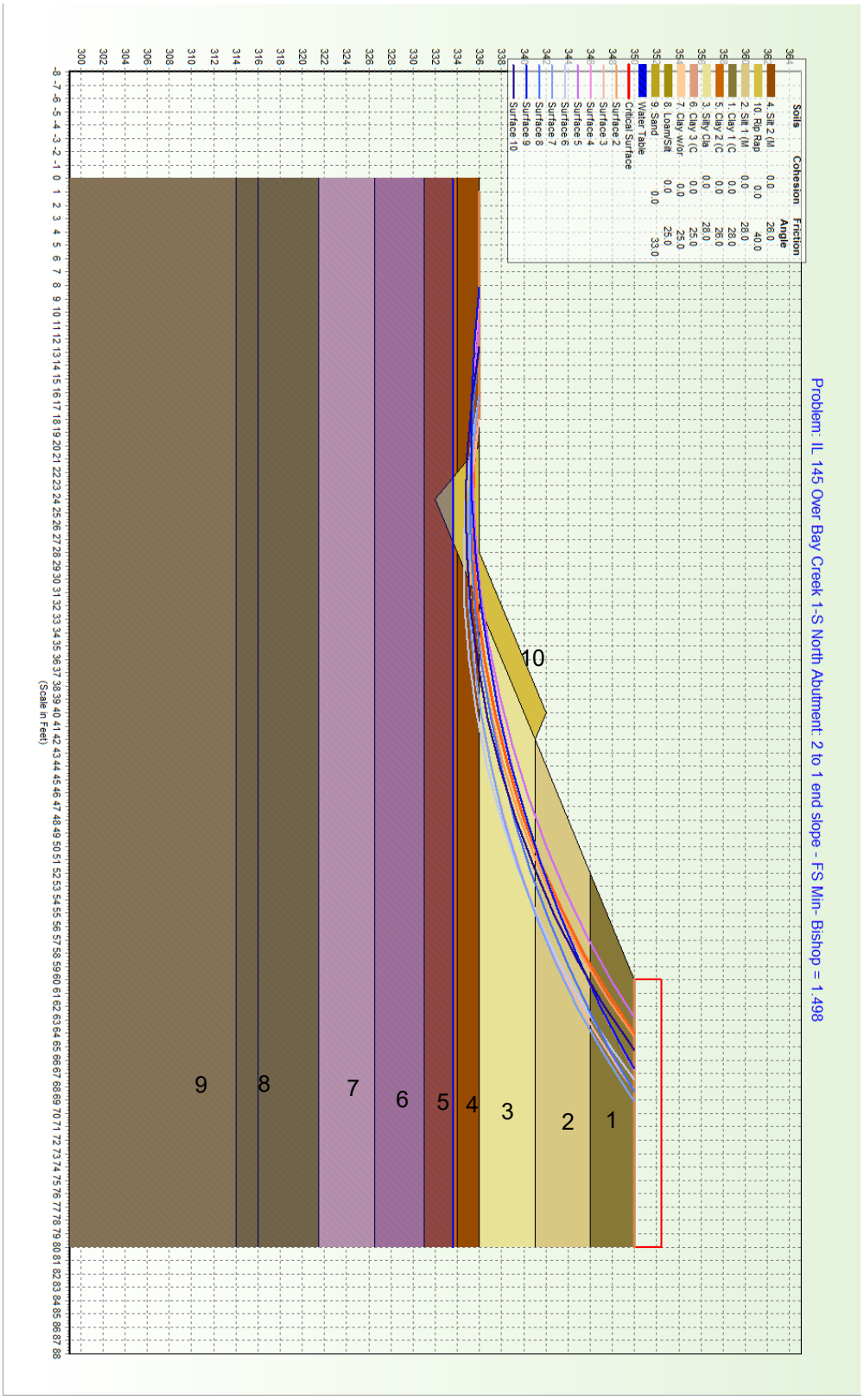
Appendix C:

Summary Stability Profiles

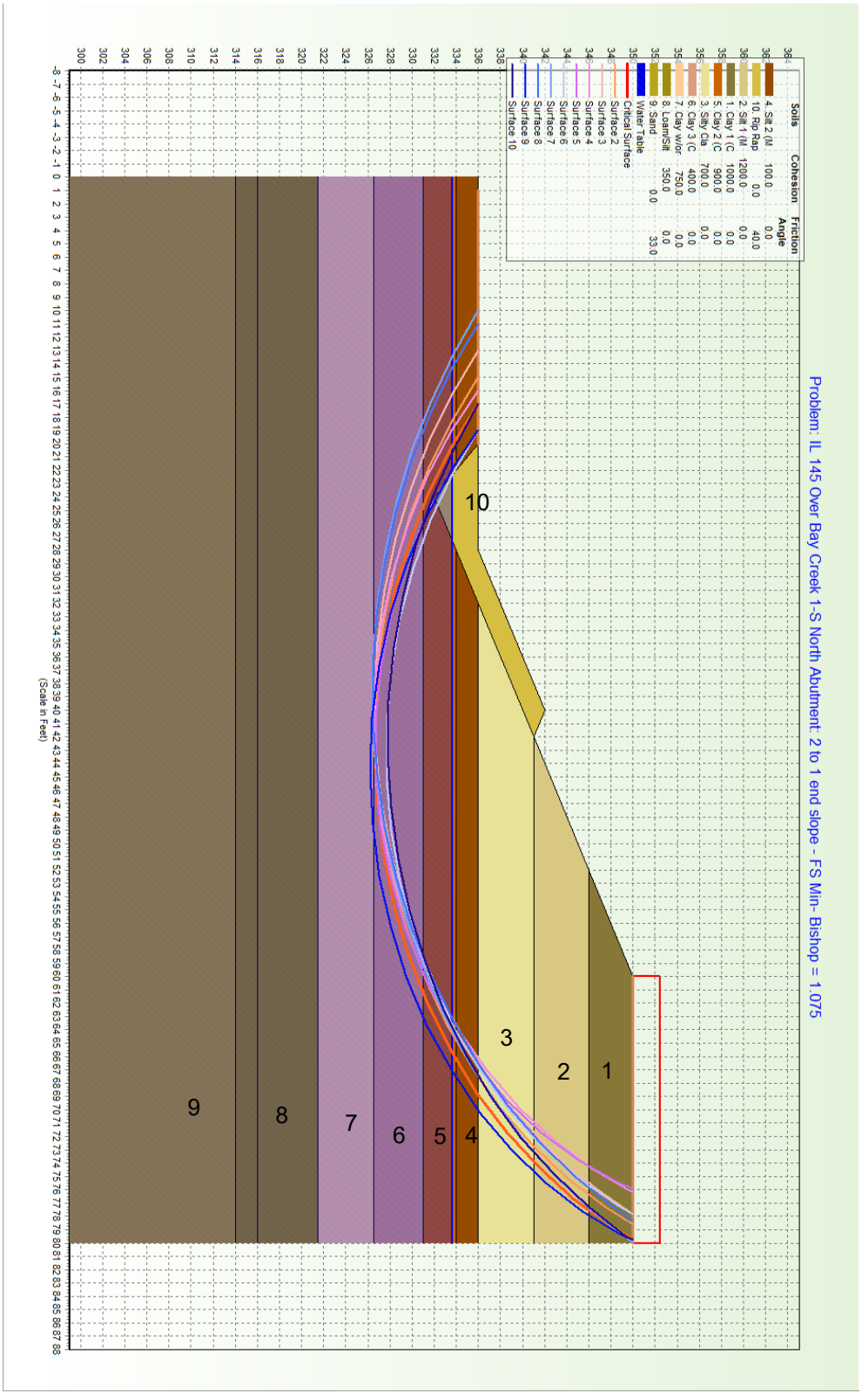
IL 145 over Bay Creek 1-S North Abutment- End Slope (undrained condition)



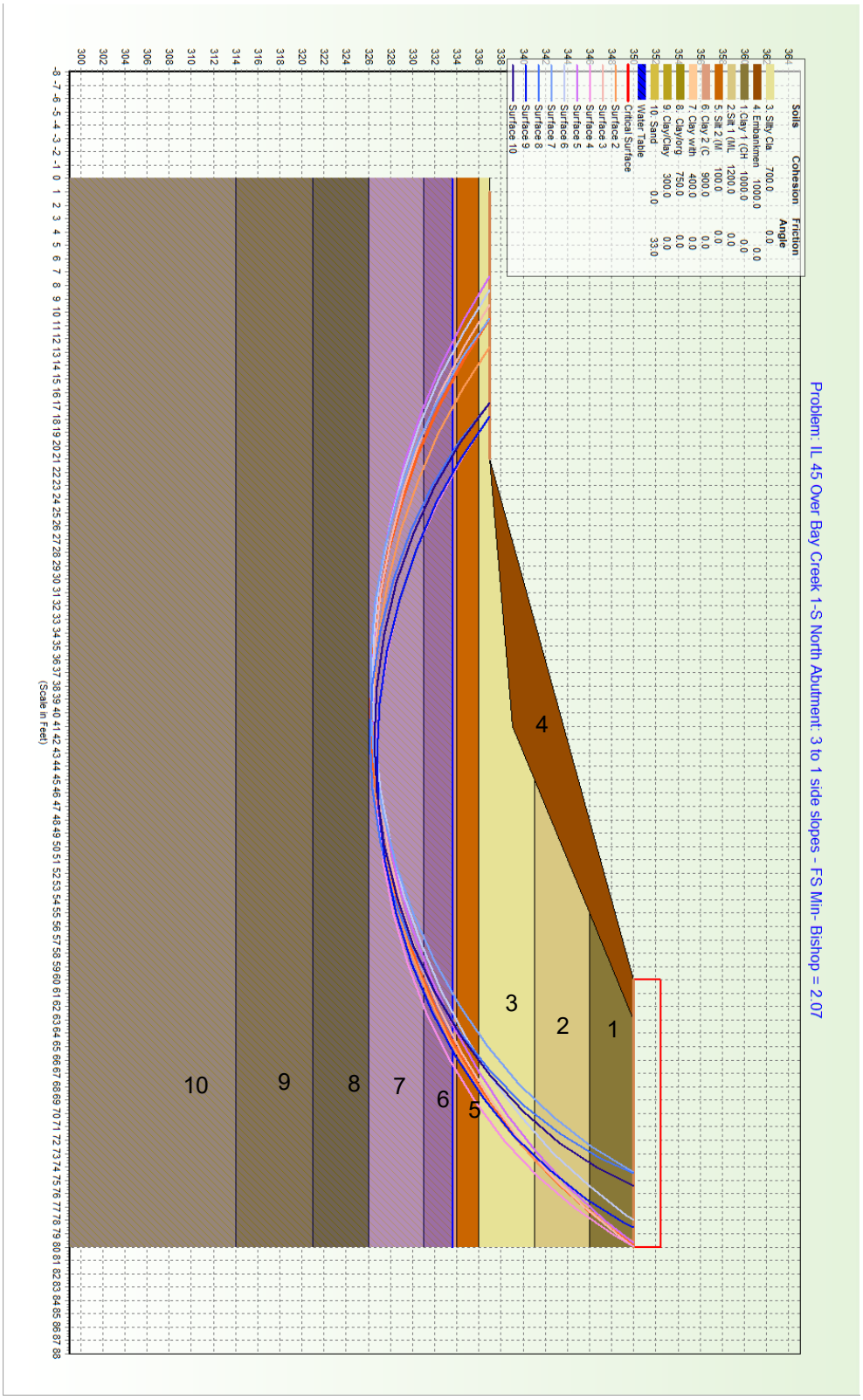
IL 145 over Bay Creek 1-S North Abutment- End Slope (drained condition)



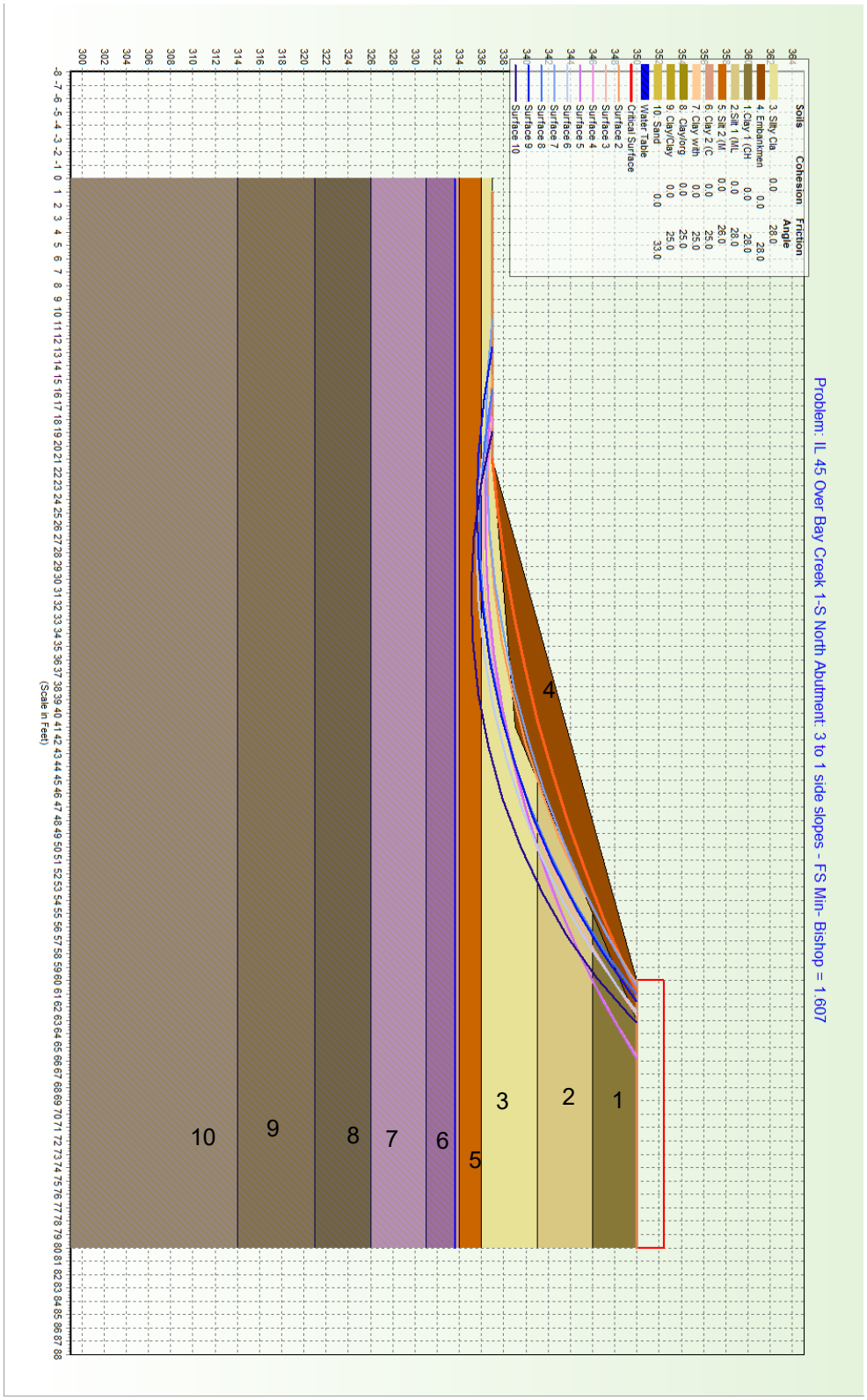
IL 145 over Bay Creek 1-S North Abutment- End Slope (seismic condition)



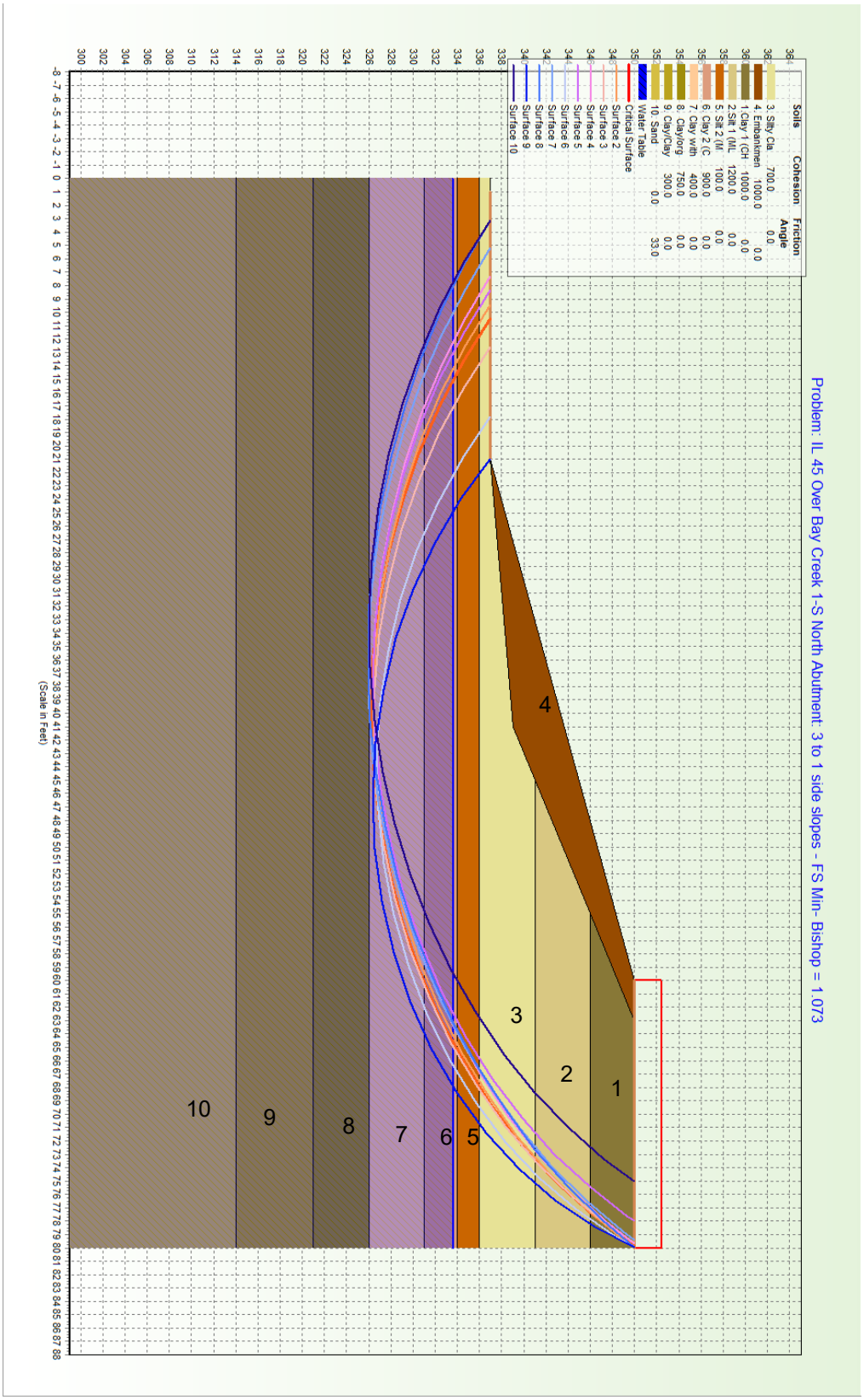
IL 145 over Bay Creek 1-S North Abutment – 3:1 Side Slope (undrained condition)



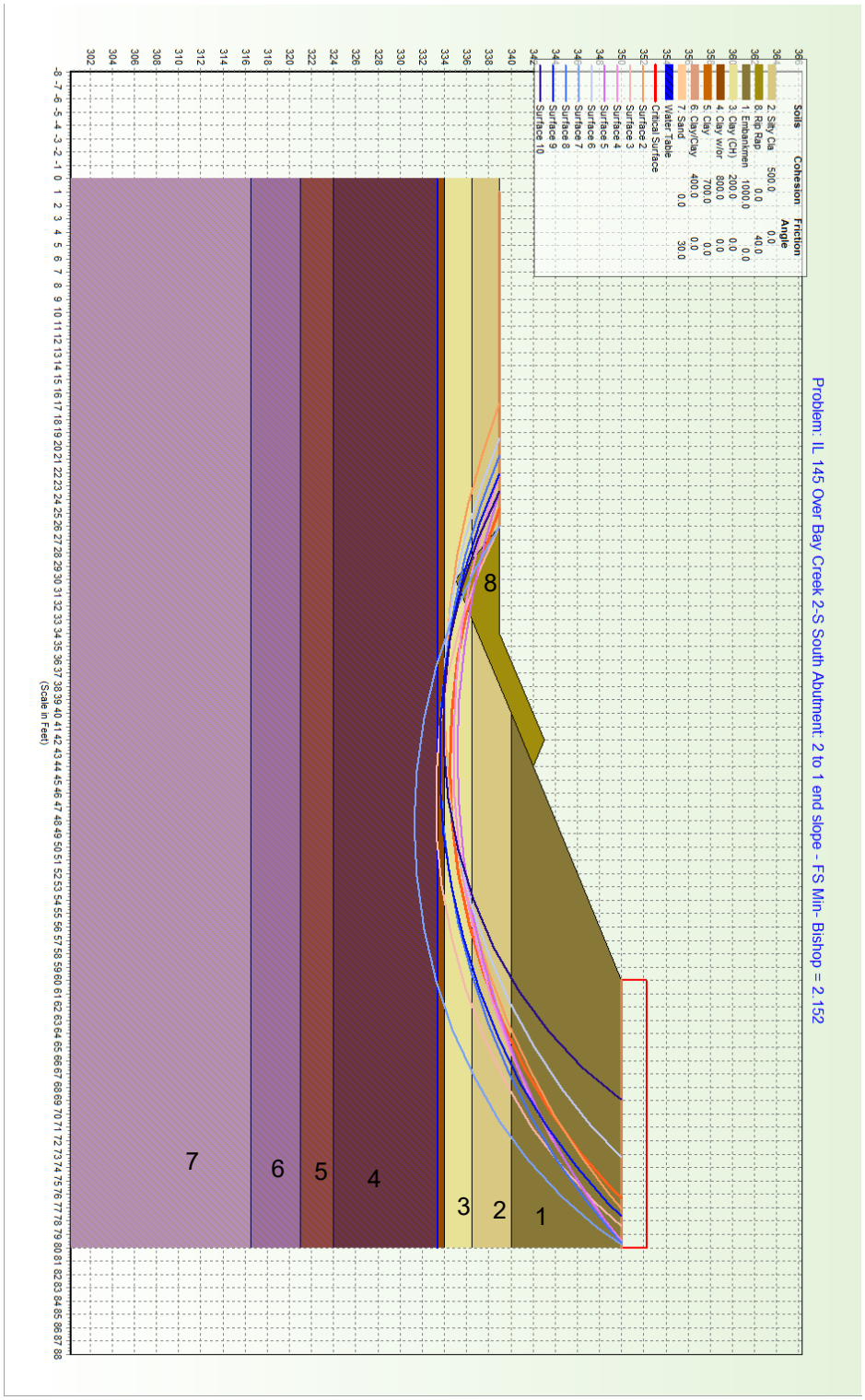
IL 145 over Bay Creek 1-S North Abutment – 3:1 Side Slope (drained condition)



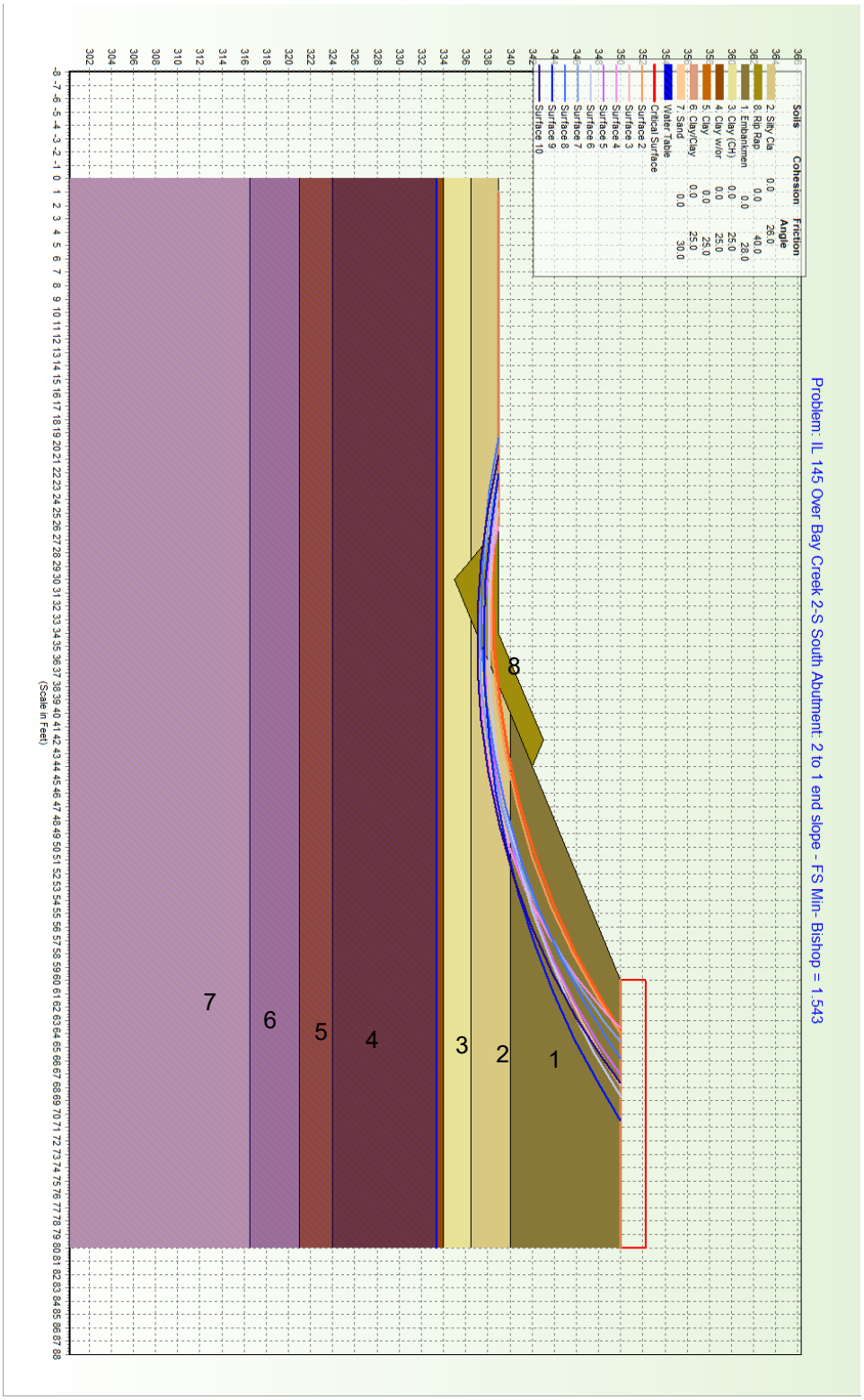
IL 145 over Bay Creek 1-S North Abutment – 3:1 Side Slope (seismic condition)



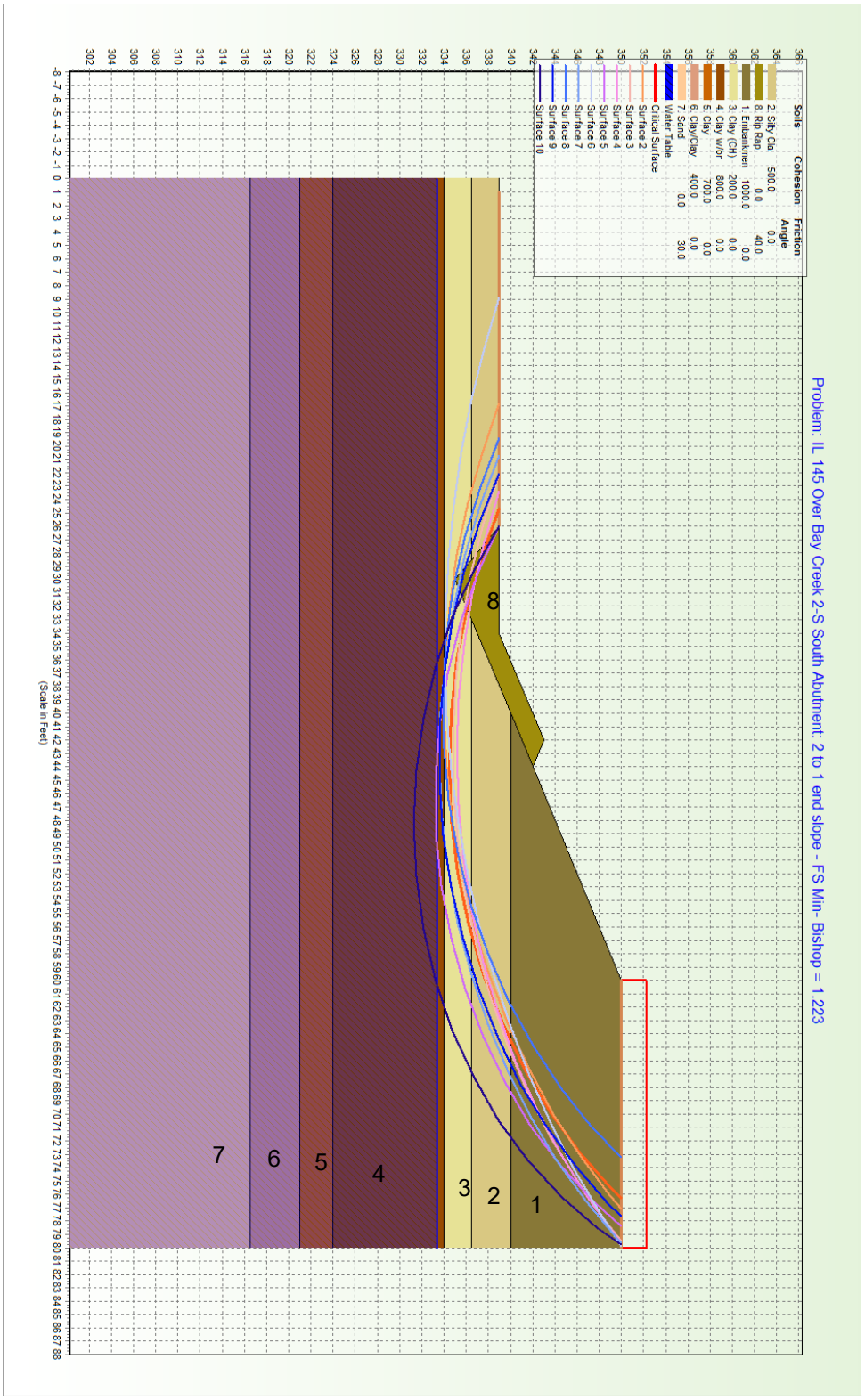
IL 145 over Bay Creek 2-S South Abutment- End Slope (undrained condition)



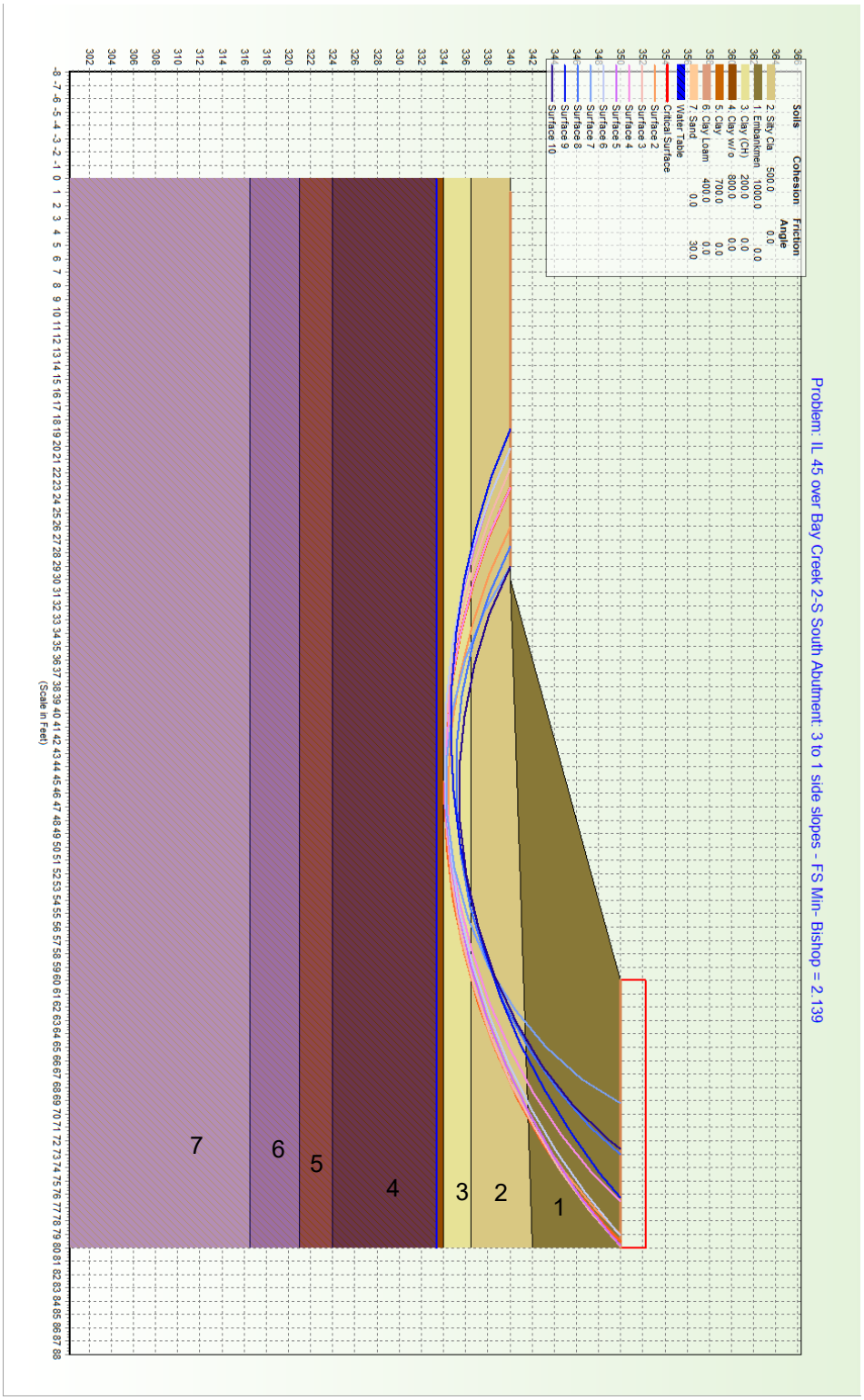
IL 145 over Bay Creek 2-S South Abutment- End Slope (drained condition)



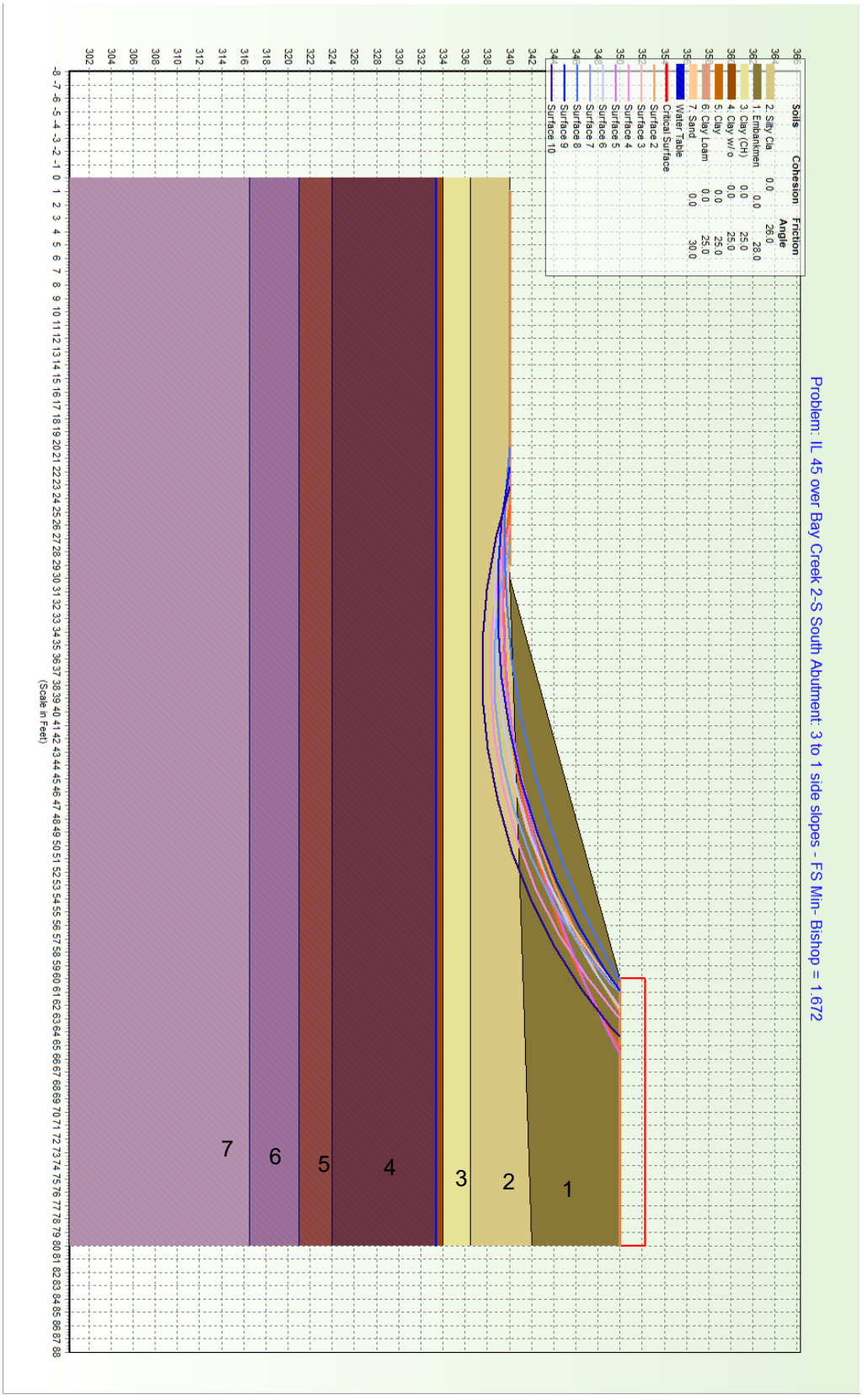
IL 145 over Bay Creek 2-S South Abutment- End Slope (seismic condition)



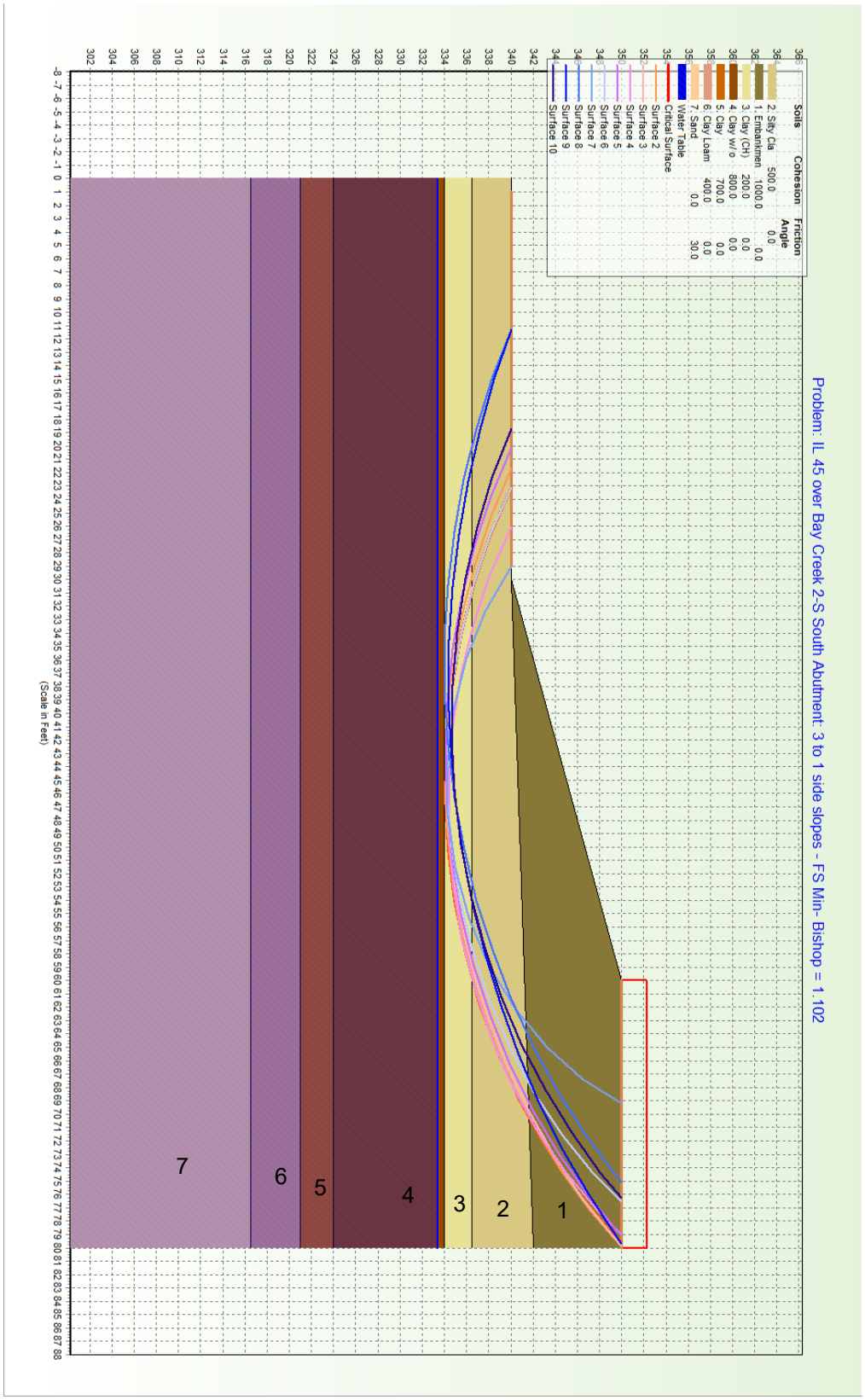
IL 145 over Bay Creek 2-S South Abutment 3:1 Side Slope (undrained condition)



IL 145 over Bay Creek 2-S South Abutment 3:1 Side Slope (drained condition)



IL 145 over Bay Creek 2-S South Abutment 3:1 Side Slope (seismic condition)



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Appendix D:

Seismic Site Class and Liquefaction Spreadsheets

SEISMIC SITE CLASS DETERMINATION

M□d□□d□□□12:10:10

Substructure 1

	342.88
	12
	1
	349.9
	336.88

Individual Site Class Definition:

	4
	13
	0.33

Seismic Soil Column Depth (ft)	Bot. Of Sample Elevation	Sample Thick. (ft.)	N	Qu (tsf)	Layer Description Boundary
	347.4	2.50	4	1.50	
	344.9	2.50	4	1.50	
	342.4	2.50	4	1.50	
	341.4	1.00	4	1.50	□
	338.9	2.50	5	0.70	
0.5	336.4	2.50	5	0.70	□
3.0	333.9	2.50	1	0.10	□
5.5	331.4	2.50	1	0.90	□
8.0	328.9	2.50	2	0.50	
10.5	326.4	2.50	1	0.30	□
13.0	323.9	2.50	1	1.20	□
15.5	321.4	2.50	1	0.70	□
18.0	318.9	2.50	1	0.30	□
20.5	316.4	2.50	1	0.40	□
23.0	313.9	2.50	1	0.30	□
25.5	311.4	2.50	6		□
28.0	308.9	2.50	9		
30.5	306.4	2.50	9		
33.0	303.9	2.50	9		
35.5	301.4	2.50	9		
38.0	298.9	2.50	9		
40.5	296.4	2.50	9		□
43.0	293.9	2.50	20		
45.5	291.4	2.50	20		
48.0	288.9	2.50	24		
50.5	286.4	2.50	24		
53.0	283.9	2.50	19		
55.5	281.4	2.50	19		
58.0	278.9	2.50	14		
60.5	276.4	2.50	14		□
63.0	273.9	2.50	21		
65.5	271.4	2.50	21		
68.0	268.9	2.50	15		
70.5	266.4	2.50	15		
73.0	263.9	2.50	11		
75.5	261.4	2.50	11		
78.0	258.9	2.50	11		
80.5	256.4	2.50	11		
83.0	253.9	2.50	11		□
85.5	251.4	2.50	14		
100.0	236.9	14.50	14		□

Substructure 2

	342.88
	12
	2
	350.1
	336.88

Individual Site Class Definition:

	4
	16
	0.38

Seismic Soil Column Depth (ft)	Bot. Of Sample Elevation	Sample Thick. (ft.)	N	Qu (tsf)	Layer Description Boundary
	347.6	2.50	3	0.90	
	345.1	2.50	3	0.90	
	344.1	1.00	3	0.90	□
	341.6	2.50	3	0.60	
0.3	336.6	2.50	3	0.40	R
2.8	334.1	2.50	2	0.20	□
5.3	331.6	2.50	3	0.80	□
7.8	329.1	2.50	1	0.60	
10.3	326.6	2.50	1	0.90	
12.8	324.1	2.50	1	0.80	□
15.3	321.6	2.50	1	0.70	□
17.8	319.1	2.50	1	0.40	□
20.3	316.6	2.50	1	0.40	□
22.8	314.1	2.50	1	0.20	
25.3	311.6	2.50	2		□
27.8	309.1	2.50	24		
30.3	306.6	2.50	24		□
32.8	304.1	2.50	22		
35.3	301.6	2.50	22		□
37.8	299.1	2.50	24		
40.3	296.6	2.50	24		
42.8	294.1	2.50	11		
45.3	291.6	2.50	11		□
47.8	289.1	2.50	16		
50.3	286.6	2.50	16		
52.8	284.1	2.50	22		
55.3	281.6	2.50	22		□
57.8	279.1	2.50	14		
60.3	276.6	2.50	14		□
62.8	274.1	2.50	16		
65.3	271.6	2.50	16		
67.8	269.1	2.50	15		
70.3	266.6	2.50	15		
72.8	264.1	2.50	15		
75.3	261.6	2.50	15		
77.8	259.1	2.50	15		
80.3	256.6	2.50	15		
82.8	254.1	2.50	16		□
100.0	236.9	17.20	15		□

Substructure 3

	336.3
	12
	3
	338.5
	330.3

Individual Site Class Definition:

	5
	16
	0.39

Seismic Soil Column Depth (ft)	Bot. Of Sample Elevation	Sample Thick. (ft.)	N	Qu (tsf)	Layer Description Boundary
	335.5	3.00	14	2.80	□
	333.0	2.50	3	1.00	□
	330.5	2.50	3	0.80	□
2.3	328.0	2.50	2	0.40	□
4.8	325.5	2.50	1	0.70	□
7.3	323.0	2.50	1	0.30	□
9.8	320.5	2.50	1	0.50	□
12.3	318.0	2.50	1	0.50	□
14.8	315.5	2.50	1	0.30	□
17.3	313.0	2.50	2	0.30	□
19.8	310.5	2.50	3		
22.3	308.0	2.50	2		
24.8	305.5	2.50	12		
27.3	303.0	2.50	5		
29.8	300.5	2.50	4		
32.3	298.0	2.50	20		
34.8	295.5	2.50	19		
37.3	293.0	2.50	19		
39.8	290.5	2.50	22		
42.3	288.0	2.50	22		
44.8	285.5	2.50	23		
47.3	283.0	2.50	23		
49.8	280.5	2.50	33		
52.3	278.0	2.50	33		
54.8	275.5	2.50	14		
57.3	273.0	2.50	14		
59.8	270.5	2.50	7		
62.3	268.0	2.50	7		
64.8	265.5	2.50	19		
67.3	263.0	2.50	19		
69.8	260.5	2.50	14		
72.3	258.0	2.50	14		
74.8	255.5	2.50	11		
77.3	253.0	2.50	11		
79.8	250.5	2.50	16		
82.3	248.0	2.50	16		
84.8	245.5	2.50	16		
87.3	243.0	2.50	16		
89.8	240.5	2.50	14		
92.3	238.0	2.50	14		
100.0	230.3	7.70	23		

Substructure 4

	339.3
	12
	4
	339.5
	333.3

Individual Site Class Definition:

	4
	15
	0.22

Seismic Soil Column Depth (ft)	Bot. Of Sample Elevation	Sample Thick. (ft.)	N	Qu (tsf)	Layer Description Boundary
	336.5	3.00	5	0.90	□
	334.0	2.50	1	0.10	□
1.8	331.5	2.50	1	0.30	□
4.3	329.0	2.50	1	0.40	□
6.8	326.5	2.50	1	0.40	□
9.3	324.0	2.50	1	0.50	□
11.8	321.5	2.50	1	0.30	□
14.3	319.0	2.50	1	0.30	□
16.8	316.5	2.50	1	0.30	□
19.3	314.0	2.50	1	0.10	□
21.8	311.5	2.50	1	0.10	□
24.3	309.0	2.50	1		
26.8	306.5	2.50	9		
29.3	304.0	2.50	15		
31.8	301.5	2.50	12		
34.3	299.0	2.50	12		
36.8	296.5	2.50	17		
39.3	294.0	2.50	20		
41.8	291.5	2.50	26		
44.3	289.0	2.50	26		
46.8	286.5	2.50	21		
49.3	284.0	2.50	21		
51.8	281.5	2.50	19		
54.3	279.0	2.50	19		
56.8	276.5	2.50	18		
59.3	274.0	2.50	18		
61.8	271.5	2.50	12		
64.3	269.0	2.50	12		
66.8	266.5	2.50	17		
69.3	264.0	2.50	17		
71.8	261.5	2.50	11		
74.3	259.0	2.50	11		
76.8	256.5	2.50	15		
79.3	254.0	2.50	15		
81.8	251.5	2.50	12		
83.8	249.5	2.00	12		
100.0	233.3	16.20	12		

Substructure 5

Individual Site Class Definition:

Seismic Soil Column Depth (ft)	Bot. Of Sample Elevation	Sample Thick. (ft.)	N	Qu (tsf)	Layer Description Boundary

Global Site Class Definition: Substructures 1 through 4

	4
	15
	0.33

SEISMIC SITE CLASS DETERMINATION

□D□ □□□□□□□□□□□□D□□□□□□□□□□□

Illinois Department of Transportation

LIQUEFACTION ANALYSIS

R□□□R□□□□□□R□□□□□□M□□R□□□□□□

Illinois Department of Transportation

LIQUEFACTION ANALYSIS

R□□□R□□□□□□R□□□□□M□□R□□□□□□

Illinois Department of Transportation

LIQUEFACTION ANALYSIS

R□□□R□□□□□□R□□□□□M□□R□□□□□□

Illinois Department of Transportation

LIQUEFACTION ANALYSIS

R□□□R□□□□□□R□□□□□□M□□R□□□□□□

Illinois Department of Transportation

LIQUEFACTION ANALYSIS

R□□□R□□□□□□R□□□□□M□□R□□□□□□

Illinois Department of Transportation

LIQUEFACTION ANALYSIS

R□□□R□□ □□□□R□□ □□M□□R□□□

Illinois Department of Transportation

LIQUEFACTION ANALYSIS

R□□□R□□ □□□□R□□ □□M□□R□□□

6439 Plymouth Avenue, Suite W-129, St. Louis, Missouri 63133 314-531-3981

Appendix E:

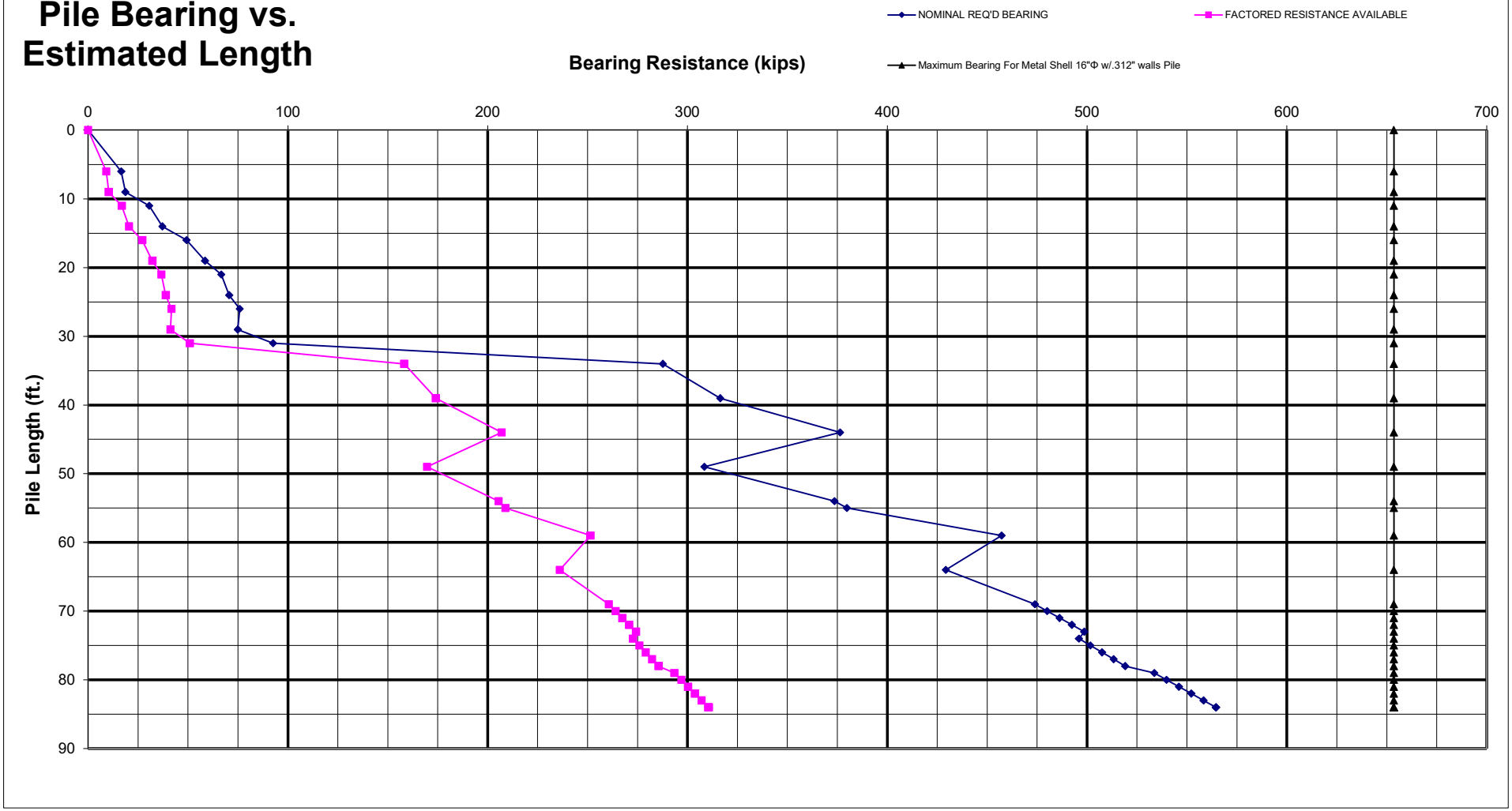
Estimated Pile Length Spreadsheets

Illinois Department of Transportation

IDOT STATIC METHOD OF ESTIMATING PILE LENGTH

□□□□R□□□□R□□□□

Pile Bearing vs. Estimated Length



Pile Design Table for South Abutment utilizing Boring #2-S 2019

Metal Shell 12"Φ w/.25" walls		
11	6	6
13	7	9
21	11	11
26	14	14
34	19	16
42	23	19
48	26	21
52	29	24
56	31	26
56	31	29
66	36	31
176	97	34
201	111	39
213	117	49
254	140	54
258	142	55
299	164	64
329	181	69
334	183	70
338	186	71
343	189	72
347	191	74
352	193	75
356	196	76
360	198	77
365	201	78
374	206	79
378	208	80
383	211	81
388	213	82
Metal Shell 14"Φ w/.25" walls		
14	8	6
16	9	9
25	14	11
32	17	14
42	23	16
50	27	19
57	31	21
61	34	24
66	36	29
79	43	31
229	126	34
256	141	39
259	143	49
311	171	54
317	174	55
362	199	64
399	220	69
405	223	70
410	226	71
415	228	72
419	231	74
425	234	75
430	236	76
435	239	77
440	242	78
452	248	79
457	251	80
Metal Shell 14"Φ w/.312" walls		
14	8	6
16	9	9
25	14	11
32	17	14
42	23	16
50	27	19
57	31	21
61	34	24
66	36	29
79	43	31
229	126	34
256	141	39
259	143	49
311	171	54
317	174	55
362	199	64
399	220	69
405	223	70
410	226	71
415	228	72
419	231	74
425	234	75
430	236	76
435	239	77
440	242	78
452	248	79
457	251	80
462	254	81
468	257	82
473	260	83
479	263	84
Metal Shell 16"Φ w/.312" walls		
17	9	6
19	10	9
31	17	11
37	20	14
49	27	16
58	32	19
67	37	21
71	39	24
75	41	29
93	51	31
288	158	34
308	170	49
374	205	54
380	209	55
429	236	64
474	261	69
480	264	70
486	267	71
492	271	72
496	273	74
502	276	75
507	279	76
513	282	77
519	285	78
534	293	79
540	297	80
546	300	81
552	304	82
558	307	83
564	310	84
Metal Shell 16"Φ w/.375" walls		
17	9	6
19	10	9
31	17	11
37	20	14
49	27	16
58	32	19
67	37	21
71	39	24
75	41	29
93	51	31
288	158	34
308	170	49
374	205	54
380	209	55
429	236	64
474	261	69
480	264	70
486	267	71
492	271	72
496	273	74
502	276	75
507	279	76
513	282	77
519	285	78
534	293	79
540	297	80
546	300	81
552	304	82
558	307	83
564	310	84
Steel HP 8 X 36		
7	4	6
8	4	9
12	6	11
15	8	14
20	11	16
24	13	19
27	15	21
29	16	24
31	17	29
33	18	31
49	27	34
57	32	39
61	33	49
69	38	54
70	38	55
76	42	64
82	45	69
83	45	70
83	46	71
84	46	72
85	47	74
85	47	75
86	47	76
87	48	77
88	48	78
89	49	79
90	50	80
91	50	81
92	50	82
93	51	83
93	51	84

Steel HP 10 X 42		
8	5	6
10	5	9
15	8	11
20	11	14
26	15	16
31	17	19
35	19	21
36	20	24
38	21	29
41	23	31
61	34	34
71	39	39
78	43	49
89	49	54
90	50	55
98	54	64
105	58	69
106	58	70
107	59	71
108	59	72
108	60	74
109	60	75
110	61	76
111	61	77
112	62	78
114	63	79
115	63	80
116	64	81
117	65	82
118	65	83
119	66	84
Steel HP 10 X 57		
8	5	6
10	6	9
15	8	11
20	11	14
27	15	16
32	17	19
36	20	21
37	20	24
38	21	29
42	23	31
63	35	34
73	40	39
80	44	49
92	50	54
93	51	55
100	55	64
108	59	69
109	60	70
110	60	71
111	61	72
111	61	74
112	61	75
113	62	76
114	62	77
115	63	78
117	64	79
118	65	80
119	66	81
120	66	82
121	67	83
122	67	84
Steel HP 12 X 53		
10	5	6
12	7	9
17	10	11
25	14	14
33	18	16
39	21	19
43	24	21
45	25	24
45	25	29
50	28	31
73	40	34
85	47	39
98	54	44
98	54	49
114	63	54
115	63	55
123	68	64
133	73	69
134	74	70
135	74	71
136	75	74
137	76	75
138	76	76
140	77	77
141	77	78
144	79	79
145	80	80
146	81	81
148	81	82
149	82	83
150	82	84
Steel HP 12 X 63		
10	6	6
12	7	9
18	10	11
25	14	14
33	18	16
39	22	19
44	24	21
45	25	24
46	25	29
51	28	31
75	41	34
88	48	39
99	54	49
115	63	54
117	64	55
124	68	64
134	74	69
136	75	70
137	75	71
138	76	74
139	76	75
140	77	76
141	78	77
142	78	78
146	80	79
147	81	80
148	81	81
149	82	82
150	83	83
152	83	84
Steel HP 12 X 74		
10	6	6
13	7	9
18	10	11
26	14	14
34	19	16
40	22	19
45	25	21
46	25	24
46	25	29
51	28	31
77	42	34
89	49	39
101	55	49
117	65	54
119	65	55
126	69	64
137	75	69
138	76	70
139	76	71
140	77	74
141	78	75
142	78	76
143	79	77
144	79	78
148	81	79
149	82	80
150	83	81
152	83	82
153	84	83
154	85	84

Steel HP 12 X 84		
10	6	6
13	7	9
19	10	11
26	14	14
34	19	16
41	22	19
45	25	21
46	25	24
47	26	29
52	29	31
79	43	34
91	50	39
102	56	49
119	65	54
121	66	55
128	71	64
139	76	69
140	77	70
141	78	71
142	78	74
143	79	75
144	79	76
145	80	77
147	81	78
150	83	79
152	83	80
153	84	81
154	85	82
155	85	83
156	86	84
Steel HP 14 X 73		
12	7	6
15	8	9
21	12	11
31	17	14
40	22	16
49	27	19
54	29	21
54	30	29
61	33	31
89	49	34
104	57	39
118	65	44
122	67	49
138	76	54
140	77	55
150	83	59
153	84	64
166	91	69
167	92	70
169	93	71
169	93	74
171	94	75
172	95	76
173	95	77
175	96	78
179	99	79
181	99	80
182	100	81
183	101	82
185	102	83
186	102	84
Steel HP 14 X 89		
12	7	6
15	8	9
22	12	11
32	17	14
40	22	16
49	27	19
54	30	29
61	34	31
92	51	34
106	58	39
121	67	44
124	68	49
140	77	54
142	78	55
153	84	59
155	85	64
168	93	69
170	93	70
171	94	71
172	94	74
173	95	75
174	96	76
176	97	77
177	97	78
182	100	79
183	101	80
185	102	81
186	102	82
187	103	83
189	104	84
Steel HP 14 X 102		
12	7	6
15	9	9
22	12	11
32	18	14
41	22	16
50	27	19
55	30	29
62	34	31
94	52	34
108	59	39
123	68	44
125	69	49
142	78	54
144	79	55
155	85	59
157	87	64
171	94	69
172	95	70
174	95	71
174	96	74
176	97	75
177	97	76
178	98	77
179	99	78
184	101	79
186	102	80
187	103	81
189	104	82
190	104	83
191	105	84
Steel HP 14 X 117		
13	7	6
16	9	9
23	12	11
32	18	14
42	23	16
51	28	19
55	30	29
63	35	31
96	53	34
111	61	39
126	69	44
127	70	49
144	79	54
146	80	55
158	87	59
160	88	64
173	95	69
175	96	70
176	97	71
177	97	74
178	98	75
179	99	76
181	99	77
182	100	78
187	103	79
188	104	80
190	104	81
191	105	82
193	106	83
194	107	84

Illinois Department of Transportation

IDOT STATIC METHOD OF ESTIMATING PILE LENGTH

R R 2019

M 345 18
D R D R 343 18
M R 314 10
r DD 319 10

M R R D
R R R
M R R R R R R
r d d d r d 8
r d d d r d 3

Metal Shell 16"Φ w/.312" walls
4 189
d r 1 396

MAX. REQUIRED BEARING & RESISTANCE for Selected Pile, Soil Profile, & Losses

M R d r	M R d r r	M R r	M Dr r
654	**564**	**413**	***

BOT. OF LAYER ELEV. (FT.)	LAYER THICK. (FT.)	UNCONF. COMPR. STRENGTH (TSF.)	S.P.T. N VALUE (BLOWS)	GRANULAR OR ROCK LAYER DESCRIPTION	ULTIMATE SIDE RESIST. (KIPS)	ULTIMATE END BRG. RESIST. (KIPS)	ULTIMATE TOTAL RESIST. (KIPS)				NOMINAL REQ'D BEARING (KIPS)	NOMINAL GEOTECH. LOSS FROM LIQUEF. & DD (KIPS)	FACTORED GEOTECH. LOSS LOAD FROM DD (KIPS)	SEISMIC RESISTANCE AVAILABLE (KIPS)	ESTIMATED PILE LENGTH (FT.)
339 10	4 08	0 50	3		10 4		***16.6***				17	10	11	5	6
336 60	2 50	0 40	3		5 2	6 1	***18.7***				19	16	17	14	9
334 10	2 50	0 20	2		2 7	3 1	***30.6***				31	18	20	8	11
331 60	2 50	0 80	3		9 7	12 3	***37.2***				37	28	31	22	14
329 10	2 50	0 60	1		7 5	9 2	***49.3***				49	36	39	25	16
326 60	2 50	0 90	1		10 7	13 8	***58.5***				58	46	51	39	19
324 10	2 50	0 80	0		9 7	12 3	***66.6***				67	56	62	51	21
321 60	2 50	0 70	0		8 6	10 7	***70.7***				71	65	71	65	24
319 10	2 50	0 40	0		5 2	6 1	***75.9***				76	70	77	71	26
316 60	2 50	0 40	0		5 2	6 1	***74.9***				75	75	77	77	29
314 10	2 50		0	d	0 0	0 0	***92.5***				93	75	77	59	31
311 60	2 50		2	d	1 8	17 6	***287.7***				288	75	77	136	34
306 60	5 00		24	M d d	46 3	210 9	***316.4***				316	75	77	165	39
301 60	5 00		22	M d d	42 4	193 4	***376.4***				376	75	77	225	44
296 60	5 00		24	M d d	46 3	210 9	***308.4***				308	75	77	157	49
291 60	5 00		11	M d d	21 2	96 7	***373.6***				374	75	77	222	54
290 60	1 00		16	M d d	6 2	140 6	***379.7***				380	75	77	228	55
286 60	4 00		16	M d d	24 7	140 6	***457.2***				457	75	77	305	59
281 60	5 00		22	M d d	42 4	193 4	***429.3***				429	75	77	277	64
276 60	5 00		14	M d d	27 0	123 1	***473.8***				474	75	77	322	69
275 60	1 00		16	M d d	6 2	140 6	***480.0***				480	75	77	328	70
274 60	1 00		16	M d d	6 2	140 6	***486.2***				486	75	77	334	71
273 60	1 00		16	M d d	6 2	140 6	***492.3***				492	75	77	341	72
272 60	1 00		16	M d d	6 2	140 6	***498.5***				499	75	77	347	73
271 60	1 00		16	M d d	6 2	140 6	***495.9***				496	75	77	344	74
270 60	1 00		15	M d d	5 8	131 8	***501.7***				502	75	77	350	75
269 60	1 00		15	M d d	5 8	131 8	***507.5***				507	75	77	356	76
268 60	1 00		15	M d d	5 8	131 8	***513.2***				513	75	77	361	77
267 60	1 00		15	M d d	5 8	131 8	***519.0***				519	75	77	367	78
266 60	1 00		15	M d d	5 8	131 8	***533.6***				534	75	77	382	79
265 60	1 00		16	M d d	6 2	140 6	***539.8***				540	75	77	388	80
264 60	1 00		16	M d d	6 2	140 6	***545.9***				546	75	77	394	81
263 60	1 00		16	M d d	6 2	140 6	***552.1***				552	75	77	400	82
262 60	1 00		16	M d d	6 2	140 6	***558.3***				558	75	77	406	83
261 60	1 00		16	M d d	6 2	140 6	***564.5***				564	75	77	413	84
260 60	1 00		16	M d d		140 6									

Illinois Department of Transportation

IDOT STATIC METHOD OF ESTIMATING PILE LENGTH

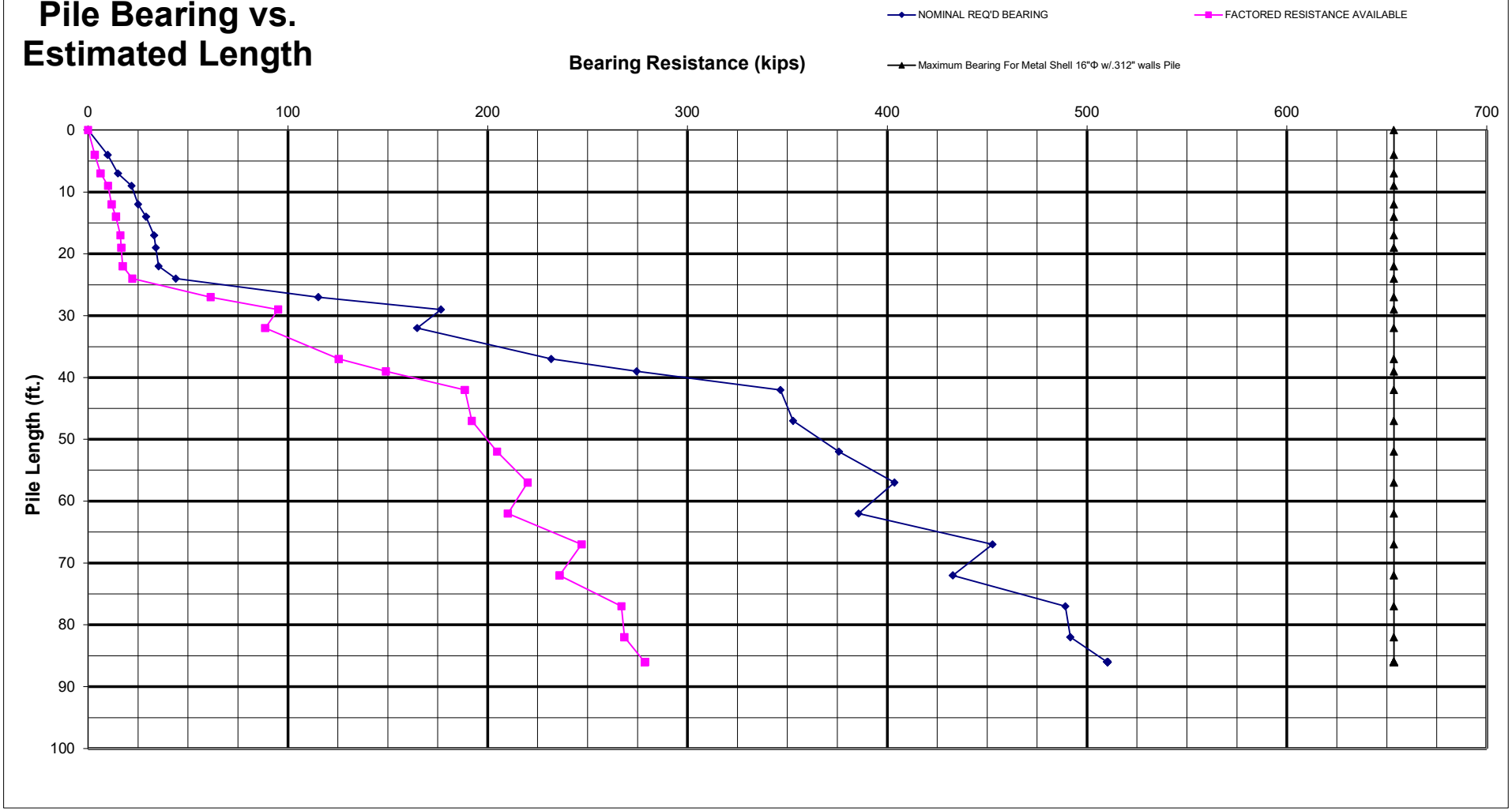
MAX. REQUIRED BEARING & RESISTANCE for Selected Pile, Soil Profile, & Losses

M	M	M	M
R	R	R	Dr
654	**510**	**279**	***

Metal Shell 16"Φ w/.312" walls

BOT. OF LAYER ELEV. (FT.)	LAYER THICK. (FT.)	UNCONF. COMPR. STRENGTH (TSF.)	S.P.T. N VALUE (BLOWS)	GRANULAR OR ROCK LAYER DESCRIPTION	NOMINAL SIDE RESIST. (KIPS)	NOMINAL END BRG. RESIST. (KIPS)	NOMINAL TOTAL RESIST. (KIPS)				NOMINAL REQ'D BEARING (KIPS)	FACTORED GEOTECH. LOSS FROM SCOUR or DD (KIPS)	FACTORED GEOTECH. LOSS LOAD FROM DD (KIPS)	FACTORED RESISTANCE AVAILABLE (KIPS)	ESTIMATED PILE LENGTH (FT.)
332.00	2.50	0.30			3.7		***9.8***				10	2	0	3	4
329.50	2.50	0.40			5.2	6.1	***15.0***				15	2	0	6	7
327.00	2.50	0.40			5.2	6.1	***21.7***				22	2	0	10	9
324.50	2.50	0.50			6.4	7.7	***25.0***				25	2	0	12	12
322.00	2.50	0.30			4.0	4.6	***29.0***				29	2	0	14	14
319.50	2.50	0.30			4.0	4.6	***33.0***				33	2	0	16	17
317.00	2.50	0.30			4.0	4.6	***33.9***				34	2	0	17	19
314.50	2.50	0.10			1.4	1.5	***35.3***				35	2	0	17	22
312.00	2.50	0.10			1.4	1.5	***43.9***				44	2	0	22	24
309.50	2.50		1	M	1.0	8.8	***115.2***				115	2	0	61	27
307.00	2.50		9	M	8.7	79.1	***176.6***				177	2	0	95	29
304.50	2.50		15	M	14.5	131.8	***164.7***				165	2	0	89	32
299.50	5.00		12	M	23.1	105.5	***231.8***				232	2	0	125	37
297.00	2.50		17	M	16.4	149.4	***274.5***				275	2	0	149	39
294.50	2.50		20	M	19.3	175.8	***346.5***				347	2	0	189	42
289.50	5.00		26	M	50.2	228.5	***352.8***				353	2	0	192	47
284.50	5.00		21	M	40.5	184.6	***375.7***				376	2	0	205	52
279.50	5.00		19	M	36.6	167.0	***403.6***				404	2	0	220	57
274.50	5.00		18	M	34.7	158.2	***385.6***				386	2	0	210	62
269.50	5.00		12	M	23.1	105.5	***452.6***				453	2	0	247	67
264.50	5.00		17	M	32.8	149.4	***432.7***				433	2	0	236	72
259.50	5.00		11	M	21.2	96.7	***489.1***				489	2	0	267	77
254.50	5.00		15	M	28.9	131.8	***491.6***				492	2	0	268	82
250.50	4.00		12	M	18.5	105.5	***510.1***				510	2	0	279	86
249.50	1.00		12	M		105.5									

Pile Bearing vs. Estimated Length



Pile Design Table for Pier 1 utilizing Boring #4-S 2021

□□□ □□□ R□□□□d □□□r□□ □□□□□	□□□□□r□d R□□□□□□□□ □□□□□□□ □□□□□	□□□□ □□□d □□□ □□□□□□ □□□□
Metal Shell 12"Φ w/.25" walls		
6	2	4
10	4	7
15	7	9
18	8	12
21	10	14
24	12	17
25	12	19
26	13	22
31	16	24
72	38	27
104	56	32
146	79	37
173	94	39
217	118	42
230	125	47
250	136	52
269	147	62
306	167	72
342	187	77
349	190	82
363	198	86
Metal Shell 14"Φ w/.25" walls		
8	3	4
12	5	7
18	8	9
21	10	12
25	12	14
28	14	17
29	14	19
31	15	22
37	19	24
92	49	27
133	71	32
186	101	37
221	120	39
278	151	42
289	157	47
311	169	52
326	177	62
368	201	72
414	226	77
419	228	82
435	237	86
Metal Shell 14"Φ w/.312" walls		
8	3	4
12	5	7
18	8	9
21	10	12
25	12	14
28	14	17
29	14	19
31	15	22
37	19	24
92	49	27
133	71	32
186	101	37
221	120	39
278	151	42
289	157	47
311	169	52
326	177	62
368	201	72
414	226	77
419	228	82
435	237	86
Metal Shell 16"Φ w/.312" walls		
10	3	4
15	6	7
22	10	9
25	12	12
29	14	14
33	16	17
34	17	19
35	17	22
44	22	24
115	61	27
165	89	32
232	125	37
275	149	39
347	189	42
353	192	47
376	205	52
386	210	62
433	236	72
489	267	77
492	268	82
510	279	86
Metal Shell 16"Φ w/.375" walls		
10	3	4
15	6	7
22	10	9
25	12	12
29	14	14
33	16	17
34	17	19
35	17	22
44	22	24
115	61	27
165	89	32
232	125	37
275	149	39
347	189	42
353	192	47
376	205	52
386	210	62
433	236	72
489	267	77
492	268	82
510	279	86
Steel HP 8 X 36		
3	1	4
6	2	7
9	4	9
10	5	12
12	6	14
14	7	17
14	7	19
14	7	22
16	8	24
23	12	27
25	13	29
27	14	32
33	17	37
36	19	39
41	22	42
49	26	47
56	30	52
59	32	62
65	35	72
72	39	77
73	39	82
75	40	86

□□□ □□□ R□□□□d □□□r□□ □□□□□	□□□□□r□d R□□□□□□□□ □□□□□□□ □□□□□	□□□□ □□□d □□□ □□□□□□ □□□□
Steel HP 10 X 42		
3	1	4
7	3	7
11	5	9
13	6	12
15	7	14
17	8	17
17	8	19
18	9	22
19	10	24
28	14	27
31	16	29
34	18	32
40	21	37
45	24	39
51	27	42
61	33	47
70	37	52
76	41	62
83	45	72
93	50	82
96	52	86
Steel HP 10 X 57		
3	1	4
7	3	7
11	5	9
13	6	12
16	7	14
18	9	17
18	9	19
18	9	22
20	10	24
29	15	27
33	17	29
35	18	32
42	22	37
47	25	39
53	28	42
63	34	47
72	38	52
78	42	62
85	46	72
95	51	82
98	53	86
Steel HP 12 X 53		
4	1	4
8	3	7
13	6	9
17	8	12
19	9	14
21	10	19
22	11	22
24	12	24
34	17	27
38	20	29
41	21	32
49	25	37
54	28	39
61	32	42
73	39	47
84	45	52
93	50	57
97	52	62
105	56	72
116	63	82
120	65	86
Steel HP 12 X 63		
4	1	4
9	4	7
14	6	9
17	8	12
19	9	14
21	10	19
22	11	22
24	12	24
35	18	27
39	20	29
42	22	32
50	26	37
56	29	39
63	33	42
75	40	47
86	46	52
96	51	57
98	52	62
106	57	72
118	63	82
121	65	86
Steel HP 12 X 74		
4	1	4
9	4	7
14	6	9
17	8	12
19	9	14
21	11	19
22	11	22
24	12	24
35	18	27
40	21	29
43	22	32
51	27	37
57	30	39
65	34	42
77	41	47
87	47	52
97	52	57
99	53	62
107	58	72
119	64	82
123	66	86

□□□ □□□ R□□□□d □□□r□□ □□□□□	□□□□□r□d R□□□□□□□□ □□□□□□□ □□□□□	□□□□ □□□d □□□ □□□□□□ □□□□
Steel HP 12 X 84		
4	1	4
9	4	7
14	6	9
17	8	12
20	10	14
22	11	19
23	11	22
25	12	24
36	18	27
41	21	29
44	23	32
52	28	37
58	31	39
66	35	42
78	42	47
89	47	52
98	53	57
101	54	62
109	59	72
121	65	82
125	67	86
Steel HP 14 X 73		
5	1	4
10	4	7
16	7	9
20	10	12
23	11	14
25	12	19
26	13	22
29	14	24
41	21	27
46	24	29
50	26	32
59	31	37
66	35	39
74	39	42
89	48	47
102	54	52
113	61	57
121	65	62
130	70	72
144	78	82
148	80	86
Steel HP 14 X 89		
5	1	4
11	4	7
16	8	9
21	10	12
24	12	14
25	13	19
26	13	22
29	14	24
42	22	27
48	25	29
51	27	32
61	32	37
68	36	39
77	41	42
91	49	47
104	56	52
116	62	57
123	66	62
132	71	72
146	79	82
150	81	86
Steel HP 14 X 102		
5	1	4
11	4	7
17	8	9
21	10	12
24	12	14
26	13	19
27	13	22
29	15	24
43	22	27
49	25	29
52	27	32
62	33	37
69	37	39
79	42	42
93	50	47
106	57	52
117	63	57
124	67	62
133	72	72
148	80	82
153	82	86
Steel HP 14 X 117		
5	1	4
11	5	7
17	8	9
21	10	12
24	12	14
26	13	19
27	13	22
30	15	24
44	23	27
50	26	29
53	28	32
64	34	37
71	38	39
81	43	42
95	51	47
108	58	52
120	64	57
126	68	62
135	73	72
150	81	82
155	84	86

IDOT STATIC METHOD OF ESTIMATING PILE LENGTH

Illinois Department of Transportation

□□□□R□□□□R□□□□

Illinois Department of Transportation

IDOT STATIC METHOD OF ESTIMATING PILE LENGTH

□□□□R□□□□R□□□□

Pile Design Table for Pier 2 utilizing Boring #3-S 2021

R	R	

Metal Shell 12"Φ w/.25" walls

7	2	5
12	2	7
15	4	10
18	6	12
23	8	17
56	26	25
138	71	27
147	77	30
189	100	35
226	120	40
253	135	55
322	173	60
325	175	65
330	177	70
340	183	73
368	198	74
373	201	75
377	203	76
382	206	77
386	208	78
391	211	79

Metal Shell 14"Φ w/.25" walls

9	3	5
15	3	7
18	5	10
22	7	12
28	10	17
69	33	25
180	94	27
190	99	30
242	128	35
286	152	40
302	161	55
393	211	65
396	213	70
407	219	73
445	240	74
450	243	75
455	246	76

Metal Shell 14"Φ w/.312" walls

9	3	5
15	3	7
18	5	10
22	7	12
28	10	17
69	33	25
180	94	27
190	99	30
242	128	35
286	152	40
302	161	55
393	211	65
396	213	70
407	219	73
445	240	74
450	243	75
455	246	76
461	248	77
466	251	78
472	254	79
477	257	80
491	265	85
509	275	89

Metal Shell 16"Φ w/.312" walls

12	4	5
18	4	7
21	6	10
25	8	12
32	12	17
83	40	25
227	119	27
238	125	30
301	160	35
352	188	40
353	188	55
464	250	65
465	250	70
478	257	73
526	283	74
532	287	75
538	290	76
544	294	77
550	297	78
557	300	79
563	304	80
576	311	85
598	323	89

Metal Shell 16"Φ w/.375" walls

12	4	5
18	4	7
21	6	10
25	8	12
32	12	17
83	40	25
227	119	27
238	125	30
301	160	35
352	188	40
353	188	55
464	250	65
465	250	70
478	257	73
526	283	74
532	287	75
538	290	76
544	294	77
550	297	78
557	300	79
563	304	80
576	311	85
598	323	89
682	369	90
700	379	92
726	394	95

Steel HP 8 X 36

3	1	5
7	1	7
9	2	10
10	3	12
12	4	17
19	8	25
25	11	27
28	13	30
36	17	35
44	22	40
53	27	55
67	35	65
67	35	70
69	36	73
75	39	74
76	39	75
77	40	76
78	40	77
78	41	78
79	41	79
80	42	80
82	43	85
84	44	89
95	50	90
98	51	92
101	53	95
123	65	98
286	157	103

Steel HP 10 X 42

4	1	5
8	2	7
11	3	10
13	4	12
16	6	17
24	10	25
31	14	27
35	16	30
44	21	35
54	27	40
66	34	45
67	34	55
86	44	70
88	46	73
97	51	74
98	51	75
99	52	76
100	52	77
101	53	78
102	53	79
103	54	80
104	55	85
108	56	89
124	65	90
127	67	92
131	69	95
153	81	98
335	181	102

Steel HP 10 X 57

4	1	5
9	2	7
12	3	10
14	5	12
16	6	17
25	11	25
32	15	27
37	17	30
46	22	35
56	28	40
69	35	55
88	46	70
90	47	73
100	52	74
101	52	75
102	53	76
103	53	77
104	54	78
104	55	79
105	55	80
107	56	85
110	58	89
127	67	90
130	68	92
134	71	95
157	84	98
454	250	103

Steel HP 12 X 53

4	1	5
10	2	7
14	4	10
17	6	12
20	7	17
29	13	20
31	13	22
31	13	25
37	17	27
42	20	30
53	26	35
65	32	40
80	40	45
84	43	55
106	55	60
108	56	70
110	57	73
123	64	74
124	65	75
126	66	76
127	66	77
128	67	78
129	68	79
130	68	80
131	69	85
135	71	89
155	82	90
160	85	92
167	88	95
183	97	98
418	227	102

Steel HP 12 X 63

4	1	5
10	2	7
14	4	10
17	6	12
20	7	17
30	13	20
31	14	25
38	18	27
44	20	30
55	27	35
67	33	40
82	42	45
84	43	55
108	56	60
109	56	70
111	58	73
125	65	74
126	66	75
127	66	76
128	67	77
129	68	78
131	68	79
132	69	80
133	69	85
137	72	89
158	84	90
163	86	92
168	89	95
188	100	98
497	273	103

Steel HP 12 X 74

5	1	5
10	2	7
15	5	10
17	6	12
20	8	17
31	14	20
32	14	25
40	18	27
45	21	30
56	27	35
68	34	40
85	43	45
86	44	55
110	57	60
111	57	70
113	59	73
127	66	74
128	67	75
129	68	76
130	68	77
131	69	78
133	69	79
134	70	80
135	71	85
139	73	89
160	85	90
165	87	92
171	91	95

Steel HP 12 X 84

5	1	5
11	2	7
15	5	10
17	6	12
20	8	17
32	14	20
32	14	25
41	19	27
46	22	30
57	28	35
70	35	40
87	44	45
87	44	55
111	58	60
112	58	70
115	60	73
129	67	74
130	68	75
131	69	76
132	69	77
134	70	78
135	71	79
136	71	80
137	72	85
141	74	89
162	86	90
167	89	92
174	92	95
195	104	98
684	365	103

Steel HP 14 X 73

5	1	5
12	3	7
18	6	10
21	7	12
24	9	17
36	16	20
37	16	22
38	17	25
45	21	27
51	24	30
65	31	35
79	39	40
97	49	45
103	52	55
128	67	60
134	69	70
137	71	73
154	81	74
156	82	75
157	82	76
159	83	77
160	84	78
162	85	79
163	85	85
168	88	89
188	99	90
194	102	92
202	107	95
223	118	98
578	318	103

Steel HP 14 X 89

6	1	5
12	3	7
18	6	10
21	7	12
24	9	17
37	16	20
38	17	22
39	17	25
47	22	27
53	25	30
67	33	35
81	41	40
101	51	45
104	53	55
131	68	60
136	70	70
138	72	73
156	82	74
158	83	75
160	84	76
161	84	77
162	85	78
164	86	79
165	87	85
170	89	89
191	101	90
197	104	92
206	109	95
228	121	98
705	388	103

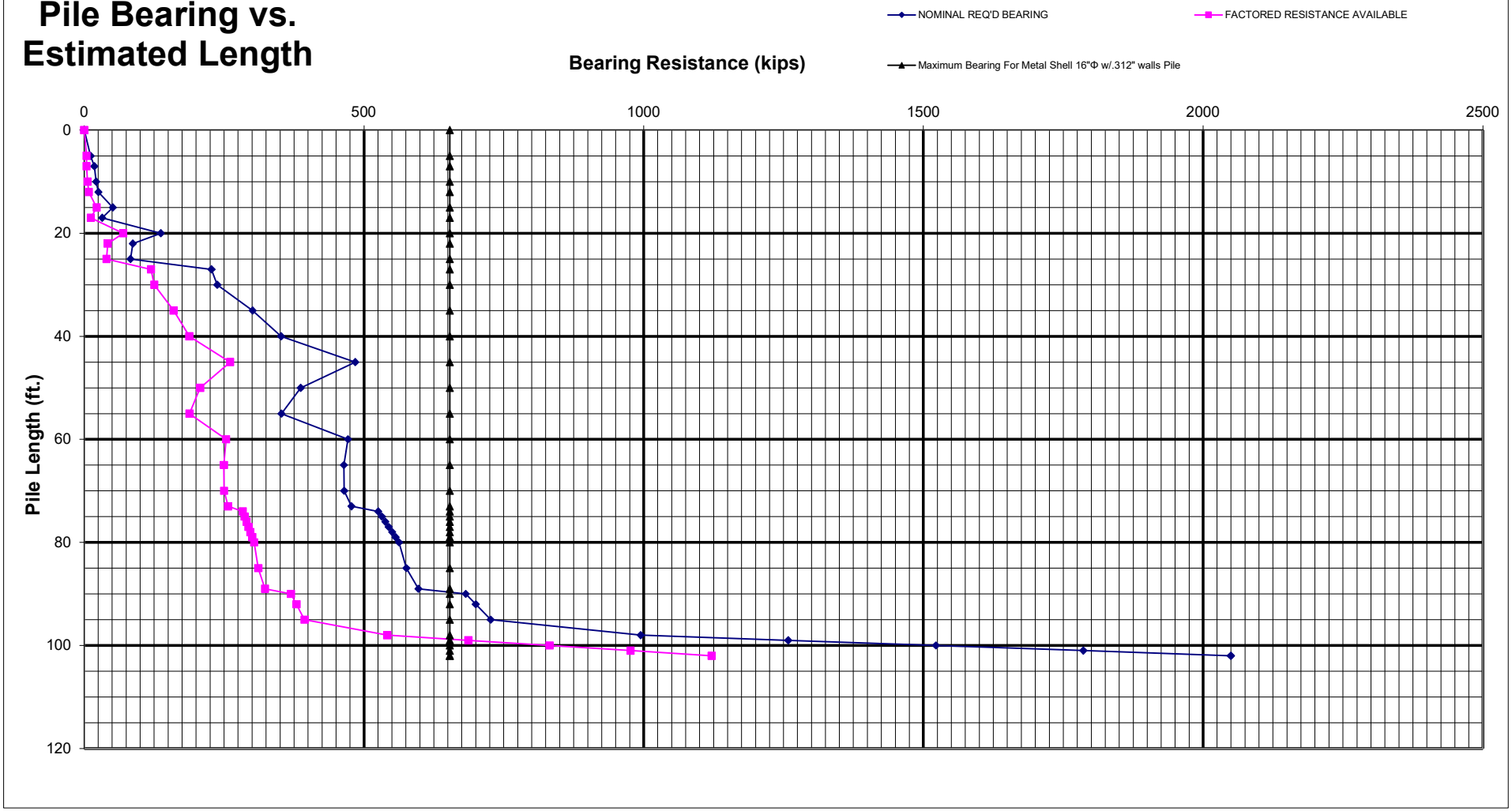
Steel HP 14 X 102

6	2	5
13	3	7
18	6	10
21	7	12
25	9	17
38	17	20
38	17	22
39	17	25
49	23	27
55	26	30
69	34	35
83	42	40
103	53	45
106	54	55
133	69	60
137	71	70
140	73	73
158	83	74
160	84	75
162	85	76
163	86	77
165	86	78
166	87	79
167	88	85
172	91	89
193	102	90
199	105	92
208	110	95
232	124	98
810	445	103

Steel HP 14 X 117

6	2	5
13	3	7
19	6	10
22	8	12
25	10	17
39	17	22
40	18	25
51	24	27
57	27	30
71	35	35
86	43	40
106	54	45
107	55	55
135	70	60
139	72	70
142	74	73
160	84	74
163	85	75
164	86	76
166	87	77
167	88	78
169	88	79
170	89	85
175	92	89

Pile Bearing vs. Estimated Length



Illinois Department of Transportation

IDOT STATIC METHOD OF ESTIMATING PILE LENGTH

MAX. REQUIRED BEARING & RESISTANCE for Selected Pile, Soil Profile, & Losses

M	M	M	M
R	R	R	Dr
654	**598**	**531**	**89**

BOT. OF LAYER ELEV. (FT.)	LAYER THICK. (FT.)	UNCONF. COMPR. STRENGTH (TSF.)	S.P.T. N VALUE (BLOWS)	GRANULAR OR ROCK LAYER DESCRIPTION	ULTIMATE SIDE RESIST. (KIPS)	ULTIMATE END BRG. RESIST. (KIPS)	ULTIMATE TOTAL RESIST. (KIPS)				NOMINAL REQ'D BEARING (KIPS)	NOMINAL GEOTECH. LOSS FROM LIQUEF. & DD (KIPS)	FACTORED GEOTECH. LOSS LOAD FROM DD (KIPS)	SEISMIC RESISTANCE AVAILABLE (KIPS)	ESTIMATED PILE LENGTH (FT.)
322.50	2.50	0.30			4.0		***11.6***				12	4	4	3	5
320.00	2.50	0.50			6.4	7.7	***18.0***				18	10	11	4	7
317.50	2.50	0.50			6.4	7.7	***21.3***				21	17	18	14	10
315.00	2.50	0.30			4.0	4.6	***25.3***				25	21	18	14	12
312.50	2.50	0.30			4.0	4.6	***51.1***				51	25	18	8	15
310.00	2.50		3	d	27.7	26.4	***32.0***				32	27	18	14	17
307.50	2.50	0.30			4.0	4.6	***136.9***				137	31	18	87	20
305.00	2.50		12	d	11.6	105.5	***86.9***				87	43	18	25	22
302.50	2.50		5	d	4.8	43.9	***82.9***				83	48	18	17	25
300.00	2.50		4	d	3.9	35.2	***227.4***				227	48	18	161	27
297.50	2.50		20	d	19.3	175.8	***237.9***				238	48	18	172	30
292.50	5.00		19	d	36.6	167.0	***300.9***				301	48	18	235	35
287.50	5.00		22	d	42.4	193.4	***352.1***				352	48	18	286	40
282.50	5.00		23	d	44.3	202.2	***484.4***				484	48	18	418	45
277.50	5.00		33	d	69.7	290.1	***387.1***				387	48	18	321	50
272.50	5.00		14	d	27.0	123.1	***352.5***				353	48	18	286	55
267.50	5.00		7	d	13.5	61.5	***471.5***				472	48	18	405	60
262.50	5.00		19	d	36.6	167.0	***464.2***				464	48	18	398	65
257.50	5.00		14	d	27.0	123.1	***464.8***				465	48	18	399	70
254.50	3.00		11	d	12.7	96.7	***477.5***				478	48	18	411	73
253.50	1.00		11	d	4.2	96.7	***525.7***				526	48	18	460	74
252.50	1.00		16	d	6.2	140.6	***531.9***				532	48	18	466	75
251.50	1.00		16	d	6.2	140.6	***538.1***				538	48	18	472	76
250.50	1.00		16	d	6.2	140.6	***544.2***				544	48	18	478	77
249.50	1.00		16	d	6.2	140.6	***550.4***				550	48	18	484	78
248.50	1.00		16	d	6.2	140.6	***556.6***				557	48	18	490	79
247.50	1.00		16	d	6.2	140.6	***562.8***				563	48	18	497	80
242.50	5.00		16	d	30.9	140.6	***576.0***				576	48	18	510	85
238.50	4.00		14	d	21.6	123.1	***597.6***				598	48	18	531	89
237.50	1.00		14	d	5.4	123.1	***682.1***				~~682~~	~~48~~	~~18~~	~~616~~	~~90~~
235.50	2.00		23	d	17.7	202.2	***699.9***				~~700~~	~~48~~	~~18~~	~~634~~	~~92~~
232.50	3.00		23	d	26.6	202.2	***726.5***				~~726~~	~~48~~	~~18~~	~~660~~	~~95~~
229.00	3.50		23	d	31.0	202.2	***994.8***				~~995~~	~~48~~	~~18~~	~~929~~	~~98~~
228.00	1.00				263.7	439.5	***1258.5***				~~1259~~	~~48~~	~~18~~	~~1192~~	~~99~~
227.00	1.00				263.7	439.5	***1522.2***				~~1522~~	~~48~~	~~18~~	~~1456~~	~~100~~
226.00	1.00				263.7	439.5	***1785.9***				~~1786~~	~~48~~	~~18~~	~~1720~~	~~101~~
225.00	1.00				263.7	439.5	***2049.6***				~~2050~~	~~48~~	~~18~~	~~1983~~	~~102~~
224.00	1.00					439.5									

Metal Shell 16"Φ w/.312" walls

4.189

1.396

Illinois Department of Transportation

IDOT STATIC METHOD OF ESTIMATING PILE LENGTH

MAX. REQUIRED BEARING & RESISTANCE for Selected Pile, Soil Profile, & Losses

654	**611**	**333**	**94**

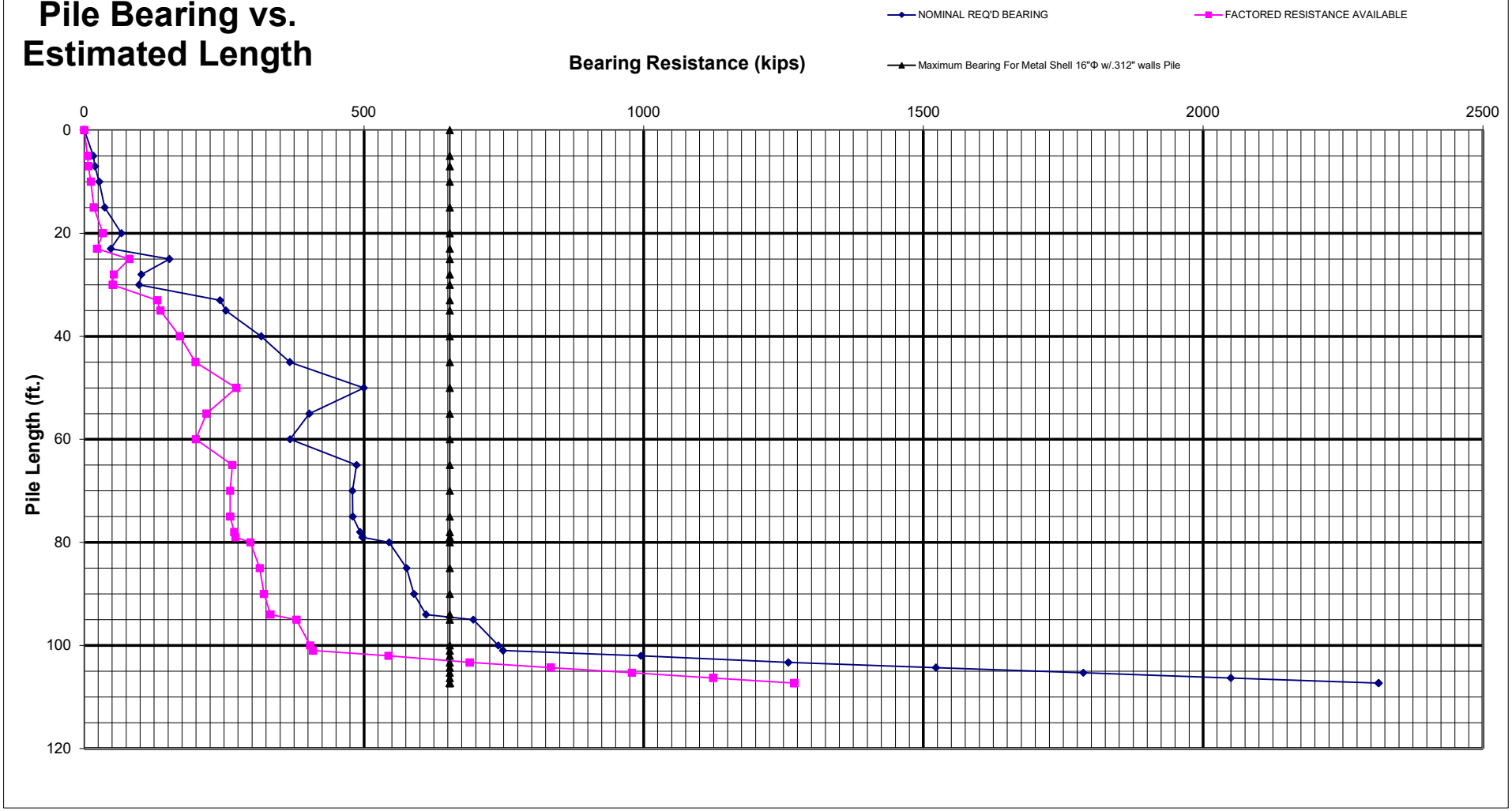
Metal Shell 16"Φ w/.312" walls

4.189

1.396

BOT. OF LAYER ELEV. (FT.)	LAYER THICK. (FT.)	UNCONF. COMPR. STRENGTH (TSF.)	S.P.T. N VALUE (BLOWS)	GRANULAR OR ROCK LAYER DESCRIPTION	NOMINAL SIDE RESIST. (KIPS)	NOMINAL END BRG. RESIST. (KIPS)	NOMINAL TOTAL RESIST. (KIPS)				NOMINAL REQ'D BEARING (KIPS)	FACTORED GEOTECH. LOSS FROM SCOUR or DD (KIPS)	FACTORED GEOTECH. LOSS LOAD FROM DD (KIPS)	FACTORED RESISTANCE AVAILABLE (KIPS)	ESTIMATED PILE LENGTH (FT.)
328.60	2.70	0.40			5.6		***16.3***				16	3	0	6	5
326.00	2.60	0.70			9.0	10.7	***19.2***				19	3	0	7	7
323.00	3.00	0.30			4.8	4.6	***27.0***				27	3	0	12	10
318.00	5.00	0.50			12.8	7.7	***36.7***				37	3	0	17	15
313.00	5.00	0.30			7.9	4.6	***66.4***				66	3	0	33	20
310.50	2.50		3	[illegible]d	2.7	26.4	***47.4***				47	3	0	23	23
308.00	2.50	0.30			4.0	4.6	***152.2***				152	3	0	81	25
305.50	2.50		12	M[illegible]d	11.6	105.5	***102.3***				102	3	0	53	28
303.00	2.50		5	M[illegible]d	4.8	43.9	***98.3***				98	3	0	51	30
300.50	2.50		4	M[illegible]d	3.9	35.2	***242.8***				243	3	0	130	33
298.00	2.50		20	M[illegible]d	19.3	175.8	***253.3***				253	3	0	136	35
293.00	5.00		19	M[illegible]d	36.6	167.0	***316.3***				316	3	0	171	40
288.00	5.00		22	M[illegible]d	42.4	193.4	***367.5***				368	3	0	199	45
283.00	5.00		23	M[illegible]d	44.3	202.2	***499.8***				500	3	0	272	50
278.00	5.00		33	M[illegible]d	69.7	290.1	***402.5***				402	3	0	218	55
273.00	5.00		14	M[illegible]d	27.0	123.1	***367.9***				368	3	0	199	60
268.00	5.00		7	M[illegible]d	13.5	61.5	***486.9***				487	3	0	265	65
263.00	5.00		19	M[illegible]d	36.6	167.0	***479.6***				480	3	0	261	70
258.00	5.00		14	M[illegible]d	27.0	123.1	***480.2***				480	3	0	261	75
255.00	3.00		11	M[illegible]d	12.7	96.7	***492.9***				493	3	0	268	78
254.00	1.00		11	M[illegible]d	4.2	96.7	***497.2***				497	3	0	270	79
253.00	1.00		11	M[illegible]d	4.2	96.7	***545.4***				545	3	0	297	80
248.00	5.00		16	M[illegible]d	30.9	140.6	***576.2***				576	3	0	314	85
243.00	5.00		16	M[illegible]d	30.9	140.6	***589.5***				589	3	0	321	90
239.00	4.00		14	M[illegible]d	21.6	123.1	***611.1***				611	3	0	333	94
238.00	1.00		14	M[illegible]d	5.4	123.1	***695.6***				~~696~~	~~3~~	~~0~~	~~379~~	~~95~~
233.00	5.00		23	M[illegible]d	44.3	202.2	***739.9***				~~740~~	~~3~~	~~0~~	~~404~~	~~100~~
232.00	1.00		23	M[illegible]d	8.9	202.2	***748.8***				~~749~~	~~3~~	~~0~~	~~409~~	~~101~~
231.00	1.00		23	M[illegible]d	8.9	202.2	***995.0***				~~995~~	~~3~~	~~0~~	~~544~~	~~102~~
230.00	1.00			[illegible]	263.7	439.5	***1258.7***				~~1259~~	~~3~~	~~0~~	~~689~~	~~103.3~~
229.00	1.00			[illegible]	263.7	439.5	***1522.4***				~~1522~~	~~3~~	~~0~~	~~834~~	~~104.3~~
228.00	1.00			[illegible]	263.7	439.5	***1786.0***				~~1786~~	~~3~~	~~0~~	~~979~~	~~105.3~~
227.00	1.00			[illegible]	263.7	439.5	***2049.7***				~~2050~~	~~3~~	~~0~~	~~1124~~	~~106.3~~
226.00	1.00			[illegible]	263.7	439.5	***2313.4***				~~2313~~	~~3~~	~~0~~	~~1269~~	~~107.3~~
225.00	1.00			[illegible]		439.5									

Pile Bearing vs. Estimated Length



Pile Design Table for Pier 3 utilizing Boring #3-S 2021

□□□ □□□ R□□□□d □□□r□□ □□□□□	□□□□r□d R□□□□□□□ □□□□□□ □□□□	□□□□ □□d □□ □□□□□ □□□□
Metal Shell 12"Φ w/.25" walls		
10	3	5
14	5	7
19	8	10
27	12	15
35	17	23
67	35	30
149	80	33
159	85	35
201	108	40
238	128	45
264	143	60
334	181	65
337	183	70
342	186	75
352	191	78
355	193	79
383	208	80
Metal Shell 14"Φ w/.25" walls		
13	5	5
16	6	7
23	10	10
32	15	15
41	20	23
82	42	30
193	104	33
203	109	35
256	138	40
299	162	45
315	171	60
406	221	70
410	223	75
421	229	78
424	231	79
Metal Shell 14"Φ w/.312" walls		
13	5	5
16	6	7
23	10	10
32	15	15
41	20	23
82	42	30
193	104	33
203	109	35
256	138	40
299	162	45
315	171	60
406	221	70
410	223	75
421	229	78
424	231	79
462	251	80
489	266	85
502	274	90
521	284	94
Metal Shell 16"Φ w/.312" walls		
16	6	5
19	7	7
27	12	10
37	17	15
47	23	23
98	51	30
243	130	33
253	136	35
316	171	40
368	199	45
368	199	60
480	261	70
480	261	75
493	268	78
497	270	79
545	297	80
576	314	85
589	321	90
611	333	94
Metal Shell 16"Φ w/.375" walls		
16	6	5
19	7	7
27	12	10
37	17	15
47	23	23
98	51	30
243	130	33
253	136	35
316	171	40
368	199	45
368	199	60
480	261	70
480	261	75
493	268	78
497	270	79
545	297	80
576	314	85
589	321	90
611	333	94
696	379	95
740	404	100
749	409	101
Steel HP 8 X 36		
4	1	5
8	3	7
11	5	10
15	7	15
19	9	23
25	13	30
34	17	33
37	19	35
45	23	40
53	28	45
59	31	60
74	39	70
74	39	75
75	40	78
76	40	79
82	44	80
86	46	85
88	47	90
90	48	94
101	54	95
107	58	100
108	58	101
129	70	102
286	156	107

□□□ □□□ R□□□□d □□□r□□ □□□□□	□□□□r□d R□□□□□□□ □□□□□□ □□□□	□□□□ □□d □□ □□□□□ □□□□
Steel HP 10 X 42		
5	1	5
10	4	7
15	6	10
19	9	15
23	11	23
32	16	30
42	22	33
46	24	35
55	29	40
65	34	45
75	40	60
94	50	75
96	51	78
96	51	79
106	56	80
110	59	85
112	60	90
115	62	94
131	71	95
138	74	100
140	75	101
161	87	102
335	183	106
Steel HP 10 X 57		
5	1	5
10	4	7
15	7	10
19	9	15
24	12	23
33	16	30
44	23	33
48	25	35
57	30	40
67	36	45
77	41	60
96	51	75
98	52	78
99	53	79
108	58	80
113	61	85
114	61	90
118	63	94
135	72	95
142	76	100
143	77	101
165	89	102
454	250	108
Steel HP 12 X 53		
6	1	5
13	5	7
18	8	10
24	11	15
29	14	23
40	20	30
51	26	33
56	29	35
66	35	40
78	41	45
93	49	60
117	63	75
120	64	78
120	64	79
133	72	80
139	75	85
140	75	90
144	77	94
167	90	95
176	95	100
177	96	101
193	104	102
418	228	106
Steel HP 12 X 63		
6	2	5
13	5	7
18	8	10
24	11	15
29	14	23
40	20	30
52	27	33
57	30	35
68	36	40
81	42	45
94	50	60
118	63	75
121	65	78
122	65	79
135	72	80
141	76	85
142	76	90
146	78	94
169	91	95
177	96	100
179	97	101
198	107	102
497	271	107
Steel HP 12 X 74		
7	2	5
13	5	7
19	8	10
24	11	15
30	14	23
41	21	30
54	28	33
59	30	35
70	37	40
82	43	45
95	50	60
120	64	75
123	66	78
124	66	79
137	73	80
143	77	85
144	77	90
148	79	94
172	93	95
180	97	100
182	98	101
201	109	102
589	324	108

□□□ □□□ R□□□□d □□□r□□ □□□□□	□□□□r□d R□□□□□□□ □□□□□□ □□□□	□□□□ □□d □□ □□□□□ □□□□
Steel HP 12 X 84		
7	2	5
14	6	7
19	8	10
25	12	15
30	15	23
42	21	30
55	28	33
60	31	35
71	37	40
84	44	45
97	51	60
122	65	75
125	67	78
125	67	79
139	75	80
145	78	85
146	78	90
150	81	94
175	94	95
183	99	100
185	100	101
205	111	102
664	365	108
Steel HP 14 X 73		
7	2	5
16	7	7
22	10	10
29	14	15
35	17	23
50	25	30
62	32	33
68	35	35
81	42	40
95	50	45
114	60	50
114	60	60
145	77	75
148	79	78
149	79	79
167	89	80
173	93	90
178	96	94
203	110	95
218	118	100
221	119	101
234	126	102
578	316	107
Steel HP 14 X 89		
8	2	5
16	7	7
22	10	10
29	14	15
36	17	23
50	25	30
64	33	33
70	36	35
83	44	40
98	52	45
115	61	60
147	78	75
150	80	78
151	81	79
169	91	80
176	94	90
181	97	94
207	112	95
222	120	100
225	121	101
240	130	102
705	388	108
Steel HP 14 X 102		
8	2	5
17	7	7
22	10	10
30	14	15
36	18	23
51	26	30
65	34	33
71	37	35
85	45	40
100	53	45
117	62	60
149	80	75
152	81	78
153	82	79
171	92	80
178	96	90
183	98	94
209	113	95
224	121	100
227	123	101
244	132	102
810	445	108
Steel HP 14 X 117		
8	2	5
17	7	7
23	10	10
30	14	15
36	18	23
52	26	30
67	35	33
73	38	35
87	46	40
102	54	45
118	63	60
151	81	75
154	82	78
155	83	79
174	93	80
181	97	90
186	100	94
213	115	95
227	123	100
230	124	101
250	135	102
929	511	108

Illinois Department of Transportation

IDOT STATIC METHOD OF ESTIMATING PILE LENGTH

MAX. REQUIRED BEARING & RESISTANCE for Selected Pile, Soil Profile, & Losses

M	M	M	M
R	R	R	Dr
654	**611**	**512**	**94**

BOT. OF LAYER ELEV. (FT.)	LAYER THICK. (FT.)	UNCONF. COMPR. STRENGTH (TSF.)	S.P.T. N VALUE (BLOWS)	GRANULAR OR ROCK LAYER DESCRIPTION	ULTIMATE SIDE RESIST. (KIPS)	ULTIMATE END BRG. RESIST. (KIPS)	ULTIMATE TOTAL RESIST. (KIPS)				NOMINAL REQ'D BEARING (KIPS)	NOMINAL GEOTECH. LOSS FROM LIQUEF. & DD (KIPS)	FACTORED GEOTECH. LOSS LOAD FROM DD (KIPS)	SEISMIC RESISTANCE AVAILABLE (KIPS)	ESTIMATED PILE LENGTH (FT.)
328.60	2.70	0.40			5.6		***16.3***				16	6	6	5	5
326.00	2.60	0.70			9.0	10.7	***19.2***				19	15	16	11	7
323.00	3.00	0.30			4.8	4.6	***27.0***				27	19	21	14	10
318.00	5.00	0.50			12.8	7.7	***36.7***				37	32	35	31	15
313.00	5.00	0.30			7.9	4.6	***66.4***				66	40	35	9	20
310.50	2.50		3		2.7	26.4	***47.4***				47	43	35	31	23
308.00	2.50	0.30			4.0	4.6	***152.2***				152	47	35	70	25
305.50	2.50		12		11.6	105.5	***102.3***				102	58	35	9	28
303.00	2.50		5		4.8	43.9	***98.3***				98	63	35	0	30
300.50	2.50		4		3.9	35.2	***242.8***				243	63	35	144	33
298.00	2.50		20		19.3	175.8	***253.3***				253	63	35	155	35
293.00	5.00		19		36.6	167.0	***316.3***				316	63	35	218	40
288.00	5.00		22		42.4	193.4	***367.5***				368	63	35	269	45
283.00	5.00		23		44.3	202.2	***499.8***				500	63	35	401	50
278.00	5.00		33		69.7	290.1	***402.5***				402	63	35	304	55
273.00	5.00		14		27.0	123.1	***367.9***				368	63	35	269	60
268.00	5.00		7		13.5	61.5	***486.9***				487	63	35	388	65
263.00	5.00		19		36.6	167.0	***479.6***				480	63	35	381	70
258.00	5.00		14		27.0	123.1	***480.2***				480	63	35	382	75
255.00	3.00		11		12.7	96.7	***492.9***				493	63	35	394	78
254.00	1.00		11		4.2	96.7	***497.2***				497	63	35	399	79
253.00	1.00		11		4.2	96.7	***545.4***				545	63	35	447	80
248.00	5.00		16		30.9	140.6	***576.2***				576	63	35	478	85
243.00	5.00		16		30.9	140.6	***589.5***				589	63	35	491	90
239.00	4.00		14		21.6	123.1	***611.1***				611	63	35	512	94
238.00	1.00		14		5.4	123.1	***695.6***				~~696~~	~~63~~	~~35~~	~~597~~	~~95~~
233.00	5.00		23		44.3	202.2	***739.9***				~~740~~	~~63~~	~~35~~	~~641~~	~~100~~
232.00	1.00		23		8.9	202.2	***748.8***				~~749~~	~~63~~	~~35~~	~~650~~	~~101~~
231.00	1.00		23		8.9	202.2	***995.0***				~~995~~	~~63~~	~~35~~	~~896~~	~~102~~
230.00	1.00				263.7	439.5	***1258.7***				~~1259~~	~~63~~	~~35~~	~~1160~~	~~103.3~~
229.00	1.00				263.7	439.5	***1522.4***				~~1522~~	~~63~~	~~35~~	~~1424~~	~~104.3~~
228.00	1.00				263.7	439.5	***1786.0***				~~1786~~	~~63~~	~~35~~	~~1687~~	~~105.3~~
227.00	1.00				263.7	439.5	***2049.7***				~~2050~~	~~63~~	~~35~~	~~1951~~	~~106.3~~
226.00	1.00				263.7	439.5	***2313.4***				~~2313~~	~~63~~	~~35~~	~~2215~~	~~107.3~~
225.00	1.00					439.5									

Metal Shell 16"Φ w/.312" walls

4.189

1.396

Illinois Department of Transportation

IDOT STATIC METHOD OF ESTIMATING PILE LENGTH

MAX. REQUIRED BEARING & RESISTANCE for Selected Pile, Soil Profile, & Losses

M	M	M	M
R	R	R	Dr
654	**531**	**292**	***

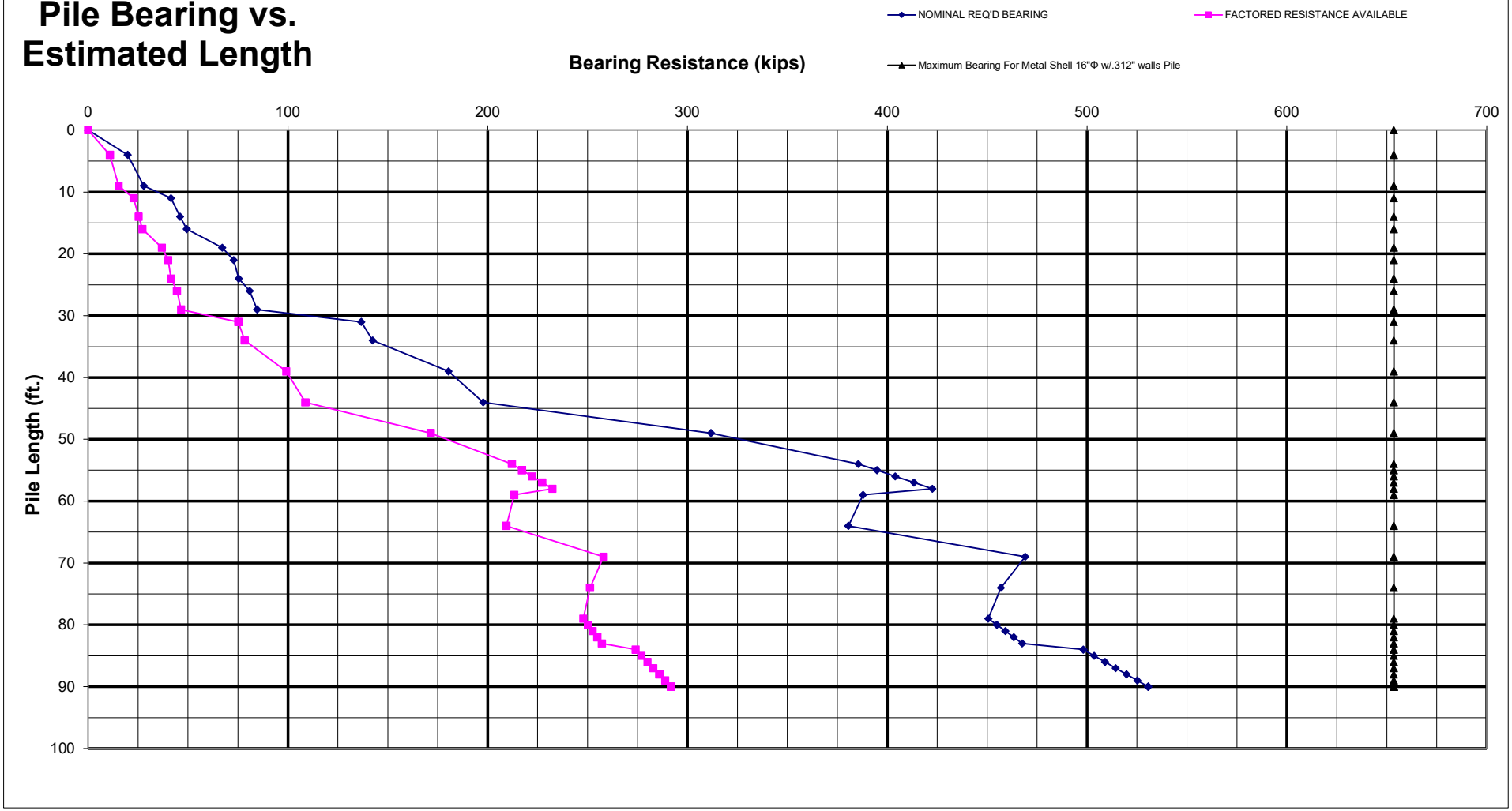
Metal Shell 16"Φ w/.312" walls

4.189

1.396

BOT. OF LAYER ELEV. (FT.)	LAYER THICK. (FT.)	UNCONF. COMPR. STRENGTH (TSF.)	S.P.T. N VALUE (BLOWS)	GRANULAR OR ROCK LAYER DESCRIPTION	NOMINAL SIDE RESIST. (KIPS)	NOMINAL END BRG. RESIST. (KIPS)	NOMINAL TOTAL RESIST. (KIPS)				NOMINAL REQ'D BEARING (KIPS)	FACTORED GEOTECH. LOSS FROM SCOUR or DD (KIPS)	FACTORED GEOTECH. LOSS LOAD FROM DD (KIPS)	FACTORED RESISTANCE AVAILABLE (KIPS)	ESTIMATED PILE LENGTH (FT.)
341.38	1.80	1.10			9.0		***19.8***				20	0	0	11	4
336.38	5.00	0.70			17.3	10.7	***27.8***				28	0	0	15	9
333.88	2.50	0.10			1.4	1.5	***41.5***				41	0	0	23	11
331.38	2.50	0.90			10.7	13.8	***46.0***				46	0	0	25	14
328.88	2.50	0.50			6.4	7.7	***49.3***				49	0	0	27	16
326.38	2.50	0.30			4.0	4.6	***67.1***				67	0	0	37	19
323.88	2.50	1.20			13.4	18.4	***72.9***				73	0	0	40	21
321.38	2.50	0.70			8.6	10.7	***75.4***				75	0	0	41	24
318.88	2.50	0.30			4.0	4.6	***80.9***				81	0	0	44	26
316.38	2.50	0.40			5.2	6.1	***84.5***				85	0	0	47	29
313.88	2.50	0.30			4.0	4.6	***136.7***				137	0	0	75	31
311.38	2.50		6	M	5.8	52.7	***142.4***				142	0	0	78	34
306.38	5.00		6	M	11.6	52.7	***180.4***				180	0	0	99	39
301.38	5.00		9	M	17.4	79.1	***197.7***				198	0	0	109	44
296.38	5.00		9	M	17.4	79.1	***311.8***				312	0	0	171	49
291.38	5.00		20	M	38.6	175.8	***385.5***				385	0	0	212	54
290.38	1.00		24	M	9.3	210.9	***394.7***				395	0	0	217	55
289.38	1.00		24	M	9.3	210.9	***404.0***				404	0	0	222	56
288.38	1.00		24	M	9.3	210.9	***413.3***				413	0	0	227	57
287.38	1.00		24	M	9.3	210.9	***422.5***				423	0	0	232	58
286.38	1.00		24	M	9.3	210.9	***387.8***				388	0	0	213	59
281.38	5.00		19	M	36.6	167.0	***380.5***				381	0	0	209	64
276.38	5.00		14	M	27.0	123.1	***469.0***				469	0	0	258	69
271.38	5.00		21	M	40.5	184.6	***456.8***				457	0	0	251	74
266.38	5.00		15	M	28.9	131.8	***450.6***				451	0	0	248	79
265.38	1.00		11	M	4.2	96.7	***454.8***				455	0	0	250	80
264.38	1.00		11	M	4.2	96.7	***459.0***				459	0	0	252	81
263.38	1.00		11	M	4.2	96.7	***463.3***				463	0	0	255	82
262.38	1.00		11	M	4.2	96.7	***467.5***				468	0	0	257	83
261.38	1.00		11	M	4.2	96.7	***498.1***				498	0	0	274	84
260.38	1.00		14	M	5.4	123.1	***503.5***				504	0	0	277	85
259.38	1.00		14	M	5.4	123.1	***508.9***				509	0	0	280	86
258.38	1.00		14	M	5.4	123.1	***514.3***				514	0	0	283	87
257.38	1.00		14	M	5.4	123.1	***519.7***				520	0	0	286	88
256.38	1.00		14	M	5.4	123.1	***525.1***				525	0	0	289	89
255.38	1.00		14	M	5.4	123.1	***530.5***				531	0	0	292	90
254.38	1.00		14	M		123.1									

Pile Bearing vs. Estimated Length



Pile Design Table for North Abutment utilizing Boring #1-S 2019

Metal Shell 12"Φ w/.25" walls		
13	7	4
21	11	9
29	16	11
33	18	14
36	20	16
47	26	19
53	29	21
56	31	24
60	33	26
63	34	29
93	51	31
97	53	34
120	66	39
133	73	44
201	110	49
250	137	54
257	141	55
260	143	59
262	144	64
317	174	69
318	175	74
320	176	79
323	178	80
326	179	81
329	181	82
333	183	83
351	193	84
355	195	85
359	197	86
363	199	87
367	202	88
371	204	89
375	206	90
Metal Shell 14"Φ w/.25" walls		
16	9	4
24	13	9
35	19	11
39	22	14
43	23	16
57	31	19
63	34	21
65	36	24
70	39	26
73	40	29
114	63	31
119	65	34
149	82	39
164	90	44
254	139	49
314	173	54
319	176	64
384	211	79
387	213	80
391	215	81
395	217	82
399	219	83
422	232	84
427	235	85
432	238	86
437	240	87
441	243	88
446	245	89
451	248	90
Metal Shell 14"Φ w/.312" walls		
16	9	4
24	13	9
35	19	11
39	22	14
43	23	16
57	31	19
63	34	21
65	36	24
70	39	26
73	40	29
114	63	31
119	65	34
149	82	39
164	90	44
254	139	49
314	173	54
319	176	64
384	211	79
387	213	80
391	215	81
395	217	82
399	219	83
422	232	84
427	235	85
432	238	86
437	240	87
441	243	88
446	245	89
451	248	90
Metal Shell 16"Φ w/.312" walls		
20	11	4
28	15	9
41	23	11
46	25	14
49	27	16
67	37	19
73	40	21
75	41	24
81	44	26
85	47	29
137	75	31
142	78	34
180	99	39
198	109	44
312	171	49
381	209	64
451	248	79
455	250	80
459	252	81
463	255	82
468	257	83
498	274	84
504	277	85
509	280	86
514	283	87
520	286	88
525	289	89
531	292	90
Metal Shell 16"Φ w/.375" walls		
20	11	4
28	15	9
41	23	11
46	25	14
49	27	16
67	37	19
73	40	21
75	41	24
81	44	26
85	47	29
137	75	31
142	78	34
180	99	39
198	109	44
312	171	49
381	209	64
451	248	79
455	250	80
459	252	81
463	255	82
468	257	83
498	274	84
504	277	85
509	280	86
514	283	87
520	286	88
525	289	89
531	292	90
Steel HP 8 X 36		
6	3	4
11	6	9
17	9	11
19	10	14
20	11	16
28	15	19
30	16	21
31	17	24
33	18	26
35	19	29
41	23	31
42	23	34
47	26	39
49	27	44
63	35	49
71	39	54
72	40	64
81	45	79
82	45	80
82	45	81
83	46	82
83	46	83
87	48	84
88	48	85
89	49	86
89	49	87
90	50	88
91	50	89
92	50	90

Steel HP 10 X 42		
8	4	4
14	8	9
22	12	11
24	13	14
25	14	16
36	20	19
38	21	21
38	21	24
41	23	26
43	24	29
52	29	31
53	29	34
60	33	39
63	35	44
78	43	49
88	48	54
90	50	55
92	51	56
93	51	64
103	57	79
104	57	80
104	57	81
105	58	82
106	58	83
111	61	84
112	62	85
113	62	86
114	63	87
115	63	88
116	64	89
116	64	90
Steel HP 10 X 57		
8	4	4
14	8	9
22	12	11
25	14	14
26	14	16
37	20	19
39	21	21
39	22	24
42	23	26
44	24	29
54	30	31
55	30	34
62	34	39
64	35	44
80	44	49
90	50	54
93	51	55
95	52	56
95	52	64
105	58	79
106	58	80
107	59	81
107	59	82
108	59	83
114	63	84
115	63	85
116	64	86
117	64	87
117	65	88
118	65	89
119	66	90
Steel HP 12 X 53		
9	5	4
17	10	9
26	14	11
30	17	14
31	17	16
45	25	19
47	26	24
51	28	26
53	29	29
65	36	31
67	37	34
76	42	39
79	44	44
94	52	49
105	58	54
108	59	55
111	61	56
113	62	57
116	64	58
117	64	59
118	65	64
128	71	79
129	71	80
130	71	81
131	72	82
131	72	83
140	77	84
141	77	85
142	78	86
143	78	87
144	79	88
145	80	89
146	80	90
Steel HP 12 X 63		
9	5	4
17	10	9
26	15	11
30	17	14
32	17	16
46	25	19
47	26	24
51	28	26
53	29	29
66	36	31
67	37	34
77	42	39
80	44	44
96	53	49
108	59	54
111	61	55
113	62	56
116	64	57
118	65	58
119	65	64
130	71	79
130	72	80
131	72	81
132	73	82
133	73	83
141	78	84
142	78	85
143	79	86
144	79	87
145	80	88
146	80	89
147	81	90
Steel HP 12 X 74		
10	5	4
18	10	9
27	15	11
31	17	14
32	18	16
46	26	19
48	26	24
52	29	26
54	30	29
67	37	31
68	38	34
78	43	39
81	45	44
98	54	49
110	60	54
113	62	55
115	63	56
118	65	57
120	66	58
121	66	64
132	72	79
132	73	80
133	73	81
134	74	82
135	74	83
143	79	84
144	79	85
145	80	86
146	81	87
147	81	88
148	82	89
149	82	90

Steel HP 12 X 84		
10	5	4
18	10	9
27	15	11
31	17	14
32	18	16
47	26	19
49	27	24
53	29	26
54	30	29
68	37	31
69	38	34
79	44	39
83	46	44
99	55	49
112	61	54
114	63	55
117	64	56
119	66	57
122	67	58
123	67	59
123	68	64
134	73	79
134	74	80
135	74	81
136	75	82
137	75	83
146	80	84
147	81	85
148	81	86
149	82	87
150	82	88
151	83	89
152	83	90
Steel HP 14 X 73		
11	6	4
21	11	9
31	17	11
37	20	14
38	21	16
54	30	19
57	31	24
61	34	26
63	35	29
81	44	31
82	45	34
95	52	39
99	54	44
114	63	49
128	70	54
131	72	55
134	74	56
137	75	57
140	77	58
141	78	59
147	81	64
158	87	79
159	87	80
160	88	81
161	88	82
162	89	83
173	95	84
174	96	85
175	96	86
176	97	87
178	98	88
179	98	89
180	99	90
Steel HP 14 X 89		
11	6	4
21	12	9
32	18	11
38	21	14
38	21	16
55	30	19
57	31	24
62	34	26
64	35	29
82	45	31
83	46	34
96	53	39
100	55	44
116	64	49
131	72	54
134	74	55
137	75	56
140	77	57
143	79	58
144	79	59
149	82	64
160	88	79
161	89	80
162	89	81
163	90	82
164	90	83
175	96	84
176	97	85
178	98	86
179	98	87
180	99	88
181	100	89
183	100	90
Steel HP 14 X 102		
12	6	4
21	12	9
32	18	11
38	21	14
39	21	16
56	31	19
58	32	24
63	35	26
65	36	29
83	46	31
84	46	34
98	54	39
102	56	44
118	65	49
133	73	54
136	75	55
139	77	56
142	78	57
145	80	58
146	80	59
151	83	64
162	89	79
163	90	80
164	90	81
165	91	82
166	91	83
178	98	84
179	98	85
180	99	86
181	100	87
183	100	88
184	101	89
185	102	90
Steel HP 14 X 117		
12	7	4
22	12	9
33	18	11
39	21	14
39	22	16
57	31	19
59	32	24
64	35	26
65	36	29
84	46	31
85	47	34
99	54	39
103	57	44
120	66	49
136	75	54
139	76	55
142	78	56
145	80	57
148	82	58
148	82	59
153	84	64
164	90	79
165	91	80
166	91	81
167	92	82
168	92	83
180	99	84
181	100	85
183	100	86
184	101	87
185	102	88
186	102	89
187	103	90

Illinois Department of Transportation

IDOT STATIC METHOD OF ESTIMATING PILE LENGTH

R R R 1 2019

M M

345 18

343 18

301 40

318 90

Metal Shell 16"Φ w/.312" walls

4 189

1 396

MAX. REQUIRED BEARING & RESISTANCE for Selected Pile, Soil Profile, & Losses

M R d r	M R d r	M R Dr	M Dr
654	**531**	**351**	***

BOT. OF LAYER ELEV. (FT.)	LAYER THICK. (FT.)	UNCONF. COMPR. STRENGTH (TSF.)	S.P.T. N VALUE (BLOWS)	GRANULAR OR ROCK LAYER DESCRIPTION	ULTIMATE SIDE RESIST. (KIPS)	ULTIMATE END BRG. RESIST. (KIPS)	ULTIMATE TOTAL RESIST. (KIPS)				NOMINAL REQ'D BEARING (KIPS)	NOMINAL GEOTECH. LOSS FROM LIQUEF. & DD (KIPS)	FACTORED GEOTECH. LOSS LOAD FROM DD (KIPS)	SEISMIC RESISTANCE AVAILABLE (KIPS)	ESTIMATED PILE LENGTH (FT.)
341 38	1 80	1 10			9 0		***19.8***				20	9	10	1	4
336 38	5 00	0 70			17 3	10 7	***27.8***				28	26	29	27	9
333 88	2 50	0 10			1 4	1 5	***41.5***				41	28	31	17	11
331 38	2 50	0 90			10 7	13 8	***46.0***				46	38	42	35	14
328 88	2 50	0 50			6 4	7 7	***49.3***				49	45	49	45	16
326 38	2 50	0 30			4 0	4 6	***67.1***				67	49	54	35	19
323 88	2 50	1 20			13 4	18 4	***72.9***				73	62	69	58	21
321 38	2 50	0 70			8 6	10 7	***75.4***				75	71	78	73	24
318 88	2 50	0 30			4 0	4 6	***80.9***				81	75	78	72	26
316 38	2 50	0 40			5 2	6 1	***84.5***				85	80	78	73	29
313 88	2 50	0 30			4 0	4 6	***136.7***				137	84	78	25	31
311 38	2 50		6	M d r	5 8	52 7	***142.4***				142	90	78	25	34
306 38	5 00		6	M d r	11 6	52 7	***180.4***				180	101	78	1	39
301 38	5 00		9	M d r	17 4	79 1	***197.7***				198	101	78	18	44
296 38	5 00		9	M d r	17 4	79 1	***311.8***				312	101	78	132	49
291 38	5 00		20	M d r	38 6	175 8	***385.5***				385	101	78	206	54
290 38	1 00		24	M d r	9 3	210 9	***394.7***				395	101	78	215	55
289 38	1 00		24	M d r	9 3	210 9	***404.0***				404	101	78	225	56
288 38	1 00		24	M d r	9 3	210 9	***413.3***				413	101	78	234	57
287 38	1 00		24	M d r	9 3	210 9	***422.5***				423	101	78	243	58
286 38	1 00		24	M d r	9 3	210 9	***387.8***				388	101	78	209	59
281 38	5 00		19	M d r	36 6	167 0	***380.5***				381	101	78	201	64
276 38	5 00		14	M d r	27 0	123 1	***469.0***				469	101	78	290	69
271 38	5 00		21	M d r	40 5	184 6	***456.8***				457	101	78	277	74
266 38	5 00		15	M d r	28 9	131 8	***450.6***				451	101	78	271	79
265 38	1 00		11	M d r	4 2	96 7	***454.8***				455	101	78	275	80
264 38	1 00		11	M d r	4 2	96 7	***459.0***				459	101	78	280	81
263 38	1 00		11	M d r	4 2	96 7	***463.3***				463	101	78	284	82
262 38	1 00		11	M d r	4 2	96 7	***467.5***				468	101	78	288	83
261 38	1 00		11	M d r	4 2	96 7	***498.1***				498	101	78	319	84
260 38	1 00		14	M d r	5 4	123 1	***503.5***				504	101	78	324	85
259 38	1 00		14	M d r	5 4	123 1	***508.9***				509	101	78	330	86
258 38	1 00		14	M d r	5 4	123 1	***514.3***				514	101	78	335	87
257 38	1 00		14	M d r	5 4	123 1	***519.7***				520	101	78	340	88
256 38	1 00		14	M d r	5 4	123 1	***525.1***				525	101	78	346	89
255 38	1 00		14	M d r	5 4	123 1	***530.5***				531	101	78	351	90
254 38	1 00		14	M d r		123 1									

6439 Plymouth Avenue, Suite W-129, St. Louis, Missouri 63133 314-531-3981

Appendix F:

Laboratory Test Results (2021 Borings)

Sieve Analysis Data Sheet

□□□M□D422□63

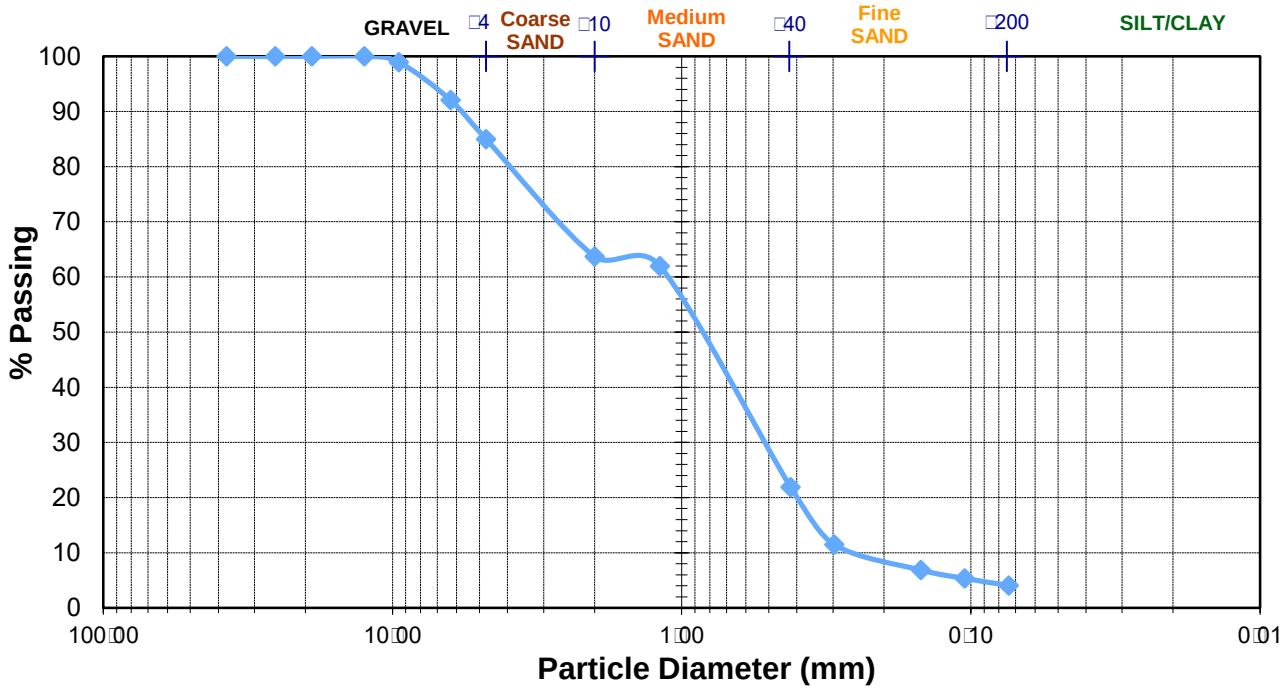
Project Name:	M□19034□09	**Tested By:**	□□□□ □□ □□□□	**Date:**	7□7□2021
Location:	□□145□□ □□r□□ □□□□r□□□	**Checked By:**	□□□□ □□□□□□□r	**Date:**	7□8□2021
Boring No:	3□□	**Sample ID**	□□13		
Sample Depth:	31□32□5□				

IDH Soil Classification: Sand with Gravel

Weight of Container (g): 152□3 **Weight of Container & Soil (g):** 349□1

Weight of Dry Sample (g): 196□8

Sieve Number	Diameter (mm)	Mass of Sieve (g)	Mass of Sieve & Soil (g)	Soil Retained (g)	Soil Retained (%)	Soil Passing (%)
1□5□□□	37□50			0□0	0□0	100□0
1□□□	25□40			0□0	0□0	100□0
3□4□□□	19□00			0□0	0□0	100□0
1□2□□□	12□50			0□0	0□0	100□0
3□8□□□	9□50	527□90	530	2□1	1□1	98□9
1□4□□□	6□30	513□00	526□5	13□5	6□9	92□1
□4	4□75	523□70	537□6	13□9	7□1	85□0
□10	2□00	678□10	720	41□9	21□3	63□7
□16	1□19	421□20	424□6	3□4	1□7	62□0
□40	0□420	564□400	643□3	78□9	40□1	21□9
□50	0□297	497□800	518□3	20□5	10□4	11□5
□100	0□149	518□300	527□4	9□1	4□6	6□9
□140	0□105	333□000	336	3□0	1□5	5□3
□200	0□074	326□100	328□6	2□5	1□3	4□1
Pan		371□1	378□8	7□7	3□9	0□2
			TOTAL:	**196.5**	**99.8**	



□□□□□□

Sieve Analysis Data Sheet

□□□M□D422□63

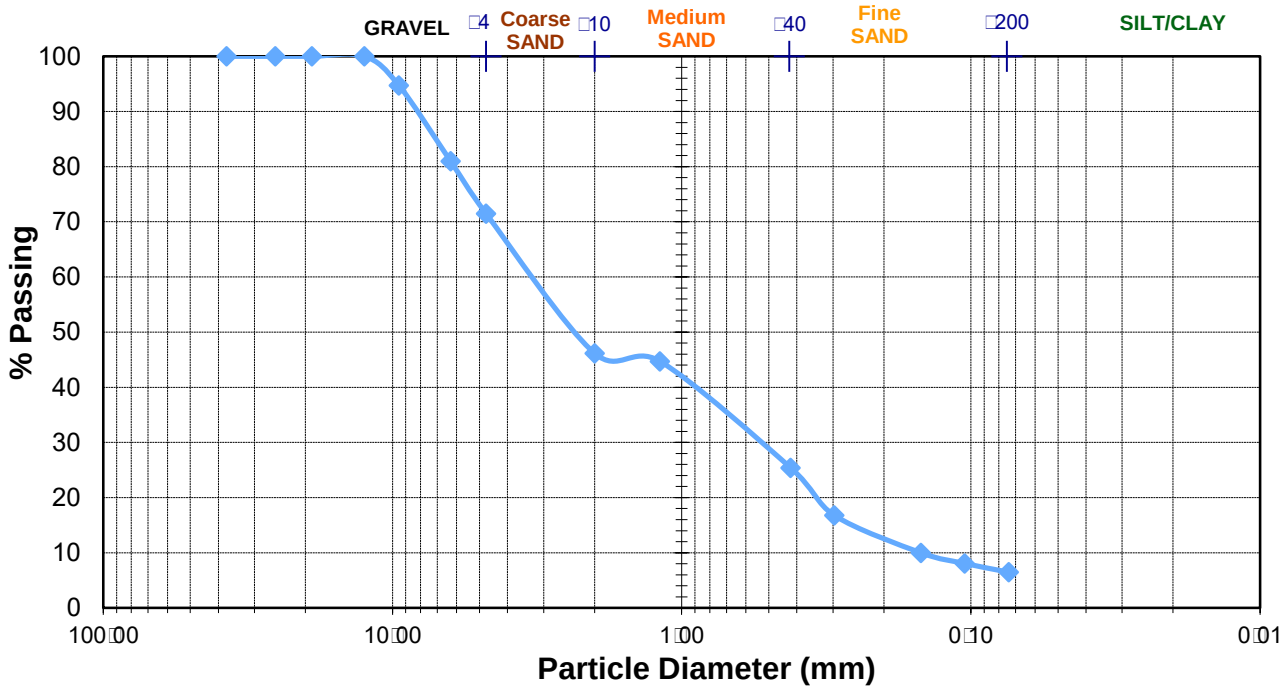
Project Name:	M□19034□09	**Tested By:**	□□□□ □□ □□□□	**Date:**	7□72021
Location:	□□145□□ □□r□□ □□□□r□□□	**Checked By:**	□□□□ □□□□□□□r	**Date:**	7□8□2021
Boring No:	3□□	**Sample ID**	□□15		
Sample Depth:	36□37□5□				

IDH Soil Classification: Sand with Gravel

Weight of Container (g): 151□2 **Weight of Container & Soil (g):** 310□2

Weight of Dry Sample (g): 159□0

Sieve Number	Diameter (mm)	Mass of Sieve (g)	Mass of Sieve & Soil (g)	Soil Retained (g)	Soil Retained (%)	Soil Passing (%)
1□5□□□	37□50			0□0	0□0	100□0
1□□□	25□40			0□0	0□0	100□0
3□4□□□	19□00			0□0	0□0	100□0
1□2□□□	12□50			0□0	0□0	100□0
3□8□□□	9□50	527□80	536□2	8□4	5□3	94□7
1□4□□□	6□30	513□00	534□8	21□8	13□7	81□0
□4	4□75	523□60	538□7	15□1	9□5	71□5
□10	2□00	676□80	717□1	40□3	25□3	46□2
□16	1□19	420□80	423□1	2□3	1□4	44□7
□40	0□420	573□000	603□7	30□7	19□3	25□4
□50	0□297	497□700	511□4	13□7	8□6	16□8
□100	0□149	518□400	529□2	10□8	6□8	10□0
□140	0□105	333□100	336□2	3□1	1□9	8□1
□200	0□074	326□300	328□8	2□5	1□6	6□5
Pan		480□2	485□7	5□5	3□5	3□0
			TOTAL:	**154.2**	**97.0**	



□□□□□□

Sieve Analysis Data Sheet

□□□M□D422□63

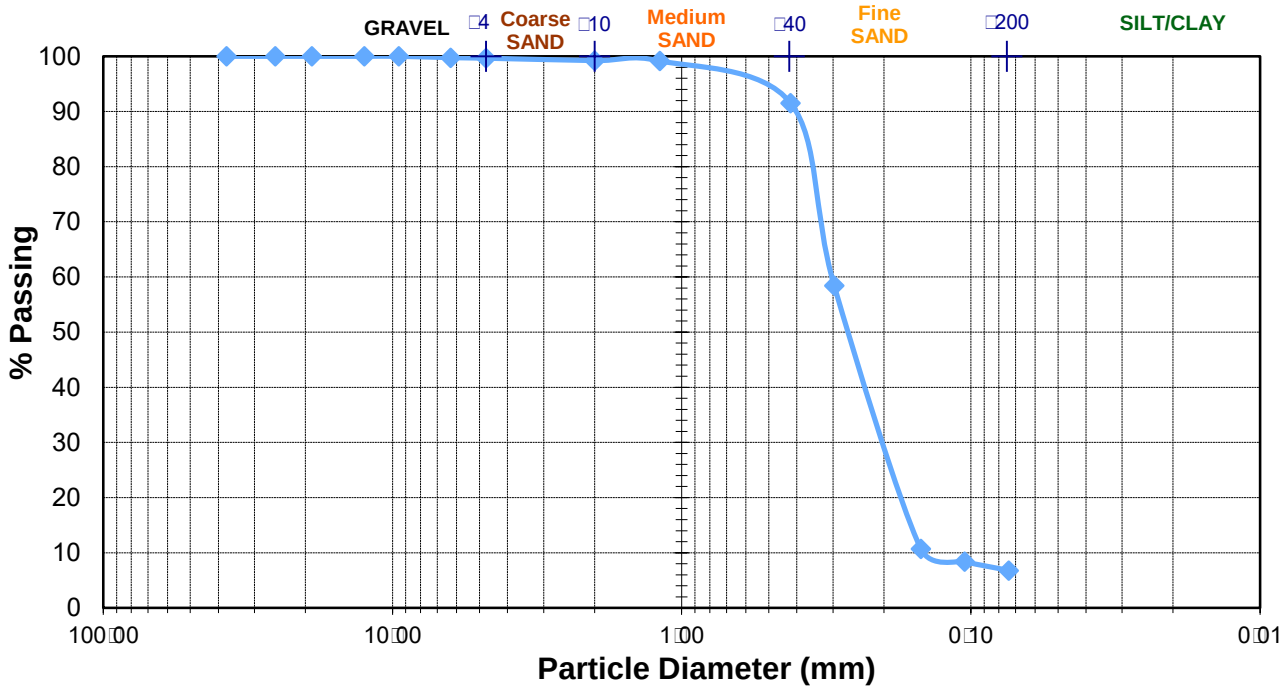
Project Name:	M□19034□09	**Tested By:**	□□□□ □□ □□□□	**Date:**	7□72021
Location:	□□145□□ □□r□□ □□□□r□□□	**Checked By:**	□□□□ □□□□□□□r	**Date:**	7□8□2021
Boring No:	3□□	**Sample ID**	□□18		
Sample Depth:	48□5□50□				

IDH Soil Classification: Fine Sand

Weight of Container (g): 151□2 **Weight of Container & Soil (g):** 357□4

Weight of Dry Sample (g): 206□2

Sieve Number	Diameter (mm)	Mass of Sieve (g)	Mass of Sieve & Soil (g)	Soil Retained (g)	Soil Retained (%)	Soil Passing (%)
1□5□□□	37□50			0□0	0□0	100□0
1□□□	25□40			0□0	0□0	100□0
3□4□□□	19□00			0□0	0□0	100□0
1□2□□□	12□50			0□0	0□0	100□0
3□8□□□	9□50			0□0	0□0	100□0
1□4□□□	6□30	513□00	513□5	0□5	0□2	99□8
□4	4□75	523□60	523□8	0□2	0□1	99□7
□10	2□00	676□80	677□7	0□9	0□4	99□2
□16	1□19	420□80	420□9	0□1	0□0	99□2
□40	0□420	573□000	588□8	15□8	7□7	91□5
□50	0□297	497□700	565□9	68□2	33□1	58□4
□100	0□149	518□400	616□8	98□4	47□7	10□7
□140	0□105	333□100	337□9	4□8	2□3	8□4
□200	0□074	326□300	329□6	3□3	1□6	6□8
Pan		480□2	494	13□8	6□7	0□1
			TOTAL:	**206**	**99.9**	



□□□□□□

Sieve Analysis Data Sheet

□□□M□D422□63

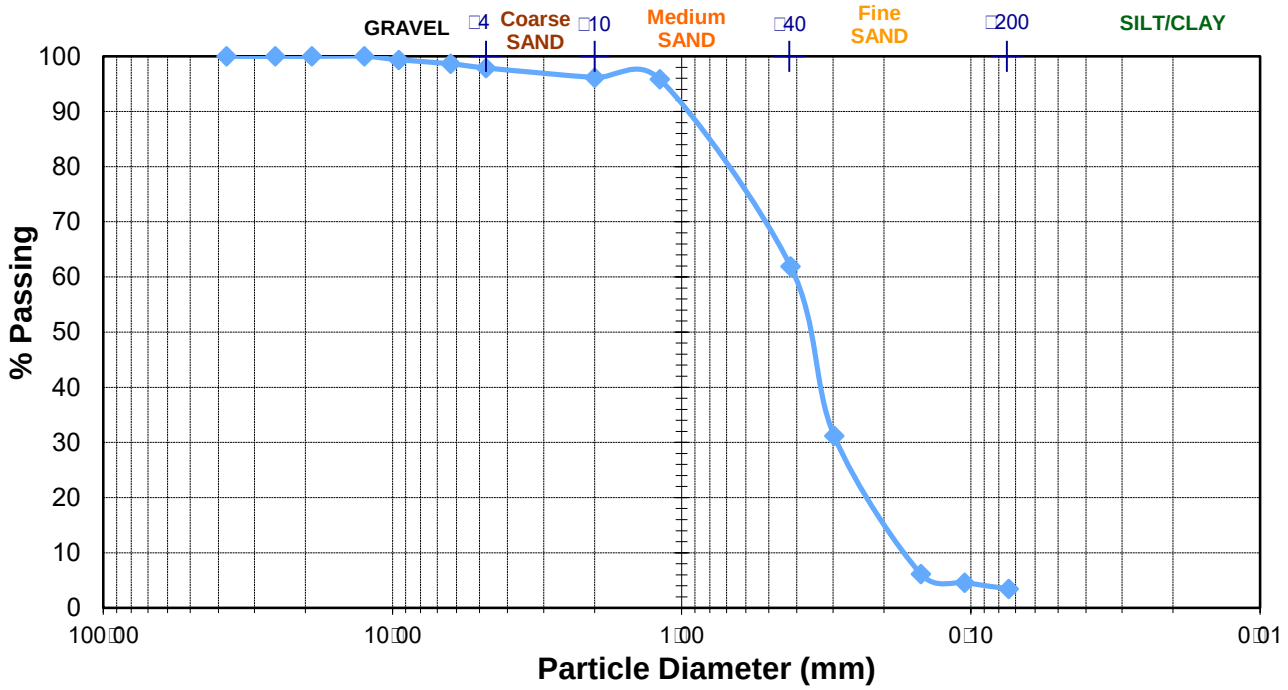
Project Name:	M□19034□09	**Tested By:**	□□□□ □□ □□□□	**Date:**	7□7□2021
Location:	□□145□□ □□r□□ □□□□r□□□	**Checked By:**	□□□□ □□□□□□□r	**Date:**	7□8□2021
Boring No:	4□□	**Sample ID**	□□17		
Sample Depth:	43□5□45□				

IDH Soil Classification: Fine SAND trace gravel

Weight of Container (g): 151□2 **Weight of Container & Soil (g):** 388□5

Weight of Dry Sample (g): 237□3

Sieve Number	Diameter (mm)	Mass of Sieve (g)	Mass of Sieve & Soil (g)	Soil Retained (g)	Soil Retained (%)	Soil Passing (%)
1□5□□□	37□50			0□0	0□0	100□0
1□□□	25□40			0□0	0□0	100□0
3□4□□□	19□00			0□0	0□0	100□0
1□2□□□	12□50			0□0	0□0	100□0
3□8□□□	9□50	527□80	529□3	1□5	0□6	99□4
1□4□□□	6□30	513□00	514□7	1□7	0□7	98□7
□4	4□75	523□60	525□4	1□8	0□8	97□9
□10	2□00	676□80	680□9	4□1	1□7	96□2
□16	1□19	420□80	421□6	0□8	0□3	95□8
□40	0□420	573□000	653□5	80□5	33□9	61□9
□50	0□297	497□700	570□6	72□9	30□7	31□2
□100	0□149	518□400	577□8	59□4	25□0	6□2
□140	0□105	333□100	336□8	3□7	1□6	4□6
□200	0□074	326□300	329	2□7	1□1	3□5
Pan		480□2	487□7	7□5	3□2	0□3
			TOTAL:	**236.6**	**99.7**	



□□□□□□

Sieve Analysis Data Sheet

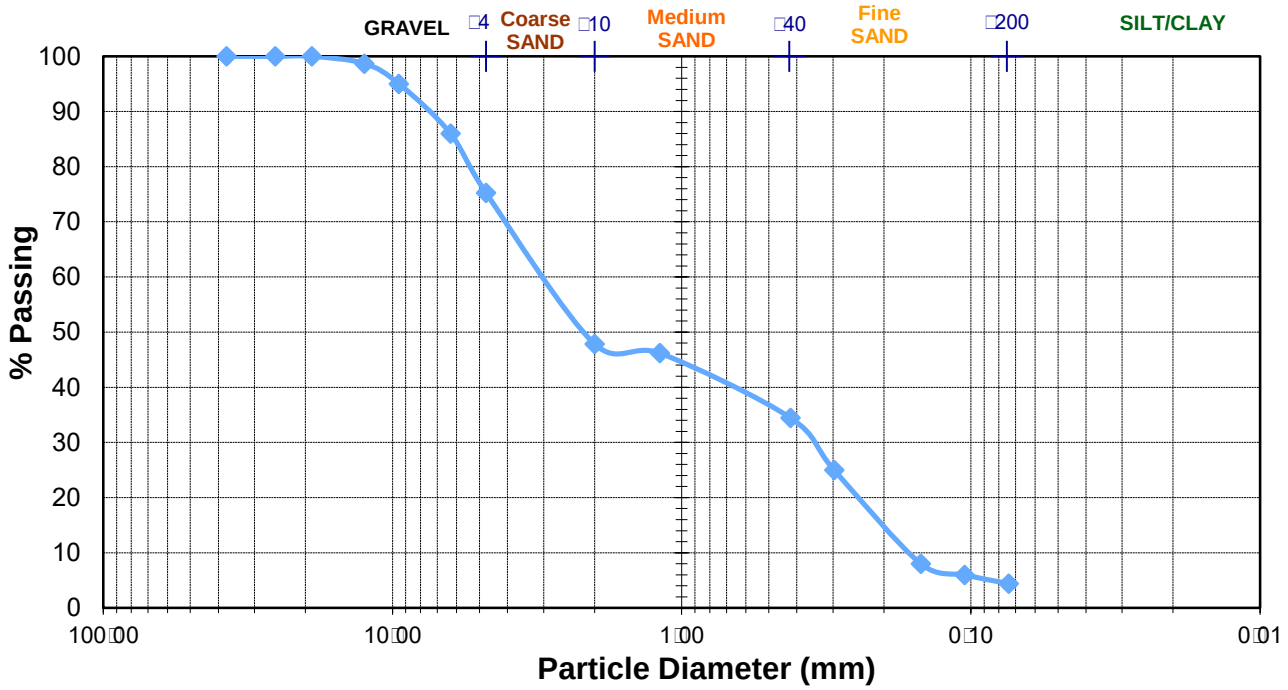
□□□M□D422□63

Project Name:	M□19034□09	**Tested By:**	□□□□ □□ □□□□	**Date:**	7□7□2021
Location:	□□145□□ □□r□□ □□□□r□□□	**Checked By:**	□□□□ □□□□□□□r	**Date:**	7□8□2021
Boring No:	4□□	**Sample ID**	□□13		
Sample Depth:	31□32□5□				

IDH Soil Classification: Fine to coarse SAND trace gravel

Weight of Container (g):	151□2	**Weight of Container & Soil (g):**	357□7
Weight of Dry Sample (g):	206□5		

Sieve Number	Diameter (mm)	Mass of Sieve (g)	Mass of Sieve & Soil (g)	Soil Retained (g)	Soil Retained (%)	Soil Passing (%)
1□5□□□	37□50			0□0	0□0	100□0
1□□□	25□40			0□0	0□0	100□0
3□4□□□	19□00			0□0	0□0	100□0
1□2□□□	12□50	551□90	554□6	2□7	1□3	98□7
3□8□□□	9□50	527□80	535□4	7□6	3□7	95□0
1□4□□□	6□30	513□00	531□6	18□6	9□0	86□0
□4	4□75	523□60	545□8	22□2	10□8	75□3
□10	2□00	676□80	733□4	56□6	27□4	47□8
□16	1□19	420□80	424□2	3□4	1□6	46□2
□40	0□420	573□000	597□3	24□3	11□8	34□4
□50	0□297	497□700	517□2	19□5	9□4	25□0
□100	0□149	518□400	553□5	35□1	17□0	8□0
□140	0□105	333□100	337□3	4□2	2□0	6□0
□200	0□074	326□300	329□5	3□2	1□5	4□4
Pan		480□2	488□9	8□7	4□2	0□2
			TOTAL:	**206.1**	**99.8**	



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Sieve / Hydrometer Analysis
(ASTM D 422)

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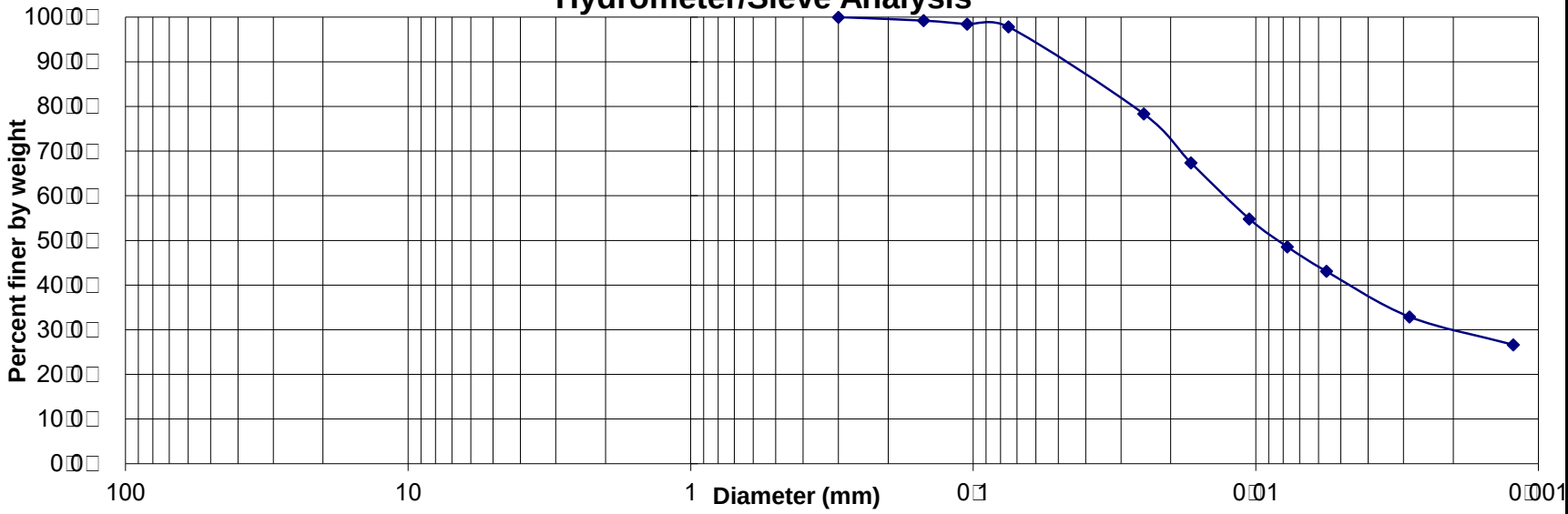
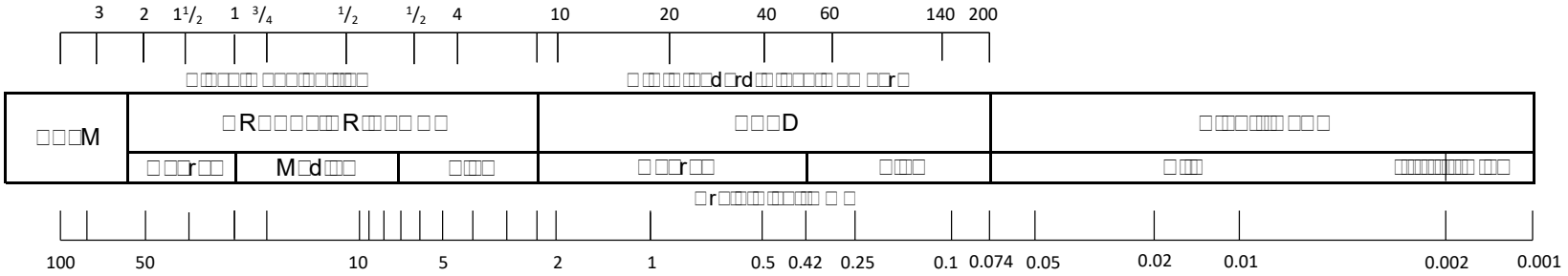
□r□□□□□□□□ □□ □□	□□□145□□□□r□□ □□□□r□□□
□r□□□□□□□□ □□□□	M□ 19034□09
□□□ □□□□□□□ □□□□	3□□ □□□ □□8

Gravel:	0□0□
Sand:	2□2□
Silt:	68□2□
Clay:	29□6□

USCS Classification:
□ □□□□□□□ □□□□□□□ □□□

Hydrometer/Sieve Analysis





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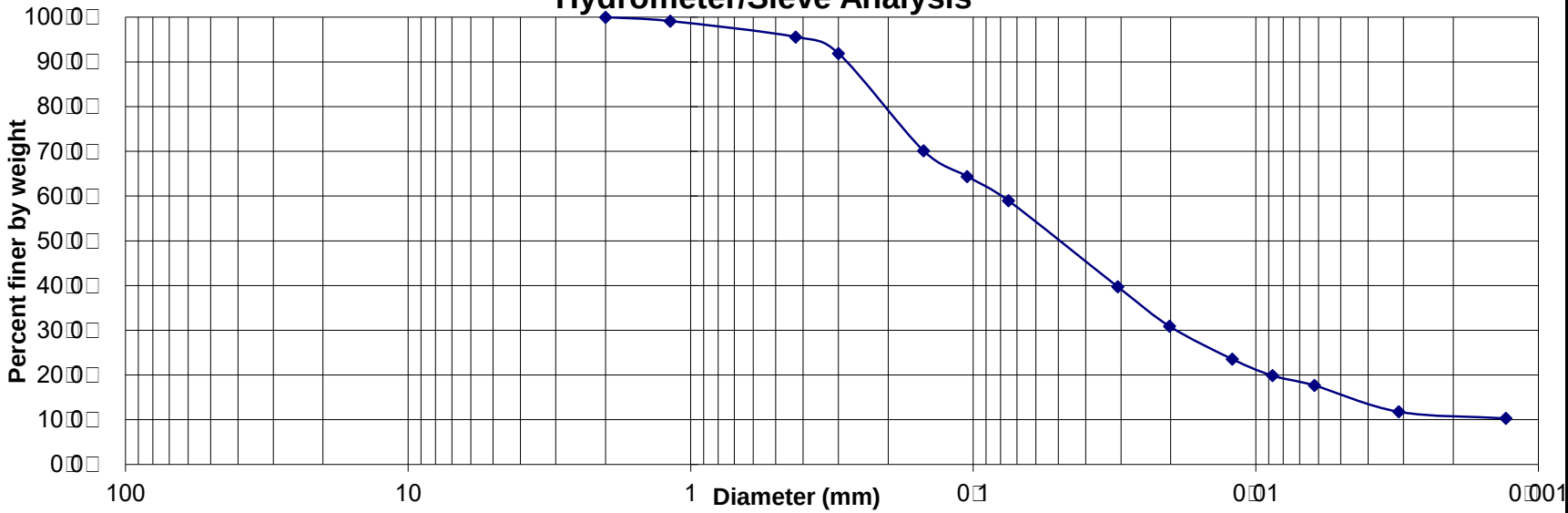
Sieve / Hydrometer Analysis
(ASTM D 422)

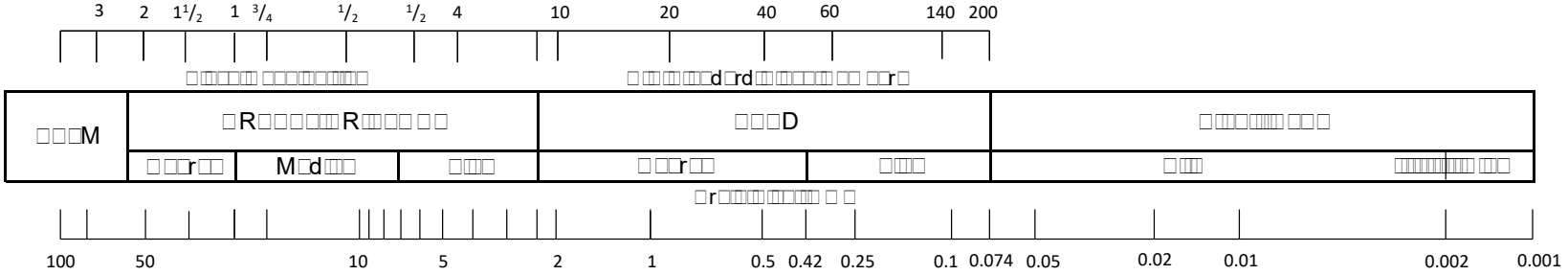
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	M 19034 09
[illegible]	3 [illegible] 10

Gravel:	0.0
Sand:	41.0
Silt:	48.1
Clay:	10.9

USCS Classification:
[illegible]

Hydrometer/Sieve Analysis





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Sieve / Hydrometer Analysis
(ASTM D 422)

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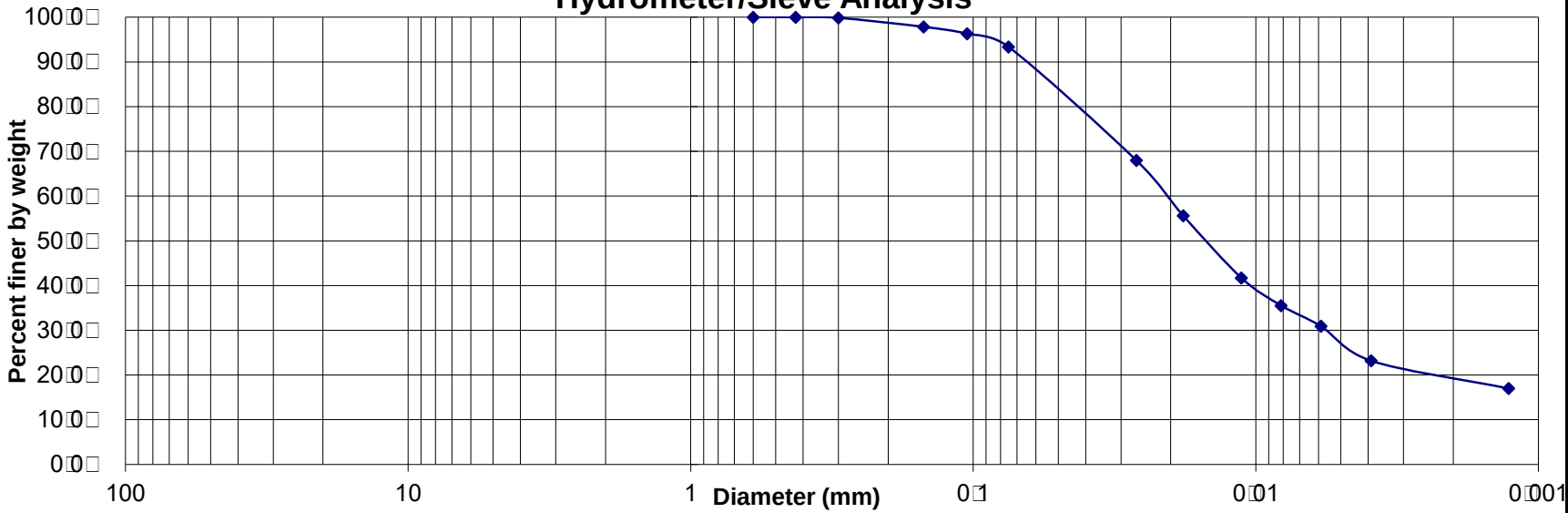
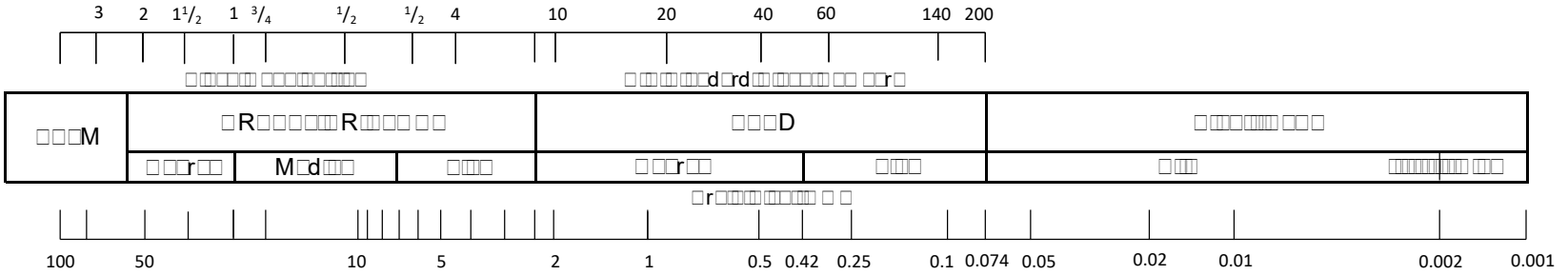
□r□□□□□□□□ □□□□	M□ 19034□09
□□□ □□□□□□□ □□□□	4□□ □□□ □□10

Gravel:	0□0□
Sand:	6□6□
Silt:	74□7□
Clay:	18□7□

USCS Classification:
□ □□□□□□□□

Hydrometer/Sieve Analysis





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