M E M O R A N D U M **S-001-2021**

TO: Michael Carpenter, P.E.
Director, Division of Structural Design

FROM: Geotechnical Branch
Division of Structural Design

BY: Tyler Sheffield, P.E.
Geotechnical Branch, Structure Foundations Section

DATE: October 25, 2021

cc: J. Van Zee
C. Van Zee
T. Lovell
T. Wright
R. Gossom
K. Sawyer
K. Downs
D. Deitz (Palmer)
D. McElmurray

SUBJECT: **Jefferson County**
Item No. 5-804.00
12F0 FD52 056 0264 021-023D;
MARS No. 8556402D
Fed. Num. 00STP2641176
RECONSTRUCT THE WATTERSON EXPRESSWAY INTERCHANGE @US 42 INCLUDING SLIP RAMP TO KY 22
2 Span Bridge (~85', ~85') on US 42 over I-264
Geotechnical Engineering 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 the development of structure plans. The drilling for this project was performed by the consulting firm of American Engineers Inc. (AEI).

The proposed bridge replacement is part of a project to reconstruct the I-264 interchange with US 42 at approximate US 42 mile point 5.75. The project is located in Louisville, KY.

I-264 at this location is in a rock cut section. The existing rock cut slopes are essentially vertical and about 10' in height. After discussions with the designer, it was decided to investigate and give recommendations for two different bridge configurations for US 42 over I-264 at this location. One configuration places the bridge ends on breastwall abutments founded on drilled shafts on top of the aforementioned existing rock cuts. The second configuration would shorten the bridge slightly and place the bridge ends on drilled shafts in front of the rock cuts, i.e. closer to the shoulders of I-264. These shafts would have a webwall between then, ultimately serving as a breastwall abutment.

2.0 Site Geologic Conditions

This structure is located in the Jeffersonville, New Albany, and Charlestown Geologic Quadrangle (GQ# 1211). The geologic mapping indicates that the bedrock at this site consists of the Sellersburg Limestone.

3.0 Field Investigation

Ten (10) sample and core holes were taken for this structure. The drill crew delivered the rock core and soil samples to the KYTC Geotechnical Branch in Frankfort where a geologist logged the rock cores and the soil samples were classified and tested in the Branch's 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 and high plasticity clays and silts, clayey and clayey silty sands, and clayey silty gravels. The soil samples were designated CL, CH, MH, ML, SC, SC-SM, and GC-GM using the Unified Soil Classification System.

5.0 SUBSURFACE CONDITIONS

Depths to rock/refusal varied from 4.1 ft. to 12.3 ft. Rock cores from this location indicated that bedrock consists mostly of gray fine to medium grain, crystalline, fossiliferous to fossil fragmental limestone with few stylolites, chert nodules, and few shale partings. The KY RQD values for the rock cores taken at this proposed bridge location ranged from 10% to 100% and core recoveries ranged from 57% to 100%. The variation in top of rock/auger refusal elevations are in the table below. varied from 560.2 ft. to 578.7 ft.

Substructure Unit	Top of Rock Elevation (ft)
Abutment 1	570.2 to 576.0
Pier 1	560.2 to 562.9
Abutment 2	571.4 to 578.7

6.0 ENGINEERING ANALYSIS

ABUTMENT 1 & 2

6.1 Option 1: Breastwall Abutments Founded on Drilled Shafts

Use drilled shafts constructed in accordance with the Special Note for Drilled Shafts. The shaft tips shall extend a minimum of two shaft diameters below the bottom of permanent casing. Drilled shafts were evaluated for axial loading, and the attached tables provide the resulting capacities and resistances for LRFD methods. The elevations in the following table are needed to both complete the design and determine plan quantities for the drilled shafts. These elevations will be verified after construction phase drilling has been performed. The final shaft tip elevations and quantities may be adjusted based on actual field conditions. The highest tip elevation noted in the following table is based on a 3.5 ft. shaft diameter.

	Abutment 1	Abutment 2
Estimated Top of Rock	572	577
Estimated Bottom of Permanent Casing/Top of Rock Socket	572	577
Highest Allowable Shaft Tip	565	570

6.2 Option 2: Drilled Shafts with Webwall (shortened bridge)

Use drilled shafts constructed in accordance with the Special Note for Drilled Shafts. The shaft tips shall extend a minimum of two shaft diameters below the bottom of permanent casing. Drilled shafts were evaluated for axial loading, and the attached tables provide the resulting capacities and resistances for LRFD methods. The elevations in the following

table are needed to both complete the design and determine plan quantities for the drilled shafts. These elevations will be verified after construction phase drilling has been performed. The final shaft tip elevations and quantities may be adjusted based on actual field conditions. The highest tip elevation noted in the following table is based on a 3.5 ft. shaft diameter.

	Abutment 1	Abutment 2
Estimated Top of Rock	565	565
Estimated Bottom of Permanent Casing/Top of Rock Socket	565	565
Highest Allowable Shaft Tip	558	558

PIER

6.3 Option 1: Spread Footing

Use spread footings on competent unweathered bedrock. Embed the footings into bedrock a minimum of 0.5 ft., as outlined in the recommendations.

6.4 Option 2: Drilled Shafts

Use drilled shafts constructed in accordance with the Special Note for Drilled Shafts. The shaft tips shall extend a minimum of two shaft diameters below the bottom of permanent casing. Drilled shafts were evaluated for axial loading, and the attached tables provide the resulting capacities and resistances for LRFD methods. The elevations in the following table are needed to both complete the design and determine plan quantities for the drilled shafts. These elevations will be verified after construction phase drilling has been performed. The final shaft tip elevations and quantities may be adjusted based on actual field conditions. The highest tip elevation noted below is based on a 3.5 ft. shaft diameter.

	Pier
Estimated Top of Rock	561.5
Estimated Bottom of Permanent Casing/Top of Rock Socket	561.5
Highest Allowable Shaft Tip	854.5

6.5 Embankment Analysis

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. If any additional 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 shallow foundation soils at the abutments, settlement is not believed to be a concern at this location.

7.0 FOUNDATION RECOMMENDATIONS

7.1 Drilled Shafts (Abutment 1 & 2, Pier Option #2)

7.1.1 Use Drilled Shaft foundations with estimated top of rock socket elevations as noted in Sections 6.1, 6.2, and 6.4 of this report.

7.1.2 For Abutment Option #1: The nearest edge of drilled shafts must be a minimum of 10 feet from the rock cut face.

7.1.3 Permanent casing is required in the overburden. It should be noted in the plans that the permanent casing is incidental to the unit bid price for Drilled Shaft, Common or Solid Rock, as applicable. Use permanent casing that is 6 inches larger in diameter than the proposed shaft diameter to the "Bottom of Permanent Casing" elevations noted above. Casings shall meet the requirements of Section 2.3 of the Special Note for Drilled Shafts.

7.1.4 Permanent casing may need to be extended through any significant void, should they be encountered. Shaft tip elevations may also need to be lowered if significant voids are encountered.

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

7.1.6 For Load & Resistance Factor Design (LRFD), evaluate the total factored axial resistances using the attached Drilled Shaft Axial Resistance Tables considering the capacity developed in the uncased rock sockets. The total factored resistances must exceed the factored loads at the strength limit state. The highest allowable tip elevations are provided in Sections 6.1, 6.2, and 6.4 of this report. Longer uncased sockets may be required to satisfy axial or lateral load design criteria.

7.1.7 Perform lateral load analysis using the geotechnical parameters provided in the attached Idealized Soil and Bedrock Profiles. These parameters may be used to perform analyses using LPILE or other similar software. Some of the parameters may not be required to input, depending on the version of software utilized. Design the substructure units neglecting any lateral resistance from the overburden.

7.1.8 Additional drilling will be required at each drilled shaft location as noted in Section 3.5, Subsurface Investigation of the Special Note for Drilled Shafts. Estimates of the amount of Rockline Sounding may be made by taking the difference between the ground surface and the rockline at each shaft location. For estimating the amount of Rock Coring at this location, we recommend that the subsurface exploration extend a minimum depth of three (3) shaft diameters (but not less than 10 feet) below the bottom of the anticipated tip elevation of each drilled shaft.

7.1.9 Use the elevations in Sections 6.1, 6.2, and 6.4 of this report to determine plan quantities as follows:

- Drilled Shaft - *-inch (Common) - Top of shaft to Top of Rock
- 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.

7.2 Spread Footing (Pier Option #1)

7.2.1 Use spread footings on unweathered bedrock with estimated base of footing elevations from the table below.

Substructure Unit	Estimated Base of Footing Elevation
Pier	559.5 ft.

7.2.2 The spread footings shall be embedded a minimum of 0.5 ft. into competent unweathered bedrock. Footings may be raised if competent unweathered bedrock is encountered at a higher elevation. (Note: Minimum 0.5 ft. of embedment must still be attained.)

7.2.3 The base of spread footings shall be a minimum of 0.5 ft. below the bottom of adjacent ditch lines.

7.2.4 The base of spread footings shall be a minimum of 0.5 ft. below the bottom of existing pier spread footings.

7.2.5 The spread footings shall be founded on solid bedrock. Size the footings at a service limit state using a presumptive factored bearing resistance of 24 ksf. Contact this branch for a more detailed analysis of the nominal bearing resistance of the strength or extreme limit states control the footing design.

8.0 PLAN NOTES

(Include the notes below at appropriate locations in the plans, if applicable.)

Drilled Shaft Notes

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

8.2 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 7.1.8 of this report.)

8.3 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.

8.4 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.

Spread Footing Notes

8.5 Solid rock excavation will be required for installation of this structure's spread footings.

8.6 Cofferdams, dewatering methods, and shoring may be required to facilitate foundation construction of spread footings.

8.7 All footing excavations in bedrock shall be cut neatly so that no forming or backfilling is necessary in the construction of the portions of the footings located in rock. Concrete should be placed directly against the cut rock faces. Mass concrete should be placed in the excavation from the top of the footing to the bedrock surface where the footing does not extend to the bedrock surface.

8.8 If the bedrock becomes softened at bearing elevation, the softened material should be undercut to unweathered material prior to placing the concrete. Seasonal groundwater fluctuations may cause groundwater infiltration into the footing excavations and a dewatering method may be necessary.

8.9 The spread footings shall be embedded a minimum of **0.5 foot** into competent unweathered bedrock. Footings may be raised if competent unweathered bedrock is encountered at a higher elevation. (Note: Minimum **0.5 foot** of embedment must still be attained.)

8.10 The base of spread footings shall be a minimum of 0.5 ft. below the bottom of adjacent ditch lines.

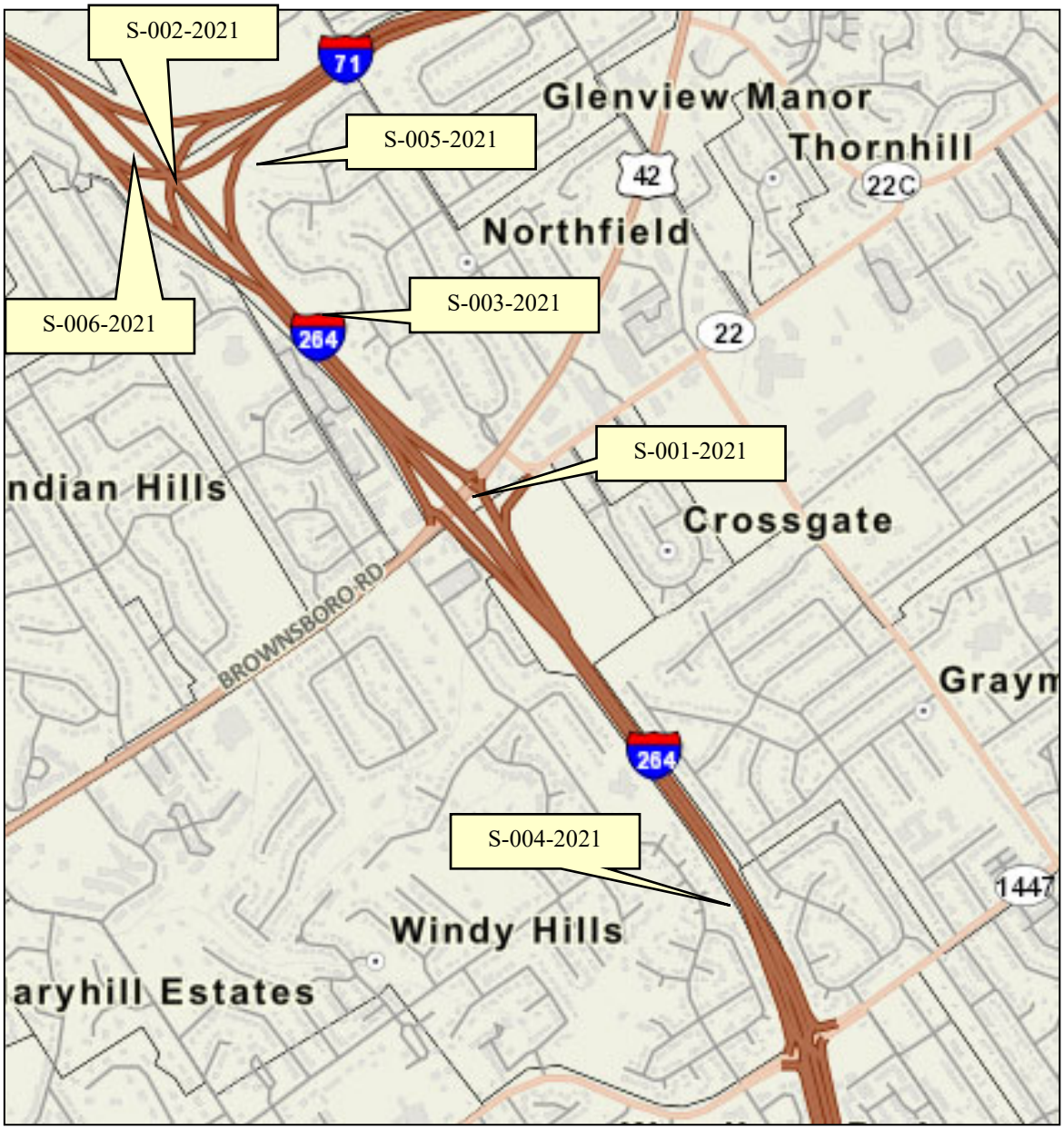
8.11 The base of spread footings shall be a minimum of 0.5 ft. below the bottom of existing spread footings.

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.

Attachments:

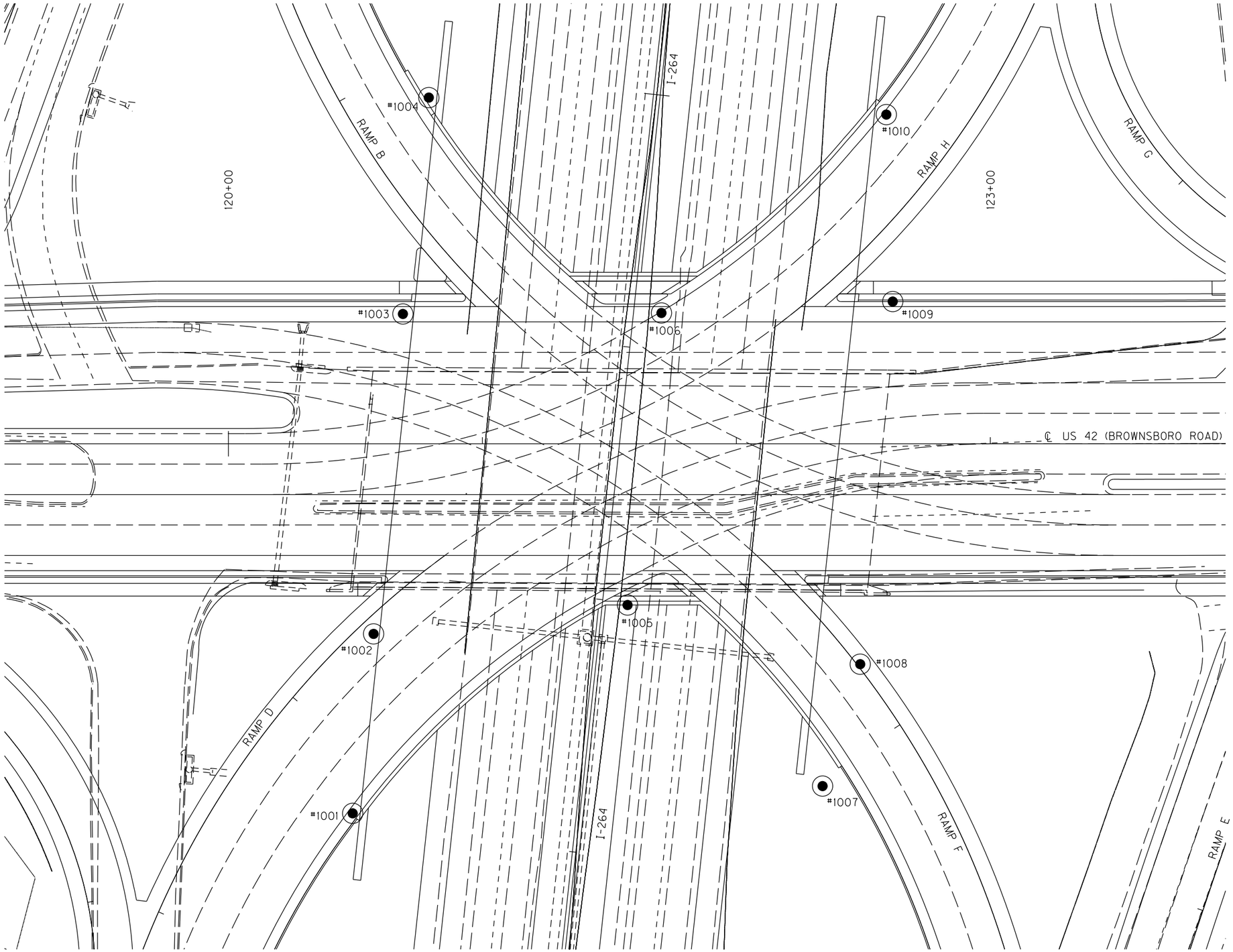
- **Project Location Map**
- **Subsurface Data Sheet**
- **Idealized Soil and Bedrock Profile**
- **Drilled Shaft Axial Resistance Table**
- **Bridge Layout**
- **Coordinate Data Sheet**

Project Location Map



SUBSURFACE DATA

Plan Scale 1" = 20'



COMMONWEALTH OF KENTUCKY DEPARTMENT OF HIGHWAYS KENTUCKY TRANSPORTATION CABINET	REVISION	DATE	PREPARED BY Division of Structural Design Geotechnical Branch	DATE: 18-OCTOBER-2021	CHECKED BY	CROSSING **US 42 Bridge over I–264**	ROUTE **I–264**	ITEM NO. **5–804.00**	COUNTY OF **JEFFERSON**
				DESIGNED BY:				SHEET NO.	DRAWING NUMBER **S–001–2021**
				DETAILED BY: E. BAILEY	T. SHEFFIELD				

OpenRoads Designer v10.16.0.80 USER: $$$$USER$$$$ DATE PLOTTED: $$$$DATE$$$$ FILE NAME: $$$$design$file$specification$$$$

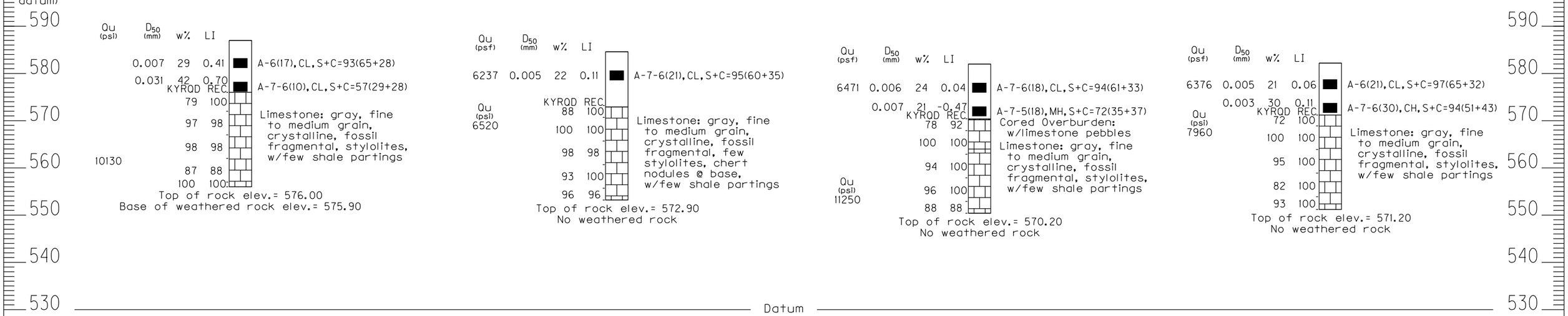
SUBSURFACE DATA

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

END BENT ONE

APPROXIMATE ROADWAY GRADE ELEV. = 592.61

Hole No.	1004	1003	1002	1001
Station	120+78.90	120+68.70	120+57.16	120+48.92
Offset	136.30 ft. Lt.	51.10 ft. Lt.	74.90 ft. Rt.	145.50 ft. Rt.
Elev.	587.00	584.60	582.00	582.20
(NAVD 88 datum)				



COMMONWEALTH OF KENTUCKY
DEPARTMENT OF HIGHWAYS
KENTUCKY TRANSPORTATION CABINET

REVISION	DATE

PREPARED BY
Division of Structural Design
Geotechnical Branch

DATE: 18-OCTOBER-2021	CHECKED BY
DESIGNED BY:	
DETAILED BY: E. BAILEY	T. SHEFFIELD

CROSSING
US 42 Bridge over I-264

ROUTE	ITEM NO.	COUNTY OF
I-264	**5-804.00**	**JEFFERSON**
	SHEET NO.	DRAWING NUMBER
		S-001-2021

SUBSURFACE DATA

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

PIER ONE

Hole No.
Station
Offset
Elev.
(NAVD 88 datum)

590
580
570
560
550
540
530

1006
121+70.50
51.50 ft. Lt.
567.00

Qu (psi): 1,317 | 5400

D_{50} (mm): 12

w%: 0.02

LI: KYROD REC

10	57	N=24, N=50/0.1 — A-2-4(0), SC, S+C=32(18+14)
		Cored Overburden
19	100	Limestone: gray, fine to medium grain, crystalline, fossiliferous, stylolites, chert nodules, w/few shale partings, (core fractured & mechanically broken from 2.1' to 6.7')
73	100	
88	98	
100	100	

Top of rock elev.= 562.90
Base of weathered rock elev.= 561.90

1005
121+57.15
63.50 ft. Rt.
567.90

Qu (psi): 4,950 | 8290

D_{50} (mm): 6 | 3

w%: -2.02 | -2.64

LI: KYROD REC

0	71	N=22, N=8 — A-1-b(0), SC-SM, S+C=25(16+9)
25	92	N=41, A-1-a(0), GC-GM, S+C=13(9+4)
		Cored Overburden
54	100	Limestone: gray, fine to medium grain, crystalline, fossiliferous, stylolites, w/few shale partings, (core fractured & mechanically broken from 6.2' to 14.2')
78	86	
96	100	

Top of rock elev.= 560.20
No weathered rock

Datum

590
580
570
560
550
540
530

COMMONWEALTH OF KENTUCKY
DEPARTMENT OF HIGHWAYS
KENTUCKY TRANSPORTATION CABINET

REVISION	DATE

PREPARED BY
Division of Structural Design
Geotechnical Branch

DATE: 18-OCTOBER-2021
DESIGNED BY:
DETAILED BY: E. BAILEY
CHECKED BY
T. SHEFFIELD

CROSSING
US 42 Bridge over I-264

ROUTE
I-264

ITEM NO.
5-804.00
SHEET NO.

COUNTY OF
JEFFERSON
DRAWING NUMBER
S-001-2021

OpenRoads Designer v10.16.0.80 USER: $$$$USER$$$$ DATE PLOTTED: $$$$DATE$$$$ FILE NAME: $$$$design$file$specification$$$$

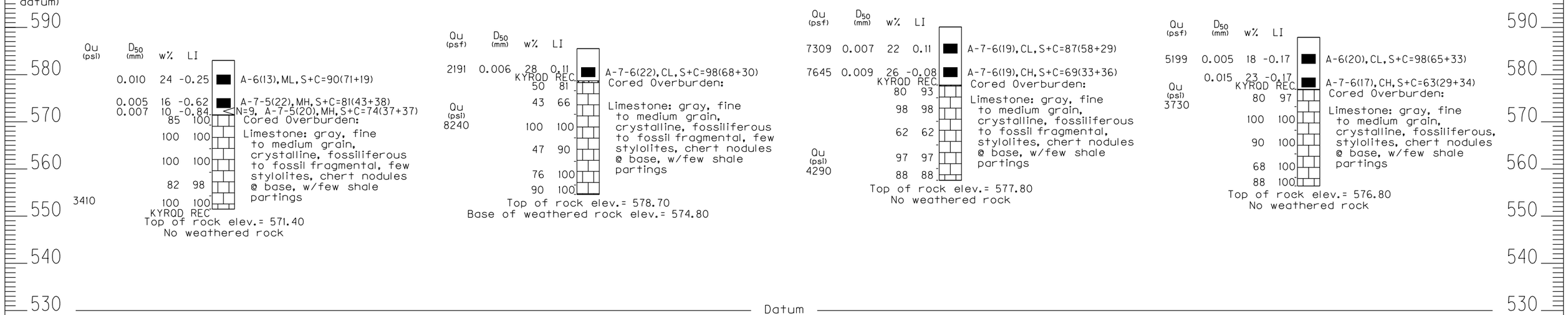
SUBSURFACE DATA

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

END BENT TWO

APPROXIMATE ROADWAY GRADE ELEV. = 593.65

Hole No.	1010	1009	1008	1007
Station	122+59.06	122+61.58	122+48.77	122+33.95
Offset	129.60 ft. Lt.	56.00 ft. Lt.	86.80 ft. Rt.	134.80 ft. Rt.
Elev. (NAVD 88 datum)	583.00	585.50	590.10	587.90



COMMONWEALTH OF KENTUCKY
DEPARTMENT OF HIGHWAYS
KENTUCKY TRANSPORTATION CABINET

REVISION	DATE

PREPARED BY
Division of Structural Design
Geotechnical Branch

DATE: 18-OCTOBER-2021	CHECKED BY	
DESIGNED BY:		CROSSING: US 42 Bridge over I-264
DETAILED BY: E. BAILEY	T. SHEFFIELD	

ROUTE	ITEM NO.	COUNTY OF
I-264	5-804.00	JEFFERSON
	SHEET NO.	DRAWING NUMBER
		S-001-2021

IDEALIZED SOIL AND BEDROCK PROFILE

S-001-2021: Jefferson Co., Item# 5-804.00, US 42 over I-264

TQS 10/11/2021

Elev. (ft.)

Top of Shaft

Overburden, Neglect for Support

Stiff Clay w/ Free Water

Effective Unit Weight,	**γ_e (lb/ft^3) =**	**120**
Undrained Cohesion,	**c (lb/ft^2) =**	**2500**
Strain Factor,	**E50 =**	**0.005**
Soil Modulus,	**k (lb/in^3) =**	**1000**

Top of Rock Socket

*

Strata		**Parameters for Lateral Load Analyses**		
Limestone		**Strong Rock (Vuggy Limestone)**		
γ_t (lb/ft^3) =	**150**	**Effective Unit Weight,**	**γ_e (lb/in^3) =**	**0.087**
q_u (psi) =	**4800**			
q_{eb} (ksf) =	**72**	**Uniaxial Compressive Strength,**	**q_u (psi) =**	**4800**
f_s (ksf) =	**32.7**			

(Side friction limited by Concrete Strength to fs = 32.7 ksf)

*

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

S-001-2021: Jefferson Co., Item# 5-804.00, US 42 over I-264

Rock Socket Diameter = 3.5 feet
Rock Socket Diameter = 42 inches **TQS 10/11/2021**

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	32.7	72	359	693	198	346	544	144
2.0	32.7	72	718	693	395	346	741	287
3.0	32.7	72	1077	693	593	346	939	431
4.0	32.7	72	1437	693	790	346	1136	575
5.0	32.7	72	1796	693	988	346	1334	718
6.0	32.7	72	2155	693	1185	346	1532	862
>>> 7.0	32.7	72	2514	693	1383	346	1729	1006
8.0	32.7	72	2873	693	1580	346	1927	1149
9.0	32.7	72	3232	693	1778	346	2124	1293
10.0	32.7	72	3591	693	1975	346	2322	1437
11.0	32.7	72	3951	693	2173	346	2519	1580
12.0	32.7	72	4310	693	2370	346	2717	1724
13.0	32.7	72	4669	693	2568	346	2914	1868
14.0	32.7	72	5028	693	2765	346	3112	2011
15.0	32.7	72	5387	693	2963	346	3309	2155
16.0	32.7	72	5746	693	3160	346	3507	2299
17.0	32.7	72	6106	693	3358	346	3704	2442
18.0	32.7	72	6465	693	3556	346	3902	2586
19.0	32.7	72	6824	693	3753	346	4099	2730
20.0	32.7	72	7183	693	3951	346	4297	2873
AASHTO Table 10.5.5.2.4-1			Resistance Factor, ϕ		0.55	0.50		0.40

AASHTO 10.5.5.2.4: *When applying this table to a single shaft supporting a bridge pier, reduce the factored resistance by another 20%.

>>> = Min. Socket Length

D (ft.) = 3.5

Load and Resistance Factor Design (LRFD)

DRILLED SHAFT AXIAL RESISTANCE TABLE

S-001-2021: Jefferson Co., Item# 5-804.00, US 42 over I-264

Rock Socket Diameter = 4.0 feet
Rock Socket Diameter = 48 inches **TQS 10/11/2021**

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	32.7	72	410	905	226	452	678	164
2.0	32.7	72	821	905	451	452	904	328
3.0	32.7	72	1231	905	677	452	1130	493
4.0	32.7	72	1642	905	903	452	1355	657
5.0	32.7	72	2052	905	1129	452	1581	821
6.0	32.7	72	2463	905	1354	452	1807	985
7.0	32.7	72	2873	905	1580	452	2033	1149
>>> 8.0	32.7	72	3284	905	1806	452	2258	1313
9.0	32.7	72	3694	905	2032	452	2484	1478
10.0	32.7	72	4105	905	2257	452	2710	1642
11.0	32.7	72	4515	905	2483	452	2936	1806
12.0	32.7	72	4925	905	2709	452	3161	1970
13.0	32.7	72	5336	905	2935	452	3387	2134
14.0	32.7	72	5746	905	3160	452	3613	2299
15.0	32.7	72	6157	905	3386	452	3839	2463
16.0	32.7	72	6567	905	3612	452	4064	2627
17.0	32.7	72	6978	905	3838	452	4290	2791
18.0	32.7	72	7388	905	4063	452	4516	2955
19.0	32.7	72	7799	905	4289	452	4742	3119
20.0	32.7	72	8209	905	4515	452	4967	3284
AASHTO Table 10.5.5.2.4-1			Resistance Factor, ϕ		0.55	0.50		0.40

AASHTO 10.5.5.2.4: *When applying this table to a single shaft supporting a bridge pier, reduce the factored resistance by another 20%.

>>> = Min. Socket Length

D (ft.) = 4.0

Load and Resistance Factor Design (LRFD)

DRILLED SHAFT AXIAL RESISTANCE TABLE

S-001-2021: Jefferson Co., Item# 5-804.00, US 42 over I-264

Rock Socket Diameter = 4.5 feet
Rock Socket Diameter = 54 inches **TQS 10/11/2021**

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	32.7	72	462	1145	254	573	827	185
2.0	32.7	72	924	1145	508	573	1080	369
3.0	32.7	72	1385	1145	762	573	1334	554
4.0	32.7	72	1847	1145	1016	573	1588	739
5.0	32.7	72	2309	1145	1270	573	1842	924
6.0	32.7	72	2771	1145	1524	573	2096	1108
7.0	32.7	72	3232	1145	1778	573	2350	1293
8.0	32.7	72	3694	1145	2032	573	2604	1478
>>> 9.0	32.7	72	4156	1145	2286	573	2858	1662
10.0	32.7	72	4618	1145	2540	573	3112	1847
11.0	32.7	72	5079	1145	2794	573	3366	2032
12.0	32.7	72	5541	1145	3048	573	3620	2216
13.0	32.7	72	6003	1145	3302	573	3874	2401
14.0	32.7	72	6465	1145	3556	573	4128	2586
15.0	32.7	72	6926	1145	3810	573	4382	2771
16.0	32.7	72	7388	1145	4063	573	4636	2955
17.0	32.7	72	7850	1145	4317	573	4890	3140
18.0	32.7	72	8312	1145	4571	573	5144	3325
19.0	32.7	72	8773	1145	4825	573	5398	3509
20.0	32.7	72	9235	1145	5079	573	5652	3694
AASHTO Table 10.5.5.2.4-1			Resistance Factor, ϕ		0.55	0.50		0.40

AASHTO 10.5.5.2.4: *When applying this table to a single shaft supporting a bridge pier, reduce the factored resistance by another 20%.

>>> = Min. Socket Length

D (ft.) = 4.5

Load and Resistance Factor Design (LRFD)

DRILLED SHAFT AXIAL RESISTANCE TABLE

S-001-2021: Jefferson Co., Item# 5-804.00, US 42 over I-264

Rock Socket Diameter = 5.0 feet
Rock Socket Diameter = 60 inches **TQS 10/11/2021**

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	32.7	72	513	1414	282	707	989	205
2.0	32.7	72	1026	1414	564	707	1271	410
3.0	32.7	72	1539	1414	847	707	1553	616
4.0	32.7	72	2052	1414	1129	707	1836	821
5.0	32.7	72	2565	1414	1411	707	2118	1026
6.0	32.7	72	3078	1414	1693	707	2400	1231
7.0	32.7	72	3591	1414	1975	707	2682	1437
8.0	32.7	72	4105	1414	2257	707	2964	1642
9.0	32.7	72	4618	1414	2540	707	3247	1847
>>> 10.0	32.7	72	5131	1414	2822	707	3529	2052
11.0	32.7	72	5644	1414	3104	707	3811	2257
12.0	32.7	72	6157	1414	3386	707	4093	2463
13.0	32.7	72	6670	1414	3668	707	4375	2668
14.0	32.7	72	7183	1414	3951	707	4657	2873
15.0	32.7	72	7696	1414	4233	707	4940	3078
16.0	32.7	72	8209	1414	4515	707	5222	3284
17.0	32.7	72	8722	1414	4797	707	5504	3489
18.0	32.7	72	9235	1414	5079	707	5786	3694
19.0	32.7	72	9748	1414	5362	707	6068	3899
20.0	32.7	72	10261	1414	5644	707	6351	4105
AASHTO Table 10.5.5.2.4-1			Resistance Factor, ϕ		0.55	0.50		0.40

AASHTO 10.5.5.2.4: *When applying this table to a single shaft supporting a bridge pier, reduce the factored resistance by another 20%.

>>> = Min. Socket Length

D (ft.) = 5.0

Load and Resistance Factor Design (LRFD)

DRILLED SHAFT AXIAL RESISTANCE TABLE

S-001-2021: Jefferson Co., Item# 5-804.00, US 42 over I-264

Rock Socket Diameter = 5.5 feet
Rock Socket Diameter = 66 inches **TQS 10/11/2021**

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	32.7	72	564	1711	310	855	1166	226
2.0	32.7	72	1129	1711	621	855	1476	451
3.0	32.7	72	1693	1711	931	855	1787	677
4.0	32.7	72	2257	1711	1242	855	2097	903
5.0	32.7	72	2822	1711	1552	855	2407	1129
6.0	32.7	72	3386	1711	1862	855	2718	1354
7.0	32.7	72	3951	1711	2173	855	3028	1580
8.0	32.7	72	4515	1711	2483	855	3339	1806
9.0	32.7	72	5079	1711	2794	855	3649	2032
10.0	32.7	72	5644	1711	3104	855	3959	2257
>>> 11.0	32.7	72	6208	1711	3414	855	4270	2483
12.0	32.7	72	6772	1711	3725	855	4580	2709
13.0	32.7	72	7337	1711	4035	855	4891	2935
14.0	32.7	72	7901	1711	4346	855	5201	3160
15.0	32.7	72	8466	1711	4656	855	5511	3386
16.0	32.7	72	9030	1711	4966	855	5822	3612
17.0	32.7	72	9594	1711	5277	855	6132	3838
18.0	32.7	72	10159	1711	5587	855	6443	4063
19.0	32.7	72	10723	1711	5898	855	6753	4289
20.0	32.7	72	11287	1711	6208	855	7063	4515
AASHTO Table 10.5.5.2.4-1			Resistance Factor, ϕ		0.55	0.50		0.40

AASHTO 10.5.5.2.4: *When applying this table to a single shaft supporting a bridge pier, reduce the factored resistance by another 20%.

>>> = Min. Socket Length

D (ft.) = 5.5

Load and Resistance Factor Design (LRFD)

DRILLED SHAFT AXIAL RESISTANCE TABLE

S-001-2021: Jefferson Co., Item# 5-804.00, US 42 over I-264

Rock Socket Diameter = 6.0 feet
Rock Socket Diameter = 72 inches **TQS 10/11/2021**

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	32.7	72	616	2036	339	1018	1357	246
2.0	32.7	72	1231	2036	677	1018	1695	493
3.0	32.7	72	1847	2036	1016	1018	2034	739
4.0	32.7	72	2463	2036	1354	1018	2372	985
5.0	32.7	72	3078	2036	1693	1018	2711	1231
6.0	32.7	72	3694	2036	2032	1018	3050	1478
7.0	32.7	72	4310	2036	2370	1018	3388	1724
8.0	32.7	72	4925	2036	2709	1018	3727	1970
9.0	32.7	72	5541	2036	3048	1018	4066	2216
10.0	32.7	72	6157	2036	3386	1018	4404	2463
11.0	32.7	72	6772	2036	3725	1018	4743	2709
>>> 12.0	32.7	72	7388	2036	4063	1018	5081	2955
13.0	32.7	72	8004	2036	4402	1018	5420	3202
14.0	32.7	72	8620	2036	4741	1018	5759	3448
15.0	32.7	72	9235	2036	5079	1018	6097	3694
16.0	32.7	72	9851	2036	5418	1018	6436	3940
17.0	32.7	72	10467	2036	5757	1018	6775	4187
18.0	32.7	72	11082	2036	6095	1018	7113	4433
19.0	32.7	72	11698	2036	6434	1018	7452	4679
20.0	32.7	72	12314	2036	6772	1018	7790	4925
AASHTO Table 10.5.5.2.4-1			Resistance Factor, ϕ		0.55	0.50		0.40

AASHTO 10.5.5.2.4: *When applying this table to a single shaft supporting a bridge pier, reduce the factored resistance by another 20%.

>>> = Min. Socket Length

D (ft.) = 6.0

Load and Resistance Factor Design (LRFD)

DRILLED SHAFT AXIAL RESISTANCE TABLE

S-001-2021: Jefferson Co., Item# 5-804.00, US 42 over I-264

Rock Socket Diameter = 6.5 feet
Rock Socket Diameter = 78 inches **TQS 10/11/2021**

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	32.7	72	667	2389	367	1195	1561	267
2.0	32.7	72	1334	2389	734	1195	1928	534
3.0	32.7	72	2001	2389	1101	1195	2295	800
4.0	32.7	72	2668	2389	1467	1195	2662	1067
5.0	32.7	72	3335	2389	1834	1195	3029	1334
6.0	32.7	72	4002	2389	2201	1195	3396	1601
7.0	32.7	72	4669	2389	2568	1195	3762	1868
8.0	32.7	72	5336	2389	2935	1195	4129	2134
9.0	32.7	72	6003	2389	3302	1195	4496	2401
10.0	32.7	72	6670	2389	3668	1195	4863	2668
11.0	32.7	72	7337	2389	4035	1195	5230	2935
12.0	32.7	72	8004	2389	4402	1195	5597	3202
>>> 13.0	32.7	72	8671	2389	4769	1195	5964	3468
14.0	32.7	72	9338	2389	5136	1195	6330	3735
15.0	32.7	72	10005	2389	5503	1195	6697	4002
16.0	32.7	72	10672	2389	5869	1195	7064	4269
17.0	32.7	72	11339	2389	6236	1195	7431	4536
18.0	32.7	72	12006	2389	6603	1195	7798	4802
19.0	32.7	72	12673	2389	6970	1195	8165	5069
20.0	32.7	72	13340	2389	7337	1195	8531	5336
AASHTO Table 10.5.5.2.4-1			Resistance Factor, ϕ		0.55	0.50		0.40

AASHTO 10.5.5.2.4: *When applying this table to a single shaft supporting a bridge pier, reduce the factored resistance by another 20%.

>>> = Min. Socket Length

D (ft.) = 6.5

Load and Resistance Factor Design (LRFD)

DRILLED SHAFT AXIAL RESISTANCE TABLE

S-001-2021: Jefferson Co., Item# 5-804.00, US 42 over I-264

Rock Socket Diameter = 7.0 feet
Rock Socket Diameter = 84 inches **TQS 10/11/2021**

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	32.7	72	718	2771	395	1385	1781	287
2.0	32.7	72	1437	2771	790	1385	2176	575
3.0	32.7	72	2155	2771	1185	1385	2571	862
4.0	32.7	72	2873	2771	1580	1385	2966	1149
5.0	32.7	72	3591	2771	1975	1385	3361	1437
6.0	32.7	72	4310	2771	2370	1385	3756	1724
7.0	32.7	72	5028	2771	2765	1385	4151	2011
8.0	32.7	72	5746	2771	3160	1385	4546	2299
9.0	32.7	72	6465	2771	3556	1385	4941	2586
10.0	32.7	72	7183	2771	3951	1385	5336	2873
11.0	32.7	72	7901	2771	4346	1385	5731	3160
12.0	32.7	72	8620	2771	4741	1385	6126	3448
13.0	32.7	72	9338	2771	5136	1385	6521	3735
>>> 14.0	32.7	72	10056	2771	5531	1385	6916	4022
15.0	32.7	72	10774	2771	5926	1385	7311	4310
16.0	32.7	72	11493	2771	6321	1385	7706	4597
17.0	32.7	72	12211	2771	6716	1385	8102	4884
18.0	32.7	72	12929	2771	7111	1385	8497	5172
19.0	32.7	72	13648	2771	7506	1385	8892	5459
20.0	32.7	72	14366	2771	7901	1385	9287	5746
AASHTO Table 10.5.5.2.4-1			Resistance Factor, ϕ		0.55	0.50		0.40

AASHTO 10.5.5.2.4: *When applying this table to a single shaft supporting a bridge pier, reduce the factored resistance by another 20%.

>>> = Min. Socket Length

D (ft.) = 7.0

Load and Resistance Factor Design (LRFD)

DRILLED SHAFT AXIAL RESISTANCE TABLE

S-001-2021: Jefferson Co., Item# 5-804.00, US 42 over I-264

Rock Socket Diameter = 7.5 feet
Rock Socket Diameter = 90 inches **TQS 10/11/2021**

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	32.7	72	770	3181	423	1590	2014	308
2.0	32.7	72	1539	3181	847	1590	2437	616
3.0	32.7	72	2309	3181	1270	1590	2860	924
4.0	32.7	72	3078	3181	1693	1590	3284	1231
5.0	32.7	72	3848	3181	2116	1590	3707	1539
6.0	32.7	72	4618	3181	2540	1590	4130	1847
7.0	32.7	72	5387	3181	2963	1590	4553	2155
8.0	32.7	72	6157	3181	3386	1590	4977	2463
9.0	32.7	72	6926	3181	3810	1590	5400	2771
10.0	32.7	72	7696	3181	4233	1590	5823	3078
11.0	32.7	72	8466	3181	4656	1590	6247	3386
12.0	32.7	72	9235	3181	5079	1590	6670	3694
13.0	32.7	72	10005	3181	5503	1590	7093	4002
14.0	32.7	72	10774	3181	5926	1590	7516	4310
>>> 15.0	32.7	72	11544	3181	6349	1590	7940	4618
16.0	32.7	72	12314	3181	6772	1590	8363	4925
17.0	32.7	72	13083	3181	7196	1590	8786	5233
18.0	32.7	72	13853	3181	7619	1590	9209	5541
19.0	32.7	72	14622	3181	8042	1590	9633	5849
20.0	32.7	72	15392	3181	8466	1590	10056	6157
AASHTO Table 10.5.5.2.4-1			Resistance Factor, ϕ		0.55	0.50		0.40

AASHTO 10.5.5.2.4: *When applying this table to a single shaft supporting a bridge pier, reduce the factored resistance by another 20%.

>>> = Min. Socket Length

D (ft.) = 7.5

Load and Resistance Factor Design (LRFD)

DRILLED SHAFT AXIAL RESISTANCE TABLE

S-001-2021: Jefferson Co., Item# 5-804.00, US 42 over I-264

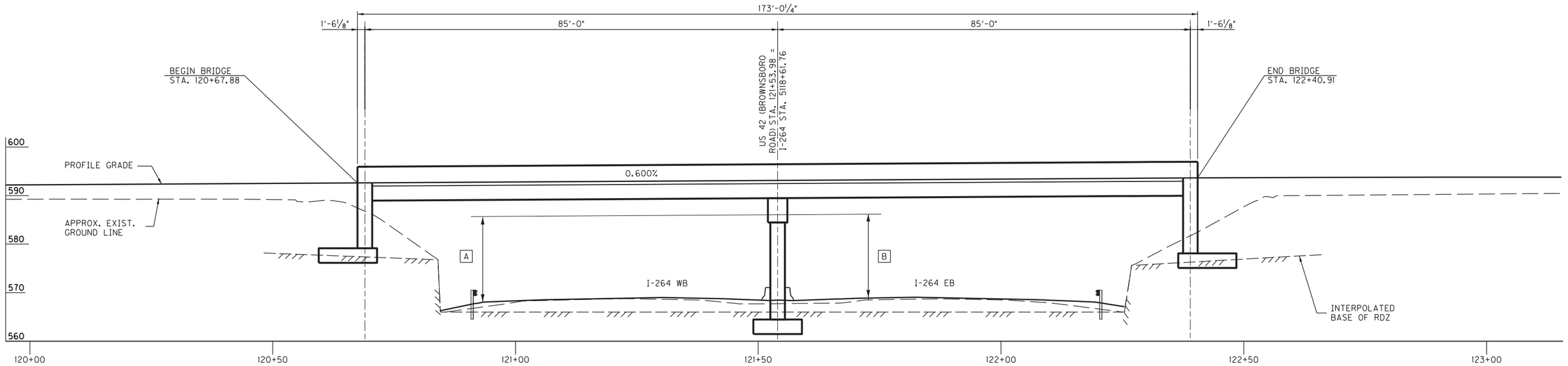
Rock Socket Diameter = 8.0 feet
Rock Socket Diameter = 96 inches **TQS 10/11/2021**

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	32.7	72	821	3619	451	1810	2261	328
2.0	32.7	72	1642	3619	903	1810	2713	657
3.0	32.7	72	2463	3619	1354	1810	3164	985
4.0	32.7	72	3284	3619	1806	1810	3616	1313
5.0	32.7	72	4105	3619	2257	1810	4067	1642
6.0	32.7	72	4925	3619	2709	1810	4519	1970
7.0	32.7	72	5746	3619	3160	1810	4970	2299
8.0	32.7	72	6567	3619	3612	1810	5422	2627
9.0	32.7	72	7388	3619	4063	1810	5873	2955
10.0	32.7	72	8209	3619	4515	1810	6325	3284
11.0	32.7	72	9030	3619	4966	1810	6776	3612
12.0	32.7	72	9851	3619	5418	1810	7228	3940
13.0	32.7	72	10672	3619	5869	1810	7679	4269
14.0	32.7	72	11493	3619	6321	1810	8131	4597
15.0	32.7	72	12314	3619	6772	1810	8582	4925
>>> 16.0	32.7	72	13135	3619	7224	1810	9034	5254
17.0	32.7	72	13955	3619	7675	1810	9485	5582
18.0	32.7	72	14776	3619	8127	1810	9937	5911
19.0	32.7	72	15597	3619	8578	1810	10388	6239
20.0	32.7	72	16418	3619	9030	1810	10840	6567
AASHTO Table 10.5.5.2.4-1			Resistance Factor, ϕ		0.55	0.50		0.40

AASHTO 10.5.5.2.4: *When applying this table to a single shaft supporting a bridge pier, reduce the factored resistance by another 20%.

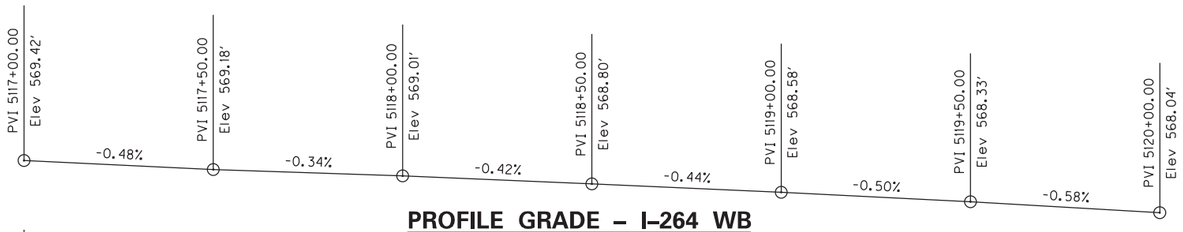
>>> = Min. Socket Length

D (ft.) = 8.0

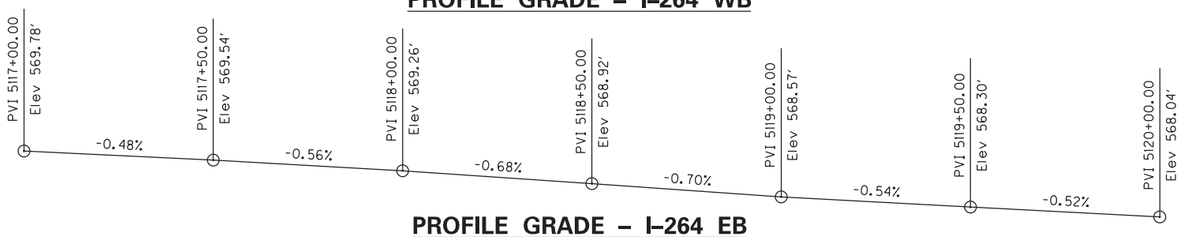


A MINIMUM VERTICAL I-264 WB BRIDGE CLEARANCE
STA.120+93.25 - 16.61'

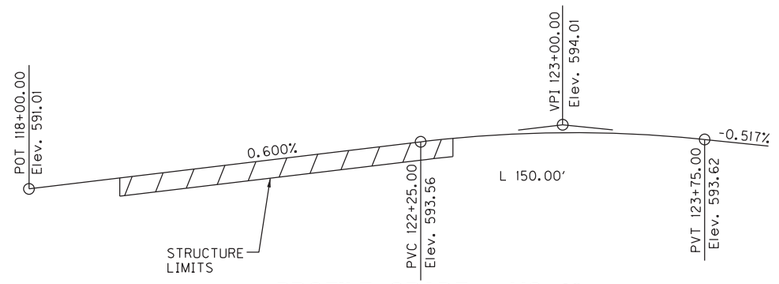
B MINIMUM VERTICAL I-264 EB BRIDGE CLEARANCE
STA.121+72.66 - 17.23'



PROFILE GRADE – I-264 WB



PROFILE GRADE – I-264 EB



PROFILE GRADE – US 42

REVISION	DATE

DATE: OCTOBER, 2020	CHECKED BY
DESIGNED BY: A.C. THOMAS	D.H. DEITZ
DETAILED BY: J.A. ROSE	D.H. DEITZ

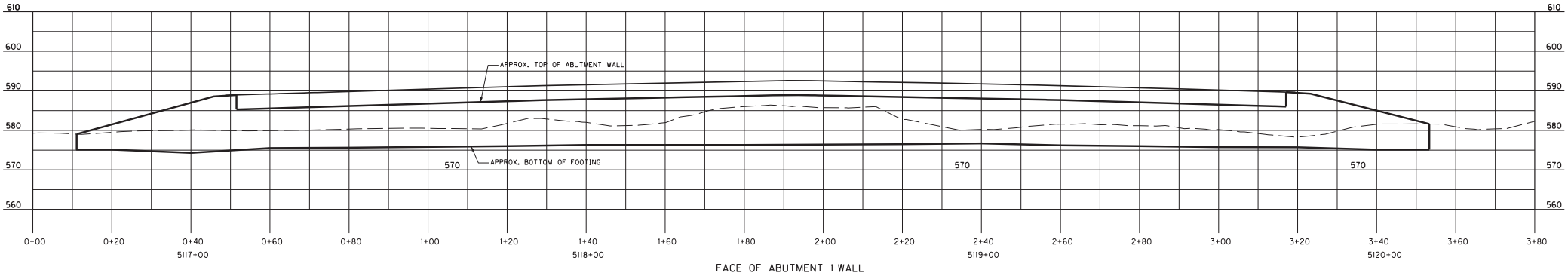
Commonwealth of Kentucky
DEPARTMENT OF HIGHWAYS

COUNTY
JEFFERSON

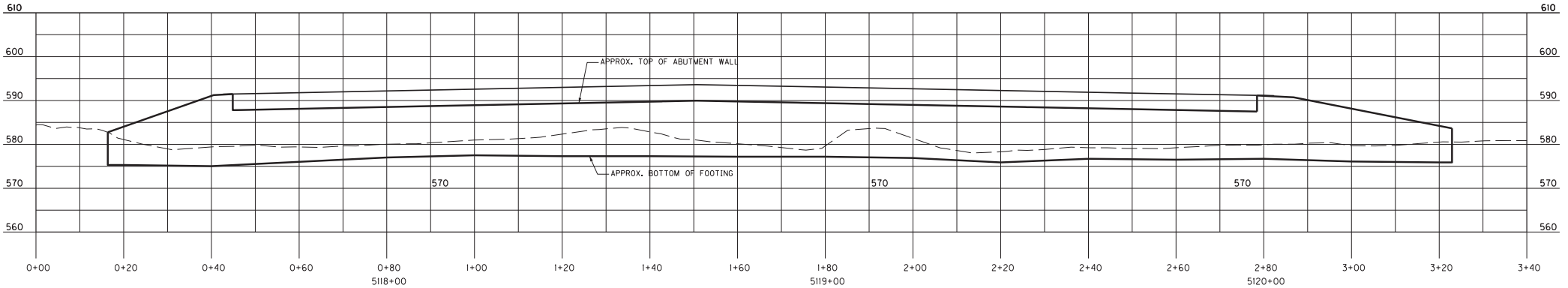
ROUTE	CROSSING
US 42	I-264

ELEVATION

ITEM NUMBER	PREPARED BY	SHEET NO.
5-804.00	*PALMER ENGINEERING CO.*	DRAWING NO.



FACE OF ABUTMENT 1 WALL



FACE OF ABUTMENT 2 WALL

S-001-2021 05-0804.00 Kentucky Transportation Cabinet

ID	Latitude	Longitude	Hole	Station	Offset	Elevation(ft)	Comments
1	38.279429	-85.636224	B-1001	120+48.92	145.54	582.19	
2	38.279577	-85.636386	B-1002	120+57.16	74.88	582.03	
3	38.279834	-85.636682	B-1003	120+68.7	-51.1	584.59	
4	38.279983	-85.636835	B-1004	120+78.9	-136.26	586.99	
5	38.2798	-85.63618	B-1005	121+57.15	63.5	567.88	
6	38.280041	-85.636443	B-1006	121+70.5	-51.49	567.01	
7	38.279871	-85.635883	B-1007	122+33.95	134.8	587.936	
8	38.279979	-85.635955	B-1008	122+48.77	86.8	590.13	
10	38.280365	-85.636435	B-1010	122+59.06	-129.61	583.04	
9	38.280233	-85.63624	B-1009	122+61.58	-55.99	585.48	