Andy Beshear
GOVERNOR

TRANSPORTATION CABINET
200 Mero Street
Frankfort, Kentucky 40601

Jim Gray
SECRETARY

June 18, 2024

CALL NO. 104
CONTRACT ID NO. 245354
ADDENDUM # 2

Subject: Marshall County, STP BRZ 9030 (470)
Letting June 20, 2024

(1) Omit Proposal Pages 54 & 92-106 of 153
(2) Added - Geotechnical Report - Pages 1-43 of 43
(3) Revised - Plan sheet S7

Proposal revisions are available at http://transportation.ky.gov/Construction-Procurement/.

If you have any questions, please contact us at 502-564-3500.

Sincerely,

Rachel Mills

Rachel Mills, P.E.
Director
Division of Construction Procurement

RM:mr
Enclosures

Stantec

Report of Geotechnical Exploration – REV1

Bridge ID: 079B00040N
KY-402 Over East Fork Clarks River
Marshall County, Kentucky
Item No. 1-10176

June 17, 2024

Prepared for:

Kentucky Transportation Cabinet
Frankfort, Kentucky

Prepared by:

Stantec Consulting Services
Lexington, Kentucky

Stantec

Stantec Consulting Services Inc.
3052 Beaumont Centre Circle, Lexington KY 40513-1703

June 17, 2024
File: rpt_001REV1_let_178568003_079B00040N

Attention: Mr. John Moss, PE
Stantec Consulting Services, Inc.
9200 Shelbyville Road Suite 800
Louisville, Kentucky 40222-5136

Reference: Bridge ID: 079B00040N
KY-402 Over EAST FORK CLARKS RIVER
Marshall County, Kentucky
Item No. 1-10176

Dear Mr. Moss,

Stantec Consulting Services Inc. (Stantec) at Lexington, KY is submitting the final geotechnical engineering report for the referenced structure with this letter.

This report presents results of the field exploration along with our recommendations for the design and construction for the referenced bridge replacement. As always, we enjoy collaborating with your staff and if we can be of further assistance, please contact our office.

Respectfully,

Stantec Consulting Services Inc.

LJ Arduz

Luis J. Arduz, PE
Senior Associate
Phone: (859) 422-3051
Luis.Arduz@stantec.com

/lja

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1.0 INTRODUCTION

The Kentucky Transportation Cabinet (KYTC) has initiated the Statewide Bridge Program Project Delivery (BPPD). The purpose of the program is to rehabilitate or replace bridges across the state. Bridges that have been identified as a part of the program are structures that are in a state of deterioration and have low load ratings that limit the movement of people and freight across the state.

This report addresses the geotechnical considerations for Bridge 079B00040N, KY-402 crossing Over East Fork Clarks River, located in Marshall County, Kentucky. The existing bridge has 16 approach spans totaling approximately 527 feet in length and a steel truss structure with a length of about 112 feet in length resulting in a total bridge length of about 639 feet. The bridge location is presented in Figure 1 below.

Figure 1. Google Image showing Project Site.

Proposed bridge plans provided by the structural designer show the replacement bridge to consist of 11 new approach spans with the existing steel truss structure to be rehabilitated in place. **No geotechnical design or foundation recommendations are provided for the existing steel truss portion of the bridge.** The approximate overall length of the new bridge is approximately 661 feet. The plans also indicate that the new bridge will be located in the same place as the existing bridge. The foundations for the new approach spans are anticipated to consist of driven piles.

2.0 SITE TOPOGRAPHY AND GEOLOGIC CONDITIONS

The new bridge location is situated within the Jackson Purchase region of Kentucky that borders the Pennyroyal Region of Kentucky. The Jackson Purchase region has flat slopes mostly composed of alluvial flood plains and uplands. The windblown deposits from the Great Plains and local rivers created flood plains containing unconsolidated sediments that are vulnerable to erosion. The KY-402 bridge Over East Fork Clarks River is located approximately 1.5 miles northeast of Hardin, Kentucky. Generally, local relief in the area is less than 100 feet.

Available geologic mapping of the area is illustrated in the Geologic Map of the Kentucky Geological Survey, which indicates the bridge site is underlain by alluvial deposits. In general, the alluvial soils consist of loess, silt, clay, and gravel.

Bedrock mapping suggests that the Clayton and McNairy Formations corresponding to the Cretaceous and Tertiary System underlies the alluvium at a depth of approximately 215 feet. The Clayton and McNairy Formations typically consists of fine white to moderate-reddish-brown quartz, generally clayey, micaceous, and iron stained.

Given the relative proximity of the site to the New Madrid Seismic area a Seismic Site Class evaluation was performed in general accordance with AASHTO 3.10.3.1. No other detrimental geologic features are noted by the available mapping within the immediate vicinity of the proposed bridge replacement site.

3.0 FIELD INVESTIGATION

A geotechnical exploration was conducted in May of 2023 which consisted of six subsurface borings, designated herein as 079B00040N-1, -2, -3, -4, -5, and -6 along the north side of the existing bridge. Stantec was able to access the site via a farm road and with the help of a bulldozer to grade the terrain. The new bridge will replace the existing bridge along the existing alignment. The boring locations and surface elevations were obtained by the Bridging Kentucky TEAM. A site vicinity map showing the project location is presented in Appendix A. Table 1 provides a summary of the locations, elevations, and depths of the borings drilled for the proposed replacement.

Table 1. Summary of Bridge Borings

Hole No.	Latitude	Longitude	Surface Elevation (ft.) MSL	Bottom of Hole Depth (ft.)	Bottom of Hole Elevation (ft.) MSL
079B00040N-1	36.769158	-88.279152	394.8	100	294.8
079B00040N-2	36.768742	-88.278869	394.9	100	294.9
079B00040N-3	36.768775	-88.278603	394.3	100	294.3
079B00040N-4	36.768678	-88.278275	394.2	100	294.2
079B00040N-5	36.768611	-88.277114	395.2	100	295.2
079B00040N-6	36.768589	-88.276908	395.8	100	295.8

Note: Bedrock was not encountered in the borings.

The borings were performed with a track-mounted drill rig (CME-45C) equipped with hollow-stem augers, and an automatic hammer. Due to the depth of the borings and relatively high groundwater table, mud rotatory drilling techniques were used to advance the borings and obtain representative soil samples. The field personnel generally performed soil sampling at five-foot intervals to obtain in situ strength data and specimens for subsequent laboratory classification testing and natural moisture content determinations. Standard penetration testing (SPT) and undisturbed Shelby Tube sampling was performed for this bridge replacement project.

4.0 SUBSURFACE CONDITIONS

The borings were performed at 6 locations on the north side of the existing bridge. In general, the subsurface conditions consisted of moderately high plasticity clays and silts, clayey gravel, poorly graded sand with silt, and silty sand. Standard penetration tests (SPT) performed on granular soils in the upper 20 to 25 feet of the profile resulted in N-values ranging from about 7 to 30 blows per foot which suggests relative densities of loose to very dense. Below about 25 feet N-values for granular soils typically ranged from 4 to 91 blows per foot indicating loose to very dense conditions. These soil deposits are consistent with the alluvial deposits along the Clarks River.

Based upon the site exploration and local geology, bedrock was not encountered in the borings to the depths explored.

Groundwater was noted in three of the six explorations performed for the bridge. Groundwater was encountered at depths ranging from 9.8 feet to 11.5 feet below the existing ground surface (elevation 383.7 to 386.0). Groundwater can be expected to be encountered near the level of Clarks River. Groundwater levels and/or conditions may vary considerably, with time, and according to the prevailing climate, rainfall, or other factors.

5.0 LABORATORY TESTING AND RESULTS

Stantec performed laboratory testing on recovered soil samples from the borings. All laboratory tests were performed in accordance with the applicable American Association of State Highway and Transportation Officials (AASHTO) or Kentucky Methods for soil and rock testing specifications. Laboratory testing consisted of natural moisture content, grain size-sieve analyses (silt plus clay determinations), soil classification index testing, and unconfined compression testing on select undisturbed soil samples.

In borings 40N-1 through 40N-3, soils encountered in the upper 30 to 40 feet of the profile consisted of interbedded soils classified as GW-GM, GC, GC-GM, MH, ML, and CL according to the Unified Soil Classification System and as A-1-a, A-2-6, A-7-5, A-7-6, and A-6 based upon the AASHTO classification system. Soils sampled below a depth of about 30 to 40 feet were typically classified as SP-SM or SM with less frequent layers of CL and ML according to the Unified Soil Classification System and as A-2-4 and A-3 with occasional A-4 and A-6 based upon the AASHTO classification system. In borings N-4 through N-6, there were less cohesive soils consisting of CL and CL-ML (USCS) or A-6 and A-4 (AASHTO) and the granular soils, classified as SP-SM and SM (USCS) or A-3 and A-2-4 were typically encountered at about 10 to 15 feet below the ground surface to the explored depth of 100 feet.

Liquid limits of cohesive soils ranged from 18 to 48 with the majority of values above 30 percent. Moisture contents ranged from 12 to 63 percent with the majority of values between 18 and 34 percent. Results of the unconfined compression tests ranged from 320 to 5940 psf, with the majority of values between 1000 and 1700 psf. Specific results of the laboratory testing are also presented next to the graphical logs in Appendix B.

6.0 ENGINEERING ANALYSES

6.1 GENERAL

This project will consist of replacing the existing 16-approach spans of the existing bridge with 11 new approach spans on the existing alignment. The existing steel truss and associated foundations will be rehabilitated in place. **No geotechnical design or foundation recommendations are provided for the existing steel truss portion of the bridge.** Any grading requirements or material placement that may be needed should be placed at 2H:1V slopes or flatter. Foundation support for the new bridge is expected to consist of driven H-piles at the approach span end bents and pier lines. Deep foundations for this project will be designed using the Load and Resistance Factor Design (LRFD) methodology. LRFD is a design approach in which applicable failure and serviceability conditions can be evaluated considering the uncertainties associated with loads and materials resistances. Where applicable, the following engineering analyses followed the current KYTC and AASHTO LRFD guidelines.

6.2 STEEL H-PILE ANALYSES

6.2.1 Pile Capacity

Based upon geologic mapping the depth to bedrock in the area exceeds 200 feet. Therefore, friction piles consisting of driven steel H-piles could be used at the approach bridges end bent and interior pier locations. As noted in Sections 3 and 4 of this report, foundation soils at the boring locations reached depths of 100 feet without encountering bedrock. Due to the nature of the soil deposits and the subsurface conditions observed at the site, an axial structural resistance factor (φ_c) of 0.6 is recommended for good driving conditions as outlined in Section 6.5.4.2 of the current LRFD Design Specifications. Although a smaller pile section could likely be used, it is anticipated that an HP14x89 will be needed to resist lateral loads. Using $\varphi_c = 0.6$, the estimated factored structural resistance for an HP14x89 is 783 kips.

Stantec performed driven pile capacity calculations to estimate the nominal and factored resistances of piles that extend to a depth of approximately 90 feet below the provided bottom of cap elevations. The bottom of cap elevations range from about 398 to 399 at the interior piers and end bents. The following table summarizes the provided required nominal axial resistance, estimated geotechnical resistances, and the anticipated pile tip elevations.

Table 2. Summary of Driven Pile Resistances

Sub-Structure Location	Required Nominal Axial Resistance (kips)	Approximate Tip Elevation (feet) [a]	Approximate Pile Length (feet) [a]	Factored Geotechnical Axial Resistance (kips)	Total Factored Geotechnical Uplift Resistance (kips) [b]
End Bent 1	310	336	58	124	93
Pier 1	502	297	84	201	148
Piers 2 & 3	558	294	87	223	164
Piers 4 & 5	578	295	87	231	173
Piers 6 & 7	419	310	72	168	119
Piers 8& 9	397	313	69	159	113
Pier 10	552	299	83	221	159
Pier 11	489	304	78	196	140
End Bent 2	263	350	45	105	73

[a] Depth as measured from the bottom of the pile cap
[b] Calculated uplift resistance for the corresponding pile length

The Designer should note that these estimates are for the factored geotechnical axial resistance for an HP14x89 at the respective substructure location. Resistances at higher elevations are also provided in the tables in Appendix D. Geotechnical axial resistances at depths deeper than 90 feet are not recommended without a deeper boring. Additionally, should the elevation of the bottom of the pile cap change, pile lengths and elevations would no longer be valid and should be adjusted accordingly.

6.2.2 Hammer Energy

Static pile analyses were conducted to estimate the nominal driving resistance that a 14-inch steel H-pile would experience during the installation process. Drivability analyses were performed at several pier lines. The analyses were performed using guidelines presented in the FHWA "Soils and Foundations Workshop Manual".

The results of FHWA research and other literature regarding pile installation indicate that significant reductions in skin resistances occur during pile driving, primarily due to the dynamics of the installation process. Soils are remolded and pore water pressures apparently increase, causing reductions in shear strengths. The driving resistances were estimated under the condition that no interruptions, and therefore no pile "set" characteristics would be experienced during the driving process.

The drivability analyses were conducted using the GRLWEAP (Version 2014) computer program for steel H-piles driven to the depth that corresponds to the Required Nominal Axial Resistance of the pile. To perform the drivability analyses, two situations were modeled. The first one involved determining the minimum hammer energy which would drive the H-piles to depth without excessive blows (<120 blow per foot). The second part of the analyses would determine what maximum hammer energy is needed to drive the piles to the required depths, with a minimum of about 30 blows per foot and without damage to the pile (compression stresses greater than 45 ksi). The FHWA publication titled "Soils and Foundations Workshop Manual-Second Edition" defines a reasonable range of hammer blows to be between 30 and 144 blows per foot for a steel H-pile. The replacement bridge has a total of thirteen substructure locations for support of the bridge. These thirteen locations have Required Nominal Axial Resistances ranging from about 263 to to 578 kips. One single pile driving hammer is unlikely able to meet KYTC’s minimum and maximum blow count criteria of 3 to 10 blow per inch (or 36 to 120 blows per foot) and not over stress the pile in compression. Based on the results of several WEAP analyses for the end bent and interior piles, Stantec recommends at least two different hammers be used to drive piles. A smaller hammer with an energy range of 40-to-84-foot kips should be able to drive the shorter piles and piles with lighter loads. A larger hammer with an energy range of 75-to-125-foot kips should be able to drive the longer piles and piles with the heavier loads.

6.3 SCOUR CONSIDERATIONS AND ANALYSES

The soils encountered at the planned substructure element locations within the Clarks River flood plain consist of shallow lean clays and silts with deeper deposits of sand and gravel. A soil’s susceptibility to scour is commonly determined by analyzing its particles size distribution. A soil’s “D_{50}” and “D_{95}” values, defined as the grain diameter (in millimeters) below which 50 percent and 95 percent of the sample is smaller, are used in analyses to predict the amount of scour that could occur in that soil for a given flow condition. Once the scour results have been completed, the pile cap, if applicable should be placed below the scour depth or the foundations should be designed to accommodate an unsupported length to the base of the scour zone. Values of D_{50} and D_{95} are presented adjacent to the boring logs on the Subsurface Data Sheets in Appendix B and may be used for applicable scour analyses to be performed by others.

7.0 SEISMIC DESIGN CONSIDERATIONS

In accordance with guidelines provided by the KYTC Division of Structural Design manual, seismic design criteria was obtained from the Kentucky Transportation Center (KTC) Research Report KTC-07-07/SPR246-02-6F. This report contains ground-motion hazard maps from which seismic parameters for a maximum credible earthquake (MCE) can be estimated for bridge design.

Based on AASHTO Table 3.10.3.1-1 Site Class Definitions, Stantec conducted a review of the soil profile data for the borings completed for this exploration. In general, the soil profile over the explored depth of about 100 feet consists of a relatively thin layer of cohesive soils (5 to 25 feet) overlying deep deposits of sand and gravel. The cohesive soils were typically soft to very stiff, while the granular soils were medium dense to very dense. Based on the predominantly granular soil profile a **Site Class D** should be used to determine Site Factors. Stantec used this site class designation to obtain the applicable site factors from the KTC report. Upon estimating the adjusted response parameters using the KTC seismic data, the resulting acceleration coefficient indicates that this bridge site may be designed within a **Seismic Zone 2**.

8.0 FOUNDATION SYSTEM RECOMMENDATIONS

Stantec developed the following recommendations based upon reviews of available data, information obtained during the field exploration, results of laboratory testing and engineering analyses, and discussions with TEAM personnel. **No geotechnical design or foundation recommendations are provided for the existing steel truss portion of the bridge.**

8.1 GENERAL

8.1.1 Foundation excavations should be properly braced/shored to provide adequate safety to people working in or around the excavations. Bracing should be performed in accordance with applicable federal, state, and local guidelines.

8.1.2 **A plan note should be included by the designer** that indicates that temporary shoring, sheeting, cofferdams, and/or dewatering methods may be required to facilitate foundation construction. It should be anticipated that groundwater will be encountered at foundation locations within the flood plain.

8.2 STEEL H-PILE FOUNDATIONS

8.2.1 The following table provides recommended maximum pile lengths applicable at the referenced substructure element locations. It is estimated that 14x89 H-pile foundations are being planned for use in supporting the new bridge substructure elements.

Table 3. Summary of Pile Foundations

Sub-Structure Location	Foundation Type	Factored Axial Resistance (kips)	Estimated Tip Elevation (ft) MSL	Approximate Pile Length [a] (ft)
End Bent 1	14x89 H-Piles	124	336	58
Pier 1	14x89 H-Piles	201	297	84
Piers 2 & 3	14x89 H-Piles	223	294	87
Piers 4 & 5	14x89 H-Piles	267	231	87
Piers 6 & 7	14x89 H-Piles	168	310	72
Piers 8 & 9	14x89 H-Piles	159	313	69
Pier 10	14x89 H-Piles	221	299	83
Pier 11	14x89 H-Piles	196	304	78
End Bent 2	14x89 H-Piles	105	350	45

a. Approximate Pile Length is from bottom of pile cap.

The Designer should note that these estimates are for the factored geotechnical axial resistance for an HP14x89 at the respective substructure locations. Resistances at other elevations are also provided in the tables in Appendix D.

8.2.2 **A plan note should be included by the designer** which states the following hammer criteria: A diesel pile driving hammer with a rated energy between 40 foot-kips and 84 foot-kips for shorter piles with lighter loads will be required to drive 14x89 steel H-piles to the estimated elevations listed in paragraph 8.2.1. And a larger hammer with a rated energy between 75-to-125-foot kips should be able to drive the longer piles and piles with the heavier loads without encountering excessive blow counts or damaging the piles. The Contractor shall submit the proposed pile driving system(s) to the Engineer for approval prior to the installation of the first pile. Approval of the pile driving system(s) by the Engineer will be subject to satisfactory field performance of the pile driving procedures.

8.2.3 The design and installation of the pile foundations should conform to current AASHTO LRFD Bridge Design Specifications, and Section 604 of the current edition of the Kentucky Department of Highways Standard Specifications for Road and Bridge Construction.

8.2.4 The AASHTO LRFD Bridge Design Specifications recommend a resistance factor for horizontal geotechnical resistance of a single pile or pile group of 1.0 for lateral capacity analyses.

8.2.5 The 2020 AASHTO LRFD Bridge Design Specifications recommends axial resistance factors based on pile driving conditions (good or severe driving conditions). Based on the general subsurface conditions encountered across the project, it is anticipated that there will be good pile driving conditions.

Therefore, it is recommended that the axial resistance of piles in compression (φ_c) used in design be 0.60. Further, the combined axial and flexural resistance factors for design should be φ_c = 0.70 and φ_f = 1.00 as noted in Section 6.5.4.2 of the referenced AASHTO specifications.

8.2.6 It is recommended that a center-to-center pile spacing of no less than 2.5 pile diameters be used in the layout and design of the pile foundations.

9.0 CLOSING

9.1 The conclusions and recommendations presented herein are based on data and subsurface conditions from the six borings performed for the geotechnical exploration using that degree of care and skill ordinarily exercised under similar circumstances by competent members of the engineering profession. No warranties can be made regarding the continuity of conditions between borings.

9.2 General soil descriptions and indicated boundaries are based on an engineering interpretation of all available subsurface information and may not necessarily reflect the actual variation in subsurface conditions between borings and samples.

9.3 The observed water levels and/or conditions indicated on the boring logs are as recorded at the time of exploration. These water levels and/or conditions may vary considerably, with time, according to the prevailing climate, rainfall, tail water elevations or other factors and are otherwise dependent on the duration of and methods used in the exploration program.

9.4 Stantec exercised sound engineering judgment in preparing the subsurface information presented herein. This information has been prepared and is intended for design and estimating purposes. Its presentation on the plans or elsewhere is for the purpose of providing intended users with access to the same information. This subsurface information interpretation is presented in good faith and is not intended as a substitute for independent interpretations or judgments of the Contractor.

9.5 All structure details shown herein are for illustrative purposes only and may not be indicative of the final design conditions shown in the contract plans.

APPENDIX A

SITE MAP

SUBSURFACE DATA

COMMONWEALTH OF KENTUCKY
DEPARTMENT OF HIGHWAYS

REVISION	DATE

PREPARED BY
Stantec

DATE: AUGUST 7, 2023	CHECKED BY
DESIGNED BY: L. ARDUZ	A. CRACE
DETAILED BY: P. BOND	Y. GU

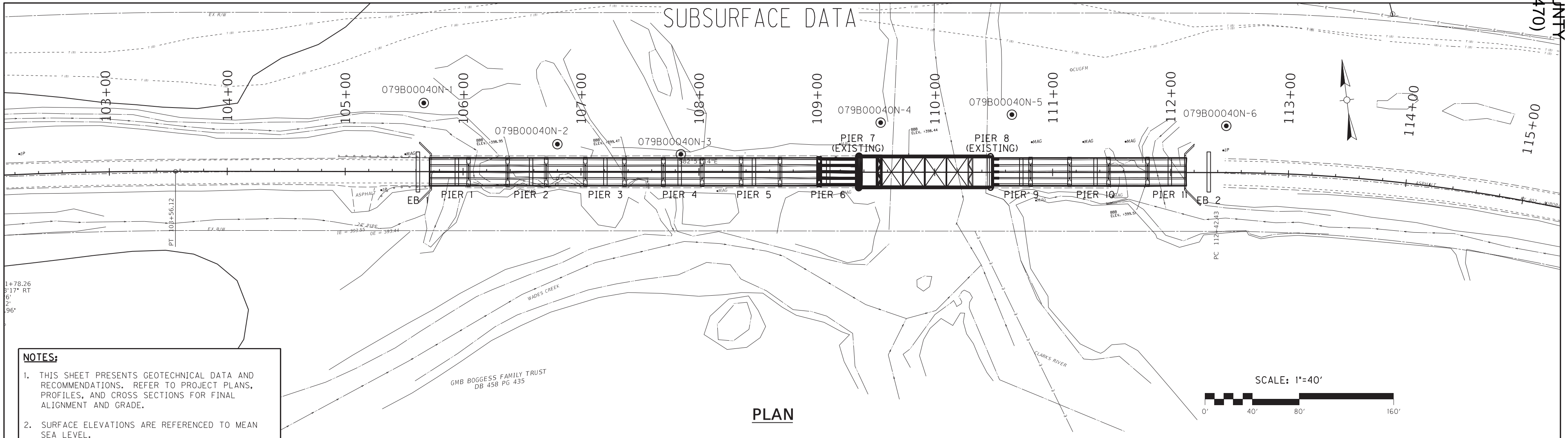
LOCATION MAP
CROSSING
EAST FORK CLARKS RIVER

ROUTE	ITEM NO.	COUNTY OF
KY 402	1-10176	MARSHALL
	SHEET NO.	DRAWING NUMBER

MicroStation v10.13.1.1 USER: PBond DATE PLOTTED: 8/10/2023 11:22 AM FILE NAME: V:\1785\ACTIVE\178568003\GEOTECHNICAL\DRAWING\SHEETS\079B00040N\079B0004N_LOCMAP.DGN

APPENDIX B
SUBSURFACE DATA SHEETS

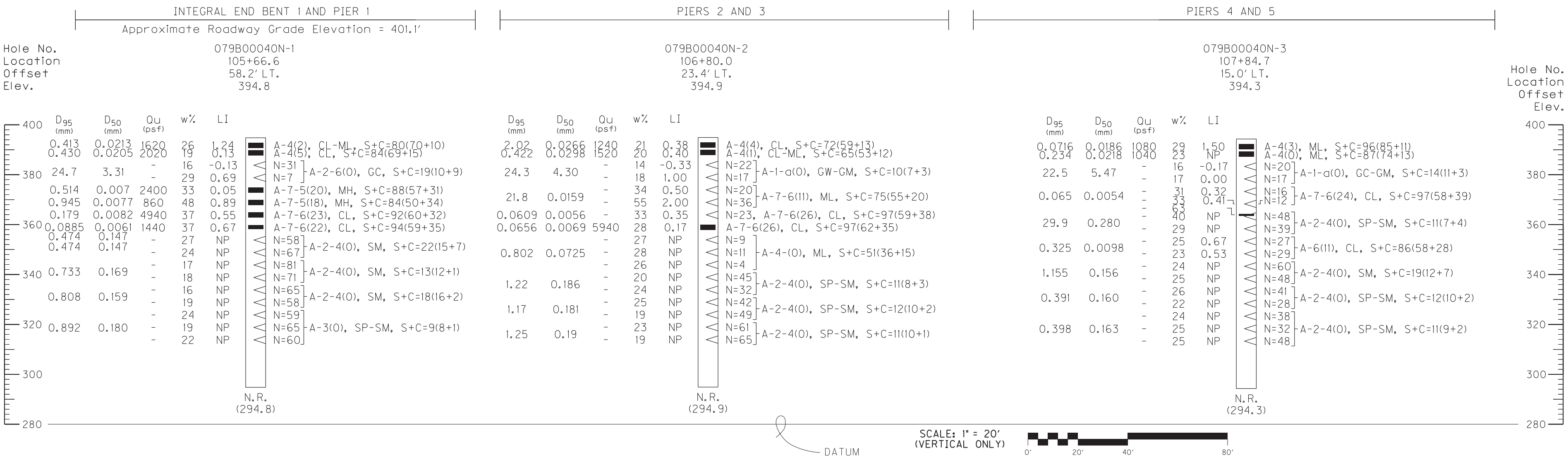
SUBSURFACE DATA



PLAN

NOTES:

1. THIS SHEET PRESENTS GEOTECHNICAL DATA AND RECOMMENDATIONS. REFER TO PROJECT PLANS, PROFILES, AND CROSS SECTIONS FOR FINAL ALIGNMENT AND GRADE.
2. SURFACE ELEVATIONS ARE REFERENCED TO MEAN SEA LEVEL.
3. ALL STANDARD PENETRATION TESTING PERFORMED FOR STRUCTURE BORINGS DEPICTED ON THIS SHEET WERE DONE UTILIZING AN AUTOMATIC HAMMER.



INTEGRAL END BENT 1 AND PIER 1

Approximate Roadway Grade Elevation = 401.1'

Hole No. 079B00040N-1
Location 105+66.6
Offset 58.2' LT.
Elev. 394.8

D_{95} (mm)	D_{50} (mm)	Qu (psf)	w%	LI		
0.413	0.0213	1620	26	1.24		A-4(2), CL-ML, S+C=80(70+10)
0.430	0.0205	2020	19	0.13		A-4(5), CL, S+C=84(69+15)
24.7	3.31	-	16	-0.13	N=31	A-2-6(0), GC, S+C=19(10+9)
		-	29	0.69	N=7	
0.514	0.007	2400	33	0.05		A-7-5(20), MH, S+C=88(57+31)
0.945	0.0077	860	48	0.89		A-7-5(18), MH, S+C=84(50+34)
0.179	0.0082	4940	37	0.55		A-7-6(23), CL, S+C=92(60+32)
0.0885	0.0061	1440	37	0.67		A-7-6(22), CL, S+C=94(59+35)
0.474	0.147	-	27	NP	N=58	A-2-4(0), SM, S+C=22(15+7)
0.474	0.147	-	24	NP	N=67	
0.733	0.169	-	17	NP	N=81	A-2-4(0), SM, S+C=13(12+1)
		-	18	NP	N=71	
0.808	0.159	-	16	NP	N=65	A-2-4(0), SM, S+C=18(16+2)
		-	19	NP	N=58	
		-	24	NP	N=59	A-3(0), SP-SM, S+C=9(8+1)
0.892	0.180	-	19	NP	N=65	
		-	22	NP	N=60	

N.R.
(294.8)

PIERS 2 AND 3

Hole No. 079B00040N-2
Location 106+80.0
Offset 23.4' LT.
Elev. 394.9

D_{95} (mm)	D_{50} (mm)	Qu (psf)	w%	LI		
2.02	0.0266	1240	21	0.38		A-4(4), CL, S+C=72(59+13)
0.422	0.0298	1520	20	0.40		A-4(1), CL-ML, S+C=65(53+12)
24.3	4.30	-	14	-0.33	N=22	A-1-a(0), GW-GM, S+C=10(7+3)
		-	18	1.00	N=17	
21.8	0.0159	-	34	0.50	N=20	A-7-6(11), ML, S+C=75(55+20)
		-	55	2.00	N=36	
0.0609	0.0056	-	33	0.35	N=23	A-7-6(26), CL, S+C=97(59+38)
0.0656	0.0069	5940	28	0.17		A-7-6(26), CL, S+C=97(62+35)
		-	27	NP	N=9	A-4-(0), ML, S+C=51(36+15)
0.802	0.0725	-	28	NP	N=11	
		-	26	NP	N=4	
1.22	0.186	-	20	NP	N=45	A-2-4(0), SP-SM, S+C=11(8+3)
		-	24	NP	N=32	
1.17	0.181	-	25	NP	N=42	A-2-4(0), SP-SM, S+C=12(10+2)
		-	19	NP	N=49	
1.25	0.19	-	23	NP	N=61	A-2-4(0), SP-SM, S+C=11(10+1)
		-	19	NP	N=65	

N.R.
(294.9)

PIERS 4 AND 5

Hole No. 079B00040N-3
Location 107+84.7
Offset 15.0' LT.
Elev. 394.3

D_{95} (mm)	D_{50} (mm)	Qu (psf)	w%	LI		
0.0716	0.0186	1080	29	1.50		A-4(3), ML, S+C=96(85+11)
0.234	0.0218	1040	23	NP		A-4(0), ML, S+C=87(74+13)
22.5	5.47	-	16	-0.17	N=20	A-1-a(0), GC-GM, S+C=14(11+3)
		-	17	0.00	N=17	
0.065	0.0054	-	31	0.32	N=16	A-7-6(24), CL, S+C=97(58+39)
		-	33	0.41	N=12	
		-	63			
29.9	0.280	-	40	NP	N=48	A-2-4(0), SP-SM, S+C=11(7+4)
		-	29	NP	N=39	
0.325	0.0098	-	25	0.67	N=27	A-6(11), CL, S+C=86(58+28)
		-	23	0.53	N=29	
1.155	0.156	-	24	NP	N=60	A-2-4(0), SM, S+C=19(12+7)
		-	25	NP	N=48	
0.391	0.160	-	26	NP	N=41	A-2-4(0), SP-SM, S+C=12(10+2)
		-	22	NP	N=28	
		-	24	NP	N=38	A-2-4(0), SP-SM, S+C=11(9+2)
0.398	0.163	-	25	NP	N=32	
		-	25	NP	N=48	

N.R.
(294.3)

Hole No.
Location
Offset
Elev.

COMMONWEALTH OF KENTUCKY
DEPARTMENT OF HIGHWAYS

KENTUCKY TRANSPORTATION CABINET

REVISION	DATE

PREPARED BY
Stantec

DATE: AUGUST 7, 2023
DESIGNED BY: L. ARDUZ
DETAILED BY: P. BOND
CHECKED BY
A. CRACE
Y. GU

BORING LAYOUT & LOGS
CROSSING
EAST FORK CLARKS RIVER

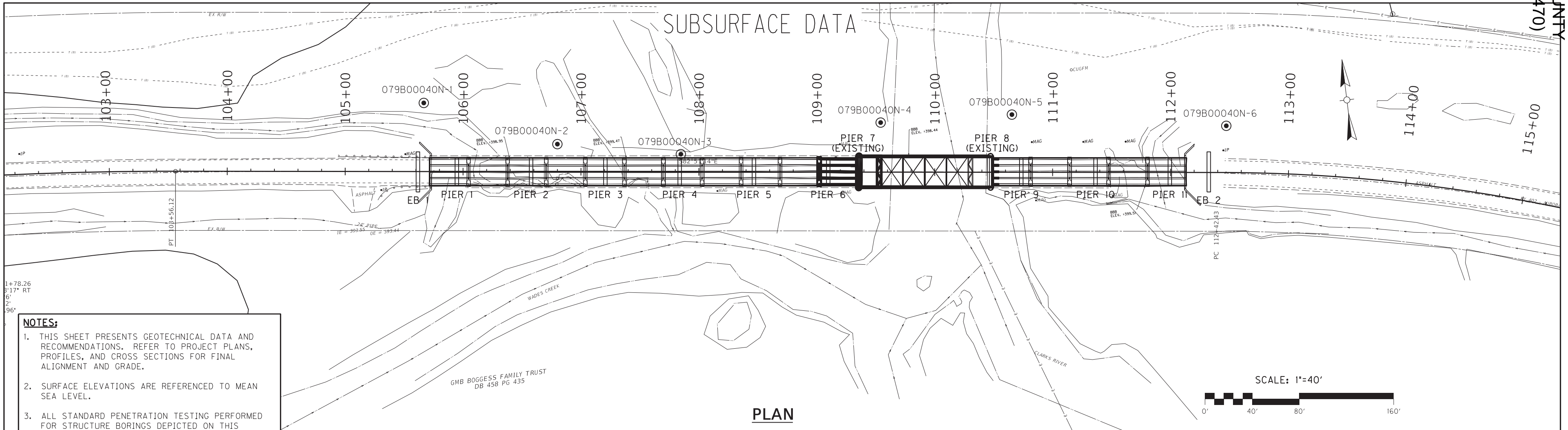
ROUTE
KY 402

ITEM NO.
1-10176
SHEET NO.

COUNTY OF
MARSHALL
DRAWING NUMBER

MicroStation v10.13.1.1   USER: PBond   DATE PLOTTED: 3/14/2024 2:53 PM   FILE NAME: V:\1785\ACTIVE\178568003\GEOTECHNICAL\DRAWING\SHEETS\079B00040N\079B0004N-LOG1.DGN

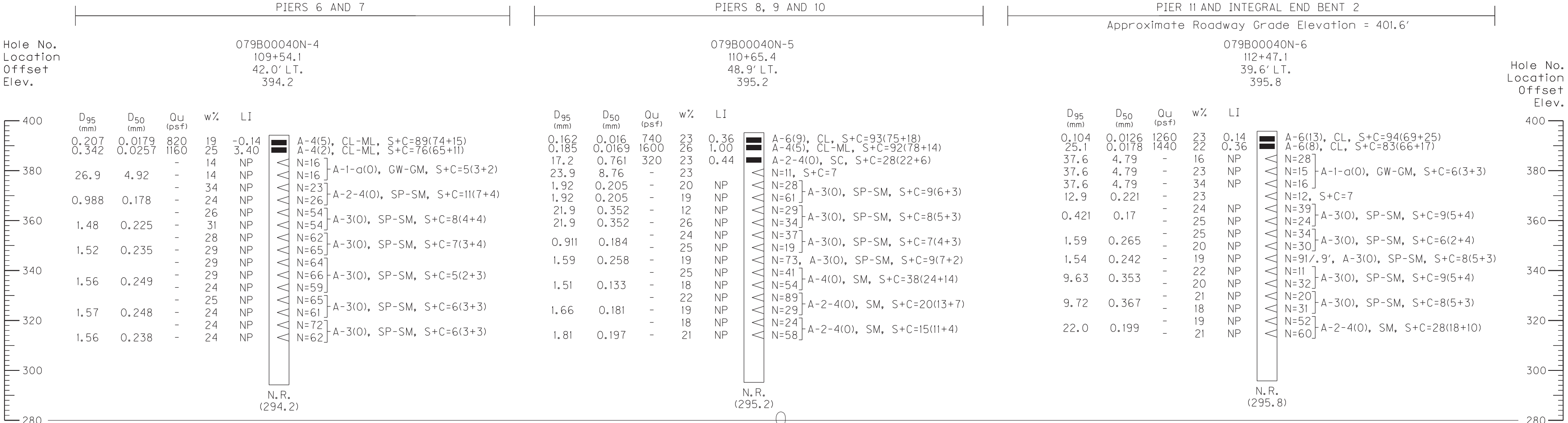
SUBSURFACE DATA



PLAN

NOTES:

1. THIS SHEET PRESENTS GEOTECHNICAL DATA AND RECOMMENDATIONS. REFER TO PROJECT PLANS, PROFILES, AND CROSS SECTIONS FOR FINAL ALIGNMENT AND GRADE.
2. SURFACE ELEVATIONS ARE REFERENCED TO MEAN SEA LEVEL.
3. ALL STANDARD PENETRATION TESTING PERFORMED FOR STRUCTURE BORINGS DEPICTED ON THIS SHEET WERE DONE UTILIZING AN AUTOMATIC HAMMER.
4. PIERS 7 AND 8 ARE EXISTING PIERS WHICH WILL REMAIN IN PLACE AND NOT BE REPLACED, THEREFORE THE SUBSURFACE DATA DOES NOT APPLY TO THESE EXISTING SUB-STRUCTURES.



PIERS 6 AND 7

Hole No. 079B00040N-4
Location 109+54.1
Offset 42.0' LT.
Elev. 394.2

D_{95} (mm)	D_{50} (mm)	Qu (psf)	w%	LI	
0.207	0.0179	820	19	-0.14	A-4(5), CL-ML, S+C=89(74+15)
0.342	0.0257	1160	25	3.40	A-4(2), CL-ML, S+C=76(65+11)
		-	14	NP	N=16 A-1-a(0), GW-GM, S+C=5(3+2)
26.9	4.92	-	14	NP	N=16
		-	34	NP	N=23 A-2-4(0), SP-SM, S+C=11(7+4)
0.988	0.178	-	24	NP	N=26
		-	26	NP	N=54 A-3(0), SP-SM, S+C=8(4+4)
1.48	0.225	-	31	NP	N=54
		-	28	NP	N=62 A-3(0), SP-SM, S+C=7(3+4)
1.52	0.235	-	29	NP	N=65
		-	29	NP	N=64 A-3(0), SP-SM, S+C=5(2+3)
1.56	0.249	-	29	NP	N=66
		-	24	NP	N=59
		-	25	NP	N=65 A-3(0), SP-SM, S+C=6(3+3)
1.57	0.248	-	24	NP	N=61
		-	24	NP	N=72 A-3(0), SP-SM, S+C=6(3+3)
1.56	0.238	-	24	NP	N=62

N.R.
(294.2)

PIERS 8, 9 AND 10

Hole No. 079B00040N-5
Location 110+65.4
Offset 48.9' LT.
Elev. 395.2

D_{95} (mm)	D_{50} (mm)	Qu (psf)	w%	LI	
0.162	0.016	740	23	0.36	A-6(9), CL, S+C=93(75+18)
0.185	0.0169	1600	26	1.00	A-4(5), CL-ML, S+C=92(78+14)
17.2	0.761	320	23	0.44	A-2-4(0), SC, S+C=28(22+6)
23.9	8.76	-	23		N=11, S+C=7
1.92	0.205	-	20	NP	N=28 A-3(0), SP-SM, S+C=9(6+3)
1.92	0.205	-	19	NP	N=61
21.9	0.352	-	12	NP	N=29 A-3(0), SP-SM, S+C=8(5+3)
21.9	0.352	-	26	NP	N=34
0.911	0.184	-	24	NP	N=37 A-3(0), SP-SM, S+C=7(4+3)
		-	25	NP	N=19
1.59	0.258	-	19	NP	N=73, A-3(0), SP-SM, S+C=9(7+2)
		-	25	NP	N=41 A-4(0), SM, S+C=38(24+14)
1.51	0.133	-	18	NP	N=54
		-	22	NP	N=89 A-2-4(0), SM, S+C=20(13+7)
1.66	0.181	-	19	NP	N=29
		-	18	NP	N=24 A-2-4(0), SM, S+C=15(11+4)
1.81	0.197	-	21	NP	N=58

N.R.
(295.2)

PIER 11 AND INTEGRAL END BENT 2

Approximate Roadway Grade Elevation = 401.6'

Hole No. 079B00040N-6
Location 112+47.1
Offset 39.6' LT.
Elev. 395.8

D_{95} (mm)	D_{50} (mm)	Qu (psf)	w%	LI	
0.104	0.0126	1260	23	0.14	A-6(13), CL, S+C=94(69+25)
25.1	0.0178	1440	22	0.36	A-6(8), CL, S+C=83(66+17)
37.6	4.79	-	16	NP	N=28 A-1-a(0), GW-GM, S+C=6(3+3)
37.6	4.79	-	23	NP	N=15
37.6	4.79	-	34	NP	N=16
12.9	0.221	-	23		N=12, S+C=7
0.421	0.17	-	24	NP	N=39 A-3(0), SP-SM, S+C=9(5+4)
		-	25	NP	N=24
1.59	0.265	-	25	NP	N=34 A-3(0), SP-SM, S+C=6(2+4)
		-	20	NP	N=30
1.54	0.242	-	19	NP	N=91/.9', A-3(0), SP-SM, S+C=8(5+3)
9.63	0.353	-	22	NP	N=11 A-3(0), SP-SM, S+C=9(5+4)
		-	20	NP	N=32
9.72	0.367	-	21	NP	N=20 A-3(0), SP-SM, S+C=8(5+3)
		-	18	NP	N=31
22.0	0.199	-	19	NP	N=52 A-2-4(0), SM, S+C=28(18+10)
		-	21	NP	N=60

N.R.
(295.8)

COMMONWEALTH OF KENTUCKY
DEPARTMENT OF HIGHWAYS

REVISION	DATE

PREPARED BY
Stantec

DATE: AUGUST 7, 2023	CHECKED BY
DESIGNED BY: L. ARDUZ	A. CRACE
DETAILED BY: P. BOND	Y. GU

LOGS OF BORING
CROSSING
EAST FORK CLARKS RIVER

ROUTE	ITEM NO.	COUNTY OF
KY 402	1-10176	MARSHALL
	SHEET NO.	DRAWING NUMBER

MicroStation v10.13.1.1 USER: PBond DATE PLOTTED: 3/14/2024 1:51 PM FILE NAME: \\US0243-PPFSS01\WORKGROUP\1785\ACTIVE\178568003\GEOTECHNICAL\DRAWING\SHEETS\079B00040N\079B0004N-LOG2.DGN

APPENDIX C
COORDINATE DATA SUBMISSION

COORDINATE DATA SUBMISSION FORM
KYTC DIVISION OF STRUCTURAL DESIGN -- GEOTECHNICAL BRANCH

County Marshall

Date 07/14/2023

Road Number KY-402 Over East Fork of Clarks River- 079B00040N

Survey Crew / Consultant Stantec Consulting Services Inc.

Contact Person Luis Arduz

Item #

Mars #

Project # 178568003

Notes:

Elevation Datum NAVD88

HOLE NUMBER	LATITUDE (Decimal Degrees)	LONGITUDE (Decimal Degrees)	HOLE NUMBER	STATION	OFFSET	ELEVATION (ft)
079B00040N-1	36.769158	-88.279152	079B00040N-1	105+66.6	58.2' Lt.	394.8
079B00040N-2	36.768742	-88.278869	079B00040N-2	106+80	23.4' Lt.	394.9
079B00040N-3	36.768775	-88.278603	079B00040N-3	107+84.7	15.0' Lt.	394.3
079B00040N-4	36.768678	-88.278275	079B00040N-4	109+54.1	42.0' Lt.	394.2
079B00040N-5	36.768611	-88.277114	079B00040N-5	110+65.4	48.9' Lt.	395.2
079B00040N-6	36.768589	-88.276908	079B00040N-6	112+47.1	39.6' Lt.	395.8

APPENDIX D
DRIVEN PILE RESISTANCE TABLES

Steel H-Pile Capacities

079B00040N

HP14x89 (50ksi steel)

Location: **EB1**

Estimated Base of Pile Cap Elevation = 394.2 ft

Depth	Soil Type	Depth Below Pile Cap (ft)	Nominal Side Resistance (kips)	Nominal End Bearing (kips)	R_n Total Nominal Geotechnical Axial Resistance (kips)	(tons)	**ϕR_n Total Factored Static Geotechnical Axial Resistance (ϕ=0.35 in clay; 0.45 in sand) (kips)**	**(tons)**	**ϕR_n Field Verification Values (ϕ=0.4 FHWA Modified (kips)**	**(tons)**	**ϕR_n Total Factored Geotechnical Uplift Resistance Static Analysis Method (kips)**	**(tons)**	**$\phi_{stat} R_n$ Total Factored Geotechnical Extreme Resistance Static Analysis Method (kips)**	**(tons)**	**$\phi_{up} R_n$ Total Factored Geotechnical Extreme Uplift Resistance Static Analysis Method (kips)**	**(tons)**
0	Clay	0	0.0	0.7	0.7	0.4	**0.2**	**0.1**	**0.6**	**0.3**	**0.0**	**0.0**	**0.7**	**0.4**	**0.0**	**0.0**
1	Clay	1	1.3	0.7	2.0	1.0	**0.7**	**0.4**	**1.8**	**0.9**	**0.3**	**0.2**	**2.0**	**1.0**	**1.0**	**0.5**
2	Clay	2	2.7	1.1	3.8	1.9	**1.3**	**0.7**	**3.3**	**1.7**	**0.7**	**0.3**	**3.8**	**1.9**	**2.2**	**1.1**
3	Clay	3	4.4	1.5	5.9	3.0	**2.1**	**1.0**	**5.2**	**2.6**	**1.1**	**0.6**	**5.9**	**3.0**	**3.5**	**1.8**
4	Clay	4	6.2	1.5	7.7	3.9	**2.7**	**1.3**	**6.7**	**3.4**	**1.6**	**0.8**	**7.7**	**3.9**	**5.0**	**2.5**
5	Clay	5	8.1	1.5	9.6	4.8	**3.4**	**1.7**	**8.4**	**4.2**	**2.0**	**1.0**	**9.6**	**4.8**	**6.5**	**3.2**
6	Clay	6	10.1	1.5	11.6	5.8	**4.1**	**2.0**	**10.2**	**5.1**	**2.5**	**1.3**	**11.6**	**5.8**	**8.1**	**4.0**
7	Clay	7	12.2	1.7	13.9	7.0	**4.9**	**2.4**	**12.2**	**6.1**	**3.1**	**1.5**	**13.9**	**7.0**	**9.8**	**4.9**
8	Clay	8	14.4	2.5	16.9	8.5	**5.9**	**3.0**	**14.8**	**7.4**	**3.6**	**1.8**	**16.9**	**8.5**	**11.5**	**5.8**
9	Sand	9	16.8	3.5	20.3	10.2	**7.4**	**3.7**	**18.6**	**9.3**	**5.9**	**2.9**	**20.3**	**10.2**	**13.4**	**6.7**
10	Sand	10	19.1	4.5	23.6	11.8	**8.9**	**4.5**	**22.3**	**11.2**	**6.7**	**3.3**	**23.6**	**11.8**	**15.3**	**7.6**
11	Sand	11	21.6	5.7	27.3	13.7	**10.6**	**5.3**	**26.5**	**13.2**	**7.6**	**3.8**	**27.3**	**13.7**	**17.3**	**8.6**
12	Sand	12	24.2	6.3	30.5	15.3	**12.0**	**6.0**	**30.1**	**15.0**	**8.5**	**4.2**	**30.5**	**15.3**	**19.4**	**9.7**
13	Sand	13	26.9	6.7	33.6	16.8	**13.4**	**6.7**	**33.6**	**16.8**	**9.4**	**4.7**	**33.6**	**16.8**	**21.5**	**10.8**
14	Sand	14	29.9	7.0	36.9	18.5	**14.9**	**7.5**	**37.3**	**18.6**	**10.5**	**5.2**	**36.9**	**18.5**	**23.9**	**12.0**
15	Sand	15	33.0	7.4	40.4	20.2	**16.5**	**8.2**	**41.2**	**20.6**	**11.6**	**5.8**	**40.4**	**20.2**	**26.4**	**13.2**
16	Sand	16	36.2	7.7	43.9	22.0	**18.1**	**9.0**	**45.2**	**22.6**	**12.7**	**6.3**	**43.9**	**22.0**	**29.0**	**14.5**
17	Sand	17	39.5	7.5	47.0	23.5	**19.5**	**9.7**	**48.7**	**24.3**	**13.8**	**6.9**	**47.0**	**23.5**	**31.6**	**15.8**
18	Sand	18	43.0	6.2	49.2	24.6	**20.5**	**10.2**	**51.1**	**25.6**	**15.1**	**7.5**	**49.2**	**24.6**	**34.4**	**17.2**
19	Clay	19	46.5	4.7	51.2	25.6	**21.2**	**10.6**	**52.9**	**26.4**	**11.6**	**5.8**	**51.2**	**25.6**	**37.2**	**18.6**
20	Clay	20	49.8	3.3	53.1	26.6	**21.8**	**10.9**	**54.5**	**27.3**	**12.5**	**6.2**	**53.1**	**26.6**	**39.8**	**19.9**
21	Clay	21	52.8	1.7	54.5	27.3	**22.3**	**11.2**	**55.8**	**27.9**	**13.2**	**6.6**	**54.5**	**27.3**	**42.2**	**21.1**
22	Clay	22	55.8	1.3	57.1	28.6	**23.2**	**11.6**	**58.0**	**29.0**	**14.0**	**7.0**	**57.1**	**28.6**	**44.6**	**22.3**
23	Clay	23	58.9	1.3	60.2	30.1	**24.3**	**12.2**	**60.8**	**30.4**	**14.7**	**7.4**	**60.2**	**30.1**	**47.1**	**23.6**
24	Clay	24	62.0	1.3	63.3	31.7	**25.4**	**12.7**	**63.5**	**31.7**	**15.5**	**7.8**	**63.3**	**31.7**	**49.6**	**24.8**
25	Clay	25	65.1	1.3	66.4	33.2	**26.5**	**13.2**	**66.2**	**33.1**	**16.3**	**8.1**	**66.4**	**33.2**	**52.1**	**26.0**
26	Clay	26	68.2	1.3	69.5	34.8	**27.6**	**13.8**	**68.9**	**34.4**	**17.1**	**8.5**	**69.5**	**34.8**	**54.6**	**27.3**
27	Clay	27	71.4	1.4	72.8	36.4	**28.7**	**14.4**	**71.8**	**35.9**	**17.9**	**8.9**	**72.8**	**36.4**	**57.1**	**28.6**
28	Clay	28	74.6	1.6	76.2	38.1	**29.9**	**15.0**	**74.8**	**37.4**	**18.7**	**9.3**	**76.2**	**38.1**	**59.7**	**29.8**
29	Clay	29	77.8	1.8	79.6	39.8	**31.1**	**15.5**	**77.7**	**38.9**	**19.5**	**9.7**	**79.6**	**39.8**	**62.2**	**31.1**
30	Clay	30	81.6	2.0	83.6	41.8	**32.5**	**16.2**	**81.2**	**40.6**	**20.4**	**10.2**	**83.6**	**41.8**	**65.3**	**32.6**
31	Clay	31	85.9	2.2	88.1	44.1	**34.1**	**17.0**	**85.2**	**42.6**	**21.5**	**10.7**	**88.1**	**44.1**	**68.7**	**34.4**
32	Clay	32	90.3	2.3	92.6	46.3	**35.6**	**17.8**	**89.1**	**44.6**	**22.6**	**11.3**	**92.6**	**46.3**	**72.2**	**36.1**
33	Clay	33	94.8	2.3	97.1	48.6	**37.2**	**18.6**	**93.0**	**46.5**	**23.7**	**11.9**	**97.1**	**48.6**	**75.8**	**37.9**
34	Clay	34	99.3	2.3	101.6	50.8	**38.8**	**19.4**	**97.0**	**48.5**	**24.8**	**12.4**	**101.6**	**50.8**	**79.4**	**39.7**
35	Clay	35	103.8	2.3	106.1	53.1	**40.4**	**20.2**	**100.9**	**50.5**	**26.0**	**13.0**	**106.1**	**53.1**	**83.0**	**41.5**
36	Clay	36	108.4	2.3	110.7	55.4	**42.0**	**21.0**	**104.9**	**52.5**	**27.1**	**13.6**	**110.7**	**55.4**	**86.7**	**43.4**
37	Clay	37	113.1	3.4	116.5	58.3	**44.0**	**22.0**	**110.0**	**55.0**	**28.3**	**14.1**	**116.5**	**58.3**	**90.5**	**45.2**
38	Clay	38	117.8	7.5	125.3	62.7	**47.1**	**23.5**	**117.7**	**58.9**	**29.5**	**14.7**	**125.3**	**62.7**	**94.2**	**47.1**
39	Sand	39	122.5	11.8	134.3	67.2	**51.1**	**25.6**	**127.8**	**63.9**	**42.9**	**21.4**	**134.3**	**67.2**	**98.0**	**49.0**
40	Sand	40	128.1	16.2	144.3	72.2	**55.6**	**27.8**	**139.1**	**69.5**	**44.8**	**22.4**	**144.3**	**72.2**	**102.5**	**51.2**
41	Sand	41	134.6	20.6	155.2	77.6	**60.5**	**30.3**	**151.4**	**75.7**	**47.1**	**23.6**	**155.2**	**77.6**	**107.7**	**53.8**
42	Sand	42	141.3	22.2	163.5	81.8	**64.3**	**32.1**	**160.7**	**80.3**	**49.5**	**24.7**	**163.5**	**81.8**	**113.0**	**56.5**
43	Sand	43	148.1	22.6	170.7	85.4	**67.5**	**33.8**	**168.8**	**84.4**	**51.8**	**25.9**	**170.7**	**85.4**	**118.5**	**59.2**
44	Sand	44	155.0	23.1	178.1	89.1	**70.8**	**35.4**	**177.1**	**88.6**	**54.3**	**27.1**	**178.1**	**89.1**	**124.0**	**62.0**
45	Sand	45	162.0	23.5	185.5	92.8	**74.2**	**37.1**	**185.4**	**92.7**	**56.7**	**28.4**	**185.5**	**92.8**	**129.6**	**64.8**
46	Sand	46	169.2	24.0	193.2	96.6	**77.6**	**38.8**	**194.1**	**97.1**	**59.2**	**29.6**	**193.2**	**96.6**	**135.4**	**67.7**
47	Sand	47	176.6	24.5	201.1	100.6	**81.2**	**40.6**	**203.0**	**101.5**	**61.8**	**30.9**	**201.1**	**100.6**	**141.3**	**70.6**
48	Sand	48	184.0	24.9	208.9	104.5	**84.7**	**42.4**	**211.8**	**105.9**	**64.4**	**32.2**	**208.9**	**104.5**	**147.2**	**73.6**

Depth	Soil Type	Depth Below Pile Cap (ft)	Nominal Side Resistance (kips)	Nominal End Bearing (kips)	R_n Total Nominal Geotechnical Axial Resistance (kips)	(tons)	**ϕR_n Total Factored Static Geotechnical Axial Resistance (ϕ=0.35 in clay; 0.45 in sand) (kips)**	**(tons)**	**ϕR_n Field Verification Values (ϕ=0.4 FHWA Modified (kips)**	**(tons)**	**ϕR_n Total Factored Geotechnical Uplift Resistance Static Analysis Method (kips)**	**(tons)**	**$\phi_{stat} R_n$ Total Factored Geotechnical Extreme Resistance Static Analysis Method (kips)**	**(tons)**	**$\phi_{up} R_n$ Total Factored Geotechnical Extreme Uplift Resistance Static Analysis Method (kips)**	**(tons)**
49	Sand	49	191.6	25.4	217.0	108.5	88.4	44.2	220.9	110.4	67.1	33.5	217.0	108.5	153.3	76.6
50	Sand	50	199.4	25.8	225.2	112.6	92.0	46.0	230.1	115.1	69.8	34.9	225.2	112.6	159.5	79.8
51	Sand	51	207.3	26.3	233.6	116.8	95.8	47.9	239.6	119.8	72.6	36.3	233.6	116.8	165.8	82.9
52	Sand	52	215.3	26.7	242.0	121.0	99.6	49.8	249.0	124.5	75.4	37.7	242.0	121.0	172.2	86.1
53	Sand	53	223.4	27.2	250.6	125.3	103.5	51.7	258.7	129.3	78.2	39.1	250.6	125.3	178.7	89.4
54	Sand	54	231.7	27.6	259.3	129.7	107.4	53.7	268.5	134.2	81.1	40.5	259.3	129.7	185.4	92.7
55	Sand	55	240.1	28.1	268.2	134.1	111.4	55.7	278.5	139.2	84.0	42.0	268.2	134.1	192.1	96.0
56	Sand	56	248.7	28.5	277.2	138.6	115.4	57.7	288.6	144.3	87.0	43.5	277.2	138.6	199.0	99.5
57	Sand	57	257.4	29.0	286.4	143.2	119.6	59.8	299.0	149.5	90.1	45.0	286.4	143.2	205.9	103.0
58	Sand	58	266.3	29.4	295.7	147.9	123.8	61.9	309.4	154.7	93.2	46.6	295.7	147.9	213.0	106.5
59	Sand	59	275.2	29.9	305.1	152.6	128.0	64.0	320.0	160.0	96.3	48.2	305.1	152.6	220.2	110.1
60	Sand	60	284.4	30.4	314.8	157.4	132.4	66.2	330.9	165.5	99.5	49.8	314.8	157.4	227.5	113.8
61	Sand	61	293.6	30.8	324.4	162.2	136.7	68.3	341.7	170.9	102.8	51.4	324.4	162.2	234.9	117.4
62	Sand	62	303.0	31.3	334.3	167.2	141.1	70.6	352.8	176.4	106.1	53.0	334.3	167.2	242.4	121.2
63	Sand	63	312.5	31.7	344.2	172.1	145.6	72.8	364.0	182.0	109.4	54.7	344.2	172.1	250.0	125.0
64	Sand	64	322.0	32.2	354.2	177.1	150.1	75.0	375.2	187.6	112.7	56.4	354.2	177.1	257.6	128.8
65	Sand	65	331.5	32.6	364.1	182.1	154.5	77.3	386.4	193.2	116.0	58.0	364.1	182.1	265.2	132.6
66	Sand	66	341.0	33.1	374.1	187.1	159.0	79.5	397.6	198.8	119.4	59.7	374.1	187.1	272.8	136.4
67	Sand	67	350.5	33.5	384.0	192.0	163.5	81.8	408.8	204.4	122.7	61.3	384.0	192.0	280.4	140.2
68	Sand	68	360.0	34.0	394.0	197.0	168.0	84.0	420.0	210.0	126.0	63.0	394.0	197.0	288.0	144.0
69	Sand	69	369.5	34.4	403.9	202.0	172.5	86.2	431.1	215.6	129.3	64.7	403.9	202.0	295.6	147.8
70	Sand	70	379.0	34.9	413.9	207.0	177.0	88.5	442.4	221.2	132.7	66.3	413.9	207.0	303.2	151.6
71	Sand	71	388.5	35.3	423.8	211.9	181.4	90.7	453.5	226.8	136.0	68.0	423.8	211.9	310.8	155.4
72	Sand	72	398.0	35.7	433.7	216.9	185.9	92.9	464.7	232.3	139.3	69.7	433.7	216.9	318.4	159.2
73	Sand	73	407.5	36.0	443.5	221.8	190.3	95.1	475.7	237.8	142.6	71.3	443.5	221.8	326.0	163.0
74	Sand	74	417.0	36.2	453.2	226.6	194.6	97.3	486.6	243.3	146.0	73.0	453.2	226.6	333.6	166.8
75	Sand	75	426.5	36.2	462.7	231.4	198.9	99.5	497.3	248.6	149.3	74.6	462.7	231.4	341.2	170.6
76	Sand	76	436.0	36.2	472.2	236.1	203.2	101.6	508.0	254.0	152.6	76.3	472.2	236.1	348.8	174.4
77	Sand	77	445.5	36.2	481.7	240.9	207.5	103.7	518.7	259.3	155.9	78.0	481.7	240.9	356.4	178.2
78	Sand	78	455.0	36.2	491.2	245.6	211.7	105.9	529.4	264.7	159.3	79.6	491.2	245.6	364.0	182.0
79	Sand	79	464.5	36.2	500.7	250.4	216.0	108.0	540.0	270.0	162.6	81.3	500.7	250.4	371.6	185.8
80	Sand	80	474.0	36.2	510.2	255.1	220.3	110.1	550.7	275.4	165.9	83.0	510.2	255.1	379.2	189.6
81	Sand	81	483.5	36.2	519.7	259.9	224.6	112.3	561.4	280.7	169.2	84.6	519.7	259.9	386.8	193.4
82	Sand	82	493.0	36.2	529.2	264.6	228.8	114.4	572.1	286.1	172.6	86.3	529.2	264.6	394.4	197.2
83	Sand	83	502.5	36.2	538.7	269.4	233.1	116.6	582.8	291.4	175.9	87.9	538.7	269.4	402.0	201.0
84	Sand	84	512.0	36.2	548.2	274.1	237.4	118.7	593.5	296.7	179.2	89.6	548.2	274.1	409.6	204.8
85	Sand	85	521.5	36.2	557.7	278.9	241.7	120.8	604.2	302.1	182.5	91.3	557.7	278.9	417.2	208.6
86	Sand	86	531.0	36.2	567.2	283.6	245.9	123.0	614.9	307.4	185.9	92.9	567.2	283.6	424.8	212.4
87	Sand	87	540.5	36.2	576.7	288.4	250.2	125.1	625.5	312.8	189.2	94.6	576.7	288.4	432.4	216.2
88	Sand	88	550.0	36.2	586.2	293.1	254.5	127.2	636.2	318.1	192.5	96.3	586.2	293.1	440.0	220.0
89	Sand	89	559.5	36.2	595.7	297.9	258.8	129.4	646.9	323.5	195.8	97.9	595.7	297.9	447.6	223.8
90	Sand	90	569.0	36.2	605.2	302.6	263.0	131.5	657.6	328.8	199.2	99.6	605.2	302.6	455.2	227.6
91	Sand	91	578.5	36.2	614.7	307.4	267.3	133.7	668.3	334.1	202.5	101.2	614.7	307.4	462.8	231.4
92	Sand	92	588.0	36.2	624.2	312.1	271.6	135.8	679.0	339.5	205.8	102.9	624.2	312.1	470.4	235.2
93	Sand	93	597.5	36.2	633.7	316.9	275.9	137.9	689.7	344.8	209.1	104.6	633.7	316.9	478.0	239.0
94	Sand	94	607.0	36.2	643.2	321.6	280.1	140.1	700.4	350.2	212.5	106.2	643.2	321.6	485.6	242.8
95	Sand	95	616.5	36.2	652.7	326.4	284.4	142.2	711.0	355.5	215.8	107.9	652.7	326.4	493.2	246.6

Steel H-Pile Capacities
079B00040N
HP14x89 (50ksi steel)

Location: **Pier 1**
Estimated Base of Pile Cap Elevation = 385.0 ft

Depth	Soil Type	Depth Below Pile Cap (ft)	Nominal Side Resistance (kips)	Nominal End Bearing (kips)	R_n Total Nominal Geotechnical Axial Resistance (kips)	(tons)	ϕR_n Total Factored Static Geotechnical Axial Resistance (ϕ=0.35 in clay; 0.45 in (kips)	(tons)	ϕR_n Field Verification Values (ϕ=0.4 FHWA Modified (kips)	(tons)	ϕR_n Total Factored Geotechnical Uplift Resistance Static Analysis Method (kips)	(tons)	$\phi_{stat} R_n$ Total Factored Geotechnical Extreme Resistance Static Analysis Method (kips)	(tons)	$\phi_{up} R_n$ Total Factored Geotechnical Extreme Uplift Resistance Static Analysis Method (kips)	(tons)
0	Sand	0	0.0	0.1	0.1	0.1	0.0	0.0	0.1	0.1	0.0	0.0	0.1	0.1	0.0	0.0
1	Sand	1	0.0	0.2	0.2	0.1	0.1	0.0	0.2	0.1	0.0	0.0	0.2	0.1	0.0	0.0
2	Sand	2	0.2	0.4	0.6	0.3	0.3	0.1	0.7	0.3	0.1	0.0	0.6	0.3	0.2	0.1
3	Sand	3	0.4	0.7	1.1	0.6	0.5	0.2	1.2	0.6	0.1	0.1	1.1	0.6	0.3	0.2
4	Sand	4	0.8	0.9	1.7	0.9	0.8	0.4	1.9	1.0	0.3	0.1	1.7	0.9	0.6	0.3
5	Sand	5	1.2	1.1	2.3	1.2	1.0	0.5	2.6	1.3	0.4	0.2	2.3	1.2	1.0	0.5
6	Sand	6	1.8	1.4	3.2	1.6	1.4	0.7	3.6	1.8	0.6	0.3	3.2	1.6	1.4	0.7
7	Sand	7	2.4	1.6	4.0	2.0	1.8	0.9	4.5	2.3	0.8	0.4	4.0	2.0	1.9	1.0
8	Sand	8	3.1	1.8	4.9	2.5	2.2	1.1	5.5	2.8	1.1	0.5	4.9	2.5	2.5	1.2
9	Sand	9	3.9	1.7	5.6	2.8	2.5	1.3	6.3	3.2	1.4	0.7	5.6	2.8	3.1	1.6
10	Sand	10	4.9	1.7	6.6	3.3	3.0	1.5	7.4	3.7	1.7	0.9	6.6	3.3	3.9	2.0
11	Clay	11	6.2	1.5	7.7	3.9	3.5	1.7	8.7	4.4	1.6	0.8	7.7	3.9	5.0	2.5
12	Clay	12	8.0	1.4	9.4	4.7	4.2	2.1	10.4	5.2	2.0	1.0	9.4	4.7	6.4	3.2
13	Clay	13	9.8	1.3	11.1	5.6	4.8	2.4	12.1	6.0	2.5	1.2	11.1	5.6	7.8	3.9
14	Clay	14	11.6	1.3	12.9	6.5	5.5	2.7	13.6	6.8	2.9	1.5	12.9	6.5	9.3	4.6
15	Clay	15	13.4	1.3	14.7	7.4	6.1	3.0	15.2	7.6	3.4	1.7	14.7	7.4	10.7	5.4
16	Clay	16	15.3	1.3	16.6	8.3	6.8	3.4	16.9	8.4	3.8	1.9	16.6	8.3	12.2	6.1
17	Clay	17	17.2	1.3	18.5	9.3	7.4	3.7	18.5	9.3	4.3	2.2	18.5	9.3	13.8	6.9
18	Clay	18	19.1	1.4	20.5	10.3	8.0	4.0	20.1	10.1	4.8	2.4	20.5	10.3	15.3	7.6
19	Clay	19	21.0	1.6	22.6	11.3	8.6	4.3	21.6	10.8	5.3	2.6	22.6	11.3	16.8	8.4
20	Clay	20	23.0	1.8	24.8	12.4	9.3	4.7	23.4	11.7	5.8	2.9	24.8	12.4	18.4	9.2
21	Clay	21	25.5	2.0	27.5	13.8	10.3	5.1	25.7	12.9	6.4	3.2	27.5	13.8	20.4	10.2
22	Clay	22	28.6	2.2	30.8	15.4	11.4	5.7	28.6	14.3	7.2	3.6	30.8	15.4	22.9	11.4
23	Clay	23	31.7	2.3	34.0	17.0	12.6	6.3	31.4	15.7	7.9	4.0	34.0	17.0	25.4	12.7
24	Clay	24	34.8	2.3	37.1	18.6	13.6	6.8	34.1	17.1	8.7	4.4	37.1	18.6	27.8	13.9
25	Clay	25	38.0	2.3	40.3	20.2	14.8	7.4	36.9	18.5	9.5	4.8	40.3	20.2	30.4	15.2
26	Clay	26	41.2	2.3	43.5	21.8	15.9	7.9	39.7	19.9	10.3	5.2	43.5	21.8	33.0	16.5
27	Clay	27	44.4	2.3	46.7	23.4	17.0	8.5	42.5	21.3	11.1	5.6	46.7	23.4	35.5	17.8
28	Clay	28	47.7	2.8	50.5	25.3	18.3	9.2	45.8	22.9	11.9	6.0	50.5	25.3	38.2	19.1
29	Clay	29	51.0	4.7	55.7	27.9	20.2	10.1	50.4	25.2	12.8	6.4	55.7	27.9	40.8	20.4
30	Clay	30	54.4	6.7	61.1	30.6	22.0	11.0	55.1	27.6	13.6	6.8	61.1	30.6	43.5	21.8
31	Sand	31	57.7	8.8	66.5	33.3	24.5	12.2	61.2	30.6	20.2	10.1	66.5	33.3	46.2	23.1
32	Sand	32	61.1	11.0	72.1	36.1	27.0	13.5	67.5	33.7	21.4	10.7	72.1	36.1	48.9	24.4
33	Sand	33	64.7	11.9	76.6	38.3	29.0	14.5	72.6	36.3	22.6	11.3	76.6	38.3	51.8	25.9
34	Sand	34	68.3	12.4	80.7	40.4	30.9	15.4	77.2	38.6	23.9	12.0	80.7	40.4	54.6	27.3
35	Sand	35	72.2	12.8	85.0	42.5	32.8	16.4	82.0	41.0	25.3	12.6	85.0	42.5	57.8	28.9
36	Sand	36	76.1	13.3	89.4	44.7	34.8	17.4	87.0	43.5	26.6	13.3	89.4	44.7	60.9	30.4
37	Sand	37	80.2	13.7	93.9	47.0	36.8	18.4	92.0	46.0	28.1	14.0	93.9	47.0	64.2	32.1
38	Sand	38	84.4	14.2	98.6	49.3	38.9	19.5	97.3	48.7	29.5	14.8	98.6	49.3	67.5	33.8
39	Sand	39	88.8	14.7	103.5	51.8	41.1	20.6	102.8	51.4	31.1	15.5	103.5	51.8	71.0	35.5
40	Sand	40	93.3	15.1	108.4	54.2	43.3	21.7	108.3	54.2	32.7	16.3	108.4	54.2	74.6	37.3
41	Sand	41	97.9	15.6	113.5	56.8	45.6	22.8	114.1	57.0	34.3	17.1	113.5	56.8	78.3	39.2
42	Sand	42	102.7	16.0	118.7	59.4	48.0	24.0	119.9	60.0	35.9	18.0	118.7	59.4	82.2	41.1
43	Sand	43	107.6	16.5	124.1	62.1	50.4	25.2	126.0	63.0	37.7	18.8	124.1	62.1	86.1	43.0
44	Sand	44	112.7	16.9	129.6	64.8	52.9	26.4	132.2	66.1	39.4	19.7	129.6	64.8	90.2	45.1
45	Sand	45	117.9	17.4	135.3	67.7	55.4	27.7	138.6	69.3	41.3	20.6	135.3	67.7	94.3	47.2
46	Sand	46	123.2	17.8	141.0	70.5	58.0	29.0	145.0	72.5	43.1	21.6	141.0	70.5	98.6	49.3
47	Sand	47	128.7	18.3	147.0	73.5	60.7	30.4	151.8	75.9	45.0	22.5	147.0	73.5	103.0	51.5
48	Sand	48	134.3	18.7	153.0	76.5	63.4	31.7	158.5	79.3	47.0	23.5	153.0	76.5	107.4	53.7
49	Sand	49	140.0	19.2	159.2	79.6	66.2	33.1	165.5	82.7	49.0	24.5	159.2	79.6	112.0	56.0
50	Sand	50	145.9	19.6	165.5	82.8	69.0	34.5	172.6	86.3	51.1	25.5	165.5	82.8	116.7	58.4

Depth	Soil Type	Depth Below Pile Cap	Nominal Side Resistance	Nominal End Bearing	R_n Total Nominal Geotechnical Axial Resistance		**ϕR_n Total Factored Static Geotechnical Axial Resistance (ϕ=0.35 in clay; 0.45 in**		**ϕR_n Field Verification Values (ϕ=0.4 FHWA Modified**		**ϕR_n Total Factored Geotechnical Uplift Resistance Static Analysis Method**		**$\phi_{stat} R_n$ Total Factored Geotechnical Extreme Resistance Static Analysis Method**		**$\phi_{up} R_n$ Total Factored Geotechnical Extreme Uplift Resistance Static Analysis Method**	
		(ft)	(kips)	(kips)	(kips)	(tons)	**(kips)**	**(tons)**	**(kips)**	**(tons)**	**(kips)**	**(tons)**	**(kips)**	**(tons)**	**(kips)**	**(tons)**
51	Sand	51	151.9	20.1	172.0	86.0	**72.0**	**36.0**	**179.9**	**89.9**	**53.2**	**26.6**	**172.0**	**86.0**	**121.5**	**60.8**
52	Sand	52	158.1	20.6	178.7	89.4	**75.0**	**37.5**	**187.4**	**93.7**	**55.3**	**27.7**	**178.7**	**89.4**	**126.5**	**63.2**
53	Sand	53	164.3	21.0	185.3	92.7	**77.9**	**39.0**	**194.8**	**97.4**	**57.5**	**28.8**	**185.3**	**92.7**	**131.4**	**65.7**
54	Sand	54	170.8	21.5	192.3	96.2	**81.1**	**40.5**	**202.7**	**101.4**	**59.8**	**29.9**	**192.3**	**96.2**	**136.6**	**68.3**
55	Sand	55	177.3	21.9	199.2	99.6	**84.2**	**42.1**	**210.5**	**105.2**	**62.1**	**31.0**	**199.2**	**99.6**	**141.8**	**70.9**
56	Sand	56	184.0	22.4	206.4	103.2	**87.4**	**43.7**	**218.6**	**109.3**	**64.4**	**32.2**	**206.4**	**103.2**	**147.2**	**73.6**
57	Sand	57	190.9	22.8	213.7	106.9	**90.7**	**45.4**	**226.8**	**113.4**	**66.8**	**33.4**	**213.7**	**106.9**	**152.7**	**76.4**
58	Sand	58	197.9	23.3	221.2	110.6	**94.1**	**47.0**	**235.2**	**117.6**	**69.3**	**34.6**	**221.2**	**110.6**	**158.3**	**79.2**
59	Sand	59	205.0	23.7	228.7	114.4	**97.5**	**48.7**	**243.7**	**121.8**	**71.8**	**35.9**	**228.7**	**114.4**	**164.0**	**82.0**
60	Sand	60	212.2	24.2	236.4	118.2	**100.9**	**50.5**	**252.3**	**126.2**	**74.3**	**37.1**	**236.4**	**118.2**	**169.8**	**84.9**
61	Sand	61	219.6	24.6	244.2	122.1	**104.4**	**52.2**	**261.1**	**130.6**	**76.9**	**38.4**	**244.2**	**122.1**	**175.7**	**87.8**
62	Sand	62	227.1	25.1	252.2	126.1	**108.0**	**54.0**	**270.1**	**135.1**	**79.5**	**39.7**	**252.2**	**126.1**	**181.7**	**90.8**
63	Sand	63	234.8	25.5	260.3	130.2	**111.7**	**55.8**	**279.2**	**139.6**	**82.2**	**41.1**	**260.3**	**130.2**	**187.8**	**93.9**
64	Sand	64	242.6	26.0	268.6	134.3	**115.4**	**57.7**	**288.6**	**144.3**	**84.9**	**42.5**	**268.6**	**134.3**	**194.1**	**97.0**
65	Sand	65	250.5	26.5	277.0	138.5	**119.2**	**59.6**	**298.0**	**149.0**	**87.7**	**43.8**	**277.0**	**138.5**	**200.4**	**100.2**
66	Sand	66	258.6	26.9	285.5	142.8	**123.0**	**61.5**	**307.6**	**153.8**	**90.5**	**45.3**	**285.5**	**142.8**	**206.9**	**103.4**
67	Sand	67	266.8	27.4	294.2	147.1	**126.9**	**63.5**	**317.4**	**158.7**	**93.4**	**46.7**	**294.2**	**147.1**	**213.4**	**106.7**
68	Sand	68	275.2	27.8	303.0	151.5	**130.9**	**65.5**	**327.3**	**163.6**	**96.3**	**48.2**	**303.0**	**151.5**	**220.2**	**110.1**
69	Sand	69	283.6	28.3	311.9	156.0	**134.9**	**67.5**	**337.3**	**168.6**	**99.3**	**49.6**	**311.9**	**156.0**	**226.9**	**113.4**
70	Sand	70	292.3	28.7	321.0	160.5	**139.0**	**69.5**	**347.5**	**173.8**	**102.3**	**51.2**	**321.0**	**160.5**	**233.8**	**116.9**
71	Sand	71	301.0	29.2	330.2	165.1	**143.1**	**71.6**	**357.9**	**178.9**	**105.4**	**52.7**	**330.2**	**165.1**	**240.8**	**120.4**
72	Sand	72	309.9	29.6	339.5	169.8	**147.3**	**73.7**	**368.3**	**184.2**	**108.5**	**54.2**	**339.5**	**169.8**	**247.9**	**124.0**
73	Sand	73	319.0	30.1	349.1	174.6	**151.6**	**75.8**	**379.1**	**189.6**	**111.7**	**55.8**	**349.1**	**174.6**	**255.2**	**127.6**
74	Sand	74	328.1	30.5	358.6	179.3	**155.9**	**78.0**	**389.8**	**194.9**	**114.8**	**57.4**	**358.6**	**179.3**	**262.5**	**131.2**
75	Sand	75	337.5	31.0	368.5	184.3	**160.4**	**80.2**	**400.9**	**200.5**	**118.1**	**59.1**	**368.5**	**184.3**	**270.0**	**135.0**
76	Sand	76	346.9	31.4	378.3	189.2	**164.8**	**82.4**	**412.0**	**206.0**	**121.4**	**60.7**	**378.3**	**189.2**	**277.5**	**138.8**
77	Sand	77	356.4	31.9	388.3	194.2	**169.3**	**84.6**	**423.2**	**211.6**	**124.7**	**62.4**	**388.3**	**194.2**	**285.1**	**142.6**
78	Sand	78	365.9	32.4	398.3	199.2	**173.8**	**86.9**	**434.5**	**217.2**	**128.1**	**64.0**	**398.3**	**199.2**	**292.7**	**146.4**
79	Sand	79	375.4	32.8	408.2	204.1	**178.2**	**89.1**	**445.6**	**222.8**	**131.4**	**65.7**	**408.2**	**204.1**	**300.3**	**150.2**
80	Sand	80	384.9	33.3	418.2	209.1	**182.7**	**91.4**	**456.9**	**228.4**	**134.7**	**67.4**	**418.2**	**209.1**	**307.9**	**154.0**
81	Sand	81	394.4	33.7	428.1	214.1	**187.2**	**93.6**	**468.0**	**234.0**	**138.0**	**69.0**	**428.1**	**214.1**	**315.5**	**157.8**
82	Sand	82	403.9	34.2	438.1	219.1	**191.7**	**95.8**	**479.2**	**239.6**	**141.4**	**70.7**	**438.1**	**219.1**	**323.1**	**161.6**
83	Sand	83	413.4	34.6	448.0	224.0	**196.2**	**98.1**	**490.4**	**245.2**	**144.7**	**72.3**	**448.0**	**224.0**	**330.7**	**165.4**
84	Sand	84	422.9	35.1	458.0	229.0	**200.7**	**100.3**	**501.6**	**250.8**	**148.0**	**74.0**	**458.0**	**229.0**	**338.3**	**169.2**
85	Sand	85	432.4	35.5	467.9	234.0	**205.1**	**102.6**	**512.8**	**256.4**	**151.3**	**75.7**	**467.9**	**234.0**	**345.9**	**173.0**
86	Sand	86	441.9	35.8	477.7	238.9	**209.5**	**104.8**	**523.8**	**261.9**	**154.7**	**77.3**	**477.7**	**238.9**	**353.5**	**176.8**
87	Sand	87	451.4	36.1	487.5	243.8	**213.9**	**107.0**	**534.8**	**267.4**	**158.0**	**79.0**	**487.5**	**243.8**	**361.1**	**180.6**
88	Sand	88	460.9	36.2	497.1	248.6	**218.2**	**109.1**	**545.6**	**272.8**	**161.3**	**80.7**	**497.1**	**248.6**	**368.7**	**184.4**
89	Sand	89	470.4	36.2	506.6	253.3	**222.5**	**111.3**	**556.3**	**278.2**	**164.6**	**82.3**	**506.6**	**253.3**	**376.3**	**188.2**
90	Sand	90	479.9	36.2	516.1	258.1	**226.8**	**113.4**	**567.0**	**283.5**	**168.0**	**84.0**	**516.1**	**258.1**	**383.9**	**192.0**
91	Sand	91	489.4	36.2	525.6	262.8	**231.1**	**115.5**	**577.7**	**288.8**	**171.3**	**85.6**	**525.6**	**262.8**	**391.5**	**195.8**
92	Sand	92	498.9	36.2	535.1	267.6	**235.3**	**117.7**	**588.4**	**294.2**	**174.6**	**87.3**	**535.1**	**267.6**	**399.1**	**199.6**
93	Sand	93	508.4	36.2	544.6	272.3	**239.6**	**119.8**	**599.1**	**299.5**	**177.9**	**89.0**	**544.6**	**272.3**	**406.7**	**203.4**
94	Sand	94	517.9	36.2	554.1	277.1	**243.9**	**121.9**	**609.7**	**304.9**	**181.3**	**90.6**	**554.1**	**277.1**	**414.3**	**207.2**
95	Sand	95	527.4	36.2	563.6	281.8	**248.2**	**124.1**	**620.4**	**310.2**	**184.6**	**92.3**	**563.6**	**281.8**	**421.9**	**211.0**

Steel H-Pile Capacities

079B00040N
HP14x89 (50ksi steel)

Location: **Piers 2&3**
Estimated Base of Pile Cap Elevation = 385 ft

					R_n		ϕR_n		ϕR_n		ϕR_n		$\phi_{stat} R_n$		$\phi_{up} R_n$	
		Depth			Total Nominal		**Total Factored**		**Field Verification**		**Total Factored**		**Total Factored**		**Total Factored**	
		Below Pile Cap	Nominal Side Resistance	Nominal End Bearing	Geotechnical Axial Resistance		**Static Geotechnical Axial Resistance (ϕ=0.35 in clay; 0.45 in**		**Values (ϕ=0.4 FHWA Modified**		**Geotechnical Uplift Resistance Static Analysis Method**		**Geotechnical Extreme Resistance Static Analysis Method**		**Geotechnical Extreme Uplift Resistance Static Analysis Method**	
Depth	Soil Type	(ft)	(kips)	(kips)	(kips)	(tons)	**(kips)**	**(tons)**	**(kips)**	**(tons)**	**(kips)**	**(tons)**	**(kips)**	**(tons)**	**(kips)**	**(tons)**
0	Sand	0	0.0	0.8	0.8	0.4	**0.4**	**0.2**	**0.9**	**0.5**	**0.0**	**0.0**	**0.8**	**0.4**	**0.0**	**0.0**
1	Sand	1	0.1	0.8	0.9	0.5	**0.4**	**0.2**	**1.0**	**0.5**	**0.0**	**0.0**	**0.9**	**0.5**	**0.1**	**0.0**
2	Sand	2	0.2	1.2	1.4	0.7	**0.6**	**0.3**	**1.6**	**0.8**	**0.1**	**0.0**	**1.4**	**0.7**	**0.2**	**0.1**
3	Sand	3	0.5	1.6	2.1	1.1	**0.9**	**0.5**	**2.4**	**1.2**	**0.2**	**0.1**	**2.1**	**1.1**	**0.4**	**0.2**
4	Sand	4	0.9	1.6	2.5	1.3	**1.1**	**0.6**	**2.8**	**1.4**	**0.3**	**0.2**	**2.5**	**1.3**	**0.7**	**0.4**
5	Sand	5	1.5	1.6	3.1	1.6	**1.4**	**0.7**	**3.5**	**1.7**	**0.5**	**0.3**	**3.1**	**1.6**	**1.2**	**0.6**
6	Sand	6	2.1	1.6	3.7	1.9	**1.7**	**0.8**	**4.2**	**2.1**	**0.7**	**0.4**	**3.7**	**1.9**	**1.7**	**0.8**
7	Sand	7	2.9	1.6	4.5	2.3	**2.0**	**1.0**	**5.1**	**2.5**	**1.0**	**0.5**	**4.5**	**2.3**	**2.3**	**1.2**
8	Sand	8	3.7	1.6	5.3	2.7	**2.4**	**1.2**	**6.0**	**3.0**	**1.3**	**0.6**	**5.3**	**2.7**	**3.0**	**1.5**
9	Sand	9	4.7	1.6	6.3	3.2	**2.8**	**1.4**	**7.1**	**3.5**	**1.6**	**0.8**	**6.3**	**3.2**	**3.8**	**1.9**
10	Clay	10	6.6	1.6	8.2	4.1	**3.5**	**1.8**	**8.8**	**4.4**	**1.7**	**0.8**	**8.2**	**4.1**	**5.3**	**2.6**
11	Clay	11	9.3	1.6	10.9	5.5	**4.4**	**2.2**	**11.1**	**5.6**	**2.3**	**1.2**	**10.9**	**5.5**	**7.4**	**3.7**
12	Clay	12	12.0	1.6	13.6	6.8	**5.4**	**2.7**	**13.5**	**6.7**	**3.0**	**1.5**	**13.6**	**6.8**	**9.6**	**4.8**
13	Clay	13	14.8	1.6	16.4	8.2	**6.4**	**3.2**	**15.9**	**8.0**	**3.7**	**1.9**	**16.4**	**8.2**	**11.8**	**5.9**
14	Clay	14	17.7	1.6	19.3	9.7	**7.4**	**3.7**	**18.5**	**9.2**	**4.4**	**2.2**	**19.3**	**9.7**	**14.2**	**7.1**
15	Clay	15	20.6	1.6	22.2	11.1	**8.4**	**4.2**	**21.0**	**10.5**	**5.2**	**2.6**	**22.2**	**11.1**	**16.5**	**8.2**
16	Clay	16	23.6	1.6	25.2	12.6	**9.5**	**4.7**	**23.6**	**11.8**	**5.9**	**3.0**	**25.2**	**12.6**	**18.9**	**9.4**
17	Clay	17	26.6	1.6	28.2	14.1	**10.5**	**5.3**	**26.3**	**13.1**	**6.7**	**3.3**	**28.2**	**14.1**	**21.3**	**10.6**
18	Clay	18	29.7	1.6	31.3	15.7	**11.6**	**5.8**	**29.0**	**14.5**	**7.4**	**3.7**	**31.3**	**15.7**	**23.8**	**11.9**
19	Clay	19	32.8	1.6	34.4	17.2	**12.7**	**6.3**	**31.7**	**15.8**	**8.2**	**4.1**	**34.4**	**17.2**	**26.2**	**13.1**
20	Clay	20	35.8	1.6	37.4	18.7	**13.7**	**6.9**	**34.3**	**17.2**	**9.0**	**4.5**	**37.4**	**18.7**	**28.6**	**14.3**
21	Clay	21	38.9	1.6	40.5	20.3	**14.8**	**7.4**	**37.0**	**18.5**	**9.7**	**4.9**	**40.5**	**20.3**	**31.1**	**15.6**
22	Clay	22	41.9	1.6	43.5	21.8	**15.9**	**7.9**	**39.6**	**19.8**	**10.5**	**5.2**	**43.5**	**21.8**	**33.5**	**16.8**
23	Clay	23	45.0	1.6	46.6	23.3	**16.9**	**8.5**	**42.4**	**21.2**	**11.3**	**5.6**	**46.6**	**23.3**	**36.0**	**18.0**
24	Clay	24	48.2	1.6	49.8	24.9	**18.1**	**9.0**	**45.2**	**22.6**	**12.1**	**6.0**	**49.8**	**24.9**	**38.6**	**19.3**
25	Clay	25	51.4	1.6	53.0	26.5	**19.2**	**9.6**	**48.0**	**24.0**	**12.9**	**6.4**	**53.0**	**26.5**	**41.1**	**20.6**
26	Clay	26	54.7	1.6	56.3	28.2	**20.3**	**10.2**	**50.8**	**25.4**	**13.7**	**6.8**	**56.3**	**28.2**	**43.8**	**21.9**
27	Clay	27	58.0	1.6	59.6	29.8	**21.5**	**10.7**	**53.7**	**26.9**	**14.5**	**7.3**	**59.6**	**29.8**	**46.4**	**23.2**
28	Clay	28	61.4	1.6	63.0	31.5	**22.7**	**11.3**	**56.7**	**28.4**	**15.4**	**7.7**	**63.0**	**31.5**	**49.1**	**24.6**
29	Clay	29	64.9	1.6	66.5	33.3	**23.9**	**12.0**	**59.8**	**29.9**	**16.2**	**8.1**	**66.5**	**33.3**	**51.9**	**26.0**
30	Sand	30	68.1	1.6	69.7	34.9	**25.3**	**12.7**	**63.4**	**31.7**	**23.8**	**11.9**	**69.7**	**34.9**	**54.5**	**27.2**
31	Sand	31	71.1	1.6	72.7	36.4	**26.7**	**13.3**	**66.7**	**33.4**	**24.9**	**12.4**	**72.7**	**36.4**	**56.9**	**28.4**
32	Sand	32	74.2	1.6	75.8	37.9	**28.1**	**14.0**	**70.2**	**35.1**	**26.0**	**13.0**	**75.8**	**37.9**	**59.4**	**29.7**
33	Sand	33	77.3	1.8	79.1	39.6	**29.6**	**14.8**	**73.9**	**37.0**	**27.1**	**13.5**	**79.1**	**39.6**	**61.8**	**30.9**
34	Sand	34	80.6	2.5	83.1	41.6	**31.4**	**15.7**	**78.4**	**39.2**	**28.2**	**14.1**	**83.1**	**41.6**	**64.5**	**32.2**
35	Sand	35	83.9	3.3	87.2	43.6	**33.2**	**16.6**	**83.1**	**41.5**	**29.4**	**14.7**	**87.2**	**43.6**	**67.1**	**33.6**
36	Sand	36	87.3	4.0	91.3	45.7	**35.1**	**17.5**	**87.7**	**43.8**	**30.6**	**15.3**	**91.3**	**45.7**	**69.8**	**34.9**
37	Sand	37	90.9	4.7	95.6	47.8	**37.0**	**18.5**	**92.5**	**46.3**	**31.8**	**15.9**	**95.6**	**47.8**	**72.7**	**36.4**
38	Sand	38	94.5	4.9	99.4	49.7	**38.7**	**19.4**	**96.8**	**48.4**	**33.1**	**16.5**	**99.4**	**49.7**	**75.6**	**37.8**
39	Sand	39	98.1	4.9	103.0	51.5	**40.3**	**20.2**	**100.8**	**50.4**	**34.3**	**17.2**	**103.0**	**51.5**	**78.5**	**39.2**
40	Sand	40	101.9	4.9	106.8	53.4	**42.0**	**21.0**	**105.1**	**52.6**	**35.7**	**17.8**	**106.8**	**53.4**	**81.5**	**40.8**
41	Sand	41	105.8	4.9	110.7	55.4	**43.8**	**21.9**	**109.5**	**54.7**	**37.0**	**18.5**	**110.7**	**55.4**	**84.6**	**42.3**
42	Sand	42	109.7	4.9	114.6	57.3	**45.6**	**22.8**	**113.9**	**56.9**	**38.4**	**19.2**	**114.6**	**57.3**	**87.8**	**43.9**
43	Sand	43	113.8	4.9	118.7	59.4	**47.4**	**23.7**	**118.5**	**59.2**	**39.8**	**19.9**	**118.7**	**59.4**	**91.0**	**45.5**
44	Sand	44	118.5	4.9	123.4	61.7	**49.5**	**24.8**	**123.8**	**61.9**	**41.5**	**20.7**	**123.4**	**61.7**	**94.8**	**47.4**
45	Sand	45	124.1	4.9	129.0	64.5	**52.0**	**26.0**	**130.1**	**65.0**	**43.4**	**21.7**	**129.0**	**64.5**	**99.3**	**49.6**
46	Sand	46	129.7	4.9	134.6	67.3	**54.6**	**27.3**	**136.4**	**68.2**	**45.4**	**22.7**	**134.6**	**67.3**	**103.8**	**51.9**
47	Sand	47	135.5	4.9	140.4	70.2	**57.2**	**28.6**	**142.9**	**71.5**	**47.4**	**23.7**	**140.4**	**70.2**	**108.4**	**54.2**
48	Sand	48	141.4	4.9	146.3	73.2	**59.8**	**29.9**	**149.5**	**74.8**	**49.5**	**24.7**	**146.3**	**73.2**	**113.1**	**56.6**

Depth	Soil Type	Depth Below Pile Cap	Nominal Side Resistance	Nominal End Bearing	R_n Total Nominal Geotechnical Axial Resistance		ϕR_n Total Factored Static Geotechnical Axial Resistance (ϕ=0.35 in clay; 0.45 in		ϕR_n Field Verification Values (ϕ=0.4 FHWA Modified		ϕR_n Total Factored Geotechnical Uplift Resistance Static Analysis Method		$\phi_{stat} R_n$ Total Factored Geotechnical Extreme Resistance Static Analysis Method		$\phi_{up} R_n$ Total Factored Geotechnical Extreme Uplift Resistance Static Analysis Method	
		(ft)	(kips)	(kips)	(kips)	(tons)	(kips)	(tons)	(kips)	(tons)	(kips)	(tons)	(kips)	(tons)	(kips)	(tons)
49	Sand	49	147.5	4.9	152.4	76.2	62.6	31.3	156.4	78.2	51.6	25.8	152.4	76.2	118.0	59.0
50	Sand	50	153.7	4.9	158.6	79.3	65.4	32.7	163.4	81.7	53.8	26.9	158.6	79.3	123.0	61.5
51	Sand	51	160.0	4.9	164.9	82.5	68.2	34.1	170.5	85.2	56.0	28.0	164.9	82.5	128.0	64.0
52	Sand	52	166.5	4.9	171.4	85.7	71.1	35.6	177.8	88.9	58.3	29.1	171.4	85.7	133.2	66.6
53	Sand	53	173.1	7.1	180.2	90.1	75.1	37.5	187.7	93.8	60.6	30.3	180.2	90.1	138.5	69.2
54	Sand	54	179.8	15.2	195.0	97.5	81.7	40.9	204.3	102.2	62.9	31.5	195.0	97.5	143.8	71.9
55	Sand	55	186.7	23.3	210.0	105.0	88.5	44.2	221.2	110.6	65.3	32.7	210.0	105.0	149.4	74.7
56	Sand	56	193.7	31.4	225.1	112.6	95.3	47.6	238.2	119.1	67.8	33.9	225.1	112.6	155.0	77.5
57	Sand	57	200.9	39.5	240.4	120.2	102.2	51.1	255.4	127.7	70.3	35.2	240.4	120.2	160.7	80.4
58	Sand	58	208.2	41.7	249.9	125.0	106.4	53.2	266.1	133.0	72.9	36.4	249.9	125.0	166.6	83.3
59	Sand	59	215.6	41.7	257.3	128.7	109.8	54.9	274.4	137.2	75.5	37.7	257.3	128.7	172.5	86.2
60	Sand	60	223.2	41.7	264.9	132.5	113.2	56.6	283.0	141.5	78.1	39.1	264.9	132.5	178.6	89.3
61	Sand	61	230.9	41.7	272.6	136.3	116.7	58.3	291.6	145.8	80.8	40.4	272.6	136.3	184.7	92.4
62	Sand	62	238.7	41.7	280.4	140.2	120.2	60.1	300.4	150.2	83.5	41.8	280.4	140.2	191.0	95.5
63	Sand	63	246.7	41.7	288.4	144.2	123.8	61.9	309.4	154.7	86.3	43.2	288.4	144.2	197.4	98.7
64	Sand	64	254.8	41.7	296.5	148.3	127.4	63.7	318.5	159.3	89.2	44.6	296.5	148.3	203.8	101.9
65	Sand	65	263.1	41.7	304.8	152.4	131.1	65.6	327.9	163.9	92.1	46.0	304.8	152.4	210.5	105.2
66	Sand	66	271.5	41.7	313.2	156.6	134.9	67.5	337.3	168.7	95.0	47.5	313.2	156.6	217.2	108.6
67	Sand	67	280.0	41.7	321.7	160.9	138.7	69.4	346.9	173.4	98.0	49.0	321.7	160.9	224.0	112.0
68	Sand	68	288.7	41.7	330.4	165.2	142.7	71.3	356.7	178.3	101.0	50.5	330.4	165.2	231.0	115.5
69	Sand	69	297.5	41.7	339.2	169.6	146.6	73.3	366.6	183.3	104.1	52.1	339.2	169.6	238.0	119.0
70	Sand	70	306.4	41.7	348.1	174.1	150.6	75.3	376.6	188.3	107.2	53.6	348.1	174.1	245.1	122.6
71	Sand	71	315.5	41.7	357.2	178.6	154.7	77.4	386.8	193.4	110.4	55.2	357.2	178.6	252.4	126.2
72	Sand	72	324.7	41.7	366.4	183.2	158.9	79.4	397.2	198.6	113.6	56.8	366.4	183.2	259.8	129.9
73	Sand	73	334.0	41.7	375.7	187.9	163.0	81.5	407.6	203.8	116.9	58.5	375.7	187.9	267.2	133.6
74	Sand	74	343.5	41.7	385.2	192.6	167.3	83.7	418.3	209.2	120.2	60.1	385.2	192.6	274.8	137.4
75	Sand	75	353.0	41.7	394.7	197.4	171.6	85.8	429.0	214.5	123.6	61.8	394.7	197.4	282.4	141.2
76	Sand	76	362.5	41.7	404.2	202.1	175.9	87.9	439.7	219.8	126.9	63.4	404.2	202.1	290.0	145.0
77	Sand	77	372.0	41.7	413.7	206.9	180.1	90.1	450.4	225.2	130.2	65.1	413.7	206.9	297.6	148.8
78	Sand	78	381.5	41.7	423.2	211.6	184.4	92.2	461.1	230.5	133.5	66.8	423.2	211.6	305.2	152.6
79	Sand	79	391.0	41.7	432.7	216.4	188.7	94.3	471.7	235.9	136.9	68.4	432.7	216.4	312.8	156.4
80	Sand	80	400.5	41.7	442.2	221.1	193.0	96.5	482.4	241.2	140.2	70.1	442.2	221.1	320.4	160.2
81	Sand	81	410.0	41.7	451.7	225.9	197.2	98.6	493.1	246.6	143.5	71.8	451.7	225.9	328.0	164.0
82	Sand	82	419.5	41.7	461.2	230.6	201.5	100.8	503.8	251.9	146.8	73.4	461.2	230.6	335.6	167.8
83	Sand	83	429.0	41.7	470.7	235.4	205.8	102.9	514.5	257.2	150.2	75.1	470.7	235.4	343.2	171.6
84	Sand	84	438.5	41.7	480.2	240.1	210.1	105.0	525.2	262.6	153.5	76.7	480.2	240.1	350.8	175.4
85	Sand	85	448.0	41.7	489.7	244.9	214.3	107.2	535.9	267.9	156.8	78.4	489.7	244.9	358.4	179.2
86	Sand	86	457.5	41.7	499.2	249.6	218.6	109.3	546.6	273.3	160.1	80.1	499.2	249.6	366.0	183.0
87	Sand	87	467.0	41.7	508.7	254.4	222.9	111.4	557.2	278.6	163.5	81.7	508.7	254.4	373.6	186.8
88	Sand	88	476.5	41.7	518.2	259.1	227.2	113.6	567.9	284.0	166.8	83.4	518.2	259.1	381.2	190.6
89	Sand	89	486.0	41.7	527.7	263.9	231.4	115.7	578.6	289.3	170.1	85.1	527.7	263.9	388.8	194.4
90	Sand	90	495.5	41.7	537.2	268.6	235.7	117.9	589.3	294.7	173.4	86.7	537.2	268.6	396.4	198.2
91	Sand	91	505.0	41.7	546.7	273.4	240.0	120.0	600.0	300.0	176.8	88.4	546.7	273.4	404.0	202.0
92	Sand	92	514.5	41.7	556.2	278.1	244.3	122.1	610.7	305.3	180.1	90.0	556.2	278.1	411.6	205.8
93	Sand	93	524.0	41.7	565.7	282.9	248.5	124.3	621.4	310.7	183.4	91.7	565.7	282.9	419.2	209.6
94	Sand	94	533.5	41.7	575.2	287.6	252.8	126.4	632.1	316.0	186.7	93.4	575.2	287.6	426.8	213.4
95	Sand	95	543.0	41.7	584.7	292.4	257.1	128.5	642.7	321.4	190.1	95.0	584.7	292.4	434.4	217.2

Steel H-Pile Capacities

079B00040N

HP14x89 (50ksi steel)

Location: **Piers 4&5**

Estimated Base of Pile Cap Elevation = 385.0 ft

Depth	Soil Type	Depth Below Pile Cap	Nominal Resistance	Nominal Bearing	R_n Total Nominal Geotechnical Axial Resistance		ϕR_n Total Factored Static Geotechnical Axial Resistance (ϕ=0.35 in clay; 0.45 in		ϕR_n Field Verification Values (ϕ=0.4 FHWA Modified		ϕR_n Total Factored Geotechnical Uplift Resistance Static Analysis Method		$\phi_{stat} R_n$ Total Factored Geotechnical Extreme Resistance Static Analysis Method		$\phi_{up} R_n$ Total Factored Geotechnical Extreme Uplift Resistance Static Analysis Method	
		(ft)	(kips)	(kips)	(kips)	(tons)	(kips)	(tons)	(kips)	(tons)	(kips)	(tons)	(kips)	(tons)	(kips)	(tons)
0	Sand	0	0.0	0.2	0.2	0.1	0.1	0.0	0.2	0.1	0.0	0.0	0.2	0.1	0.0	0.0
1	Sand	1	0.1	0.4	0.5	0.3	0.2	0.1	0.6	0.3	0.0	0.0	0.5	0.3	0.1	0.0
2	Sand	2	0.2	0.6	0.8	0.4	0.4	0.2	0.9	0.5	0.1	0.0	0.8	0.4	0.2	0.1
3	Sand	3	0.5	1.0	1.5	0.8	0.7	0.3	1.7	0.8	0.2	0.1	1.5	0.8	0.4	0.2
4	Sand	4	0.9	1.3	2.2	1.1	1.0	0.5	2.5	1.2	0.3	0.2	2.2	1.1	0.7	0.4
5	Sand	5	1.5	1.7	3.2	1.6	1.4	0.7	3.6	1.8	0.5	0.3	3.2	1.6	1.2	0.6
6	Sand	6	2.1	2.0	4.1	2.1	1.8	0.9	4.6	2.3	0.7	0.4	4.1	2.1	1.7	0.8
7	Sand	7	2.9	2.3	5.2	2.6	2.3	1.2	5.9	2.9	1.0	0.5	5.2	2.6	2.3	1.2
8	Sand	8	3.7	2.4	6.1	3.1	2.7	1.4	6.9	3.4	1.3	0.6	6.1	3.1	3.0	1.5
9	Sand	9	4.7	2.5	7.2	3.6	3.2	1.6	8.1	4.1	1.6	0.8	7.2	3.6	3.8	1.9
10	Clay	10	6.6	2.4	9.0	4.5	3.9	1.9	9.7	4.8	1.7	0.8	9.0	4.5	5.3	2.6
11	Clay	11	9.3	2.3	11.6	5.8	4.8	2.4	12.0	6.0	2.3	1.2	11.6	5.8	7.4	3.7
12	Clay	12	12.0	2.3	14.3	7.2	5.7	2.9	14.3	7.2	3.0	1.5	14.3	7.2	9.6	4.8
13	Clay	13	14.8	2.3	17.1	8.6	6.7	3.4	16.8	8.4	3.7	1.9	17.1	8.6	11.8	5.9
14	Clay	14	17.7	2.3	20.0	10.0	7.7	3.9	19.3	9.7	4.4	2.2	20.0	10.0	14.2	7.1
15	Clay	15	20.6	2.3	22.9	11.5	8.7	4.4	21.8	10.9	5.2	2.6	22.9	11.5	16.5	8.2
16	Clay	16	23.6	2.3	25.9	13.0	9.8	4.9	24.5	12.2	5.9	3.0	25.9	13.0	18.9	9.4
17	Clay	17	26.6	2.6	29.2	14.6	10.9	5.5	27.4	13.7	6.7	3.3	29.2	14.6	21.3	10.6
18	Clay	18	29.7	3.7	33.4	16.7	12.4	6.2	31.0	15.5	7.4	3.7	33.4	16.7	23.8	11.9
19	Clay	19	32.8	4.9	37.7	18.9	13.9	7.0	34.8	17.4	8.2	4.1	37.7	18.9	26.2	13.1
20	Sand	20	35.6	6.3	41.9	21.0	15.8	7.9	39.5	19.8	12.5	6.2	41.9	21.0	28.5	14.2
21	Sand	21	38.1	7.7	45.8	22.9	17.6	8.8	43.9	22.0	13.3	6.7	45.8	22.9	30.5	15.2
22	Sand	22	40.7	8.4	49.1	24.6	19.0	9.5	47.6	23.8	14.2	7.1	49.1	24.6	32.6	16.3
23	Sand	23	43.5	8.8	52.3	26.2	20.5	10.2	51.2	25.6	15.2	7.6	52.3	26.2	34.8	17.4
24	Sand	24	46.4	9.2	55.6	27.8	22.0	11.0	54.9	27.5	16.2	8.1	55.6	27.8	37.1	18.6
25	Sand	25	49.4	9.6	59.0	29.5	23.5	11.8	58.8	29.4	17.3	8.6	59.0	29.5	39.5	19.8
26	Sand	26	52.6	10.0	62.6	31.3	25.1	12.6	62.8	31.4	18.4	9.2	62.6	31.3	42.1	21.0
27	Sand	27	55.9	9.9	65.8	32.9	26.6	13.3	66.4	33.2	19.6	9.8	65.8	32.9	44.7	22.4
28	Sand	28	59.3	8.4	67.7	33.9	27.4	13.7	68.5	34.3	20.8	10.4	67.7	33.9	47.4	23.7
29	Sand	29	62.8	6.8	69.6	34.8	28.3	14.1	70.7	35.3	22.0	11.0	69.6	34.8	50.2	25.1
30	Clay	30	66.8	5.2	72.0	36.0	29.1	14.6	72.8	36.4	16.7	8.4	72.0	36.0	53.4	26.7
31	Clay	31	71.1	3.4	74.5	37.3	30.0	15.0	75.0	37.5	17.8	8.9	74.5	37.3	56.9	28.4
32	Clay	32	75.4	2.9	78.3	39.2	31.3	15.7	78.3	39.1	18.9	9.4	78.3	39.2	60.3	30.2
33	Clay	33	79.9	2.9	82.8	41.4	32.9	16.4	82.2	41.1	20.0	10.0	82.8	41.4	63.9	32.0
34	Clay	34	84.4	2.9	87.3	43.7	34.5	17.2	86.2	43.1	21.1	10.6	87.3	43.7	67.5	33.8
35	Clay	35	89.0	2.9	91.9	46.0	36.1	18.0	90.2	45.1	22.3	11.1	91.9	46.0	71.2	35.6
36	Clay	36	93.6	2.9	96.5	48.3	37.7	18.8	94.2	47.1	23.4	11.7	96.5	48.3	74.9	37.4
37	Clay	37	98.3	3.8	102.1	51.1	39.6	19.8	99.1	49.6	24.6	12.3	102.1	51.1	78.6	39.3
38	Clay	38	103.1	7.0	110.1	55.1	42.4	21.2	106.1	53.1	25.8	12.9	110.1	55.1	82.5	41.2
39	Clay	39	108.0	10.2	118.2	59.1	45.3	22.6	113.2	56.6	27.0	13.5	118.2	59.1	86.4	43.2
40	Sand	40	113.0	13.6	126.6	63.3	49.1	24.5	122.7	61.3	39.6	19.8	126.6	63.3	90.4	45.2
41	Sand	41	118.4	17.1	135.5	67.8	53.1	26.5	132.7	66.3	41.4	20.7	135.5	67.8	94.7	47.4
42	Sand	42	123.9	18.4	142.3	71.2	56.1	28.1	140.3	70.2	43.4	21.7	142.3	71.2	99.1	49.6
43	Sand	43	129.5	18.8	148.3	74.2	58.8	29.4	147.1	73.5	45.3	22.7	148.3	74.2	103.6	51.8
44	Sand	44	135.3	19.3	154.6	77.3	61.7	30.8	154.2	77.1	47.4	23.7	154.6	77.3	108.2	54.1
45	Sand	45	141.2	19.7	160.9	80.5	64.5	32.2	161.2	80.6	49.4	24.7	160.9	80.5	113.0	56.5
46	Sand	46	147.2	20.2	167.4	83.7	67.4	33.7	168.6	84.3	51.5	25.8	167.4	83.7	117.8	58.9
47	Sand	47	153.4	20.6	174.0	87.0	70.4	35.2	176.0	88.0	53.7	26.8	174.0	87.0	122.7	61.4
48	Sand	48	159.7	21.1	180.8	90.4	73.5	36.7	183.6	91.8	55.9	27.9	180.8	90.4	127.8	63.9
49	Sand	49	166.2	21.5	187.7	93.9	76.6	38.3	191.4	95.7	58.2	29.1	187.7	93.9	133.0	66.5
50	Sand	50	172.8	22.0	194.8	97.4	79.8	39.9	199.4	99.7	60.5	30.2	194.8	97.4	138.2	69.1

Depth	Soil Type	Depth Below Pile Cap	Nominal Resistance	Nominal Bearing	R_n Total Nominal Geotechnical Axial Resistance		ϕR_n Total Factored Static Geotechnical Axial Resistance (ϕ=0.35 in clay; 0.45 in		ϕR_n Field Verification Values (ϕ=0.4 FHWA Modified		ϕR_n Total Factored Geotechnical Uplift Resistance Static Analysis Method		$\phi_{stat} R_n$ Total Factored Geotechnical Extreme Resistance Static Analysis Method		$\phi_{up} R_n$ Total Factored Geotechnical Extreme Uplift Resistance Static Analysis Method	
		(ft)	(kips)	(kips)	(kips)	(tons)	(kips)	(tons)	(kips)	(tons)	(kips)	(tons)	(kips)	(tons)	(kips)	(tons)
51	Sand	51	179.5	22.5	202.0	101.0	83.0	41.5	207.5	103.7	62.8	31.4	202.0	101.0	143.6	71.8
52	Sand	52	186.4	22.9	209.3	104.7	86.3	43.1	215.7	107.8	65.2	32.6	209.3	104.7	149.1	74.6
53	Sand	53	193.4	23.4	216.8	108.4	89.7	44.8	224.1	112.1	67.7	33.8	216.8	108.4	154.7	77.4
54	Sand	54	200.5	23.8	224.3	112.2	93.0	46.5	232.6	116.3	70.2	35.1	224.3	112.2	160.4	80.2
55	Sand	55	207.8	24.3	232.1	116.1	96.5	48.3	241.3	120.7	72.7	36.4	232.1	116.1	166.2	83.1
56	Sand	56	215.2	24.7	239.9	120.0	100.0	50.0	250.1	125.1	75.3	37.7	239.9	120.0	172.2	86.1
57	Sand	57	222.7	25.2	247.9	124.0	103.6	51.8	259.1	129.6	77.9	39.0	247.9	124.0	178.2	89.1
58	Sand	58	230.4	25.6	256.0	128.0	107.3	53.6	268.2	134.1	80.6	40.3	256.0	128.0	184.3	92.2
59	Sand	59	238.3	26.1	264.4	132.2	111.1	55.5	277.7	138.8	83.4	41.7	264.4	132.2	190.6	95.3
60	Sand	60	246.2	26.5	272.7	136.4	114.8	57.4	287.0	143.5	86.2	43.1	272.7	136.4	197.0	98.5
61	Sand	61	254.3	27.0	281.3	140.7	118.7	59.3	296.7	148.3	89.0	44.5	281.3	140.7	203.4	101.7
62	Sand	62	262.6	27.4	290.0	145.0	122.6	61.3	306.5	153.2	91.9	46.0	290.0	145.0	210.1	105.0
63	Sand	63	270.9	27.9	298.8	149.4	126.6	63.3	316.4	158.2	94.8	47.4	298.8	149.4	216.7	108.4
64	Sand	64	279.4	28.4	307.8	153.9	130.6	65.3	326.5	163.3	97.8	48.9	307.8	153.9	223.5	111.8
65	Sand	65	288.1	28.8	316.9	158.5	134.7	67.3	336.7	168.4	100.8	50.4	316.9	158.5	230.5	115.2
66	Sand	66	296.9	29.3	326.2	163.1	138.9	69.4	347.2	173.6	103.9	52.0	326.2	163.1	237.5	118.8
67	Sand	67	305.8	29.7	335.5	167.8	143.1	71.5	357.7	178.8	107.0	53.5	335.5	167.8	244.6	122.3
68	Sand	68	314.9	30.2	345.1	172.6	147.4	73.7	368.5	184.2	110.2	55.1	345.1	172.6	251.9	126.0
69	Sand	69	324.1	30.6	354.7	177.4	151.7	75.9	379.3	189.6	113.4	56.7	354.7	177.4	259.3	129.6
70	Sand	70	333.4	31.1	364.5	182.3	156.1	78.1	390.3	195.1	116.7	58.3	364.5	182.3	266.7	133.4
71	Sand	71	342.9	31.5	374.4	187.2	160.6	80.3	401.4	200.7	120.0	60.0	374.4	187.2	274.3	137.2
72	Sand	72	352.4	32.0	384.4	192.2	165.1	82.5	412.7	206.3	123.3	61.7	384.4	192.2	281.9	141.0
73	Sand	73	361.9	32.4	394.3	197.2	169.5	84.8	423.8	211.9	126.7	63.3	394.3	197.2	289.5	144.8
74	Sand	74	371.4	32.9	404.3	202.2	174.0	87.0	435.1	217.5	130.0	65.0	404.3	202.2	297.1	148.6
75	Sand	75	380.9	33.3	414.2	207.1	178.5	89.2	446.2	223.1	133.3	66.7	414.2	207.1	304.7	152.4
76	Sand	76	390.4	33.8	424.2	212.1	183.0	91.5	457.5	228.7	136.6	68.3	424.2	212.1	312.3	156.2
77	Sand	77	399.9	34.3	434.2	217.1	187.5	93.7	468.7	234.4	140.0	70.0	434.2	217.1	319.9	160.0
78	Sand	78	409.4	34.7	444.1	222.1	191.9	96.0	479.8	239.9	143.3	71.6	444.1	222.1	327.5	163.8
79	Sand	79	418.9	35.2	454.1	227.1	196.4	98.2	491.1	245.5	146.6	73.3	454.1	227.1	335.1	167.6
80	Sand	80	428.4	35.6	464.0	232.0	200.9	100.4	502.2	251.1	149.9	75.0	464.0	232.0	342.7	171.4
81	Sand	81	437.9	35.9	473.8	236.9	205.3	102.7	513.3	256.6	153.3	76.6	473.8	236.9	350.3	175.2
82	Sand	82	447.4	36.1	483.5	241.8	209.7	104.8	524.2	262.1	156.6	78.3	483.5	241.8	357.9	179.0
83	Sand	83	456.9	36.2	493.1	246.6	214.0	107.0	535.0	267.5	159.9	80.0	493.1	246.6	365.5	182.8
84	Sand	84	466.4	36.2	502.6	251.3	218.3	109.1	545.7	272.8	163.2	81.6	502.6	251.3	373.1	186.6
85	Sand	85	475.9	36.2	512.1	256.1	222.5	111.3	556.3	278.2	166.6	83.3	512.1	256.1	380.7	190.4
86	Sand	86	485.4	36.2	521.6	260.8	226.8	113.4	567.0	283.5	169.9	84.9	521.6	260.8	388.3	194.2
87	Sand	87	494.9	36.2	531.1	265.6	231.1	115.5	577.7	288.9	173.2	86.6	531.1	265.6	395.9	198.0
88	Sand	88	504.4	36.2	540.6	270.3	235.4	117.7	588.4	294.2	176.5	88.3	540.6	270.3	403.5	201.8
89	Sand	89	513.9	36.2	550.1	275.1	239.6	119.8	599.1	299.5	179.9	89.9	550.1	275.1	411.1	205.6
90	Sand	90	523.4	36.2	559.6	279.8	243.9	122.0	609.8	304.9	183.2	91.6	559.6	279.8	418.7	209.4
91	Sand	91	532.9	36.2	569.1	284.6	248.2	124.1	620.5	310.2	186.5	93.3	569.1	284.6	426.3	213.2
92	Sand	92	542.4	36.2	578.6	289.3	252.5	126.2	631.2	315.6	189.8	94.9	578.6	289.3	433.9	217.0
93	Sand	93	551.9	36.2	588.1	294.1	256.7	128.4	641.8	320.9	193.2	96.6	588.1	294.1	441.5	220.8
94	Sand	94	561.4	36.2	597.6	298.8	261.0	130.5	652.5	326.3	196.5	98.2	597.6	298.8	449.1	224.6
95	Sand	95	570.9	36.2	607.1	303.6	265.3	132.6	663.2	331.6	199.8	99.9	607.1	303.6	456.7	228.4

Steel H-Pile Capacities
079B00040N
HP14x89 (50ksi steel)

Location: **Piers 6&7**
Estimated Base of Pile Cap Elevation = 385 ft

Depth	Soil Type	Depth Below Pile Cap	Nominal Resistance	Nominal Bearing	R_n Total Nominal Geotechnical Axial Resistance		**ϕR_n Total Factored Static Geotechnical Axial Resistance (ϕ=0.35 in clay; 0.45 in**		**ϕR_n Field Verification Values (ϕ=0.4 FHWA Modified**		**ϕR_n Total Factored Geotechnical Uplift Resistance Static Analysis Method**		**$\phi_{stat} R_n$ Total Factored Geotechnical Extreme Resistance Static Analysis Method**		**$\phi_{up} R_n$ Total Factored Geotechnical Extreme Uplift Resistance Static Analysis Method**	
		(ft)	(kips)	(kips)	(kips)	(tons)	**(kips)**	**(tons)**	**(kips)**	**(tons)**	**(kips)**	**(tons)**	**(kips)**	**(tons)**	**(kips)**	**(tons)**
0	Sand	0	0.0	0.2	0.2	0.1	0.1	0.0	0.2	0.1	0.0	0.0	0.2	0.1	0.0	0.0
1	Sand	1	0.1	0.4	0.5	0.3	0.2	0.1	0.6	0.3	0.0	0.0	0.5	0.3	0.1	0.0
2	Sand	2	0.2	0.6	0.8	0.4	0.4	0.2	0.9	0.5	0.1	0.0	0.8	0.4	0.2	0.1
3	Sand	3	0.5	1.0	1.5	0.8	0.7	0.3	1.7	0.8	0.2	0.1	1.5	0.8	0.4	0.2
4	Sand	4	0.9	1.3	2.2	1.1	1.0	0.5	2.5	1.2	0.3	0.2	2.2	1.1	0.7	0.4
5	Sand	5	1.5	1.7	3.2	1.6	1.4	0.7	3.6	1.8	0.5	0.3	3.2	1.6	1.2	0.6
6	Sand	6	2.1	2.0	4.1	2.1	1.8	0.9	4.6	2.3	0.7	0.4	4.1	2.1	1.7	0.8
7	Sand	7	2.9	2.3	5.2	2.6	2.3	1.2	5.9	2.9	1.0	0.5	5.2	2.6	2.3	1.2
8	Sand	8	3.7	2.7	6.4	3.2	2.9	1.4	7.2	3.6	1.3	0.6	6.4	3.2	3.0	1.5
9	Sand	9	4.7	3.0	7.7	3.9	3.5	1.7	8.7	4.3	1.6	0.8	7.7	3.9	3.8	1.9
10	Sand	10	5.8	3.3	9.1	4.6	4.1	2.0	10.2	5.1	2.0	1.0	9.1	4.6	4.6	2.3
11	Sand	11	7.0	3.7	10.7	5.4	4.8	2.4	12.0	6.0	2.5	1.2	10.7	5.4	5.6	2.8
12	Sand	12	8.4	4.0	12.4	6.2	5.6	2.8	14.0	7.0	2.9	1.5	12.4	6.2	6.7	3.4
13	Sand	13	9.8	4.3	14.1	7.1	6.3	3.2	15.9	7.9	3.4	1.7	14.1	7.1	7.8	3.9
14	Sand	14	11.4	4.7	16.1	8.1	7.2	3.6	18.1	9.1	4.0	2.0	16.1	8.1	9.1	4.6
15	Sand	15	13.1	5.0	18.1	9.1	8.1	4.1	20.4	10.2	4.6	2.3	18.1	9.1	10.5	5.2
16	Sand	16	14.9	5.3	20.2	10.1	9.1	4.5	22.7	11.4	5.2	2.6	20.2	10.1	11.9	6.0
17	Sand	17	16.8	5.7	22.5	11.3	10.1	5.1	25.3	12.7	5.9	2.9	22.5	11.3	13.4	6.7
18	Sand	18	18.9	6.1	25.0	12.5	11.3	5.6	28.1	14.1	6.6	3.3	25.0	12.5	15.1	7.6
19	Sand	19	21.0	6.8	27.8	13.9	12.5	6.3	31.3	15.6	7.4	3.7	27.8	13.9	16.8	8.4
20	Sand	20	23.3	7.6	30.9	15.5	13.9	7.0	34.8	17.4	8.2	4.1	30.9	15.5	18.6	9.3
21	Sand	21	25.8	8.4	34.2	17.1	15.4	7.7	38.5	19.2	9.0	4.5	34.2	17.1	20.6	10.3
22	Sand	22	28.5	9.2	37.7	18.9	17.0	8.5	42.4	21.2	10.0	5.0	37.7	18.9	22.8	11.4
23	Sand	23	31.4	9.7	41.1	20.6	18.5	9.2	46.2	23.1	11.0	5.5	41.1	20.6	25.1	12.6
24	Sand	24	34.4	10.2	44.6	22.3	20.1	10.0	50.2	25.1	12.0	6.0	44.6	22.3	27.5	13.8
25	Sand	25	37.5	10.6	48.1	24.1	21.6	10.8	54.1	27.1	13.1	6.6	48.1	24.1	30.0	15.0
26	Sand	26	40.8	11.1	51.9	26.0	23.4	11.7	58.4	29.2	14.3	7.1	51.9	26.0	32.6	16.3
27	Sand	27	44.2	11.5	55.7	27.9	25.1	12.5	62.7	31.3	15.5	7.7	55.7	27.9	35.4	17.7
28	Sand	28	47.8	12.0	59.8	29.9	26.9	13.5	67.3	33.6	16.7	8.4	59.8	29.9	38.2	19.1
29	Sand	29	51.5	12.4	63.9	32.0	28.8	14.4	71.9	35.9	18.0	9.0	63.9	32.0	41.2	20.6
30	Sand	30	55.3	12.9	68.2	34.1	30.7	15.3	76.7	38.4	19.4	9.7	68.2	34.1	44.2	22.1
31	Sand	31	59.3	13.3	72.6	36.3	32.7	16.3	81.7	40.8	20.8	10.4	72.6	36.3	47.4	23.7
32	Sand	32	63.4	13.8	77.2	38.6	34.7	17.4	86.9	43.4	22.2	11.1	77.2	38.6	50.7	25.4
33	Sand	33	67.6	14.3	81.9	41.0	36.9	18.4	92.1	46.1	23.7	11.8	81.9	41.0	54.1	27.0
34	Sand	34	72.0	14.7	86.7	43.4	39.0	19.5	97.5	48.8	25.2	12.6	86.7	43.4	57.6	28.8
35	Sand	35	76.5	15.2	91.7	45.9	41.3	20.6	103.2	51.6	26.8	13.4	91.7	45.9	61.2	30.6
36	Sand	36	81.2	15.6	96.8	48.4	43.6	21.8	108.9	54.5	28.4	14.2	96.8	48.4	65.0	32.5
37	Sand	37	86.0	16.1	102.1	51.1	45.9	23.0	114.9	57.4	30.1	15.1	102.1	51.1	68.8	34.4
38	Sand	38	90.9	16.5	107.4	53.7	48.3	24.2	120.8	60.4	31.8	15.9	107.4	53.7	72.7	36.4
39	Sand	39	96.0	17.0	113.0	56.5	50.9	25.4	127.1	63.6	33.6	16.8	113.0	56.5	76.8	38.4
40	Sand	40	101.2	17.4	118.6	59.3	53.4	26.7	133.4	66.7	35.4	17.7	118.6	59.3	81.0	40.5
41	Sand	41	106.5	17.9	124.4	62.2	56.0	28.0	140.0	70.0	37.3	18.6	124.4	62.2	85.2	42.6
42	Sand	42	112.0	18.3	130.3	65.2	58.6	29.3	146.6	73.3	39.2	19.6	130.3	65.2	89.6	44.8
43	Sand	43	117.6	18.8	136.4	68.2	61.4	30.7	153.5	76.7	41.2	20.6	136.4	68.2	94.1	47.0
44	Sand	44	123.4	19.2	142.6	71.3	64.2	32.1	160.4	80.2	43.2	21.6	142.6	71.3	98.7	49.4
45	Sand	45	129.3	19.7	149.0	74.5	67.1	33.5	167.6	83.8	45.3	22.6	149.0	74.5	103.4	51.7
46	Sand	46	135.3	20.2	155.5	77.8	70.0	35.0	174.9	87.5	47.4	23.7	155.5	77.8	108.2	54.1
47	Sand	47	141.5	20.6	162.1	81.1	72.9	36.5	182.4	91.2	49.5	24.8	162.1	81.1	113.2	56.6
48	Sand	48	147.8	21.1	168.9	84.5	76.0	38.0	190.0	95.0	51.7	25.9	168.9	84.5	118.2	59.1
49	Sand	49	154.2	21.5	175.7	87.9	79.1	39.5	197.7	98.8	54.0	27.0	175.7	87.9	123.4	61.7
50	Sand	50	160.8	22.0	182.8	91.4	82.3	41.1	205.7	102.8	56.3	28.1	182.8	91.4	128.6	64.3

Depth	Soil Type	Depth Below Pile Cap	Nominal Resistance	Nominal Bearing	R_n Total Nominal Geotechnical Axial Resistance		**ϕR_n Total Factored Static Geotechnical Axial Resistance (ϕ=0.35 in clay; 0.45 in**		**ϕR_n Field Verification Values (ϕ=0.4 FHWA Modified**		**ϕR_n Total Factored Geotechnical Uplift Resistance Static Analysis Method**		**$\phi_{stat} R_n$ Total Factored Geotechnical Extreme Resistance Static Analysis Method**		**$\phi_{up} R_n$ Total Factored Geotechnical Extreme Uplift Resistance Static Analysis Method**	
		(ft)	(kips)	(kips)	(kips)	(tons)	**(kips)**	**(tons)**	**(kips)**	**(tons)**	**(kips)**	**(tons)**	**(kips)**	**(tons)**	**(kips)**	**(tons)**
51	Sand	51	167.5	22.4	189.9	95.0	**85.5**	**42.7**	**213.6**	**106.8**	**58.6**	**29.3**	**189.9**	**95.0**	**134.0**	**67.0**
52	Sand	52	174.4	22.9	197.3	98.7	**88.8**	**44.4**	**222.0**	**111.0**	**61.0**	**30.5**	**197.3**	**98.7**	**139.5**	**69.8**
53	Sand	53	181.4	23.3	204.7	102.4	**92.1**	**46.1**	**230.3**	**115.1**	**63.5**	**31.7**	**204.7**	**102.4**	**145.1**	**72.6**
54	Sand	54	188.5	23.8	212.3	106.2	**95.5**	**47.8**	**238.8**	**119.4**	**66.0**	**33.0**	**212.3**	**106.2**	**150.8**	**75.4**
55	Sand	55	195.8	24.2	220.0	110.0	**99.0**	**49.5**	**247.5**	**123.8**	**68.5**	**34.3**	**220.0**	**110.0**	**156.6**	**78.3**
56	Sand	56	203.2	24.7	227.9	114.0	**102.6**	**51.3**	**256.4**	**128.2**	**71.1**	**35.6**	**227.9**	**114.0**	**162.6**	**81.3**
57	Sand	57	210.7	25.1	235.8	117.9	**106.1**	**53.1**	**265.3**	**132.6**	**73.7**	**36.9**	**235.8**	**117.9**	**168.6**	**84.3**
58	Sand	58	218.4	25.6	244.0	122.0	**109.8**	**54.9**	**274.5**	**137.3**	**76.4**	**38.2**	**244.0**	**122.0**	**174.7**	**87.4**
59	Sand	59	226.2	26.1	252.3	126.2	**113.5**	**56.8**	**283.8**	**141.9**	**79.2**	**39.6**	**252.3**	**126.2**	**181.0**	**90.5**
60	Sand	60	234.1	26.5	260.6	130.3	**117.3**	**58.6**	**293.2**	**146.6**	**81.9**	**41.0**	**260.6**	**130.3**	**187.3**	**93.6**
61	Sand	61	242.2	27.0	269.2	134.6	**121.1**	**60.6**	**302.9**	**151.4**	**84.8**	**42.4**	**269.2**	**134.6**	**193.8**	**96.9**
62	Sand	62	250.5	27.4	277.9	139.0	**125.1**	**62.5**	**312.6**	**156.3**	**87.7**	**43.8**	**277.9**	**139.0**	**200.4**	**100.2**
63	Sand	63	258.8	27.9	286.7	143.4	**129.0**	**64.5**	**322.5**	**161.3**	**90.6**	**45.3**	**286.7**	**143.4**	**207.0**	**103.5**
64	Sand	64	267.3	28.3	295.6	147.8	**133.0**	**66.5**	**332.6**	**166.3**	**93.6**	**46.8**	**295.6**	**147.8**	**213.8**	**106.9**
65	Sand	65	276.0	28.8	304.8	152.4	**137.2**	**68.6**	**342.9**	**171.5**	**96.6**	**48.3**	**304.8**	**152.4**	**220.8**	**110.4**
66	Sand	66	284.7	29.2	313.9	157.0	**141.3**	**70.6**	**353.1**	**176.6**	**99.6**	**49.8**	**313.9**	**157.0**	**227.8**	**113.9**
67	Sand	67	293.7	29.7	323.4	161.7	**145.5**	**72.8**	**363.8**	**181.9**	**102.8**	**51.4**	**323.4**	**161.7**	**235.0**	**117.5**
68	Sand	68	302.7	30.1	332.8	166.4	**149.8**	**74.9**	**374.4**	**187.2**	**105.9**	**53.0**	**332.8**	**166.4**	**242.2**	**121.1**
69	Sand	69	311.9	30.6	342.5	171.3	**154.1**	**77.1**	**385.3**	**192.7**	**109.2**	**54.6**	**342.5**	**171.3**	**249.5**	**124.8**
70	Sand	70	321.2	31.0	352.2	176.1	**158.5**	**79.2**	**396.2**	**198.1**	**112.4**	**56.2**	**352.2**	**176.1**	**257.0**	**128.5**
71	Sand	71	330.7	31.5	362.2	181.1	**163.0**	**81.5**	**407.5**	**203.7**	**115.7**	**57.9**	**362.2**	**181.1**	**264.6**	**132.3**
72	Sand	72	340.2	32.0	372.2	186.1	**167.5**	**83.7**	**418.7**	**209.4**	**119.1**	**59.5**	**372.2**	**186.1**	**272.2**	**136.1**
73	Sand	73	349.7	32.4	382.1	191.1	**171.9**	**86.0**	**429.9**	**214.9**	**122.4**	**61.2**	**382.1**	**191.1**	**279.8**	**139.9**
74	Sand	74	359.2	32.9	392.1	196.1	**176.4**	**88.2**	**441.1**	**220.6**	**125.7**	**62.9**	**392.1**	**196.1**	**287.4**	**143.7**
75	Sand	75	368.7	33.3	402.0	201.0	**180.9**	**90.5**	**452.3**	**226.1**	**129.0**	**64.5**	**402.0**	**201.0**	**295.0**	**147.5**
76	Sand	76	378.2	33.8	412.0	206.0	**185.4**	**92.7**	**463.5**	**231.8**	**132.4**	**66.2**	**412.0**	**206.0**	**302.6**	**151.3**
77	Sand	77	387.7	34.2	421.9	211.0	**189.9**	**94.9**	**474.6**	**237.3**	**135.7**	**67.8**	**421.9**	**211.0**	**310.2**	**155.1**
78	Sand	78	397.2	34.7	431.9	216.0	**194.4**	**97.2**	**485.9**	**242.9**	**139.0**	**69.5**	**431.9**	**216.0**	**317.8**	**158.9**
79	Sand	79	406.7	35.1	441.8	220.9	**198.8**	**99.4**	**497.0**	**248.5**	**142.3**	**71.2**	**441.8**	**220.9**	**325.4**	**162.7**
80	Sand	80	416.2	35.5	451.7	225.9	**203.3**	**101.6**	**508.2**	**254.1**	**145.7**	**72.8**	**451.7**	**225.9**	**333.0**	**166.5**
81	Sand	81	425.7	35.9	461.6	230.8	**207.7**	**103.9**	**519.3**	**259.7**	**149.0**	**74.5**	**461.6**	**230.8**	**340.6**	**170.3**
82	Sand	82	435.2	36.1	471.3	235.7	**212.1**	**106.0**	**530.2**	**265.1**	**152.3**	**76.2**	**471.3**	**235.7**	**348.2**	**174.1**
83	Sand	83	444.7	36.2	480.9	240.5	**216.4**	**108.2**	**541.0**	**270.5**	**155.6**	**77.8**	**480.9**	**240.5**	**355.8**	**177.9**
84	Sand	84	454.2	36.2	490.4	245.2	**220.7**	**110.3**	**551.7**	**275.9**	**159.0**	**79.5**	**490.4**	**245.2**	**363.4**	**181.7**
85	Sand	85	463.7	36.2	499.9	250.0	**225.0**	**112.5**	**562.4**	**281.2**	**162.3**	**81.1**	**499.9**	**250.0**	**371.0**	**185.5**
86	Sand	86	473.2	36.2	509.4	254.7	**229.2**	**114.6**	**573.1**	**286.5**	**165.6**	**82.8**	**509.4**	**254.7**	**378.6**	**189.3**
87	Sand	87	482.7	36.2	518.9	259.5	**233.5**	**116.8**	**583.8**	**291.9**	**168.9**	**84.5**	**518.9**	**259.5**	**386.2**	**193.1**
88	Sand	88	492.2	36.2	528.4	264.2	**237.8**	**118.9**	**594.5**	**297.2**	**172.3**	**86.1**	**528.4**	**264.2**	**393.8**	**196.9**
89	Sand	89	501.7	36.2	537.9	269.0	**242.1**	**121.0**	**605.1**	**302.6**	**175.6**	**87.8**	**537.9**	**269.0**	**401.4**	**200.7**
90	Sand	90	511.2	36.2	547.4	273.7	**246.3**	**123.2**	**615.8**	**307.9**	**178.9**	**89.5**	**547.4**	**273.7**	**409.0**	**204.5**
91	Sand	91	520.7	36.2	556.9	278.5	**250.6**	**125.3**	**626.5**	**313.3**	**182.2**	**91.1**	**556.9**	**278.5**	**416.6**	**208.3**
92	Sand	92	530.2	36.2	566.4	283.2	**254.9**	**127.4**	**637.2**	**318.6**	**185.6**	**92.8**	**566.4**	**283.2**	**424.2**	**212.1**
93	Sand	93	539.7	36.2	575.9	288.0	**259.2**	**129.6**	**647.9**	**323.9**	**188.9**	**94.4**	**575.9**	**288.0**	**431.8**	**215.9**
94	Sand	94	549.2	36.2	585.4	292.7	**263.4**	**131.7**	**658.6**	**329.3**	**192.2**	**96.1**	**585.4**	**292.7**	**439.4**	**219.7**
95	Sand	95	558.7	36.2	594.9	297.5	**267.7**	**133.9**	**669.3**	**334.6**	**195.5**	**97.8**	**594.9**	**297.5**	**447.0**	**223.5**

Steel H-Pile Capacities

079B00040N

HP14x89 (50ksi steel)

Location: **Piers 8, 9, 10**

Estimated Base of Pile Cap Elevation = 385 ft

Depth	Soil Type	Depth Below Pile Cap	Nominal Resistance	Nominal Bearing	R_n Total Nominal Geotechnical Axial Resistance		ϕR_n Total Factored Static Geotechnical Axial Resistance (ϕ=0.35 in clay; 0.45 in		ϕR_n Field Verification Values (ϕ=0.4 FHWA Modified		ϕR_n Total Factored Geotechnical Uplift Resistance Static Analysis Method		$\phi_{stat} R_n$ Total Factored Geotechnical Extreme Resistance Static Analysis Method		$\phi_{up} R_n$ Total Factored Geotechnical Extreme Uplift Resistance Static Analysis Method	
		(ft)	(kips)	(kips)	(kips)	(tons)	(kips)	(tons)	(kips)	(tons)	(kips)	(tons)	(kips)	(tons)	(kips)	(tons)
0	Clay	0	0.0	0.7	0.7	0.4	0.2	0.1	0.5	0.3	0.0	0.0	0.7	0.4	0.0	0.0
1	Clay	1	1.0	0.6	1.6	0.8	0.7	0.3	1.7	0.8	0.3	0.1	1.6	0.8	0.8	0.4
2	Clay	2	2.1	0.9	3.0	1.5	1.2	0.6	3.1	1.5	0.5	0.3	3.0	1.5	1.7	0.8
3	Clay	3	3.4	1.4	4.8	2.4	1.7	0.9	4.3	2.1	0.9	0.4	4.8	2.4	2.7	1.4
4	Sand	4	4.3	1.5	5.8	2.9	2.2	1.1	5.4	2.7	1.5	0.8	5.8	2.9	3.4	1.7
5	Sand	5	4.8	1.8	6.6	3.3	2.5	1.3	6.3	3.2	1.7	0.8	6.6	3.3	3.8	1.9
6	Sand	6	5.5	2.1	7.6	3.8	3.0	1.5	7.4	3.7	1.9	1.0	7.6	3.8	4.4	2.2
7	Sand	7	6.3	2.4	8.7	4.4	3.5	1.7	8.7	4.3	2.2	1.1	8.7	4.4	5.0	2.5
8	Sand	8	7.2	2.8	10.0	5.0	4.1	2.0	10.1	5.1	2.5	1.3	10.0	5.0	5.8	2.9
9	Sand	9	8.2	3.1	11.3	5.7	4.6	2.3	11.6	5.8	2.9	1.4	11.3	5.7	6.6	3.3
10	Sand	10	9.3	3.4	12.7	6.4	5.3	2.6	13.2	6.6	3.3	1.6	12.7	6.4	7.4	3.7
11	Sand	11	10.6	3.8	14.4	7.2	6.0	3.0	15.1	7.5	3.7	1.9	14.4	7.2	8.5	4.2
12	Sand	12	12.0	4.4	16.4	8.2	6.9	3.5	17.3	8.7	4.2	2.1	16.4	8.2	9.6	4.8
13	Sand	13	13.4	5.1	18.5	9.3	7.9	3.9	19.7	9.9	4.7	2.3	18.5	9.3	10.7	5.4
14	Sand	14	15.1	5.7	20.8	10.4	8.9	4.5	22.3	11.1	5.3	2.6	20.8	10.4	12.1	6.0
15	Sand	15	17.0	6.4	23.4	11.7	10.1	5.0	25.2	12.6	6.0	3.0	23.4	11.7	13.6	6.8
16	Sand	16	19.0	6.9	25.9	13.0	11.2	5.6	28.0	14.0	6.7	3.3	25.9	13.0	15.2	7.6
17	Sand	17	21.2	7.4	28.6	14.3	12.4	6.2	31.1	15.5	7.4	3.7	28.6	14.3	17.0	8.5
18	Sand	18	23.5	7.8	31.3	15.7	13.6	6.8	34.1	17.1	8.2	4.1	31.3	15.7	18.8	9.4
19	Sand	19	25.9	8.3	34.2	17.1	14.9	7.5	37.4	18.7	9.1	4.5	34.2	17.1	20.7	10.4
20	Sand	20	28.5	8.7	37.2	18.6	16.3	8.1	40.7	20.4	10.0	5.0	37.2	18.6	22.8	11.4
21	Sand	21	31.2	9.2	40.4	20.2	17.7	8.9	44.3	22.2	10.9	5.5	40.4	20.2	25.0	12.5
22	Sand	22	34.0	9.6	43.6	21.8	19.2	9.6	47.9	24.0	11.9	6.0	43.6	21.8	27.2	13.6
23	Sand	23	37.0	10.1	47.1	23.6	20.8	10.4	51.9	25.9	13.0	6.5	47.1	23.6	29.6	14.8
24	Sand	24	40.1	10.5	50.6	25.3	22.3	11.2	55.8	27.9	14.0	7.0	50.6	25.3	32.1	16.0
25	Sand	25	43.4	11.0	54.4	27.2	24.0	12.0	60.1	30.0	15.2	7.6	54.4	27.2	34.7	17.4
26	Sand	26	46.8	11.4	58.2	29.1	25.7	12.9	64.4	32.2	16.4	8.2	58.2	29.1	37.4	18.7
27	Sand	27	50.3	11.9	62.2	31.1	27.5	13.8	68.9	34.4	17.6	8.8	62.2	31.1	40.2	20.1
28	Sand	28	54.0	12.3	66.3	33.2	29.4	14.7	73.5	36.7	18.9	9.5	66.3	33.2	43.2	21.6
29	Sand	29	57.8	12.8	70.6	35.3	31.3	15.7	78.3	39.2	20.2	10.1	70.6	35.3	46.2	23.1
30	Sand	30	61.7	13.3	75.0	37.5	33.3	16.7	83.3	41.6	21.6	10.8	75.0	37.5	49.4	24.7
31	Sand	31	65.8	13.7	79.5	39.8	35.3	17.7	88.3	44.2	23.0	11.5	79.5	39.8	52.6	26.3
32	Sand	32	70.0	14.2	84.2	42.1	37.4	18.7	93.6	46.8	24.5	12.3	84.2	42.1	56.0	28.0
33	Sand	33	74.4	14.6	89.0	44.5	39.6	19.8	99.0	49.5	26.0	13.0	89.0	44.5	59.5	29.8
34	Sand	34	78.9	15.1	94.0	47.0	41.9	20.9	104.6	52.3	27.6	13.8	94.0	47.0	63.1	31.6
35	Sand	35	83.5	15.5	99.0	49.5	44.1	22.1	110.3	55.1	29.2	14.6	99.0	49.5	66.8	33.4
36	Sand	36	88.3	16.0	104.3	52.2	46.5	23.2	116.2	58.1	30.9	15.5	104.3	52.2	70.6	35.3
37	Sand	37	93.2	16.4	109.6	54.8	48.9	24.4	122.2	61.1	32.6	16.3	109.6	54.8	74.6	37.3
38	Sand	38	98.2	16.9	115.1	57.6	51.4	25.7	128.4	64.2	34.4	17.2	115.1	57.6	78.6	39.3
39	Sand	39	103.4	17.3	120.7	60.4	53.9	26.9	134.7	67.3	36.2	18.1	120.7	60.4	82.7	41.4
40	Sand	40	108.7	17.8	126.5	63.3	56.5	28.2	141.2	70.6	38.0	19.0	126.5	63.3	87.0	43.5
41	Sand	41	114.1	18.2	132.3	66.2	59.1	29.5	147.7	73.9	39.9	20.0	132.3	66.2	91.3	45.6
42	Sand	42	119.7	18.7	138.4	69.2	61.8	30.9	154.6	77.3	41.9	20.9	138.4	69.2	95.8	47.9
43	Sand	43	125.5	19.2	144.7	72.4	64.7	32.3	161.7	80.8	43.9	22.0	144.7	72.4	100.4	50.2
44	Sand	44	131.3	19.6	150.9	75.5	67.5	33.7	168.7	84.3	46.0	23.0	150.9	75.5	105.0	52.5
45	Sand	45	137.3	20.1	157.4	78.7	70.4	35.2	176.0	88.0	48.1	24.0	157.4	78.7	109.8	54.9
46	Sand	46	143.5	20.5	164.0	82.0	73.4	36.7	183.4	91.7	50.2	25.1	164.0	82.0	114.8	57.4
47	Sand	47	149.7	21.0	170.7	85.4	76.4	38.2	190.9	95.5	52.4	26.2	170.7	85.4	119.8	59.9
48	Sand	48	156.2	21.4	177.6	88.8	79.5	39.7	198.7	99.3	54.7	27.3	177.6	88.8	125.0	62.5
49	Sand	49	162.7	21.9	184.6	92.3	82.6	41.3	206.6	103.3	56.9	28.5	184.6	92.3	130.2	65.1
50	Sand	50	169.4	22.3	191.7	95.9	85.8	42.9	214.6	107.3	59.3	29.6	191.7	95.9	135.5	67.8

Depth	Soil Type	Depth Below Pile Cap	Nominal Resistance	Nominal Bearing	R_n Total Nominal Geotechnical Axial Resistance		ϕR_n Total Factored Static Geotechnical Axial Resistance (ϕ=0.35 in clay; 0.45 in		ϕR_n Field Verification Values (ϕ=0.4 FHWA Modified		ϕR_n Total Factored Geotechnical Uplift Resistance Static Analysis Method		$\phi_{stat}R_n$ Total Factored Geotechnical Extreme Resistance Static Analysis Method		$\phi_{up}R_n$ Total Factored Geotechnical Extreme Uplift Resistance Static Analysis Method	
		(ft)	(kips)	(kips)	(kips)	(tons)	(kips)	(tons)	(kips)	(tons)	(kips)	(tons)	(kips)	(tons)	(kips)	(tons)
51	Sand	51	176.2	22.8	199.0	99.5	89.1	44.6	222.8	111.4	61.7	30.8	199.0	99.5	141.0	70.5
52	Sand	52	183.2	23.2	206.4	103.2	92.4	46.2	231.1	115.5	64.1	32.1	206.4	103.2	146.6	73.3
53	Sand	53	190.3	23.7	214.0	107.0	95.9	47.9	239.6	119.8	66.6	33.3	214.0	107.0	152.2	76.1
54	Sand	54	197.5	24.1	221.6	110.8	99.3	49.6	248.2	124.1	69.1	34.6	221.6	110.8	158.0	79.0
55	Sand	55	204.9	24.6	229.5	114.8	102.8	51.4	257.1	128.5	71.7	35.9	229.5	114.8	163.9	82.0
56	Sand	56	212.4	25.1	237.5	118.8	106.4	53.2	266.1	133.0	74.3	37.2	237.5	118.8	169.9	85.0
57	Sand	57	220.1	25.5	245.6	122.8	110.1	55.0	275.2	137.6	77.0	38.5	245.6	122.8	176.1	88.0
58	Sand	58	227.8	26.0	253.8	126.9	113.8	56.9	284.4	142.2	79.7	39.9	253.8	126.9	182.2	91.1
59	Sand	59	235.8	26.4	262.2	131.1	117.5	58.8	293.9	146.9	82.5	41.3	262.2	131.1	188.6	94.3
60	Sand	60	243.8	26.9	270.7	135.4	121.4	60.7	303.4	151.7	85.3	42.7	270.7	135.4	195.0	97.5
61	Sand	61	252.0	27.3	279.3	139.7	125.2	62.6	313.1	156.6	88.2	44.1	279.3	139.7	201.6	100.8
62	Sand	62	260.4	27.8	288.2	144.1	129.2	64.6	323.1	161.6	91.1	45.6	288.2	144.1	208.3	104.2
63	Sand	63	268.8	28.2	297.0	148.5	133.2	66.6	333.0	166.5	94.1	47.0	297.0	148.5	215.0	107.5
64	Sand	64	277.5	28.7	306.2	153.1	137.3	68.7	343.4	171.7	97.1	48.6	306.2	153.1	222.0	111.0
65	Sand	65	286.2	29.1	315.3	157.7	141.4	70.7	353.6	176.8	100.2	50.1	315.3	157.7	229.0	114.5
66	Sand	66	295.1	29.6	324.7	162.4	145.7	72.8	364.2	182.1	103.3	51.6	324.7	162.4	236.1	118.0
67	Sand	67	304.1	30.0	334.1	167.1	149.9	75.0	374.8	187.4	106.4	53.2	334.1	167.1	243.3	121.6
68	Sand	68	313.3	30.5	343.8	171.9	154.3	77.1	385.7	192.8	109.7	54.8	343.8	171.9	250.6	125.3
69	Sand	69	322.6	31.0	353.6	176.8	158.7	79.3	396.7	198.3	112.9	56.5	353.6	176.8	258.1	129.0
70	Sand	70	332.0	31.4	363.4	181.7	163.1	81.5	407.7	203.9	116.2	58.1	363.4	181.7	265.6	132.8
71	Sand	71	341.5	31.9	373.4	186.7	167.6	83.8	419.0	209.5	119.5	59.8	373.4	186.7	273.2	136.6
72	Sand	72	351.0	32.3	383.3	191.7	172.0	86.0	430.1	215.1	122.9	61.4	383.3	191.7	280.8	140.4
73	Sand	73	360.5	32.8	393.3	196.7	176.5	88.3	441.4	220.7	126.2	63.1	393.3	196.7	288.4	144.2
74	Sand	74	370.0	33.2	403.2	201.6	181.0	90.5	452.5	226.2	129.5	64.8	403.2	201.6	296.0	148.0
75	Sand	75	379.5	33.7	413.2	206.6	185.5	92.7	463.7	231.9	132.8	66.4	413.2	206.6	303.6	151.8
76	Sand	76	389.0	34.1	423.1	211.6	190.0	95.0	474.9	237.4	136.2	68.1	423.1	211.6	311.2	155.6
77	Sand	77	398.5	34.6	433.1	216.6	194.5	97.2	486.1	243.1	139.5	69.7	433.1	216.6	318.8	159.4
78	Sand	78	408.0	35.0	443.0	221.5	198.9	99.5	497.3	248.6	142.8	71.4	443.0	221.5	326.4	163.2
79	Sand	79	417.5	35.5	453.0	226.5	203.4	101.7	508.5	254.3	146.1	73.1	453.0	226.5	334.0	167.0
80	Sand	80	427.0	35.8	462.8	231.4	207.8	103.9	519.5	259.8	149.5	74.7	462.8	231.4	341.6	170.8
81	Sand	81	436.5	36.1	472.6	236.3	212.2	106.1	530.6	265.3	152.8	76.4	472.6	236.3	349.2	174.6
82	Sand	82	446.0	36.2	482.2	241.1	216.5	108.3	541.4	270.7	156.1	78.1	482.2	241.1	356.8	178.4
83	Sand	83	455.5	36.2	491.7	245.9	220.8	110.4	552.1	276.0	159.4	79.7	491.7	245.9	364.4	182.2
84	Sand	84	465.0	36.2	501.2	250.6	225.1	112.5	562.7	281.4	162.8	81.4	501.2	250.6	372.0	186.0
85	Sand	85	474.5	36.2	510.7	255.4	229.4	114.7	573.4	286.7	166.1	83.0	510.7	255.4	379.6	189.8
86	Sand	86	484.0	36.2	520.2	260.1	233.6	116.8	584.1	292.1	169.4	84.7	520.2	260.1	387.2	193.6
87	Sand	87	493.5	36.2	529.7	264.9	237.9	119.0	594.8	297.4	172.7	86.4	529.7	264.9	394.8	197.4
88	Sand	88	503.0	36.2	539.2	269.6	242.2	121.1	605.5	302.7	176.1	88.0	539.2	269.6	402.4	201.2
89	Sand	89	512.5	36.2	548.7	274.4	246.5	123.2	616.2	308.1	179.4	89.7	548.7	274.4	410.0	205.0
90	Sand	90	522.0	36.2	558.2	279.1	250.7	125.4	626.9	313.4	182.7	91.4	558.2	279.1	417.6	208.8
91	Sand	91	531.5	36.2	567.7	283.9	255.0	127.5	637.6	318.8	186.0	93.0	567.7	283.9	425.2	212.6
92	Sand	92	541.0	36.2	577.2	288.6	259.3	129.6	648.2	324.1	189.4	94.7	577.2	288.6	432.8	216.4
93	Sand	93	550.5	36.2	586.7	293.4	263.6	131.8	658.9	329.5	192.7	96.3	586.7	293.4	440.4	220.2
94	Sand	94	560.0	36.2	596.2	298.1	267.8	133.9	669.6	334.8	196.0	98.0	596.2	298.1	448.0	224.0
95	Sand	95	569.5	36.2	605.7	302.9	272.1	136.1	680.3	340.2	199.3	99.7	605.7	302.9	455.6	227.8

Steel H-Pile Capacities
079B00040N
HP14x89 (50ksi steel)

Location: **Pier 11**
Estimated Base of Pile Cap Elevation = 385 ft

Depth	Soil Type	Depth Below Pile Cap	Nominal Side Resistance	Nominal End Bearing	R_n Total Nominal Geotechnical Axial Resistance		**ϕR_n Total Factored Static Geotechnical Axial Resistance (ϕ=0.35 in clay; 0.45 in sand)**		**ϕR_n Field Verification Values (ϕ=0.4 FHWA Modified**		**ϕR_n Total Factored Geotechnical Uplift Resistance Static Analysis Method**		**$\phi_{stat} R_n$ Total Factored Geotechnical Extreme Resistance Static Analysis Method**		**$\phi_{up} R_n$ Total Factored Geotechnical Extreme Uplift Resistance Static Analysis Method**	
		(ft)	(kips)	(kips)	(kips)	(tons)	**(kips)**	**(tons)**	**(kips)**	**(tons)**	**(kips)**	**(tons)**	**(kips)**	**(tons)**	**(kips)**	**(tons)**
0	Sand	0	0.0	0.2	0.2	0.1	**0.2**	**0.1**	**0.5**	**0.2**	**0.0**	**0.0**	**0.2**	**0.1**	**0.0**	**0.0**
1	Sand	1	0.1	0.4	0.5	0.3	**0.3**	**0.2**	**0.8**	**0.4**	**0.0**	**0.0**	**0.5**	**0.3**	**0.1**	**0.0**
2	Sand	2	0.2	0.6	0.8	0.4	**0.5**	**0.3**	**1.4**	**0.7**	**0.1**	**0.0**	**0.8**	**0.4**	**0.2**	**0.1**
3	Sand	3	0.5	1.0	1.5	0.8	**0.8**	**0.4**	**2.0**	**1.0**	**0.2**	**0.1**	**1.5**	**0.8**	**0.4**	**0.2**
4	Sand	4	0.9	1.3	2.2	1.1	**1.1**	**0.6**	**2.8**	**1.4**	**0.3**	**0.2**	**2.2**	**1.1**	**0.7**	**0.4**
5	Sand	5	1.5	1.7	3.2	1.6	**1.6**	**0.8**	**3.9**	**2.0**	**0.5**	**0.3**	**3.2**	**1.6**	**1.2**	**0.6**
6	Sand	6	2.1	2.0	4.1	2.1	**2.0**	**1.0**	**5.0**	**2.5**	**0.7**	**0.4**	**4.1**	**2.1**	**1.7**	**0.8**
7	Sand	7	2.9	2.3	5.2	2.6	**2.5**	**1.2**	**6.2**	**3.1**	**1.0**	**0.5**	**5.2**	**2.6**	**2.3**	**1.2**
8	Sand	8	3.7	2.7	6.4	3.2	**3.0**	**1.5**	**7.5**	**3.8**	**1.3**	**0.6**	**6.4**	**3.2**	**3.0**	**1.5**
9	Sand	9	4.7	3.0	7.7	3.9	**3.6**	**1.8**	**9.0**	**4.5**	**1.6**	**0.8**	**7.7**	**3.9**	**3.8**	**1.9**
10	Sand	10	5.8	3.3	9.1	4.6	**4.2**	**2.1**	**10.6**	**5.3**	**2.0**	**1.0**	**9.1**	**4.6**	**4.6**	**2.3**
11	Sand	11	7.0	3.7	10.7	5.4	**5.0**	**2.5**	**12.4**	**6.2**	**2.5**	**1.2**	**10.7**	**5.4**	**5.6**	**2.8**
12	Sand	12	8.4	4.0	12.4	6.2	**5.7**	**2.9**	**14.3**	**7.1**	**2.9**	**1.5**	**12.4**	**6.2**	**6.7**	**3.4**
13	Sand	13	9.8	4.3	14.1	7.1	**6.5**	**3.2**	**16.2**	**8.1**	**3.4**	**1.7**	**14.1**	**7.1**	**7.8**	**3.9**
14	Sand	14	11.4	4.7	16.1	8.1	**7.4**	**3.7**	**18.5**	**9.2**	**4.0**	**2.0**	**16.1**	**8.1**	**9.1**	**4.6**
15	Sand	15	13.1	5.1	18.2	9.1	**8.3**	**4.2**	**20.8**	**10.4**	**4.6**	**2.3**	**18.2**	**9.1**	**10.5**	**5.2**
16	Sand	16	14.9	5.8	20.7	10.4	**9.5**	**4.7**	**23.6**	**11.8**	**5.2**	**2.6**	**20.7**	**10.4**	**11.9**	**6.0**
17	Sand	17	16.8	6.5	23.3	11.7	**10.6**	**5.3**	**26.6**	**13.3**	**5.9**	**2.9**	**23.3**	**11.7**	**13.4**	**6.7**
18	Sand	18	18.9	7.2	26.1	13.1	**11.9**	**5.9**	**29.7**	**14.9**	**6.6**	**3.3**	**26.1**	**13.1**	**15.1**	**7.6**
19	Sand	19	21.3	7.9	29.2	14.6	**13.3**	**6.6**	**33.2**	**16.6**	**7.5**	**3.7**	**29.2**	**14.6**	**17.0**	**8.5**
20	Sand	20	23.8	8.5	32.3	16.2	**14.7**	**7.3**	**36.7**	**18.3**	**8.3**	**4.2**	**32.3**	**16.2**	**19.0**	**9.5**
21	Sand	21	26.4	8.9	35.3	17.7	**16.0**	**8.0**	**40.1**	**20.0**	**9.2**	**4.6**	**35.3**	**17.7**	**21.1**	**10.6**
22	Sand	22	29.2	9.4	38.6	19.3	**17.5**	**8.8**	**43.8**	**21.9**	**10.2**	**5.1**	**38.6**	**19.3**	**23.4**	**11.7**
23	Sand	23	32.1	9.8	41.9	21.0	**19.0**	**9.5**	**47.5**	**23.7**	**11.2**	**5.6**	**41.9**	**21.0**	**25.7**	**12.8**
24	Sand	24	35.1	10.3	45.4	22.7	**20.6**	**10.3**	**51.4**	**25.7**	**12.3**	**6.1**	**45.4**	**22.7**	**28.1**	**14.0**
25	Sand	25	38.3	10.7	49.0	24.5	**22.2**	**11.1**	**55.5**	**27.7**	**13.4**	**6.7**	**49.0**	**24.5**	**30.6**	**15.3**
26	Sand	26	41.6	11.2	52.8	26.4	**23.9**	**11.9**	**59.7**	**29.9**	**14.6**	**7.3**	**52.8**	**26.4**	**33.3**	**16.6**
27	Sand	27	45.1	11.6	56.7	28.4	**25.7**	**12.8**	**64.1**	**32.1**	**15.8**	**7.9**	**56.7**	**28.4**	**36.1**	**18.0**
28	Sand	28	48.7	12.1	60.8	30.4	**27.5**	**13.7**	**68.7**	**34.4**	**17.0**	**8.5**	**60.8**	**30.4**	**39.0**	**19.5**
29	Sand	29	52.4	12.5	64.9	32.5	**29.3**	**14.7**	**73.4**	**36.7**	**18.3**	**9.2**	**64.9**	**32.5**	**41.9**	**21.0**
30	Sand	30	56.3	13.0	69.3	34.7	**31.3**	**15.7**	**78.3**	**39.2**	**19.7**	**9.9**	**69.3**	**34.7**	**45.0**	**22.5**
31	Sand	31	60.3	13.5	73.8	36.9	**33.3**	**16.7**	**83.4**	**41.7**	**21.1**	**10.6**	**73.8**	**36.9**	**48.2**	**24.1**
32	Sand	32	64.4	13.9	78.3	39.2	**35.4**	**17.7**	**88.4**	**44.2**	**22.5**	**11.3**	**78.3**	**39.2**	**51.5**	**25.8**
33	Sand	33	68.7	14.4	83.1	41.6	**37.5**	**18.8**	**93.8**	**46.9**	**24.0**	**12.0**	**83.1**	**41.6**	**55.0**	**27.5**
34	Sand	34	73.1	14.8	87.9	44.0	**39.7**	**19.8**	**99.2**	**49.6**	**25.6**	**12.8**	**87.9**	**44.0**	**58.5**	**29.2**
35	Sand	35	77.7	15.3	93.0	46.5	**42.0**	**21.0**	**105.0**	**52.5**	**27.2**	**13.6**	**93.0**	**46.5**	**62.2**	**31.1**
36	Sand	36	82.3	15.7	98.0	49.0	**44.2**	**22.1**	**110.6**	**55.3**	**28.8**	**14.4**	**98.0**	**49.0**	**65.8**	**32.9**
37	Sand	37	87.2	16.2	103.4	51.7	**46.7**	**23.3**	**116.7**	**58.3**	**30.5**	**15.3**	**103.4**	**51.7**	**69.8**	**34.9**
38	Sand	38	92.1	16.6	108.7	54.4	**49.1**	**24.5**	**122.6**	**61.3**	**32.2**	**16.1**	**108.7**	**54.4**	**73.7**	**36.8**
39	Sand	39	97.2	17.1	114.3	57.2	**51.6**	**25.8**	**128.9**	**64.5**	**34.0**	**17.0**	**114.3**	**57.2**	**77.8**	**38.9**
40	Sand	40	102.5	17.5	120.0	60.0	**54.1**	**27.1**	**135.3**	**67.7**	**35.9**	**17.9**	**120.0**	**60.0**	**82.0**	**41.0**
41	Sand	41	107.8	18.0	125.8	62.9	**56.7**	**28.4**	**141.9**	**70.9**	**37.7**	**18.9**	**125.8**	**62.9**	**86.2**	**43.1**
42	Sand	42	113.4	18.4	131.8	65.9	**59.4**	**29.7**	**148.6**	**74.3**	**39.7**	**19.8**	**131.8**	**65.9**	**90.7**	**45.4**
43	Sand	43	119.0	18.9	137.9	69.0	**62.2**	**31.1**	**155.5**	**77.7**	**41.7**	**20.8**	**137.9**	**69.0**	**95.2**	**47.6**
44	Sand	44	124.8	19.4	144.2	72.1	**65.0**	**32.5**	**162.6**	**81.3**	**43.7**	**21.8**	**144.2**	**72.1**	**99.8**	**49.9**
45	Sand	45	130.7	19.8	150.5	75.3	**67.9**	**33.9**	**169.7**	**84.8**	**45.7**	**22.9**	**150.5**	**75.3**	**104.6**	**52.3**
46	Sand	46	136.8	20.3	157.1	78.6	**70.8**	**35.4**	**177.1**	**88.5**	**47.9**	**23.9**	**157.1**	**78.6**	**109.4**	**54.7**
47	Sand	47	143.0	20.7	163.7	81.9	**73.8**	**36.9**	**184.5**	**92.3**	**50.1**	**25.0**	**163.7**	**81.9**	**114.4**	**57.2**
48	Sand	48	149.3	21.2	170.5	85.3	**76.9**	**38.4**	**192.2**	**96.1**	**52.3**	**26.1**	**170.5**	**85.3**	**119.4**	**59.7**
49	Sand	49	155.8	21.6	177.4	88.7	**80.0**	**40.0**	**199.9**	**100.0**	**54.5**	**27.3**	**177.4**	**88.7**	**124.6**	**62.3**
50	Sand	50	162.4	22.1	184.5	92.3	**83.2**	**41.6**	**207.9**	**104.0**	**56.8**	**28.4**	**184.5**	**92.3**	**129.9**	**65.0**

Depth	Soil Type	Depth Below Pile Cap	Nominal Side Resistance	Nominal End Bearing	R_n Total Nominal Geotechnical Axial Resistance		ϕR_n Total Factored Static Geotechnical Axial Resistance (ϕ=0.35 in clay; 0.45 in sand)		ϕR_n Field Verification Values (ϕ=0.4 FHWA Modified		ϕR_n Total Factored Geotechnical Uplift Resistance Static Analysis Method		$\phi_{stat} R_n$ Total Factored Geotechnical Extreme Resistance Static Analysis Method		$\phi_{up} R_n$ Total Factored Geotechnical Extreme Uplift Resistance Static Analysis Method	
		(ft)	(kips)	(kips)	(kips)	(tons)	(kips)	(tons)	(kips)	(tons)	(kips)	(tons)	(kips)	(tons)	(kips)	(tons)
51	Sand	51	169.2	22.5	191.7	95.9	86.4	43.2	216.0	108.0	59.2	29.6	191.7	95.9	135.4	67.7
52	Sand	52	176.0	23.0	199.0	99.5	89.7	44.8	224.2	112.1	61.6	30.8	199.0	99.5	140.8	70.4
53	Sand	53	183.1	23.4	206.5	103.3	93.1	46.5	232.7	116.3	64.1	32.0	206.5	103.3	146.5	73.2
54	Sand	54	190.2	23.9	214.1	107.1	96.5	48.2	241.2	120.6	66.6	33.3	214.1	107.1	152.2	76.1
55	Sand	55	197.5	24.3	221.8	110.9	99.9	50.0	249.9	124.9	69.1	34.6	221.8	110.9	158.0	79.0
56	Sand	56	205.0	24.8	229.8	114.9	103.5	51.8	258.9	129.4	71.8	35.9	229.8	114.9	164.0	82.0
57	Sand	57	212.5	25.3	237.8	118.9	107.1	53.6	267.9	133.9	74.4	37.2	237.8	118.9	170.0	85.0
58	Sand	58	220.2	25.7	245.9	123.0	110.8	55.4	277.0	138.5	77.1	38.5	245.9	123.0	176.2	88.1
59	Sand	59	228.1	26.2	254.3	127.2	114.6	57.3	286.4	143.2	79.8	39.9	254.3	127.2	182.5	91.2
60	Sand	60	236.1	26.6	262.7	131.4	118.4	59.2	295.9	147.9	82.6	41.3	262.7	131.4	188.9	94.4
61	Sand	61	244.2	27.1	271.3	135.7	122.2	61.1	305.6	152.8	85.5	42.7	271.3	135.7	195.4	97.7
62	Sand	62	252.5	27.5	280.0	140.0	126.1	63.1	315.3	157.7	88.4	44.2	280.0	140.0	202.0	101.0
63	Sand	63	260.9	28.0	288.9	144.5	130.1	65.1	325.4	162.7	91.3	45.7	288.9	144.5	208.7	104.4
64	Sand	64	269.4	28.4	297.8	148.9	134.1	67.1	335.4	167.7	94.3	47.1	297.8	148.9	215.5	107.8
65	Sand	65	278.1	28.9	307.0	153.5	138.3	69.1	345.7	172.9	97.3	48.7	307.0	153.5	222.5	111.2
66	Sand	66	286.9	29.3	316.2	158.1	142.4	71.2	356.1	178.0	100.4	50.2	316.2	158.1	229.5	114.8
67	Sand	67	295.8	29.8	325.6	162.8	146.7	73.3	366.6	183.3	103.5	51.8	325.6	162.8	236.6	118.3
68	Sand	68	304.9	30.2	335.1	167.6	150.9	75.5	377.3	188.7	106.7	53.4	335.1	167.6	243.9	122.0
69	Sand	69	314.1	30.7	344.8	172.4	155.3	77.6	388.2	194.1	109.9	55.0	344.8	172.4	251.3	125.6
70	Sand	70	323.5	31.2	354.7	177.4	159.8	79.9	399.4	199.7	113.2	56.6	354.7	177.4	258.8	129.4
71	Sand	71	332.9	31.6	364.5	182.3	164.2	82.1	410.4	205.2	116.5	58.3	364.5	182.3	266.3	133.2
72	Sand	72	342.4	32.1	374.5	187.3	168.7	84.3	421.7	210.8	119.8	59.9	374.5	187.3	273.9	137.0
73	Sand	73	351.9	32.5	384.4	192.2	173.1	86.6	432.8	216.4	123.2	61.6	384.4	192.2	281.5	140.8
74	Sand	74	361.4	33.0	394.4	197.2	177.6	88.8	444.0	222.0	126.5	63.2	394.4	197.2	289.1	144.6
75	Sand	75	370.9	33.4	404.3	202.2	182.1	91.0	455.2	227.6	129.8	64.9	404.3	202.2	296.7	148.4
76	Sand	76	380.4	33.9	414.3	207.2	186.6	93.3	466.4	233.2	133.1	66.6	414.3	207.2	304.3	152.2
77	Sand	77	389.9	34.3	424.2	212.1	191.0	95.5	477.6	238.8	136.5	68.2	424.2	212.1	311.9	156.0
78	Sand	78	399.4	34.8	434.2	217.1	195.5	97.8	488.8	244.4	139.8	69.9	434.2	217.1	319.5	159.8
79	Sand	79	408.9	35.2	444.1	222.1	200.0	100.0	500.0	250.0	143.1	71.6	444.1	222.1	327.1	163.6
80	Sand	80	418.4	35.6	454.0	227.0	204.4	102.2	511.1	255.5	146.4	73.2	454.0	227.0	334.7	167.4
81	Sand	81	427.9	35.9	463.8	231.9	208.8	104.4	522.1	261.1	149.8	74.9	463.8	231.9	342.3	171.2
82	Sand	82	437.4	36.1	473.5	236.8	213.2	106.6	533.0	266.5	153.1	76.5	473.5	236.8	349.9	175.0
83	Sand	83	446.9	36.2	483.1	241.6	217.5	108.8	543.8	271.9	156.4	78.2	483.1	241.6	357.5	178.8
84	Sand	84	456.4	36.2	492.6	246.3	221.8	110.9	554.5	277.3	159.7	79.9	492.6	246.3	365.1	182.6
85	Sand	85	465.9	36.2	502.1	251.1	226.1	113.0	565.2	282.6	163.1	81.5	502.1	251.1	372.7	186.4
86	Sand	86	475.4	36.2	511.6	255.8	230.4	115.2	575.9	287.9	166.4	83.2	511.6	255.8	380.3	190.2
87	Sand	87	484.9	36.2	521.1	260.6	234.6	117.3	586.6	293.3	169.7	84.9	521.1	260.6	387.9	194.0
88	Sand	88	494.4	36.2	530.6	265.3	238.9	119.5	597.3	298.6	173.0	86.5	530.6	265.3	395.5	197.8
89	Sand	89	503.9	36.2	540.1	270.1	243.2	121.6	608.0	304.0	176.4	88.2	540.1	270.1	403.1	201.6
90	Sand	90	513.4	36.2	549.6	274.8	247.5	123.7	618.6	309.3	179.7	89.8	549.6	274.8	410.7	205.4
91	Sand	91	522.9	36.2	559.1	279.6	251.7	125.9	629.3	314.7	183.0	91.5	559.1	279.6	418.3	209.2
92	Sand	92	532.4	36.2	568.6	284.3	256.0	128.0	640.0	320.0	186.3	93.2	568.6	284.3	425.9	213.0
93	Sand	93	541.9	36.2	578.1	289.1	260.3	130.1	650.7	325.4	189.7	94.8	578.1	289.1	433.5	216.8
94	Sand	94	551.4	36.2	587.6	293.8	264.6	132.3	661.4	330.7	193.0	96.5	587.6	293.8	441.1	220.6
95	Sand	95	560.9	36.2	597.1	298.6	268.8	134.4	672.1	336.0	196.3	98.2	597.1	298.6	448.7	224.4

Steel H-Pile Capacities
079B00040N
HP14x89 (50ksi steel)

Location: **EB2**
Estimated Base of Pile Cap Elevation = 394.8 ft

Depth	Soil Type	Depth Below Pile Cap	Nominal Side Resistance	Nominal End Bearing	R_n Total Nominal Geotechnical Axial Resistance		ϕR_n Total Factored Static Geotechnical Axial Resistance (ϕ=0.35 in clay; 0.45 in		ϕR_n Field Verification Values (ϕ=0.4 FHWA Modified		ϕR_n Total Factored Geotechnical Uplift Resistance Static Analysis Method		$\phi_{stat} R_n$ Total Factored Geotechnical Extreme Resistance Static Analysis Method		$\phi_{up} R_n$ Total Factored Geotechnical Extreme Uplift Resistance Static Analysis Method	
		(ft)	(kips)	(kips)	(kips)	(tons)	(kips)	(tons)	(kips)	(tons)	(kips)	(tons)	(kips)	(tons)	(kips)	(tons)
0	Clay	0	0.0	0.6	0.6	0.3	0.2	0.1	0.5	0.3	0.0	0.0	0.6	0.3	0.0	0.0
1	Clay	1	1.0	0.6	1.6	0.8	0.6	0.3	1.6	0.8	0.3	0.1	1.6	0.8	0.8	0.4
2	Clay	2	2.2	0.8	3.0	1.5	1.2	0.6	2.9	1.4	0.6	0.3	3.0	1.5	1.8	0.9
3	Clay	3	3.5	1.1	4.6	2.3	1.6	0.8	4.0	2.0	0.9	0.4	4.6	2.3	2.8	1.4
4	Clay	4	4.9	1.1	6.0	3.0	2.2	1.1	5.4	2.7	1.2	0.6	6.0	3.0	3.9	2.0
5	Clay	5	6.4	1.3	7.7	3.9	3.0	1.5	7.6	3.8	1.6	0.8	7.7	3.9	5.1	2.6
6	Clay	6	8.0	2.3	10.3	5.2	4.0	2.0	10.0	5.0	2.0	1.0	10.3	5.2	6.4	3.2
7	Clay	7	9.7	3.4	13.1	6.6	5.0	2.5	12.5	6.3	2.4	1.2	13.1	6.6	7.8	3.9
8	Sand	8	11.6	4.6	16.2	8.1	6.4	3.2	16.0	8.0	4.1	2.0	16.2	8.1	9.3	4.6
9	Sand	9	13.7	6.0	19.7	9.9	8.0	4.0	19.9	10.0	4.8	2.4	19.7	9.9	11.0	5.5
10	Sand	10	15.9	6.9	22.8	11.4	9.4	4.7	23.4	11.7	5.6	2.8	22.8	11.4	12.7	6.4
11	Sand	11	18.4	7.5	25.9	13.0	10.8	5.4	26.9	13.5	6.4	3.2	25.9	13.0	14.7	7.4
12	Sand	12	21.2	8.1	29.3	14.7	12.3	6.1	30.7	15.4	7.4	3.7	29.3	14.7	17.0	8.5
13	Sand	13	24.1	8.7	32.8	16.4	13.9	6.9	34.7	17.3	8.4	4.2	32.8	16.4	19.3	9.6
14	Sand	14	27.2	9.3	36.5	18.3	15.5	7.8	38.8	19.4	9.5	4.8	36.5	18.3	21.8	10.9
15	Sand	15	30.5	9.8	40.3	20.2	17.2	8.6	43.1	21.6	10.7	5.3	40.3	20.2	24.4	12.2
16	Sand	16	34.1	10.4	44.5	22.3	19.1	9.6	47.8	23.9	11.9	6.0	44.5	22.3	27.3	13.6
17	Sand	17	37.8	10.9	48.7	24.4	21.0	10.5	52.6	26.3	13.2	6.6	48.7	24.4	30.2	15.1
18	Sand	18	41.7	11.4	53.1	26.6	23.0	11.5	57.5	28.8	14.6	7.3	53.1	26.6	33.4	16.7
19	Sand	19	45.7	11.9	57.6	28.8	25.0	12.5	62.6	31.3	16.0	8.0	57.6	28.8	36.6	18.3
20	Sand	20	49.9	12.3	62.2	31.1	27.1	13.6	67.8	33.9	17.5	8.7	62.2	31.1	39.9	20.0
21	Sand	21	54.3	12.8	67.1	33.6	29.3	14.7	73.3	36.6	19.0	9.5	67.1	33.6	43.4	21.7
22	Sand	22	58.8	13.2	72.0	36.0	31.5	15.8	78.8	39.4	20.6	10.3	72.0	36.0	47.0	23.5
23	Sand	23	63.5	13.6	77.1	38.6	33.8	16.9	84.5	42.3	22.2	11.1	77.1	38.6	50.8	25.4
24	Sand	24	68.3	14.0	82.3	41.2	36.1	18.1	90.4	45.2	23.9	12.0	82.3	41.2	54.6	27.3
25	Sand	25	73.3	14.6	87.9	44.0	38.7	19.3	96.7	48.3	25.7	12.8	87.9	44.0	58.6	29.3
26	Sand	26	78.4	15.8	94.2	47.1	41.5	20.8	103.8	51.9	27.4	13.7	94.2	47.1	62.7	31.4
27	Sand	27	83.6	17.0	100.6	50.3	44.4	22.2	111.0	55.5	29.3	14.6	100.6	50.3	66.9	33.4
28	Sand	28	89.1	18.3	107.4	53.7	47.4	23.7	118.6	59.3	31.2	15.6	107.4	53.7	71.3	35.6
29	Sand	29	95.0	19.6	114.6	57.3	50.7	25.3	126.7	63.4	33.3	16.6	114.6	57.3	76.0	38.0
30	Sand	30	101.1	20.2	121.3	60.7	53.7	26.8	134.2	67.1	35.4	17.7	121.3	60.7	80.9	40.4
31	Sand	31	107.3	20.7	128.0	64.0	56.7	28.4	141.8	70.9	37.6	18.8	128.0	64.0	85.8	42.9
32	Sand	32	113.6	21.1	134.7	67.4	59.7	29.9	149.3	74.7	39.8	19.9	134.7	67.4	90.9	45.4
33	Sand	33	120.1	21.6	141.7	70.9	62.9	31.4	157.2	78.6	42.0	21.0	141.7	70.9	96.1	48.0
34	Sand	34	126.7	22.1	148.8	74.4	66.1	33.0	165.2	82.6	44.3	22.2	148.8	74.4	101.4	50.7
35	Sand	35	133.4	22.5	155.9	78.0	69.3	34.6	173.2	86.6	46.7	23.3	155.9	78.0	106.7	53.4
36	Sand	36	140.3	23.0	163.3	81.7	72.6	36.3	181.5	90.7	49.1	24.6	163.3	81.7	112.2	56.1
37	Sand	37	147.3	23.4	170.7	85.4	75.9	38.0	189.8	94.9	51.6	25.8	170.7	85.4	117.8	58.9
38	Sand	38	154.5	23.9	178.4	89.2	79.4	39.7	198.5	99.2	54.1	27.0	178.4	89.2	123.6	61.8
39	Sand	39	161.8	24.3	186.1	93.1	82.9	41.4	207.1	103.6	56.6	28.3	186.1	93.1	129.4	64.7
40	Sand	40	169.2	24.8	194.0	97.0	86.4	43.2	216.0	108.0	59.2	29.6	194.0	97.0	135.4	67.7
41	Sand	41	176.8	25.2	202.0	101.0	90.0	45.0	225.0	112.5	61.9	30.9	202.0	101.0	141.4	70.7
42	Sand	42	184.5	25.7	210.2	105.1	93.7	46.9	234.3	117.1	64.6	32.3	210.2	105.1	147.6	73.8
43	Sand	43	192.3	26.1	218.4	109.2	97.4	48.7	243.5	121.7	67.3	33.7	218.4	109.2	153.8	76.9
44	Sand	44	200.3	26.6	226.9	113.5	101.2	50.6	253.0	126.5	70.1	35.1	226.9	113.5	160.2	80.1
45	Sand	45	208.4	27.0	235.4	117.7	105.0	52.5	262.6	131.3	72.9	36.5	235.4	117.7	166.7	83.4
46	Sand	46	216.7	27.5	244.2	122.1	109.0	54.5	272.5	136.3	75.8	37.9	244.2	122.1	173.4	86.7
47	Sand	47	225.0	28.0	253.0	126.5	113.0	56.5	282.4	141.2	78.8	39.4	253.0	126.5	180.0	90.0
48	Sand	48	233.6	28.4	262.0	131.0	117.0	58.5	292.5	146.3	81.8	40.9	262.0	131.0	186.9	93.4

Depth	Soil Type	Depth Below Pile Cap	Nominal Side Resistance	Nominal End Bearing	R_n Total Nominal Geotechnical Axial Resistance		ϕR_n Total Factored Static Geotechnical Axial Resistance (ϕ=0.35 in clay; 0.45 in		ϕR_n Field Verification Values (ϕ=0.4 FHWA Modified		ϕR_n Total Factored Geotechnical Uplift Resistance Static Analysis Method		$\phi_{stat} R_n$ Total Factored Geotechnical Extreme Resistance Static Analysis Method		$\phi_{up} R_n$ Total Factored Geotechnical Extreme Uplift Resistance Static Analysis Method	
		(ft)	(kips)	(kips)	(kips)	(tons)	(kips)	(tons)	(kips)	(tons)	(kips)	(tons)	(kips)	(tons)	(kips)	(tons)
49	Sand	49	242.2	28.9	271.1	135.6	121.1	60.6	302.8	151.4	84.8	42.4	271.1	135.6	193.8	96.9
50	Sand	50	251.0	29.3	280.3	140.2	125.2	62.6	313.1	156.6	87.9	43.9	280.3	140.2	200.8	100.4
51	Sand	51	260.0	29.8	289.8	144.9	129.5	64.8	323.8	161.9	91.0	45.5	289.8	144.9	208.0	104.0
52	Sand	52	269.1	30.2	299.3	149.7	133.8	66.9	334.5	167.2	94.2	47.1	299.3	149.7	215.3	107.6
53	Sand	53	278.3	30.7	309.0	154.5	138.2	69.1	345.4	172.7	97.4	48.7	309.0	154.5	222.6	111.3
54	Sand	54	287.6	31.1	318.7	159.4	142.5	71.3	356.3	178.2	100.7	50.3	318.7	159.4	230.1	115.0
55	Sand	55	297.1	31.6	328.7	164.4	147.0	73.5	367.6	183.8	104.0	52.0	328.7	164.4	237.7	118.8
56	Sand	56	306.6	32.0	338.6	169.3	151.5	75.7	378.7	189.4	107.3	53.7	338.6	169.3	245.3	122.6
57	Sand	57	316.1	32.5	348.6	174.3	156.0	78.0	390.0	195.0	110.6	55.3	348.6	174.3	252.9	126.4
58	Sand	58	325.6	32.9	358.5	179.3	160.4	80.2	401.1	200.5	114.0	57.0	358.5	179.3	260.5	130.2
59	Sand	59	335.1	33.4	368.5	184.3	164.9	82.5	412.3	206.2	117.3	58.6	368.5	184.3	268.1	134.0
60	Sand	60	344.6	33.9	378.5	189.3	169.4	84.7	423.6	211.8	120.6	60.3	378.5	189.3	275.7	137.8
61	Sand	61	354.1	34.3	388.4	194.2	173.9	86.9	434.7	217.4	123.9	62.0	388.4	194.2	283.3	141.6
62	Sand	62	363.6	34.8	398.4	199.2	178.4	89.2	446.0	223.0	127.3	63.6	398.4	199.2	290.9	145.4
63	Sand	63	373.1	35.2	408.3	204.2	182.8	91.4	457.1	228.6	130.6	65.3	408.3	204.2	298.5	149.2
64	Sand	64	382.6	35.6	418.2	209.1	187.3	93.7	468.3	234.1	133.9	67.0	418.2	209.1	306.1	153.0
65	Sand	65	392.1	35.9	428.0	214.0	191.7	95.9	479.3	239.6	137.2	68.6	428.0	214.0	313.7	156.8
66	Sand	66	401.6	36.1	437.7	218.9	196.1	98.0	490.2	245.1	140.6	70.3	437.7	218.9	321.3	160.6
67	Sand	67	411.1	36.2	447.3	223.7	200.4	100.2	501.0	250.5	143.9	71.9	447.3	223.7	328.9	164.4
68	Sand	68	420.6	36.2	456.8	228.4	204.7	102.3	511.7	255.8	147.2	73.6	456.8	228.4	336.5	168.2
69	Sand	69	430.1	36.2	466.3	233.2	208.9	104.5	522.4	261.2	150.5	75.3	466.3	233.2	344.1	172.0
70	Sand	70	439.6	36.2	475.8	237.9	213.2	106.6	533.1	266.5	153.9	76.9	475.8	237.9	351.7	175.8
71	Sand	71	449.1	36.2	485.3	242.7	217.5	108.7	543.7	271.9	157.2	78.6	485.3	242.7	359.3	179.6
72	Sand	72	458.6	36.2	494.8	247.4	221.8	110.9	554.4	277.2	160.5	80.3	494.8	247.4	366.9	183.4
73	Sand	73	468.1	36.2	504.3	252.2	226.0	113.0	565.1	282.6	163.8	81.9	504.3	252.2	374.5	187.2
74	Sand	74	477.6	36.2	513.8	256.9	230.3	115.2	575.8	287.9	167.2	83.6	513.8	256.9	382.1	191.0
75	Sand	75	487.1	36.2	523.3	261.7	234.6	117.3	586.5	293.2	170.5	85.2	523.3	261.7	389.7	194.8
76	Sand	76	496.6	36.2	532.8	266.4	238.9	119.4	597.2	298.6	173.8	86.9	532.8	266.4	397.3	198.6
77	Sand	77	506.1	36.2	542.3	271.2	243.1	121.6	607.9	303.9	177.1	88.6	542.3	271.2	404.9	202.4
78	Sand	78	515.6	36.2	551.8	275.9	247.4	123.7	618.6	309.3	180.5	90.2	551.8	275.9	412.5	206.2
79	Sand	79	525.1	36.2	561.3	280.7	251.7	125.8	629.2	314.6	183.8	91.9	561.3	280.7	420.1	210.0
80	Sand	80	534.6	36.2	570.8	285.4	256.0	128.0	639.9	320.0	187.1	93.6	570.8	285.4	427.7	213.8
81	Sand	81	544.1	36.2	580.3	290.2	260.2	130.1	650.6	325.3	190.4	95.2	580.3	290.2	435.3	217.6
82	Sand	82	553.6	36.2	589.8	294.9	264.5	132.3	661.3	330.7	193.8	96.9	589.8	294.9	442.9	221.4
83	Sand	83	563.1	36.2	599.3	299.7	268.8	134.4	672.0	336.0	197.1	98.5	599.3	299.7	450.5	225.2
84	Sand	84	572.6	36.2	608.8	304.4	273.1	136.5	682.7	341.3	200.4	100.2	608.8	304.4	458.1	229.0
85	Sand	85	582.1	36.2	618.3	309.2	277.3	138.7	693.4	346.7	203.7	101.9	618.3	309.2	465.7	232.8
86	Sand	86	591.6	36.2	627.8	313.9	281.6	140.8	704.1	352.0	207.1	103.5	627.8	313.9	473.3	236.6
87	Sand	87	601.1	36.2	637.3	318.7	285.9	142.9	714.7	357.4	210.4	105.2	637.3	318.7	480.9	240.4
88	Sand	88	610.6	36.2	646.8	323.4	290.2	145.1	725.4	362.7	213.7	106.9	646.8	323.4	488.5	244.2
89	Sand	89	620.1	36.2	656.3	328.2	294.4	147.2	736.1	368.1	217.0	108.5	656.3	328.2	496.1	248.0
90	Sand	90	629.6	36.2	665.8	332.9	298.7	149.4	746.8	373.4	220.4	110.2	665.8	332.9	503.7	251.8
91	Sand	91	639.1	36.2	675.3	337.7	303.0	151.5	757.5	378.7	223.7	111.8	675.3	337.7	511.3	255.6
92	Sand	92	648.6	36.2	684.8	342.4	307.3	153.6	768.2	384.1	227.0	113.5	684.8	342.4	518.9	259.4
93	Sand	93	658.1	36.2	694.3	347.2	311.5	155.8	778.9	389.4	230.3	115.2	694.3	347.2	526.5	263.2
94	Sand	94	667.6	36.2	703.8	351.9	315.8	157.9	789.6	394.8	233.7	116.8	703.8	351.9	534.1	267.0
95	Sand	95	677.1	36.2	713.3	356.7	320.1	160.0	800.2	400.1	237.0	118.5	713.3	356.7	541.7	270.8

APPENDIX E
IDEALIZED SOIL AND ROCK PROFILES

GENERAL SOIL AND BEDROCK PROFILE

KY-402 over East Fork Clarks River
End Bent 1 & Pier 1
Based on Boring 079B00040N-1

Approximate		Description		
		STRATA		
Elevation (ft)	Depth (ft)	Description (USCS Classification)	Parameters	
394.8	0.0			
		Lean Clay	γ_t (lb/ft^3) = 128	
		(CL/CL-ML)	γ_e (lb/ft^3) = 65.6	
			C_u (psf) = 1000	
			K_S (lb/in^3) = 430	
			E_{50} = 0.012	
386.6	8.2			
		Clayey Gravel	γ_t (lb/ft^3) = 115	
		(GC)	γ_e (lb/ft^3) = 52.6	
			ϕ (^{o}) = 31	
			K_S (lb/in^3) = 53	(above water table)
			K_S (lb/in^3) = 40	(below water table)
376.6	18.2			
		Silt	γ_t (lb/ft^3) = 100	
		(MH)	γ_e (lb/ft^3) = 37.6	
			C_u (psf) = 800	
			K_S (lb/in^3) = 400	
			E_{50} = 0.013	
366.6	28.2			
		Lean Clay	γ_t (lb/ft^3) = 118	
		(CL)	γ_e (lb/ft^3) = 55.6	
			C_u (psf) = 1400	
			K_S (lb/in^3) = 500	
			E_{50} = 0.012	
356.6	38.2			
		Silty Sand	γ_t (lb/ft^3) = 125	
		(SM)	γ_e (lb/ft^3) = 62.6	
			ϕ (^{o}) = 35	
			K_S (lb/in^3) = 130	(above water table)
			K_S (lb/in^3) = 80	(below water table)
294.8	100.0	Bottom of Hole		

Note: The top of rock was not encountered.

Groundwater estimated at elevation 384

GENERAL SOIL AND BEDROCK PROFILE

KY-402 over East Fork Clarks River
Piers 2 and 3
Based on Boring 079B00040N-2

Approximate		Description STRATA		
Elevation (ft)	Depth (ft)	Description (USCS Classification)	Parameters	
394.9	0.0			
		Lean Clay	γ_t (lb/ft^3) = 125	
		(CL/CL-ML)	γ_e (lb/ft^3) = 62.6	
			C_u (psf) = 690	
			K_S (lb/in^3) = 380	
			E_{50} = 0.013	
386.0	8.9			
		Silty Gravel	γ_t (lb/ft^3) = 120	
		(GW-GM)	γ_e (lb/ft^3) = 57.6	
			ϕ (^{o}) = 33	
			K_S (lb/in^3) = 90	(above water table)
			K_S (lb/in^3) = 60	(below water table)
377.0	17.9			
		Gravelly Silt	γ_t (lb/ft^3) = 120	
		(ML)	γ_e (lb/ft^3) = 57.6	
			C_u (psf) = 1400	
			K_S (lb/in^3) = 500	
			E_{50} = 0.012	
367.0	27.9			
		Lean Clay	γ_t (lb/ft^3) = 121	
		(CL)	γ_e (lb/ft^3) = 58.6	
			C_u (psf) = 1300	
			K_S (lb/in^3) = 485	
			E_{50} = 0.012	
357.0	37.9			
		Sandy Silt	γ_t (lb/ft^3) = 115	
		(ML)	γ_e (lb/ft^3) = 52.6	
			ϕ (^{o}) = 29	
			K_S (lb/in^3) = 20	(above water table)
			K_S (lb/in^3) = 20	(below water table)
343.0	51.9			
		Sand with Silt	γ_t (lb/ft^3) = 125	
		(SP-SM)	γ_e (lb/ft^3) = 62.6	
			ϕ (^{o}) = 35	
			K_S (lb/in^3) = 130	(above water table)
			K_S (lb/in^3) = 80	(below water table)
294.9	100.0	Bottom of Hole		

Note: The top of rock was not encountered.
Groundwater estimated at elevation 384

GENERAL SOIL AND BEDROCK PROFILE

KY-402 over East Fork Clarks River
Piers 4 and 5
Based on Boring 079B00040N-3

Approximate		Description STRATA	
Elevation (ft)	Depth (ft)	Description (USCS Classification)	Parameters
394.3	0.0		
		Silt	γ_t (lb/ft^3) = 120
		(ML)	γ_e (lb/ft^3) = 57.6
			C_u (psf) = 530
			K_S (lb/in^3) = 355
			E_{50} = 0.014
386.0	8.3		
		Silty Gravel	γ_t (lb/ft^3) = 120
		(GC-GM)	γ_e (lb/ft^3) = 57.6
			ϕ (^{o}) = 33
			K_S (lb/in^3) = 90 (above water table)
			K_S (lb/in^3) = 60 (below water table)
377.0	17.3		
		Lean Clay	γ_t (lb/ft^3) = 120
		(CL)	γ_e (lb/ft^3) = 57.6
			C_u (psf) = 1400
			K_S (lb/in^3) = 505
			E_{50} = 0.012
367.0	27.3		
		Sand with Silt	γ_t (lb/ft^3) = 125
		(SP-SM)	γ_e (lb/ft^3) = 62.6
			ϕ (^{o}) = 34
			K_S (lb/in^3) = 110 (above water table)
			K_S (lb/in^3) = 72 (below water table)
357.0	37.3		
		Lean Clay	γ_t (lb/ft^3) = 125
		(CL)	γ_e (lb/ft^3) = 62.6
			C_u (psf) = 1800
			K_S (lb/in^3) = 590
			E_{50} = 0.011
347.0	47.3		
		Sand with Silt	γ_t (lb/ft^3) = 125
		(SP-SM)	γ_e (lb/ft^3) = 62.6
			ϕ (^{o}) = 35
			K_S (lb/in^3) = 130 (above water table)
			K_S (lb/in^3) = 80 (below water table)
294.3	100.0	Bottom of Hole	

Note: The top of rock was not encountered.
Groundwater estimated at elevation 384

GENERAL SOIL AND BEDROCK PROFILE

KY-402 over East Fork Clarks River
Piers 6 and 7
Based on Boring 079B00040N-4

Approximate		Description STRATA			
Elevation (ft)	Depth (ft)	Description (USCS Classification)	Parameters		
394.2	0.0				
		Silty Clay	γ_t (lb/ft^3)	= 118	
		(CL-ML)	γ_e (lb/ft^3)	= 55.6	
			C_u (psf)	= 950	
			K_S (lb/in^3)	= 420	
			E_{50}	= 0.013	
386.0	8.2				
		Gravel with Silt	γ_t (lb/ft^3)	= 120	
		(GW-GM)	γ_e (lb/ft^3)	= 57.6	
			ϕ (^{o})	= 33	
			K_S (lb/in^3)	= 90	(above water table)
			K_S (lb/in^3)	= 60	(below water table)
366.0	28.2				
		Sand with Silt	γ_t (lb/ft^3)	= 125	
		(SP-SM)	γ_e (lb/ft^3)	= 62.6	
			ϕ (^{o})	= 35	
			K_S (lb/in^3)	= 130	(above water table)
			K_S (lb/in^3)	= 80	(below water table)
294.2	100.0	Bottom of Hole			

Note: The top of rock was not encountered.
Groundwater estimated at elevation 384

GENERAL SOIL AND BEDROCK PROFILE

KY-402 over East Fork Clarks River
Piers 8, 9, and 10
Based on Boring 079B00040N-5

Approximate		Description STRATA			
Elevation (ft)	Depth (ft)	Description (USCS Classification)	Parameters		
395.2	0.0				
		Silty Clay	γ_t (lb/ft^3)	= 125	
		(CL-ML)	γ_e (lb/ft^3)	= 62.6	
			C_u (psf)	= 800	
			K_S (lb/in^3)	= 395	
			E_{50}	= 0.013	
382.0	13.2				
		Gravel with Silt	γ_t (lb/ft^3)	= 120	
		(GW-GM)	γ_e (lb/ft^3)	= 57.6	
			ϕ (^{o})	= 33	
			K_S (lb/in^3)	= 90	(above water table)
			K_S (lb/in^3)	= 60	(below water table)
372.0	23.2				
		Sand with Silt	γ_t (lb/ft^3)	= 125	
		(SP-SM)	γ_e (lb/ft^3)	= 62.6	
			ϕ (^{o})	= 35	
			K_S (lb/in^3)	= 130	(above water table)
			K_S (lb/in^3)	= 80	(below water table)
295.2	100.0	Bottom of Hole			

Note: The top of rock was not encountered.
Groundwater estimated at elevation 384

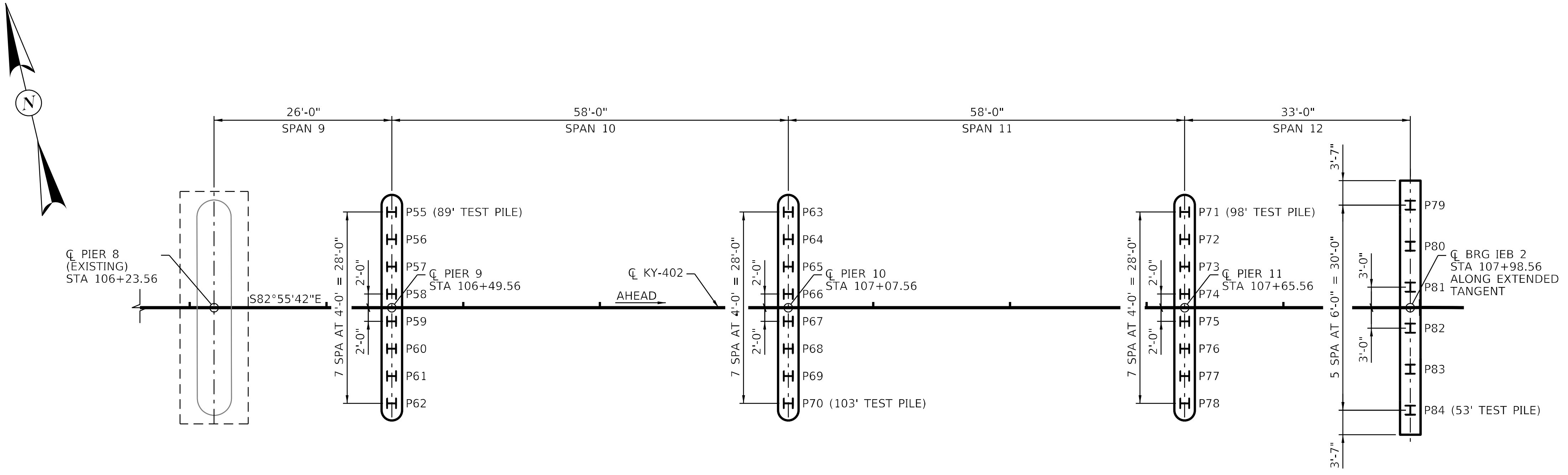
GENERAL SOIL AND BEDROCK PROFILE

KY-402 over East Fork Clarks River
End Bent 2 & Pier 11
Based on Boring 079B00040N-6

Approximate		Description STRATA	
Elevation (ft)	Depth (ft)	Description (USCS Classification)	Parameters
395.8	0.0		
		Lean Clay (CL)	γ_t (lb/ft^3) = 120 γ_e (lb/ft^3) = 57.6 C_u (psf) = 675 K_S (lb/in^3) = 375 E_{50} = 0.013
389.0	6.8		
		Gravel with Silt (GW-GM)	γ_t (lb/ft^3) = 120 γ_e (lb/ft^3) = 57.6 ϕ (^{o}) = 33 K_S (lb/in^3) = 90 (above water table) K_S (lb/in^3) = 60 (below water table)
368.0	27.8		
		Sand with Silt (SP-SM)	γ_t (lb/ft^3) = 125 γ_e (lb/ft^3) = 62.6 ϕ (^{o}) = 35 K_S (lb/in^3) = 130 (above water table) K_S (lb/in^3) = 80 (below water table)
295.8	100.0	Bottom of Hole	

Note: The top of rock was not encountered.

Groundwater estimated at elevation 384



PARTIAL PLAN - SPANS 9 THRU 12

DEFINITIONS OF TERMS

PILE CUT-OFF ELEVATION: ELEVATION OF THE TOP OF PILE IN THE FINISHED STRUCTURE.

PILE LENGTH IN PLACE: ACTUAL PILE LENGTH BELOW THE PILE CUT-OFF ELEVATION IN THE FINISHED STRUCTURE.

PILE TIP LEVATION AS DRIVEN: ACTUAL PILE TIP ELEVATION IN THE FINISHED STRUCTURE.

DESIGN FACTORED AXIAL LOAD: THE DESIGN FACTORED STRENGTH LOADS AS ESTIMATED FROM STRUCTURAL DESIGN CALCULATIONS.

REQUIRED NOMINAL AXIAL RESISTANCE: THE TOTAL GEOTECHNICAL AXIAL RESISTANCE REQUIRED BY THE PILE TO SATISFY APPLICABLE DESIGN REQUIREMENTS. THIS IS ARRIVED AT BY DIVIDING THE DESIGN FACTORED AXIAL LOAD BY THE RESISTANCE FACTOR, $\Phi = 0.40$, PLUS ANY OTHER APPLICABLE CONSIDERATIONS SUCH AS SCOUR, EMBANKMENT LAYERS, ETC. NOTE THAT DYNAMIC FORMULAS, INCLUDING THE FHWA MODIFIED GATES FORMULA, SHOULD NOT BE USED WHEN THE REQUIRED NOMINAL AXIAL RESISTANCE EXCEEDS 600 KIPS.

END OF DRIVING (EOD): WHEN THE PILE WAS DRIVEN TO TIP ELEVATION.

HAMMER STROKE (H): THE LENGTH OF THE FREE-FALL OF THE RAM FOR A GRAVITY, DIESEL OR SINGLE-ACTING STEAM OR COMPRESSED AIR HAMMER.

DEVELOPED HAMMER ENERGY (E): THIS IS THE ENERGY OF THE RAM IMPACT FOR A GIVEN BLOW. IF A DIRECT ENERGY READING IS NOT TAKEN, "E" CAN BE ASSUMED TO BE THE RAM WEIGHT (IN POUNDS) TIMES THE HAMMER STROKE (IN FEET). (E=WH) FT-LBS.

SET: AMOUNT OF DOWNWARD VERTICAL DISPLACEMENT IN THE PILE OVER THE LAST 10 BLOWS.

BLOW COUNT (N): NUMBER OF HAMMER BLOWS PER INCH AT THE END OF INITIAL DRIVING TO BE TAKEN AS 10 BLOWS DIVIDED BY THE SET IN INCHES.

FHWA MODIFIED GATES FORMULA: CALCULATED NOMINAL PILE RESISTANCE
$Rn = 0.875\sqrt{E}\,\log_{10}(10N) - 50$. RESULTING VALUE IS IN TONS.

DRIVING CRITERIA

SATISFY TWO CRITERIA WHEN DRIVING FRICTION PILES:
1. DRIVE PILES TO THE HIGHEST ALLOWABLE PILE TIP ELEVATION
2. DRIVE PILES UNTIL THE CALCULATED NOMINAL PILE RESISTANCE (Rn) IS EQUAL TO THE REQUIRED NOMINAL PILE RESISTANCE AT THE END OF DRIVING (EOD).

HAMMER FUEL SETTING SHALL BE ADJUSTED SO THAT THE BLOW COUNT AT THE END OF DRIVING RANGES FROM 3 TO 10 BLOWS PER INCH.

IF THE CALCULATED NOMINAL PILE RESISTANCE (Rn) IS ACHIEVED AT AN ELEVATION HIGHER THAN THE HIGHEST ALLOWABLE PILE TIP ELEVATION, CONTINUE DRIVING UNTIL THE HIGHEST ALLOWABLE PILE TIP ELEVATION IS REACHED. IF THE PILE CANNOT BE ADVANCED TO THE MINIMUM POINT OF PILE ELEVATION OR IF THE PILE IS BEING DRIVEN "SIGNIFICANTLY" PAST THE ESTIMATED PILE TIP ELEVATION, CONSULT THE CENTRAL OFFICE DIVISION OF CONSTRUCTION.

DUE TO THE LOADING RANGES AND PILE LENGTHS, TWO PILE DRIVING HAMMERS ARE RECOMMENDED. A SINGLE ACTING DIESEL HAMMER WITH A RATED ENERGY BETWEEN 40 FOOT-KIPS AND 84 FOOT-KIPS IS RECOMMENDED FOR SHORTER PILES WITH LIGHTER LOADS. A SINGLE ACTING DIESEL HAMMER WITH A RATED ENERGY BETWEEN 75 FOOT-KIPS AND 125 FOOT-KIPS IS RECOMMENDED FOR LONGER PILES WITH HEAVIER LOADS. THE PILE DRIVING HAMMER ENERGIES PROVIDED ARE ESTIMATES BASED ON A HAMMER'S MAX FUEL SETTING. OTHER PILE DRIVING HAMMERS WITH DIFFERENT ENERGIES AND FUEL SETTINGS COULD ALSO BE CONSIDERED.
THE USE OF HAMMERS OTHER THAN SINGLE ACTING DIESEL MAY REQUIRE DIFFERENT RATED ENERGIES. THE CONTRACTOR SHALL SUBMIT TO PROPOSED PILE DRIVING SYSTEM TO THE ENGINEER FOR APPROVAL PRIOR TO THE INSTALLATION OF THE FIRST PILE. APPROVAL OF THE PILE DRIVING SYSTEM BY THE ENGINEER WILL BE SUBJECT TO SATISFACTORY FIELD PERFORMANCE OF THE PILE DRIVING PROCEDURE.

PROJECT HAMMER NUMBER	HAMMER MANUFACTURER AND MODEL	WEIGHT OF RAM W LBS	MAXIMUM RATED ENERGY FT-LBS

FIELD DATA

FOR EACH PILE, THE PROJECT ENGINEER SHALL RECORD ALL APPLICABLE DATA IN THE PILE RECORD FOR FRICTION PILES SHEETS.

SUBMIT THIS RECORD TO:
KENTUCKY TRANSPORTATION CABINET
DIRECTOR, DIVISION OF STRUCTURAL DESIGN
3RD FLOOR EAST
200 MERO STREET
FRANKFORT, KY 40622

THIS PILE RECORD DOES NOT REPLACE OTHER PILE RECORDS THE PROJECT ENGINEER IS REQUIRED TO KEEP AND SUBMIT.

USE HP 14X89 IN ACCORDANCE WITH BPS-011, C.E.

COMMONWEALTH OF KENTUCKY
DEPARTMENT OF HIGHWAYS

REVISION	DATE
REV 1: PILE HAMMER ENERGIES	06/17/2024

Stantec

	CHECKED BY
DATE: MAY 02, 2024	
DESIGNED BY: J. CAMPBELL	S. KING
DETAILED BY: A. GRACE	S. KING

FOUNDATION LAYOUT - SPANS 9-12

CROSSING
EAST FORK CLARKS RIVER

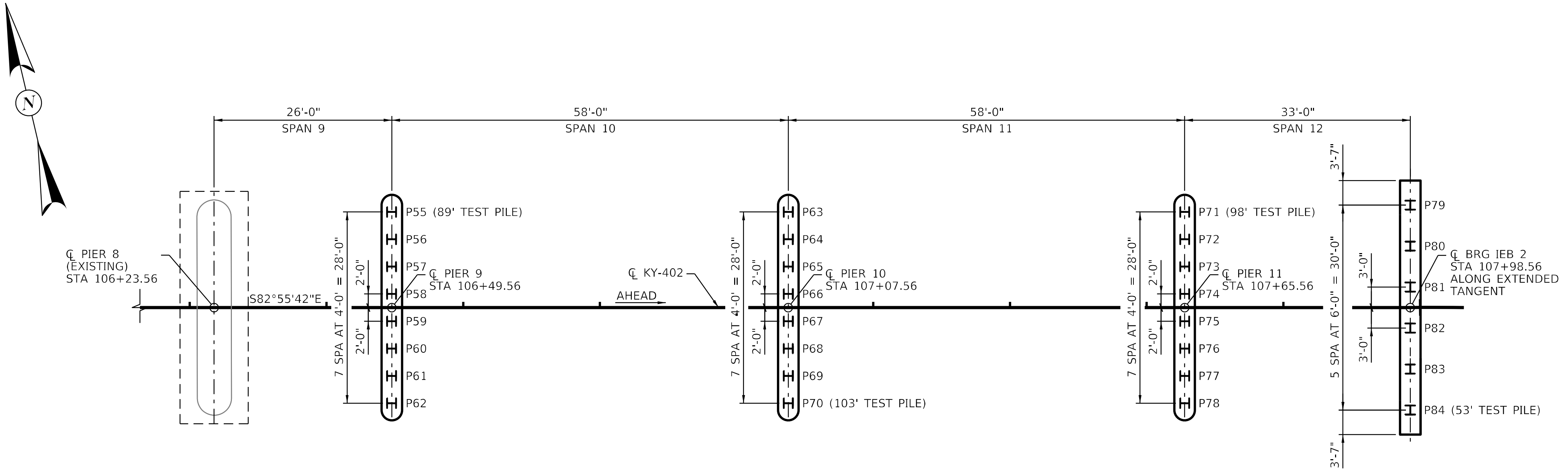
ROUTE
KY-402

ITEM NO.
1-10176

SHEET NO.
S7

COUNTY OF
MARSHALL

DRAWING NUMBER
28783



PARTIAL PLAN - SPANS 9 THRU 12

DEFINITIONS OF TERMS

PILE CUT-OFF ELEVATION: ELEVATION OF THE TOP OF PILE IN THE FINISHED STRUCTURE.

PILE LENGTH IN PLACE: ACTUAL PILE LENGTH BELOW THE PILE CUT-OFF ELEVATION IN THE FINISHED STRUCTURE.

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1

PROJECT HAMMER NUMBER	HAMMER MANUFACTURER AND MODEL	WEIGHT OF RAM W LBS	MAXIMUM RATED ENERGY FT-LBS

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