M E M O R A N D U M **S-083-2024**

cc: J. VanZee
M. Bezold
C. Wilson
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TO: Michael Carpenter, P.E.
Director, Division of Structural Design

FROM: Adam Ross, P.E.
TEBM, Geotechnical Services Branch

BY: Robert McDonald, P.E.
Geotechnical Services Branch,
Structure Foundation Section

DATE: August 15th, 2025

SUBJECT: **Kenton County**
FD52 12F0 059 0536 003-004 01D
Mars #: 69777 01 D
KY-536
3-Span Bridge (105’, 127’, 105’) Sta. 292+63.50, no skew (over Brushy Fork)
Item #: 6-162.40
Geotechnical Engineering Addendum Structure Foundation Report

1.0 Location and Description

The geotechnical investigation for this structure has been completed. The DGN file for the subsurface data sheet has been made available on Projectwise and through email for use in development of structure plans. The most recent drilling for the project was performed by one of the KYTC Geotechnical Branches’ Central Office Drill Crews.

The proposed bridge is part of a safety improvement and congestion reduction project for KY-536 from Williamswood Rd./Calvary Dr. to KY-17 (priority section 3). The proposed structure will be a new bridge on KY-536 at MP3.5. The project is located in Independence, KY.

2.0 Site Geologic Conditions

This structure is located in the Independence Geologic Quadrangle (GQ# 785). The geologic mapping indicates that the bedrock at this site consists primarily of the Fairview Formation.

3.0 Field Investigation

Fourteen (14) borings were taken for this structure. Five (5) of these borings were sample and core holes, five (5) were core holes, and four (4) were mechanical rockline soundings. KYTC Central Office drill crews delivered rock cores and soil samples to the Geotechnical Branches’, where a geologist logged the rock cores, and the soils were classified and tested in the Branches laboratory.

4.0 Laboratory Testing

The laboratory soil testing was completed by the Geotechnical Branch. The soil samples obtained from the borings were determined to consist of inorganic, low plasticity clays, low plasticity silts, and silty gravels. The samples were designated as CL, ML, and GM, respectively, in the Unified Soil Classification System.

5.0 SUBSURFACE CONDITIONS

Depths to refusal vary from 1.3 ft to 9.1 ft. The rock cores obtained for this location revealed brown to dark-gray, clayey to silty, non-durable, shales interbedded with fine to coarse grained/crystalline, fossiliferous, gray, limestone with shale laminations and lenses. KY RQD values for the rock cores taken at this proposed bridge location ranged from 0% to 50% and core recoveries ranged from 79% to 100%. The variations in top of rock/auger refusal elevations at the substructure units encountered during drilling are provided below.

Substructure Unit	Refusal Elev. Range
• End Bent 1	795.4 to 805.4 ft
• Pier 1	779.3 to 781.5 ft
• Pier 2	775.2 to 780.0 ft
• End Bent 2	779.2 to 802.2 ft

6.0 ENGINEERING ANALYSIS

6.1 End Bents 1 & 2

Use end bearing **H-Pile foundations** seated in bedrock with spill through slopes for End Bents 1 & 2. Slope protection will be required as a scour abatement measure on the 2H: 1V spill-thru slopes at end bent 1 with the use of piles. Local scour can be negated with the use of slope protection.

A wave equation analysis was performed for this location. Based on this analyses it will be possible to drive 12" or 14" H-piles to bedrock and practical refusal without encountering excessive blow counts or damaging the pile. The contractor shall submit the proposed pile driving system to the Department 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 procedures. A hammer with a rated energy between **25 and 35 kip-ft** will be required to drive the H-piles to practical refusal without encountering excessive blow counts or damaging the piles.

6.2 Piers 1 & 2

Use **Drilled Shafts** for Piers 1 & 2.

Table 1 contains relevant elevations needed to both complete the design and determine plan quantities for the drilled shafts. Some of the "Estimated Bottom of Permanent Casing" and "Highest Allowable Shaft Tip" elevations are due to rockline variations.

Drilled shafts were evaluated for axial loading, and the attached tables provide the resulting capacities and resistances for the Load & Resistance Factor Design (LRFD) and Allowable Stress Design (ASD) design methods.

Table 1 Estimated Drilled Shaft Elevations					
Sub structural Unit No.	Elevations (ft.) *				
	Est. Top of Rock	Est. Base of Weathered Rock	Top of Rock Socket	Bottom of Permanent Casing	Highest** Allowable Shaft Tip
Pier 1	781.5	780.5	778.8	778.8	767.8
Pier 2	780.0	780.0	775.2	775.2	764.2
* Elevations for all shafts will be verified after construction-phase drilling has been performed. The final shaft tip elevations and quantities may be adjusted based on the actual conditions encountered in the field. ** The Shaft tip shall extend a minimum of two shaft diameters below the bottom of permanent casing (Based on 5.5 ft diameter shafts.)					

6.3 Scour Considerations

No scour analysis was performed. For H-Pile foundations subsequently driven to bedrock with spill through slopes (2H:1V spill-through slopes), slope protection will be required at the bridge meeting the requirements of Sections 703 & 805 of the Standard Specifications for Road and Bridge Construction, current edition. Place a Class I (Slope Protection) Geotextile Fabric, in accordance with Sections 214 & 843 of the Standard Specifications for Road and Bridge Construction, current edition, between the embankment and the slope protection. The effects of local scour on the end bents can be negated through the use of the aforementioned cyclopean protection.

Contraction scour was evaluated. Evaluate as described in the KYTC Geotechnical Manual, Section GT-606-1. Assuming the contraction scour depth extended to bedrock. To do this, construct a vertical line from the toe of the spill-thru slope where the stone slope protection terminates, down to the contraction scour depth, for the respective end bent. Then construct a 1:1 (45°) line back towards the end bent until it intercepts the pile line. The piles can then either be designed to withstand the potential unsupported length, the pile cap can be set down to that depth to avoid any unsupported length, or a combination of these measures can be employed. The base of the pile caps should be set below the total contraction and local scour depths or the piles should be designed for some unsupported length. Contraction scour at the proposed end bent locations will not a geotechnical concern. Contraction scour at the proposed pier locations will not a geotechnical concern with the utilization of drilled shaft foundations.

6.4 Embankment Analysis

Due to minimal amounts of new fill and shallow depths to bedrock, embankment stability is not considered to be a concern at this location. The current in-place embankment slopes appear to be stable. Embankment is to be constructed at slopes the same as those currently in existence or a 2H: 1V, whichever is flatter. **All spill-through slopes shall be 2H: 1V.** Embankments at the end bent locations at both ends of the bridge shall also be constructed in accordance with **Special Provision #69 for Embankment at Bridge End Bent Structures**. If any additional/new embankment is to be constructed at slopes steeper than those currently in existence or a 2H: 1V, please contact the geotechnical branch for further analysis.

In view of the minimal new embankment heights and foundation soil depths at the end bents, settlement is not believed to be a concern at this location.

The designer should feel free to contact the Geotechnical Branch at 502-564-2374 for further recommendations or if any questions arise pertaining to this project.

7.0 FOUNDATION RECOMMENDATIONS:

7.1 End Bents 1 & 2

7.1.1 End Bent 1: Use end-bearing steel H-Piles with approximate pile tip elevations ranging from 795 to 806 ft. We recommend a resistance factor (f_c) of 0.5 to determine the maximum nominal resistance of the pile.

7.1.2 End Bent 2: Use end-bearing steel H-Piles with approximate pile tip elevations ranging from 797.5 to 802 ft. We recommend a resistance factor (f_c) of 0.5 to determine the maximum nominal resistance of the pile.

7.1.3 For determining practical refusal for point-bearing steel H-Piles, we recommend using Case 2.

7.2 Piers 1 & 2

7.2.1 Use drilled shafts constructed in accordance with the **Special Note for Drilled Shafts**, current edition.

7.2.2 Use permanent casing that is 6 inches larger in diameter than the proposed shaft diameter, to the “Bottom of Permanent Casing” elevations provided in Table 1. The permanent casing is incidental to “Drilled Shaft (Common)” or “Drilled Shaft (Solid Rock)”, as applicable.

7.2.3 Require a 6-inch minimum rebar cover in the uncased rock sockets.

7.2.4 For Load & Resistance Factor Design (LRFD), evaluate the **total factored axial resistances** using the attached Drilled Shaft Axial Capacity Tables considering the capacity developed in the uncased rock sockets. The total factored axial resistance must equal or exceed the factored loads at the strength limit state.
For Allowable Stress Design (ASD), evaluate the **total allowable axial capacity** using the Drilled Shaft Axial Capacity Tables considering the capacity developed in the uncased rock sockets. The allowable capacities must equal or exceed the applied structural loads calculated utilizing ASD design.
The highest allowable shaft tip elevations are provided in Table 1 for a 42-inch diameter shaft. Highest allowable shaft tip elevations for larger diameter shafts are indicated on corresponding attached Drilled Shaft Axial Capacity Table. Longer uncased sockets may be required to satisfy axial or lateral load design criteria.

7.2.5 Design the end bents neglecting any lateral resistance (side shear capacity ASD) above the “Bottom of Permanent Casing” elevations provided in Table 1 and considering lateral resistance (side shear capacity ASD) only in the uncased portions below the "Bottom of Permanent Casing" elevations.

7.2.6 Perform lateral load analysis using the geotechnical parameters provided in the attached Idealized Soil and Bedrock Profile. These parameters may be used to perform analyses using LPILE Plus. Some of the parameters may not be required to be input, depending on the version of the program being used.

7.2.7 It should be noted in the plans that the permanent casing is incidental to the unit bid price for "Drilled Shaft - __-inch (Common)" or "Drilled Shaft - ____-inch (Solid Rock)", as applicable.

7.2.8 Embed the shafts a minimum of 2 shaft diameters below the permanent casing.

7.2.9 The Contractor will be responsible for providing subsurface exploration drilling during construction to finalize the drilled shaft tip elevations. Additional drilling will be required at each drilled shaft location in accordance with the **Special Note for Drilled Shafts**, current edition.

7.2.10 For **Piers 1 & 2,** use the elevations in Table 1 to determine plan quantities as follows:

- Drilled Shaft - *-inch (Common) - Top of shaft to Top of Rock
- Drilled Shaft - *-inch (Solid Rock) - Top of Rock to Bottom of Permanent Casing
- Drilled Shaft - **-inch (Solid Rock) - Bottom of Permanent Casing to Shaft Tip
- *- Insert diameter 6-inches larger than shaft diameter chosen
- ** - Shaft diameter (Rock Socket diameter) chosen

The final shaft tip elevations and quantities may be adjusted based on the actual conditions encountered in the field.

8.0 Plan Notes
(Include the notes below at appropriate locations in the plans.)

End Bents 1 & 2

8.1 PRACTICAL REFUSAL: Drive point bearing piles to practical refusal. For this project minimum blow requirements are reached after total penetration becomes ½ inch or less for 10 consecutive blows, practical refusal is obtained after the pile is struck an additional 10 blows with total penetration of ½ inch or less. Advance the production piling to the driving resistances specified above and to depths determined by test pile(s) and subsurface data sheet(s). Immediately cease driving operations if the pile visibly yields or becomes damaged during driving. If hard driving is encountered because of dense strata or an obstruction, such as a boulder before the pile is advanced to the depth anticipated, the Engineer will determine if more blows than the average driving resistance specified for practical refusal is required to further advance the pile. Drive additional production and test piles if directed by the Engineer.

8.2 HAMMER CRITERIA: A hammer with a rated energy of between **25 and 35 kip-ft** will be required to drive the H-piles to practical refusal without encountering excessive blow counts or damaging the pile. The contractor shall submit the proposed pile driving system to the Department 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 procedures.

8.3 Slope protection will be required at the bridge meeting the requirements of Sections 703 & 805 of the Standard Specifications for Road and Bridge Construction, current edition. Place a Class 1 Geotextile Fabric, in accordance with Sections 214 & 843 of the Standard Specifications for Road and Bridge Construction, current edition, between the embankment and the slope protection.

8.4 Embankments at the bridge end bent locations shall be constructed in accordance with Special Provision #69 for Embankment at Bridge End Bent Structures.

8.5 Cofferdams and/or dewatering methods may be required to facilitate foundation construction of pile caps.

8.6 Temporary sheeting and/or shoring may be required for installation of pile caps. The contractor shall be responsible for the stability and safety of all excavations.

For Piers 1 & 2

8.7 Permanent casing is required in the overburden. Permanent casing will also be required through portions of solid rock where voids or karst features may be found. Permanent casing is incidental to the unit bid price for "Drilled Shaft - - inch (Common)" or "Drilled Shaft - -inch (Solid Rock) as applicable. (Insert shaft sizes 6" larger than the chosen drilled shaft rock socket diameter as noted in Section 6.1.10 of this report.)

8.8 The Contractor will be responsible for providing subsurface exploration drilling during construction to finalize the drilled shaft tip elevations. Additional drilling will be required at each drilled shaft location in accordance with the **Special Note for Drilled Shafts**, current edition.

8.9 Drilled shafts shall be constructed in accordance with the Special Note for Drilled Shafts. Include all costs (labor, equipment, and materials including spiral and longitudinal reinforcement, reinforcement splices, mechanical couplers, concrete, and temporary or permanent casing) associated with the drilled shafts in the unit price bid for Drilled Shaft, Common or Solid Rock, as applicable.

8.10 Cofferdams and/or dewatering methods will be required to facilitate foundation construction of drilled shafts.

8.11 Temporary sheeting and/or shoring may be required for installation of drilled shafts.

Attachments:

- **Project Location Map**
- **Subsurface Data Sheet**
- **Bridge Layout Sheet**
- **Drilled Shaft Capacities Tables**
- **Coordinate Data Sheet**

S-083-2024
Kenton Co., KY-536
August 15th, 2025
Item #: 6-162.40

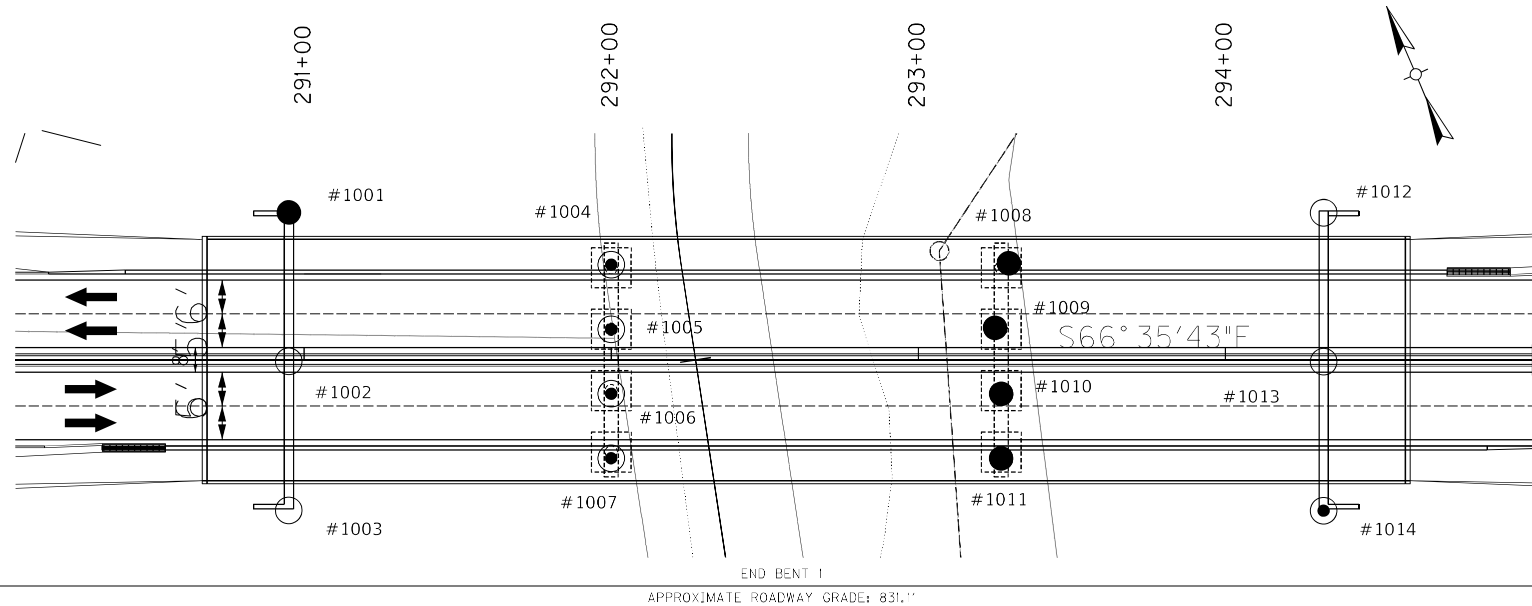
Structure Location Map:

Project Location Map:

(Improve safety and reduce congestion on KY-536 from Williamswood Rd./Calvary Dr. to KY-17 (PRIORITY SECTION 3). Replace bridge at KY-536 MP 3.5. Design phase under PARENT NO. 6-162.01. in Independence , KY.)

SUBSURFACE DATA

PLAN SCALE 1" = 20'



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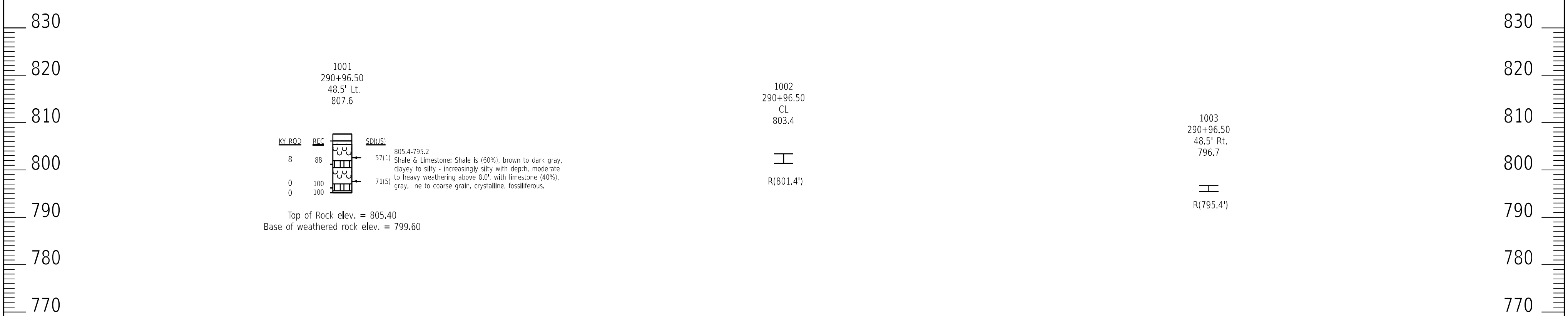
Vertical 1" = 10'
Horizontal not to scale



THE PRESUMPTIVE FACTORED BEARING RESISTANCE AT THE SERVICE LIMIT STATE
IS 16 KSF FOR SPREAD FOOTINGS ON COMPETENT UNWEATHERED BEDROCK

COMMONWEALTH OF KENTUCKY DEPARTMENT OF HIGHWAYS	REVISION	DATE	PREPARED BY Division of Structural Design Geotechnical Branch	DATE: -	CHECKED BY		ROUTE KY 536	ITEM NO. 06–00162.40	COUNTY OF KENTON
				DESIGNED BY:		CROSSING BRUSHY FORK		SHEET NO.	DRAWING NUMBER S–083–2024
				DETAILED BY: -	--				

OpenRoads Designer v23.00.01.11 USER: $$$$USER$$$$ DATE PLOTTED: $$$$DATE$$$$ FILE NAME: $$$$design$ lesspeci cation$$$$

SUBSURFACE DATA

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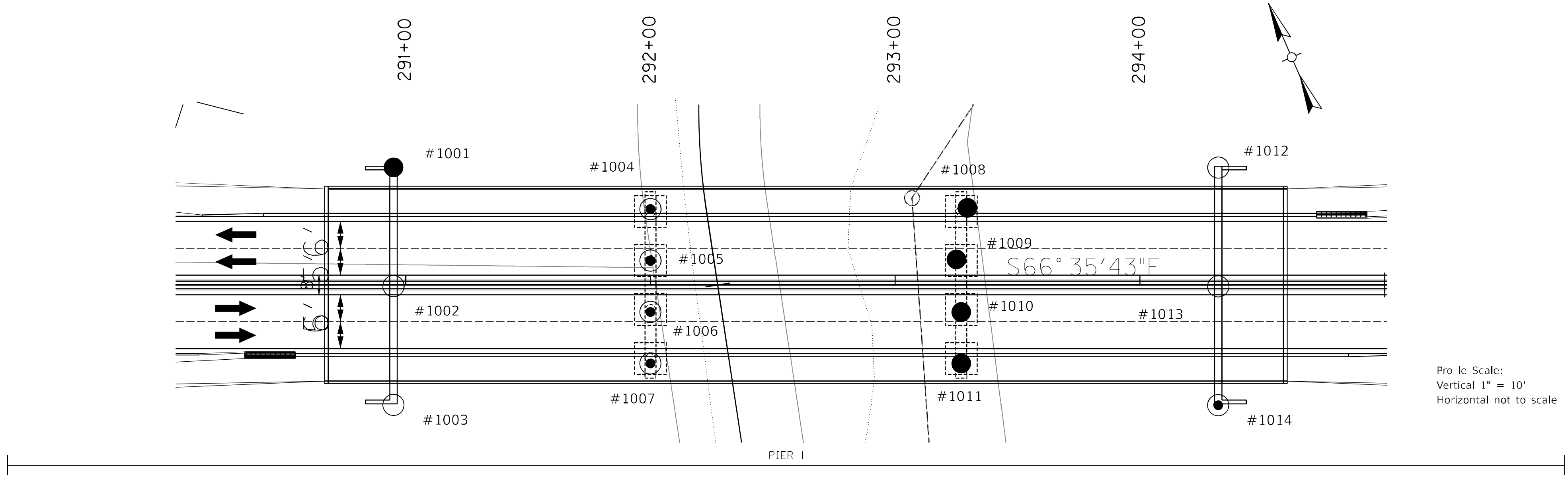

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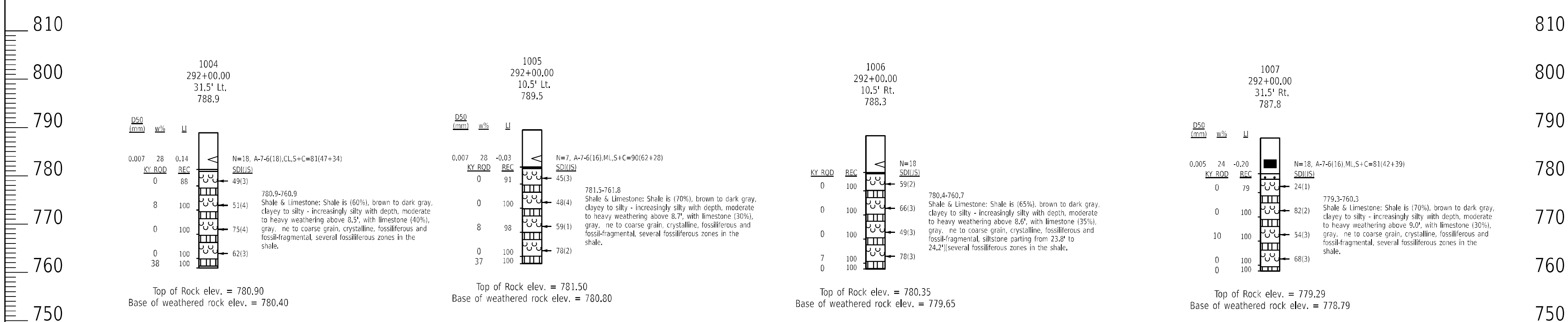

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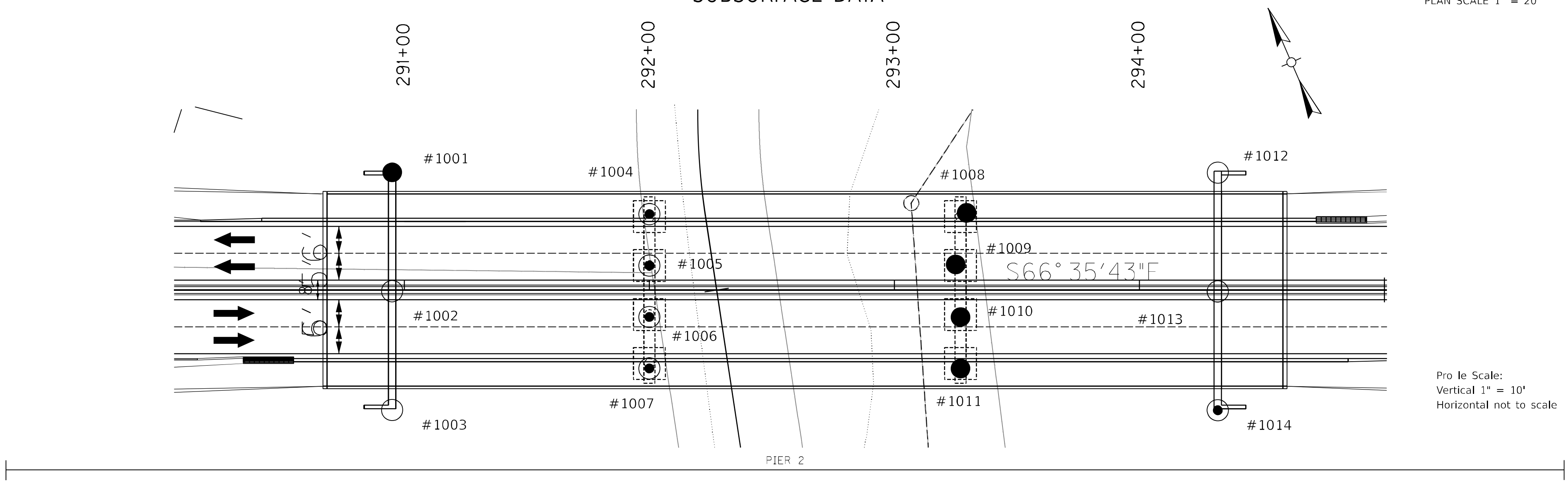
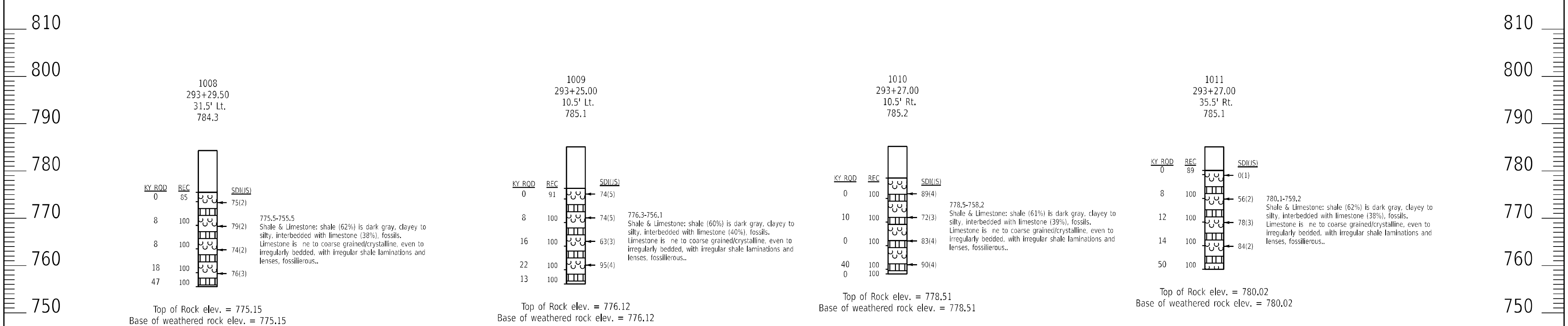
PLAN SCALE 1" = 20'



Pro le Scale:
Vertical 1" = 10'
Horizontal not to scale



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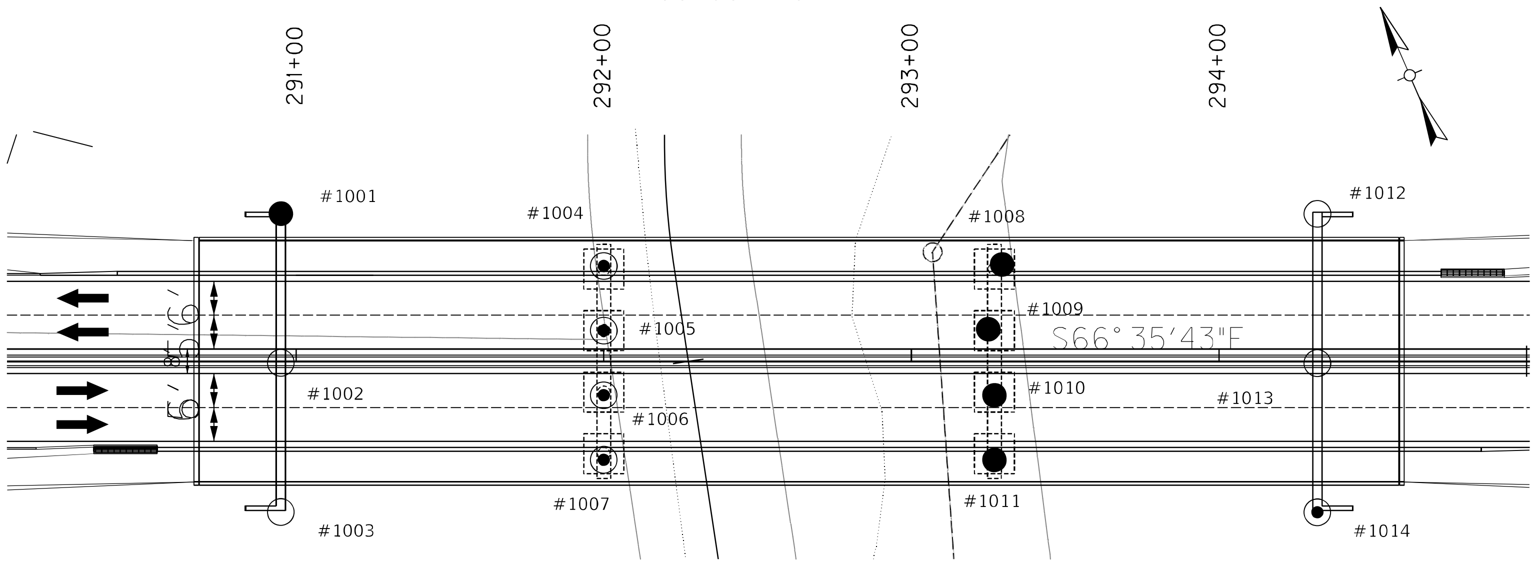
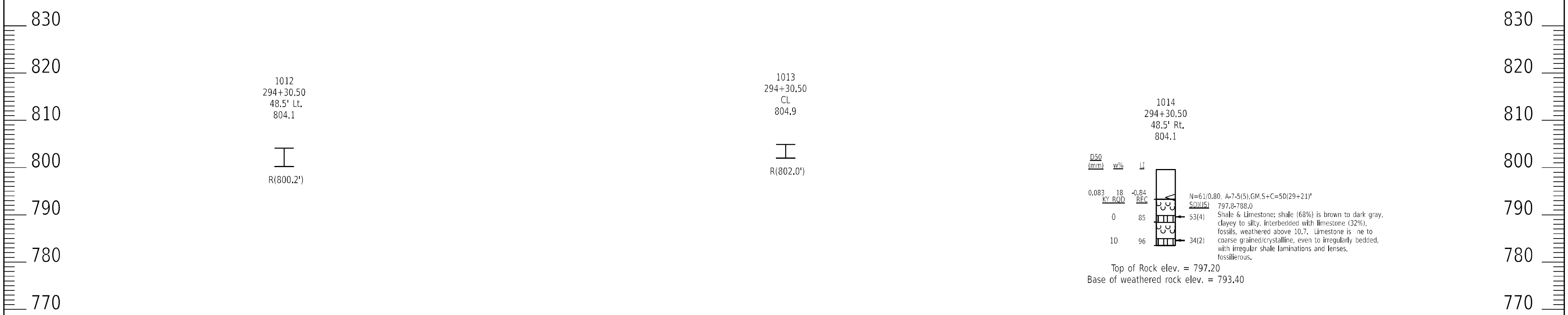
COMMONWEALTH OF KENTUCKY DEPARTMENT OF HIGHWAYS	REVISION	DATE	PREPARED BY Division of Structural Design Geotechnical Branch	DATE: - DESIGNED BY: DETAILED BY: -	CHECKED BY --	CROSSING BRUSHY FORK	ROUTE KY 536	ITEM NO. 06–00162.40 SHEET NO.	COUNTY OF KENTON DRAWING NUMBER S–083–2024

SUBSURFACE DATA

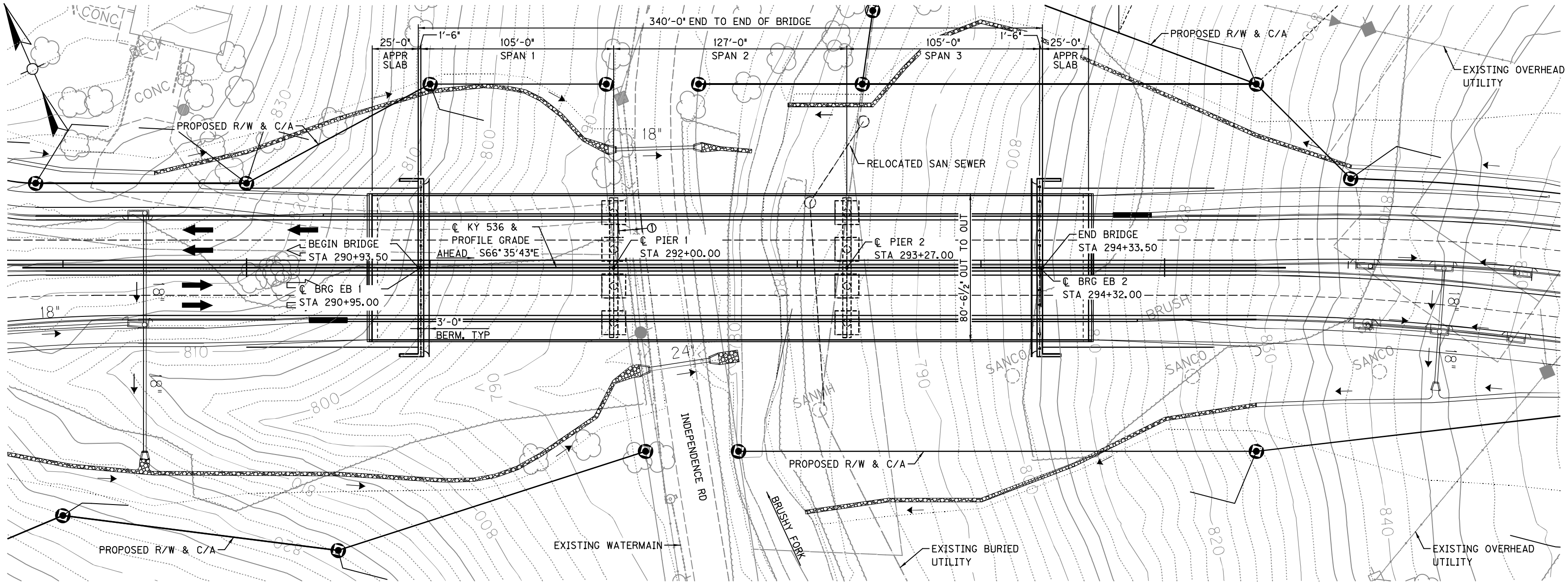
PLAN SCALE 1" = 20'





THE PRESUMPTIVE FACTORED BEARING RESISTANCE AT THE SERVICE LIMIT STATE
IS 16 KSF FOR SPREAD FOOTINGS ON COMPETENT UNWEATHERED BEDROCK

COMMONWEALTH OF KENTUCKY DEPARTMENT OF HIGHWAYS	REVISION	DATE	PREPARED BY Division of Structural Design Geotechnical Branch	DATE: -	CHECKED BY		ROUTE KY 536	ITEM NO. 06–00162.40	COUNTY OF KENTON
				DESIGNED BY:		CROSSING BRUSHY FORK		SHEET NO.	DRAWING NUMBER S–083–2024
				DETAILED BY: -	--				



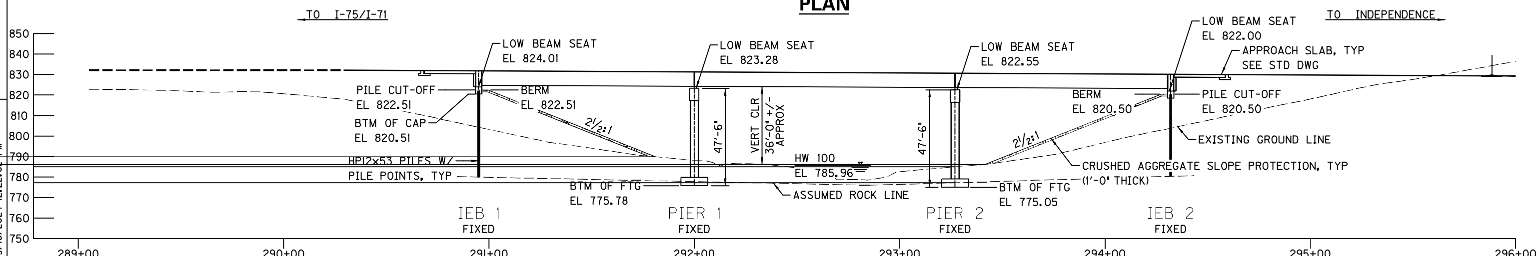
PLAN

CURVE DATA

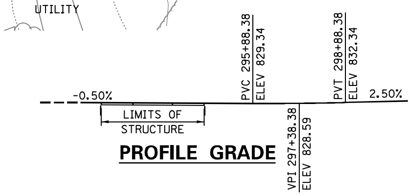
PI STA = B 301+17.65
Δ = 47° 37' 19" RT
D = 4° 35' 01.18"
T = 551.60'
L = 1038.95'
R = 1250.00'
E = 116.30'
e = 5.00%
RUNOFF = 200'
RUNOUT = 80'

NOTATION:

① 12'-3" +/- MIN CLEARANCE COLUMN TO EDGE OF RDWY

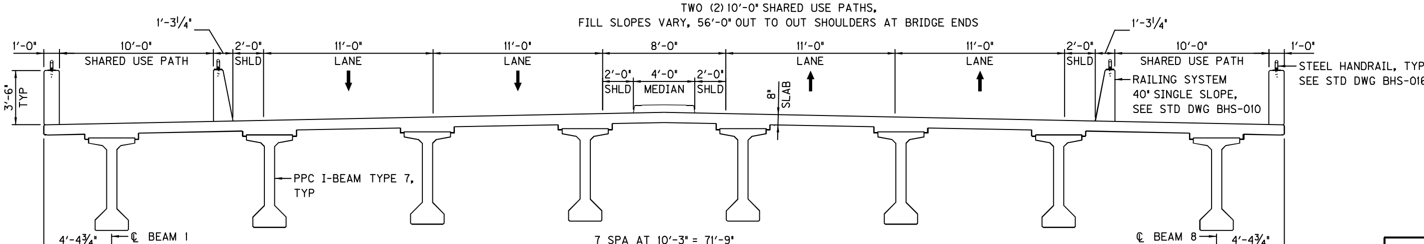


PROFILE



PROFILE GRADE

105'-0"~127'-0"~105'-0" SPANS, PPC I-BEAMS TYPE 7
CONTINUOUS LIVE LOAD, HL-93 (+25%) LOADING,
0° SKEW, 22'-0" ROADWAYS, 8'-0" MEDIAN,
TWO (2) 10'-0" SHARED USE PATHS,
FILL SLOPES VARY, 56'-0" OUT TO OUT SHOULDERS AT BRIDGE ENDS



TYPICAL SECTION

LOOKING AHEAD STATION

REVISION	DATE
DATE: SEPTEMBER 2024	CHECKED BY
DESIGNED BY: S. KING	J. CAMPBELL
DETAILED BY: A. GRACE	J. CAMPBELL

Commonwealth of Kentucky
DEPARTMENT OF HIGHWAYS

COUNTY: KENTON

ROUTE: KY 536 | CROSSING: BRUSHY FORK & INDEPENDENCE RD

ADVANCE SITUATION LAYOUT

PREPARED BY Stantec

ITEM NUMBER 6–162.40

SHEET NO. S0

DRAWING NO.

FILE NAME: V:\1785\ACTIVE\178561001\STRUCTURES\BRUSHY FORK & INDEPENDENCE RD\ANALYSIS\ASF\LAYOUT_KY 536_BRUSHY FORK_ASF.DGN

USER: agrace DATE PLOTTED: 9/16/2024 12:22:02 PM

E-SHEET NAME:

MicroStation v8.11.9.916

IDEALIZED SOIL AND BEDROCK PROFILE

Kenton Co., 6-162.40, KY-536
Piers 1 & 2

RDM 7/2/2025

Top of Shaft

Elev. (ft.)

Overburden, Neglect for Support

Top of Rock Socket

*

Strata | **Parameters for Lateral Load Analyses**

Shale		**Strong Rock (Vuggy Limestone)**		
γ_t (lb/ft^3) =	150	Effective Unit Weight,	γ_e (lb/in^3) =	0.087
q_u (psi) =	750	Elastic Modulus,	E_r (psi) =	9,400
q_{eb} (ksf) =	48	Uniaxial Compressive Strength,	q_u (psi) =	750
f_s (ksf) =	15.1	Cohesive Strength,	c_u (psi) =	375

*

Shaft Tip

* **Elevations vary and are provided in the report body.**

ADDITIONAL DATA FOR GEOTECHNICAL CALCULATIONS ONLY:	
min. f'_c (psi) =	3500
p_a (psi) =	14.7

Load and Resistance Factor Design (LRFD)

DRILLED SHAFT AXIAL RESISTANCE TABLE

Kenton Co., 6-162.40, KY-536
Piers 1 & 2

Rock Socket Diameter = 3.5 feet
Rock Socket Diameter = 42 inches **RDM 7/2/2025**

Rock Socket Length (ft.)	Nominal Unit Side Shear q_{ss} (ksf)	Nominal Unit End Bearing q_{eb} (ksf)	Nominal Side Resistance R_{sr} (kips)	Nominal End Bearing Resistance R_{eb} (kips)	Factored Side Resistance ϕR_{sr} (kips)	Factored End Bearing Resistance ϕR_{eb} (kips)	Total Factored Axial Resistance ϕR_t (kips)	Total Factored Uplift Resistance ϕR_{tu} (kips)
0.0								
1.0	15.1	48	166	462	83	231	314	66
2.0	15.1	48	332	462	166	231	397	133
3.0	15.1	48	498	462	249	231	480	199
4.0	15.1	48	664	462	332	231	563	266
5.0	15.1	48	830	462	415	231	646	332
6.0	15.1	48	996	462	498	231	729	398
>>> 7.0	15.1	48	1162	462	581	231	812	465
8.0	15.1	48	1328	462	664	231	895	531
9.0	15.1	48	1494	462	747	231	978	598
10.0	15.1	48	1660	462	830	231	1061	664
11.0	15.1	48	1826	462	913	231	1144	731
12.0	15.1	48	1992	462	996	231	1227	797
13.0	15.1	48	2158	462	1079	231	1310	863
14.0	15.1	48	2324	462	1162	231	1393	930
15.0	15.1	48	2490	462	1245	231	1476	996
16.0	15.1	48	2657	462	1328	231	1559	1063
17.0	15.1	48	2823	462	1411	231	1642	1129
18.0	15.1	48	2989	462	1494	231	1725	1195
19.0	15.1	48	3155	462	1577	231	1808	1262
20.0	15.1	48	3321	462	1660	231	1891	1328
21.0	15.1	48	3487	462	1743	231	1974	1395
22.0	15.1	48	3653	462	1826	231	2057	1461
23.0	15.1	48	3819	462	1909	231	2140	1528
24.0	15.1	48	3985	462	1992	231	2223	1594
AASHTO Table 10.5.5.2.4-1				Resistance Factor, ϕ	0.50	0.50		0.40
>>> = Min. Socket Length							D (ft.) =	3.5

Load and Resistance Factor Design (LRFD)

DRILLED SHAFT AXIAL RESISTANCE TABLE

Kenton Co., 6-162.40, KY-536
Piers 1 & 2

Rock Socket Diameter = 4.0 feet
Rock Socket Diameter = 48 inches

RDM 7/2/2025

Rock Socket Length (ft.)	Nominal Unit Side Shear q_{ss} (ksf)	Nominal Unit End Bearing q_{eb} (ksf)	Nominal Side Resistance R_{sr} (kips)	Nominal End Bearing Resistance R_{eb} (kips)	Factored Side Resistance ϕR_{sr} (kips)	Factored End Bearing Resistance ϕR_{eb} (kips)	Total Factored Axial Resistance ϕR_t (kips)	Total Factored Uplift Resistance ϕR_{tu} (kips)
0.0								
1.0	15.1	48	190	603	95	302	396	76
2.0	15.1	48	380	603	190	302	491	152
3.0	15.1	48	569	603	285	302	586	228
4.0	15.1	48	759	603	380	302	681	304
5.0	15.1	48	949	603	474	302	776	380
6.0	15.1	48	1139	603	569	302	871	455
7.0	15.1	48	1328	603	664	302	966	531
>>> 8.0	15.1	48	1518	603	759	302	1061	607
9.0	15.1	48	1708	603	854	302	1155	683
10.0	15.1	48	1898	603	949	302	1250	759
11.0	15.1	48	2087	603	1044	302	1345	835
12.0	15.1	48	2277	603	1139	302	1440	911
13.0	15.1	48	2467	603	1233	302	1535	987
14.0	15.1	48	2657	603	1328	302	1630	1063
15.0	15.1	48	2846	603	1423	302	1725	1139
16.0	15.1	48	3036	603	1518	302	1820	1214
17.0	15.1	48	3226	603	1613	302	1914	1290
18.0	15.1	48	3416	603	1708	302	2009	1366
19.0	15.1	48	3605	603	1803	302	2104	1442
20.0	15.1	48	3795	603	1898	302	2199	1518
21.0	15.1	48	3985	603	1992	302	2294	1594
22.0	15.1	48	4175	603	2087	302	2389	1670
23.0	15.1	48	4364	603	2182	302	2484	1746
24.0	15.1	48	4554	603	2277	302	2579	1822
AASHTO Table 10.5.5.2.4-1				Resistance Factor, ϕ	0.50	0.50		0.40
>>> = Min. Socket Length							D (ft.) =	4.0

Load and Resistance Factor Design (LRFD)

DRILLED SHAFT AXIAL RESISTANCE TABLE

Kenton Co., 6-162.40, KY-536
Piers 1 & 2

Rock Socket Diameter = 4.5 feet
Rock Socket Diameter = 54 inches RDM 7/2/2025

Rock Socket Length (ft.)	Nominal Unit Side Shear q_{ss} (ksf)	Nominal Unit End Bearing q_{eb} (ksf)	Nominal Side Resistance R_{sr} (kips)	Nominal End Bearing Resistance R_{eb} (kips)	Factored Side Resistance ϕ R_{sr} (kips)	Factored End Bearing Resistance ϕ R_{eb} (kips)	Total Factored Axial Resistance ϕ R_t (kips)	Total Factored Uplift Resistance ϕ R_{tu} (kips)
0.0								
1.0	15.1	48	213	763	107	382	488	85
2.0	15.1	48	427	763	213	382	595	171
3.0	15.1	48	640	763	320	382	702	256
4.0	15.1	48	854	763	427	382	809	342
5.0	15.1	48	1067	763	534	382	915	427
6.0	15.1	48	1281	763	640	382	1022	512
7.0	15.1	48	1494	763	747	382	1129	598
8.0	15.1	48	1708	763	854	382	1236	683
>>> 9.0	15.1	48	1921	763	961	382	1342	768
10.0	15.1	48	2135	763	1067	382	1449	854
11.0	15.1	48	2348	763	1174	382	1556	939
12.0	15.1	48	2562	763	1281	382	1663	1025
13.0	15.1	48	2775	763	1388	382	1769	1110
14.0	15.1	48	2989	763	1494	382	1876	1195
15.0	15.1	48	3202	763	1601	382	1983	1281
16.0	15.1	48	3416	763	1708	382	2089	1366
17.0	15.1	48	3629	763	1815	382	2196	1452
18.0	15.1	48	3842	763	1921	382	2303	1537
19.0	15.1	48	4056	763	2028	382	2410	1622
20.0	15.1	48	4269	763	2135	382	2516	1708
21.0	15.1	48	4483	763	2241	382	2623	1793
22.0	15.1	48	4696	763	2348	382	2730	1879
23.0	15.1	48	4910	763	2455	382	2837	1964
24.0	15.1	48	5123	763	2562	382	2943	2049
AASHTO Table 10.5.5.2.4-1			Resistance Factor, ϕ		0.50	0.50		0.40
>>> = Min. Socket Length							D (ft.) =	4.5

Load and Resistance Factor Design (LRFD)

DRILLED SHAFT AXIAL RESISTANCE TABLE

Kenton Co., 6-162.40, KY-536
Piers 1 & 2

Rock Socket Diameter = 5.0 feet
Rock Socket Diameter = 60 inches
RDM 7/2/2025

Rock Socket Length (ft.)	Nominal Unit Side Shear q_{ss} (ksf)	Nominal Unit End Bearing q_{eb} (ksf)	Nominal Side Resistance R_{sr} (kips)	Nominal End Bearing Resistance R_{eb} (kips)	Factored Side Resistance ϕR_{sr} (kips)	Factored End Bearing Resistance ϕR_{eb} (kips)	Total Factored Axial Resistance ϕR_t (kips)	Total Factored Uplift Resistance ϕR_{tu} (kips)
0.0								
1.0	15.1	48	237	942	119	471	590	95
2.0	15.1	48	474	942	237	471	708	190
3.0	15.1	48	712	942	356	471	827	285
4.0	15.1	48	949	942	474	471	946	380
5.0	15.1	48	1186	942	593	471	1064	474
6.0	15.1	48	1423	942	712	471	1183	569
7.0	15.1	48	1660	942	830	471	1301	664
8.0	15.1	48	1898	942	949	471	1420	759
9.0	15.1	48	2135	942	1067	471	1539	854
>>> 10.0	15.1	48	2372	942	1186	471	1657	949
11.0	15.1	48	2609	942	1305	471	1776	1044
12.0	15.1	48	2846	942	1423	471	1894	1139
13.0	15.1	48	3083	942	1542	471	2013	1233
14.0	15.1	48	3321	942	1660	471	2132	1328
15.0	15.1	48	3558	942	1779	471	2250	1423
16.0	15.1	48	3795	942	1898	471	2369	1518
17.0	15.1	48	4032	942	2016	471	2487	1613
18.0	15.1	48	4269	942	2135	471	2606	1708
19.0	15.1	48	4507	942	2253	471	2725	1803
20.0	15.1	48	4744	942	2372	471	2843	1898
21.0	15.1	48	4981	942	2490	471	2962	1992
22.0	15.1	48	5218	942	2609	471	3080	2087
23.0	15.1	48	5455	942	2728	471	3199	2182
24.0	15.1	48	5693	942	2846	471	3318	2277
AASHTO Table 10.5.5.2.4-1				Resistance Factor, ϕ	0.50	0.50		0.40
>>> = Min. Socket Length							D (ft.) =	5.0

Load and Resistance Factor Design (LRFD)

DRILLED SHAFT AXIAL RESISTANCE TABLE

Kenton Co., 6-162.40, KY-536
Piers 1 & 2

Rock Socket Diameter = 5.5 feet
Rock Socket Diameter = 66 inches

RDM 7/2/2025

Rock Socket Length (ft.)	Nominal Unit Side Shear q_{ss} (ksf)	Nominal Unit End Bearing q_{eb} (ksf)	Nominal Side Resistance R_{sr} (kips)	Nominal End Bearing Resistance R_{eb} (kips)	Factored Side Resistance ϕR_{sr} (kips)	Factored End Bearing Resistance ϕR_{eb} (kips)	Total Factored Axial Resistance ϕR_t (kips)	Total Factored Uplift Resistance ϕR_{tu} (kips)
0.0								
1.0	15.1	48	261	1140	130	570	701	104
2.0	15.1	48	522	1140	261	570	831	209
3.0	15.1	48	783	1140	391	570	962	313
4.0	15.1	48	1044	1140	522	570	1092	417
5.0	15.1	48	1305	1140	652	570	1222	522
6.0	15.1	48	1565	1140	783	570	1353	626
7.0	15.1	48	1826	1140	913	570	1483	731
8.0	15.1	48	2087	1140	1044	570	1614	835
9.0	15.1	48	2348	1140	1174	570	1744	939
10.0	15.1	48	2609	1140	1305	570	1875	1044
>>> 11.0	15.1	48	2870	1140	1435	570	2005	1148
12.0	15.1	48	3131	1140	1565	570	2136	1252
13.0	15.1	48	3392	1140	1696	570	2266	1357
14.0	15.1	48	3653	1140	1826	570	2397	1461
15.0	15.1	48	3914	1140	1957	570	2527	1565
16.0	15.1	48	4175	1140	2087	570	2657	1670
17.0	15.1	48	4435	1140	2218	570	2788	1774
18.0	15.1	48	4696	1140	2348	570	2918	1879
19.0	15.1	48	4957	1140	2479	570	3049	1983
20.0	15.1	48	5218	1140	2609	570	3179	2087
21.0	15.1	48	5479	1140	2740	570	3310	2192
22.0	15.1	48	5740	1140	2870	570	3440	2296
23.0	15.1	48	6001	1140	3000	570	3571	2400
24.0	15.1	48	6262	1140	3131	570	3701	2505
AASHTO Table 10.5.5.2.4-1			Resistance Factor, ϕ		0.50	0.50		0.40

>>> = Min. Socket Length

D (ft.) = 5.5

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

County: Kenton/Boone Co.s

Date: 8-Jan-25

Road Number: KY-536

Survey Crew / Consultant: District 6

Contact Person: Mike Bezold

Item #: 6-162.40

Survey Crew / Consultant: 69777 02 D

Project #: FD52 12F0 059 0536 003-004 02 D

Notes:

Elevations are based off NAVD88

S-083-2024

(circle one)

Elevation Datum: NAVD88 Assumed

HOLE NUMBER	LATITUDE (Decimal Degrees)	LONGITUDE (Decimal Degrees)	HOLE NUMBER	STATION	OFFSET	ELEVATION (ft)
1001	N38.93398	W84.56011	1001	290+96.50'--	-48.5	807.6
1002	N38.93386	W84.56017	1002	290+96.50'--	0	803.35
1003	N38.93373	W84.56024	1003	290+96.50'--	48.5	796.73
1004	N38.93382	W84.55980	1004	292+00	-31.5	788.9
1005	N38.93377	W84.55983	1005	292+00	-10.5	789.5
1006	N38.93372	W84.55986	1006	292+00	10.5	788.25
1007	N38.93367	W84.55988	1007	292+00	31.5	787.79
1008	N38.93369	W84.55939	1008	293+27	-31.5	784.26
1009	N38.93363	W84.55942	1009	293+27	-10.5	785.12
1010	N38.93358	W84.55944	1010	293+27	10.5	785.21
1011	N38.93353	W84.55947	1011	293+27	31.5	785.12
1012	N38.93362	W84.55903	1012	294+30.50	-48.5	804.11
1013	N38.93350	W84.55910	1013	294+30.50	0	804.91
1014	N38.93337	W84.55916	1014	294+30.50	48.5	804.1
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