STRUCTURE GEOTECHNICAL REPORT

IL-15 Bridge over F.A.I. 57/64

Existing S.N. 041-0025
Proposed S.N. 041-0023

FAP 821
SECTION (41-3HB-1)I
JEFFERSON COUNTY, ILLINOIS
JOB NO. P-99-007-20
JOB NO. D-99-043-15
PTB 195/063
KEG NO. 20-1066.00

02/24/2022
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Kaskaskia
Engineering Group, LLC

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EXHIBITS

1.0 Project Description and Scope

1.1 Introduction

The geotechnical study summarized in this report was performed by Kaskaskia Engineering Group, LLC (KEG) for a proposed bridge carrying FAP 821 (IL Route 15) over I-57/64 in Jefferson County, Illinois. The purpose of this report is to document subsurface geotechnical conditions, provide analyses of anticipated site conditions as they pertain to the project described herein, and to present design and construction recommendations for the proposed structure.

1.2 Project Description

The project consists of the replacement of a four-span rigid frame steel bridge (existing SN 041-0025) carrying FAP 821 (IL Route 15) over I-57/64 in Jefferson County, Illinois.

The general location of the proposed structure is shown on a Location Map, Exhibit A. The project is located approximately 2.5 miles West of Mt. Vernon, Illinois. The site lies within the limits of the Third Principal Meridian (T. 2S R. 2E) within the Mt. Vernon Hill Country of the Till Plains Section of the Central Lowland Province.

1.3 Proposed Structure Information

The proposed structure SN 041-0023 will consist of a two-span bridge, which will be built on a 10-degree skew from the centerline of I-57/64 and will provide three 15 ft.-wide driving lanes in each direction, and a 14-foot multi-use path down the center, with a total width of 118 ft out-to-out. The proposed bridge centerline station will be at 529+60.23 on IL 15 and 770+55.16 on I-57/64. The bridge will consist of two, 124 ft.- 7 5/8-inch spans and will measure 253 ft. back-to-back of abutments. A Type, Size, and Location Plan (TS&L) is included in Exhibit C. Further substructure details will be based on the findings of this SGR.

2.0 Field Exploration

2.1 Subsurface Exploration and Testing

The field exploration consisted of five (5) structure borings advanced using Standard Penetration Test (SPT) methods (Designated ST-1 through ST-5) and two (2) Shelby Tube (ST) borings (Designated BM-03ST and BM-04ST. The boring locations were determined by KEG in conjunction with Crawford, Murphy, and Tilly (CM&T). The boring locations were staked and surveyed for stationing and elevations by CM&T. All SPT samples were taken with a calibrated automatic hammer. The borings were drilled from October 5 through October 12, 2021. See Exhibit B, Boring Locations and Exhibit E, Soil Profile.

The drilling was performed by Geotechnology, Inc. A KEG representative was present to log samples and perform field testing. The field testing consisted of Rimac strength tests on all intact cohesive samples as well as a pocket penetrometer. Pocket penetrometer readings were taken for informational purposes only. The hollow stem auger (HSA) method was utilized to obtain SPT soil samples on 2.5-ft. intervals to termination, or refusal depths . Shelby Tube (ST) samples were also obtained. NX rock coring was also conducted to obtain rock samples. A summary of the materials encountered can be found below. Detailed information regarding the nature and

thickness of the soils and rock encountered and the results of the field sampling and laboratory testing are shown in Exhibit D, Boring Logs.

2.2 Subsurface Conditions

The depths of the borings ranged from 22-ft to 46.33-ft. Topsoil was noted in the boring ranging from 2 to 3-inches thick.

Below the topsoil, the soils consist of clays, silty clays, shales, limestone, and sandstone. Three (3) of the borings were advanced into bedrock using NX rock coring methods. Atterberg Limit tests and unconfined compression tests were performed on various samples. The results of the laboratory testing are shown on Exhibit C, Boring Logs.

Clay – Exhibited in ST-3 from 0 to 3.0 ft. below GSE and in ST-4 from 2.0 to 8.0 ft. below GSE. The N-values ranged from 3 to 10 blows per foot (bpf) and the unconfined compressive strength (Qu) ranged from 1.0 to 2.1 tons per square foot (tsf). The moisture content ranged from 18 to 24 percent.

Silty Clay/Clayey Silt/Loam – Exhibited in ST-1 from 0 to 8.0 ft. below GSE, ST-2 from 0 to 5.5 ft. below GSE, and ST-4 from 0 to 2.0 ft. below GSE. The N-values ranged from 7 to 9 bpf and the Qu ranged from 1.1 to 2.4 tsf. The moisture content ranged from 18 to 28 percent.

Shale/Shaley Clay/Clayey Shale (Soil Borings) – Exhibited in ST-1 from 8.0 to 11.25 and 13.0 to 20.0 ft. below GSE, ST-2 from 5.5 to 23.0 ft. below GSE, ST-3 from 3.0 to 15.5 ft. below GSE, ST-4 from 8.0 to 15.0 ft. below GSE, and 0.17 to 20.5 ft. below GSE. The N-values ranged from 8 bpf to 50 blows per 1 inch of penetration. The Qu ranged from 1.3 to greater than 4.5 tsf. The moisture content ranged from 6 to 27 percent.

Limestone (Soil Borings) – Exhibited in ST-2 from 23.0 to 25.0 ft. below GSE and in ST-5 from 20.5 to 22.0 ft. below GSE. The N-value was approximately 50 blows per 1” of penetration. The Qu and moisture content was unable to be determined for this layer.

Limestone (Rock Core) – Three (3) borings were advanced into bedrock after Hollow-Stem Auger refusal. ST-1 exhibited limestone from 25.5 to 29.0, 32.0 to 33.5, and 42.5 to 46.33 ft. below GSE. ST-3 exhibited limestone from 23.5 to 27.0, 29.0 to 30.0, and 39.0 to 42.0 ft. below GSE. ST-4 exhibited limestone from 27.0 to 31.75 and 38.0 to 40.0 ft. below GSE.

Shale (Rock Core) – Three (3) borings were advanced into bedrock after Hollow-Stem Auger refusal. ST-1 exhibited shale from 20.0 to 25.5, 29.0-32.0, and 33.5 to 42.5 ft. below GSE. ST-3 exhibited Shale from 15.5 to 23.5, 27.0 to 29.0, and 30.0 to 39.0 ft. below GSE. ST-4 exhibited Shale from 15.0 to 27.0 and 31.75 to 38.0 ft. below GSE.

Sandstone – Exhibited in ST-1 from 11.25 to 13.0 ft. below GSE. The N-value was determined to be 40 bpf. The UCS and Moisture Content was unable to be determined for this layer.

3.0 Geotechnical Evaluations

3.1 Settlement

Settlement is expected in the west, and east access ramp due to the 17 to 20 feet fill necessary for their construction. Therefore, settlement calculations were performed. Consolidation tests were performed on samples from Boring BM-03ST and BM-04ST at depths between 3 to 5 feet

and 9 to 11 feet below the ground surface, respectively. Boring BM-03 was used for the settlement analysis in the west access ramp and BM-04 for the east access ramp. The over-consolidation ratios (OCRs) ranged between 2.02 and 15.18, indicating that the soils are generally over consolidated. The pre-consolidation pressures of these soils were determined to be 2,800 psf. Therefore, a settlement of 1.78 in. was calculated for the west access ramp and 1.16 in. for the east access ramp.

The time for consolidation was calculated using empirical values, giving the time for 90 percent consolidation (t90) less than one day. Based on these estimates, settlement is not anticipated to be a concern, and the soil is expected to settle in the early stages of construction. Settlement calculations can be found in Exhibit F.

3.2 Slope Stability

A stability analysis using SLOPE/W was performed using the proposed roadway and bridge geometry on the TS&L and soil characteristics from Boring ST-1 and ST-4. Two conditions were modeled for each scenario: end-of-construction and long-term stability. A critical factor of safety (FOS) was calculated for each condition. According to current standard of practice, the target FOS is 1.5 for end-of-construction and long-term slope stability. The slope stability analyses indicated that the required minimum FOS for all conditions were met.

In order to model the end-of-construction condition: full cohesion and a friction angle of 0 degrees were assumed. Nominal values for cohesion were used with full friction angle to model the long-term condition to analyze the theoretical condition where pore water pressure has dissipated. Nominal values were between 50 and 100 psf for the cohesive soils, with friction angles between 26 and 30 degrees.

The Bishop Circular Method, which generates circular-shaped failure surfaces, was used to calculate the critical failure surfaces and FOS for the proposed conditions. The FOS obtained in the analysis is shown in Table 3.2. SLOPE/W program output from this analysis can be found in SLOPE/W Slope Stability Analysis, Exhibit G.

Table 3.2 – Slope Stability Critical FOS

Location (2H:1V Slope)	Critical FOS	
	End-of Construction	Long Term
West Abutment (ST-1)	6.4	1.8
East Abutment (ST-4)	6.6	1.7

3.3 Scour

The proposed structure will not cross a river or other tributary; therefore, scour is not an issue.

3.4 Seismic Considerations

The determination of Seismic Site Class was based on the method described by IDOT AGMU Memo 09.1 - Seismic Site Class Definition and the IDOT provided spreadsheet titled: '*Seismic Site Class Determination*.' Using these resources, the controlling global site class for this project is Soil Site Class C.

Additional seismic parameters were calculated for use in design of the structure. Published information and mapping from the USGS, including software directly applicable to the AASHTO Guide Specifications for LRFD Seismic Bridge Design, was used to develop the parameters for the bridge location. The values, based on Soil Site Class C, are summarized below.

Table 3.4 - Summary of Seismic Parameters

Parameter	Value
Soil Site Class	C
Spectral Response Acceleration, 0.2 Sec, S_{DS}	0.598g (Site Class C)
Spectral Response Acceleration, 1.0 Sec, S_{D1}	0.216g (Site Class C)
Seismic Performance Zone	2

As indicated in the table above, the Seismic Performance Zone is 2, based on S_{D1} and Table 3.15.2 in the IDOT Bridge Manual, the Soil Site Class C, and Figure 2.3.10-2 in the IDOT Bridge Manual.

4.0 Foundation Evaluations and Design Recommendations

4.1 Bearing Resistance

A shallow foundation is considered a feasible alternative to driven piles for the pier. The soil encountered in the borings at the anticipated bearing elevation of the pier consists of a clay material. The assumed bearing elevation at the bottom of the pier is El. 485.7. The soil from Boring ST-3 at the assumed bearing elevation has an N-value of 7 bpf and a UCS of 1.5 tsf. The calculated allowable bearing resistance, using a Bearing Resistance Factor of 0.5, at the approximate bottom elevation of the pier (El. 485.7), is estimated to be 4,500 psf. Sliding resistance is calculated as the lessor of the cohesion or one half of the vertical stress. See Exhibit H for calculations performed.

Table 4.1 – Factored Bearing and Sliding Resistances

Substructure Unit	Factored Bearing Resistance (psf)	Factored Sliding Resistance (psf)
Pier 1	4,500	240

If after final design the bearing elevation changes, KEG should be informed to review that the above recommendations still apply.

4.2 Driven Piles

The foundations supporting the proposed bridge must provide sufficient support to resist dead and live loads. The IDOT Static Method uses the LRFD Pile Design Guide Procedure to estimate the pile lengths (Pile Length/Pile Type, Exhibit I).The factored reactions and the preliminary design loads, as provided by CM&T are shown in Table 4.2.1. The Nominal Required Bearing (RN) represents the resistance the pile will experience during driving and will assist the contractor in selecting a proper hammer size. The Factored Resistance Available (RF) documents the net

long term axial factored pile capacity available at the top of the pile to support factored substructure loadings.

Table 4.2.1 - Preliminary Design Loads

Substructure Unit	Factored Reactions (kips)
West Abutment	6,100
Pier 1	13,400
East Abutment	6,100

The estimated pile lengths for applicable H-pile types are shown in Tables 4.2.2 through 4.2.7 below. The Nominal Required Bearing (R_N) represents the resistance the pile will experience during driving and will assist the contractor in selecting a proper hammer size. The Factored Resistance Available (R_F) documents the net long-term axial factored pile capacity available at the top of the pile to support factored substructure loadings.

According to the IDOT Geotechnical Manual (2020), down drag (DD) loading becomes a concern when more than 0.4 inches of downward soil movement along the pile is anticipated after driving. While the settlement expected ranged between 1.29 and 1.79 in., as mentioned in section 3.1, 90 percent of consolidation is expected in the early stages of construction, not after driving. Therefore, down drag is not expected to be a concern. The Factored Resistance Available (R_F) and pile length with DD considered is included in the results for consideration. Liquefaction has not been included in the pile calculations.

Table 4.2.2 - Estimated Pile Lengths for HP 10x42 Steel H-Piles

Substructure Unit	R_n Nominal Required Bearing (kips)	Without Downdrag		With Downdrag		Assumed Pile Cut-off Elevation (ft.)
		R_F Factored Resistance Available (LRFD) (kips)	Estimated Pile Length (ft.)	R_F Factored Resistance Available (LRFD) (kips)	Estimated Pile Length (ft.)	
West Abutment ST-1	335	178	29	44	29	507.62
Pier 1 ST-3	335	172	13	-	-	487.70
East Abutment ST-4	335	182	29	78	29	508.53

Table 4.2.3 - Estimated Pile Lengths for HP 12x53 Steel H-Piles

Substructure Unit	R_n Nominal Required Bearing (kips)	Without Downdrag		With Downdrag		Assumed Pile Cut-off Elevation (ft.)
		R_F Factored Resistance Available (LRFD) (kips)	Estimated Pile Length (ft.)	R_F Factored Resistance Available (LRFD) (kips)	Estimated Pile Length (ft.)	
West Abutment ST-1	418	225	29	64	29	507.62
Pier 1 ST-3	418	219	13	-	-	487.70
East Abutment ST-4	418	203	28	78	28	508.53

Table 4.2.4 - Estimated Pile Lengths for HP 12x63 Steel H-Piles

Substructure Unit	R_n Nominal Required Bearing (kips)	Without Downdrag		With Downdrag		Assumed Pile Cut-off Elevation (ft.)
		R_F Factored Resistance Available (LRFD) (kips)	Estimated Pile Length (ft.)	R_F Factored Resistance Available (LRFD) (kips)	Estimated Pile Length (ft.)	
West Abutment ST-1	497	255	30	93	30	507.62
Pier 1 ST-3	497	248	14	-	-	487.70
East Abutment ST-4	497	260	30	134	30	508.53

Table 4.2.5 - Estimated Pile Lengths for HP 14x73 Steel H-Piles

Substructure Unit	R_n Nominal Required Bearing (kips)	Without Downdrag		With Downdrag		Assumed Pile Cut-off Elevation (ft.)
		R_F Factored Resistance Available (LRFD) (kips)	Estimated Pile Length (ft.)	R_F Factored Resistance Available (LRFD) (kips)	Estimated Pile Length (ft.)	
West Abutment ST-1	578	313	30	123	30	507.62
Pier 1 ST-3	578	306	14	-	-	487.70
East Abutment ST-4	578	288	29	140	29	508.53

Table 4.2.6 - Estimated Pile Lengths for HP 14x89 Steel H-Piles

Substructure Unit	R_n Nominal Required Bearing (kips)	Without Downdrag		With Downdrag		Assumed Pile Cut-off Elevation (ft.)
		R_F Factored Resistance Available (LRFD) (kips)	Estimated Pile Length (ft.)	R_F Factored Resistance Available (LRFD) (kips)	Estimated Pile Length (ft.)	
West Abutment ST-1	705	383	32	191	32	507.62
Pier 1 ST-3	705	375	16	-	-	487.70
East Abutment ST-4	705	357	31	207	31	508.53

Table 4.2.7 - Estimated Pile Lengths for HP 14x117 Steel H-Piles

Substructure Unit	R_n Nominal Required Bearing (kips)	Without Downdrag		With Downdrag		Assumed Pile Cut-off Elevation (ft.)
		R_F Factored Resistance Available (LRFD) (kips)	Estimated Pile Length (ft.)	R_F Factored Resistance Available (LRFD) (kips)	Estimated Pile Length (ft.)	
West Abutment ST-1	929	493	35	296	35	507.62
Pier 1 ST-3	929	485	19	-	-	487.70
East Abutment ST-4	929	499	35	347	35	508.53

KEG recommends one test pile be performed at the pier location, at a minimum. A test pile is performed prior to production driving so that actual, on-site field data can be gathered to determine pile driving requirements for the project. This is also the manner in which the contractor's proposed equipment and methodologies identified in their Pile Installation Plan can be assessed.

The piles are expected to be driven into penetrable shale and weathered sandstone and pre-coring should not be required to reach estimated embedment depths. Therefore, KEG recommends using pile shoes to facilitate driving and protect piles from damage.

4.3 Drilled Shafts

The foundations supporting the proposed bridge must provide sufficient support to resist dead and live loads. The preliminary design loads for the abutments and the pier, as provided by CM&T, are provided in Table 4.2 above. Based on the subsurface exploration, competent shale is encountered around elevation El. 479.3 and 481.50, near the abutments and pier locations.

Recommendations for drilled shafts with varying sockets extending to various depths into the underlying competent shale and limestone, developing capacity from side and/or tip resistance, are provided for design support of the abutments and the pier. The provided capacities are based on boring information, empirical values of weathered limestone and shale strength properties and utilizing the IDOT Drilled Shaft Axial Capacity in Rock spreadsheet as provided by IDOT BBS Foundations and Geotechnical Unit. LRFD Resistance Factors of 0.55 for side resistance and 0.5 for tip resistance are incorporated into the allowable capacities, respectively.

Tables 4.3.1 thru 4.3.3 – Estimated Drilled Shaft Axial Capacity below contain a summary of Factored Shaft Resistances available for various shaft diameters based on socket depths into the underlying shale and limestone for each substructure. IDOT Drilled Axial Capacity Input sheets and Design Tables are included in Exhibit J, Drilled Shaft Design.

Table 4.3.1 - Estimated Drilled Shaft Axial Capacity for West Abutment (ST-1)

Diameter Socket (in.)	Socket Depth (ft.)	Nominal Shaft Resistance Available (kips) TIP	Factored Shaft Resistance Available (kips) TIP	Nominal Shaft Resistance Available (kips) SIDE	Factored Shaft Resistance Available (kips) SIDE	Tip Elev. (ft.)
36	4	772*	411*	--	--	477.2
	8	1137*	606*	--	--	473.2
	12	1791*	943*	--	--	469.2
42	4	951*	505*	--	--	477.2
	8	1397*	741*	--	--	473.2
	12	2263*	1186*	--	--	469.2
48	4	1143*	605*	--	--	477.2
	8	1912*	1008*	--	--	473.2
	12	2710*	1418*	--	--	469.2
60	4	1568*	826*	--	--	477.2
	8	3152*	1643*	--	--	473.2
	12	3721*	1940*	--	--	469.2

*Resistance Method Side + Tip

Table 4.3.2 - Estimated Drilled Shaft Axial Capacity for Pier (ST-3)

Diameter Socket (in.)	Socket Depth (ft.)	Nominal Shaft Resistance Available (kips) TIP	Factored Shaft Resistance Available (kips) TIP	Nominal Shaft Resistance Available (kips) SIDE	Factored Shaft Resistance Available (kips) SIDE	Tip Elev. (ft.)
36	4	--	--	465	256	475.4
	8	4874*	2484*	--	--	471.4
	12	10554	5277	--	--	467.4
42	4	--	--	543	299	475.4
	8	8676	4338	--	--	471.4
	12	14366	7183	--	--	467.4

Diameter Socket (in.)	Socket Depth (ft.)	Nominal Shaft Resistance Available (kips) TIP	Factored Shaft Resistance Available (kips) TIP	Nominal Shaft Resistance Available (kips) SIDE	Factored Shaft Resistance Available (kips) SIDE	Tip Elev. (ft.)
48	4	660*	340*	660*	340*	475.4
	8	13843	6921	--	--	471.4
	12	18412	9206	--	--	467.4
60	4	1329*	677*	1329*	677*	475.4
	8	19652	9826	--	--	471.4
	12	27560	13780	--	--	467.4

*Resistance Method Side + Tip

Table 4.3.3 - Estimated Drilled Shaft Axial Capacity for East Abutment (ST-4)

Diameter Socket (in.)	Socket Depth (ft.)	Nominal Shaft Resistance Available (kips) TIP	Factored Shaft Resistance Available (kips) TIP	Nominal Shaft Resistance Available (kips) SIDE	Factored Shaft Resistance Available (kips) SIDE	Tip Elev. (ft.)
36	4	--	--	562	309	477.5
	8	5369*	2741*	--	--	473.5
	12	12399	6200	--	--	469.5
42	4	693*	356*	--	--	477.5
	8	8676	4338	--	--	473.5
	12	16365	8182	--	--	469.5
48	4	873*	447*	--	--	477.5
	8	13843	6921	--	--	473.5
	12	19115	9557	--	--	469.5
60	4	1786*	907*	--	--	477.5
	8	22727	11364	--	--	473.5
	12	24924	12462	--	--	469.5

*Resistance Method Side + Tip

4.4 Lateral Pile Response

Generally, the geotechnical engineer provides soil parameters to the structural engineer so that an L-Pile program or other approved software can be used for the lateral or displacement analysis of the foundations. Tables 4.4.1 and 4.4.2 are included for the structural engineer's use in determining lateral pile response.

Table 4.4.1 - Soil Parameters for Lateral Pile Load Analysis

Boring	Depth at Bottom of Layer (Feet)	γ (pcf)	Short Term		Long Term		N Value (Est. Range)	Assumed % Fines < #200	K (pci)	ε50
			Φ (deg.)	c (psf)	Φ (deg.)	c (psf)				
ST-1	492.5	120	0	1000	26	100	6-10	65	100	0.01
	484.5	120	0	2200	26	100	7-8	65	1000	0.005
	481.2	135	0	1300	19	100	9	85	500	0.007
ST-2	492.3	120	0	1000	26	100	6-10	65	100	0.01
	486.8	120	0	1100	26	100	7-8	65	500	0.007
	476.8	135	0	1500	19	150	8-38	85	500	0.007
ST-3	489.9	120	0	1000	26	100	6-10	65	100	0.01
	486.6	120	0	1000	26	50	3	85	100	0.01
	479.3	135	0	1700	19	150	7-42	85	500	0.007
ST-4	494.5	120	0	1000	26	100	6-10	65	100	0.01
	492.5	120	0	4000	26	100	10	65	1000	0.005
	486.5	120	0	1750	26	100	9-10	85	500	0.007
ST-5	492.7	125	0	2200	12	150	7-18	25	1000	0.005

Table 4.4.2 - Rock Parameters for Lateral Pile Load Analysis

Rock Type	Weak Rock			Strong Rock	
	y (psf)	RQD	Qu (tsf)	y (psf)	Qu (tsf)
Shale (Soft)	135	18-53	5-7	--	--
Shale	--	--	--	145	300
Limestone	--	--	--	150	665

5.0 Construction Considerations

5.1 Construction Activities

Construction activities should be performed in accordance with the current IDOT Standard Specifications for Road and Bridge Construction and any pertinent Special Provisions or Policies.

Should any design considerations assumed by KEG change, KEG should be contacted to determine if the recommendations stated in this report still apply.

5.2 Temporary Sheeting and Soil Retention

Temporary shoring is not anticipated as the proposed bridge will be constructed with the existing bridge remaining open to traffic.

5.3 Site and Soil Conditions

Provisions of the Standard Specifications should adequately address site and soil conditions.

6.0 Computations

Computations and analyses for special circumstances, if any, are included as exhibits. Please refer to each section of the report for reference to the exhibit containing any such calculations or analysis used.

7.0 Geotechnical Data

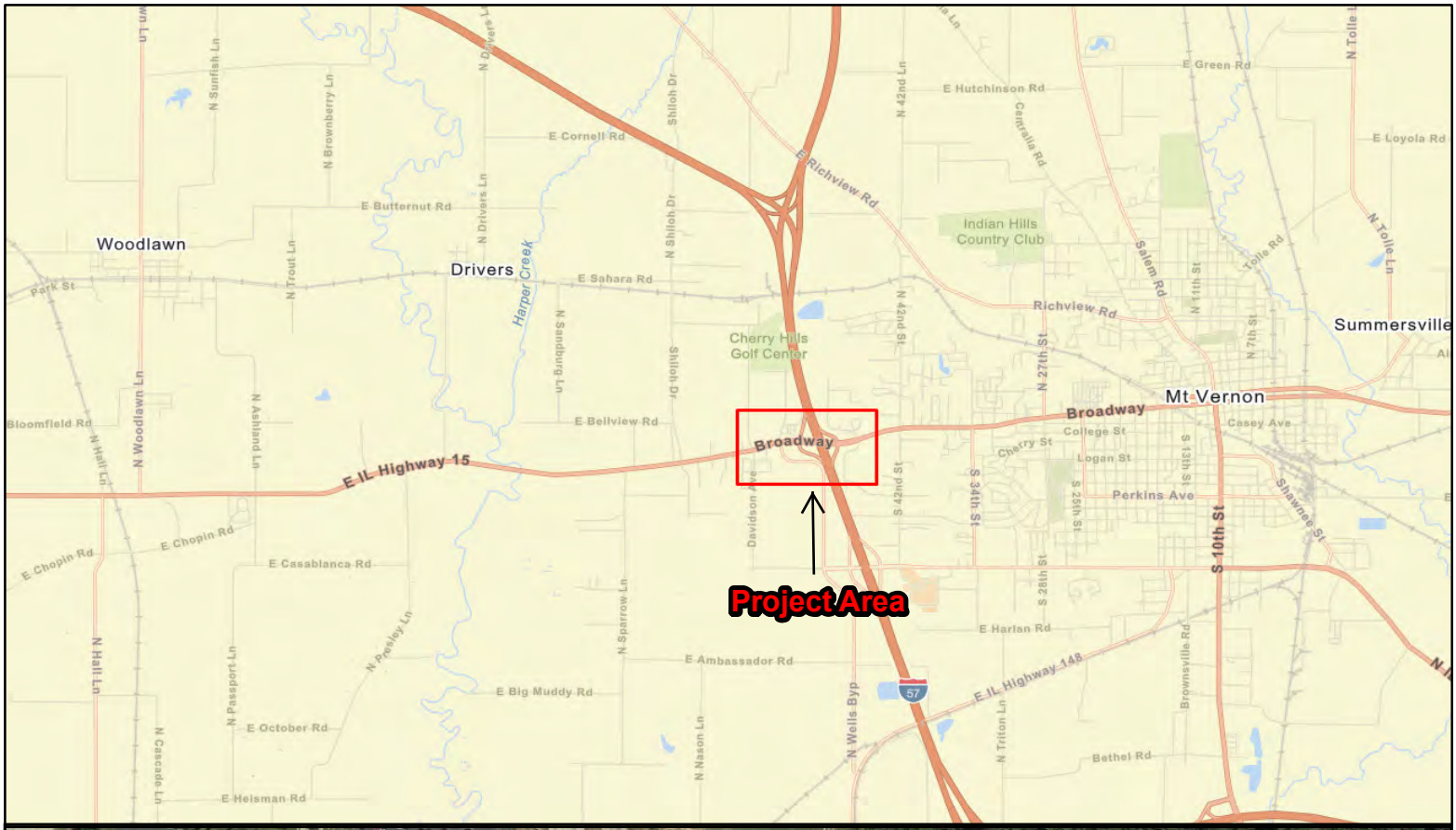
Soil boring logs can be found in Exhibit D. The Subsurface Profile can be found in Exhibit E.

8.0 Limitations

The recommendations provided herein are for the exclusive use of CM&T and the Illinois Department of Transportation (IDOT). They are specific only to the project described and are based on the subsurface information obtained by KEG at the seven boring locations within the structure area, KEG's understanding of the project as described herein, and geotechnical engineering practice consistent with the standard of care. No other warranty is expressed or implied. KEG should be contacted if conditions encountered during construction are not consistent with those described.

EXHIBIT A

LOCATION MAP



Kaskaskia Engineering Group, LLC

LOCATION MAP

IL 15 Bridge over F.A.I. 57/64
Jefferson County, Illinois

Exhibit No.

A

KEG JOB #20-1066.00

EXHIBIT B

BORING PLAN

Kaskaskia Engineering Group, LLC

BORING LOCATION MAP

IL 15 Bridge over F.A.I. 57/64
Jefferson County, Illinois

Exhibit No.

B

KEG JOB #20-1066.00

EXHIBIT C

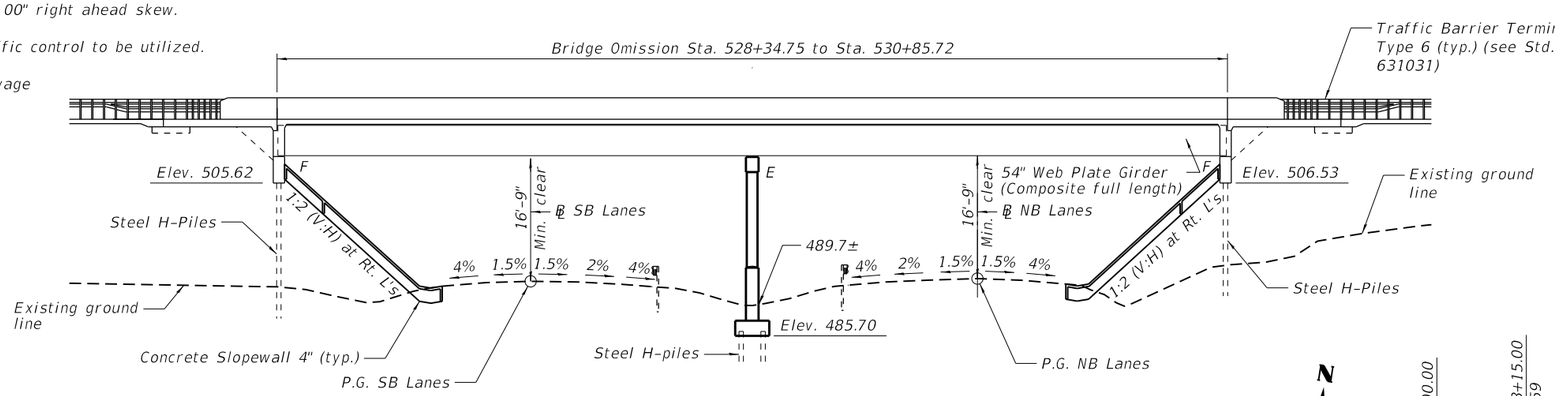
TYPE, SIZE, AND LOCATION PLAN (TS&L)

Benchmark: BM #365 – "□" cut on northwest parapet wall of existing SN 041-0025, NAVD 88, Elevation = 514.687'

Existing Structure: SN 041-0025 was originally built in 1968 as F.A.P. 821 (IL Rt. 15) Section (41-3HB-1)I. The existing structure is a 4 span rigid frame steel bridge with stub abutments on steel H-piles. The intermediate supports are founded on concrete spread footings with pedestals. 330'-0" Bk. to Bk. abutments, 88'-0" out to out deck, 22° 40' 00" right ahead skew.

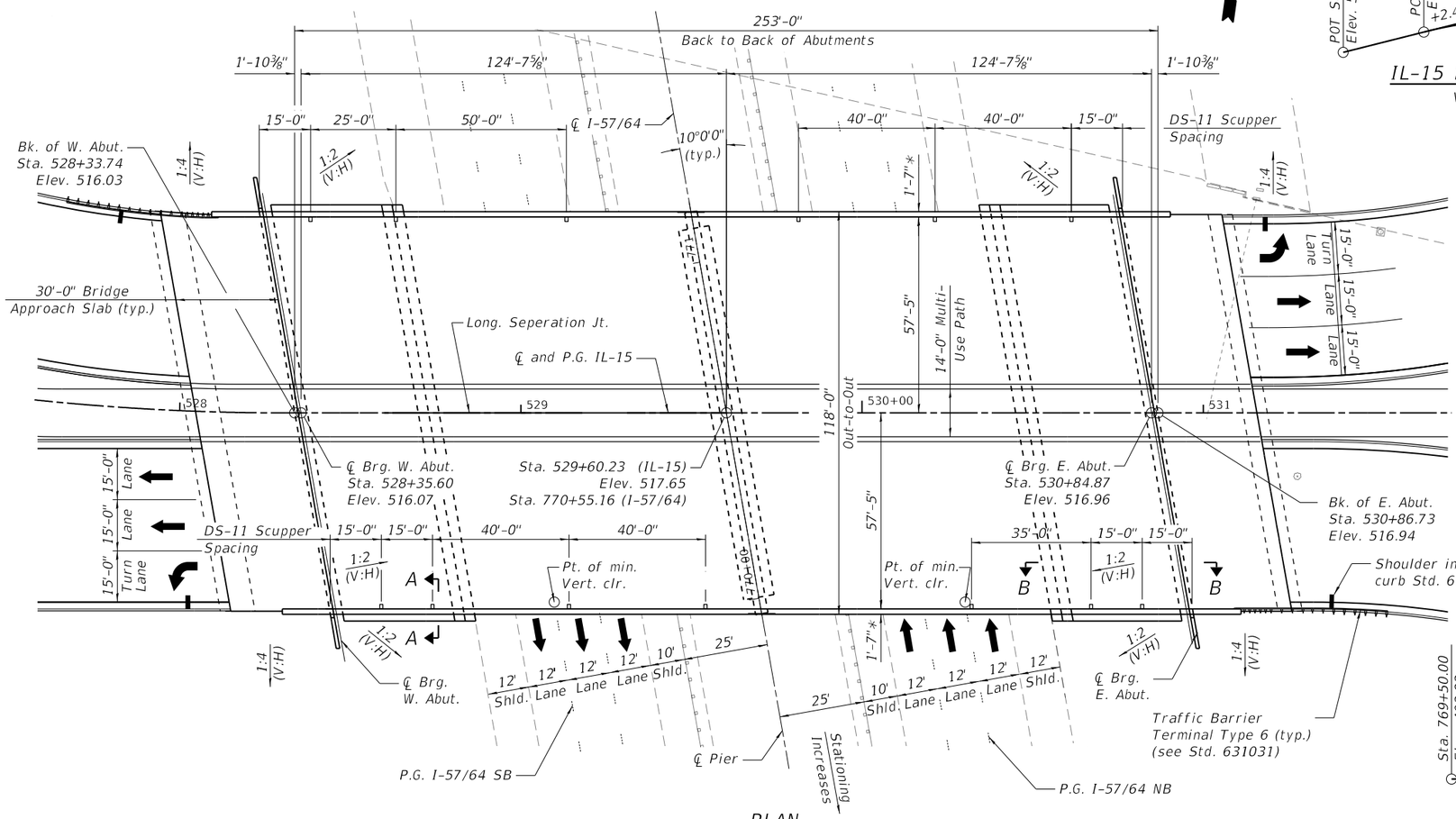
No traffic control to be utilized.

No Salvage



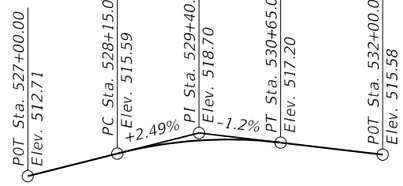
ELEVATION

(Looking North)



PLAN

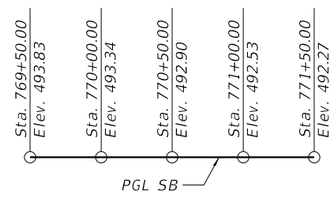
* Additional parapet width to accomodate aesthetic form liners



IL-15 PROFILE GRADE

V.C. = 250'-0"

LOCATION SKETCH



I-57/64 SB PROFILE GRADE

I-57/64 NB PROFILE GRADE

HIGHWAY CLASSIFICATION

F.A.P. 821 – IL Rt. 15
Functional Class: Other Principal Arterial
ADT: 21,500 (2024); 27,300 (2044)
ADTT: 3,010 (2024); 3,822 (2044)
DHV: 2,482 (2044)
Speed: 25 mph (posted); 30 mph (design)
Two-Way traffic: Directional Dist. 50-50

HIGHWAY CLASSIFICATION

F.A.I. 57/64 – I-57/64
Functional Class: Interstate
ADT: 43,300 (2024) I-57/64 SB; 52,800 (2044) I-57/64 SB
ADT: 49,700 (2024) I-57/64 NB; 60,700 (2044) I-57/64 NB
ADTT: 17,753 (2024) I-57/64 SB; 21,648 (2044) I-57/64 SB
ADTT: 14,910 (2024) I-57/64 NB; 18,210 (2044) I-57/64 NB
DHV: 1,749 (2044) I-57/64 SB
DHV: 1,885 (2044) I-57/64 NB
Speed: 70 mph (posted) 75 mph (design)

LOADING HL-93

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

DESIGN SPECIFICATIONS

2020 AASHTO LRFD Bridge Design Specifications 9th Edition

DESIGN STRESSES

FIELD UNITS

f'c = 4,000 psi (superstructure)
f'c = 3,500 psi (substructure)
fy = 60,000 psi (reinforcement)
fy = 50,000 psi (M270 Grade 50) (girders)
fy = 36,000 psi (M270 Grade 36) (diaphragms)

SEISMIC DATA

Seismic Performance Zone (SPZ) = 2
Design Spectral Acceleration at 1.0 sec. (SD1) = 0.216g
Design Spectral Acceleration at 0.2 sec. (SDS) = 0.598g
Soil Site Class = C

GENERAL PLAN
IL 15 BRIDGE OVER F.A.I. 57/64
F.A.P. RTE 821 - SEC. XX-X
JEFFERSON COUNTY
STATION 529+60.23
STRUCTURE NO. 041-0025

MODEL: Default
FILE NAME: i:\IDOT\200660\Drawi\Structures\TSL_DDI-GPE IL 15 SN-0012.dgn

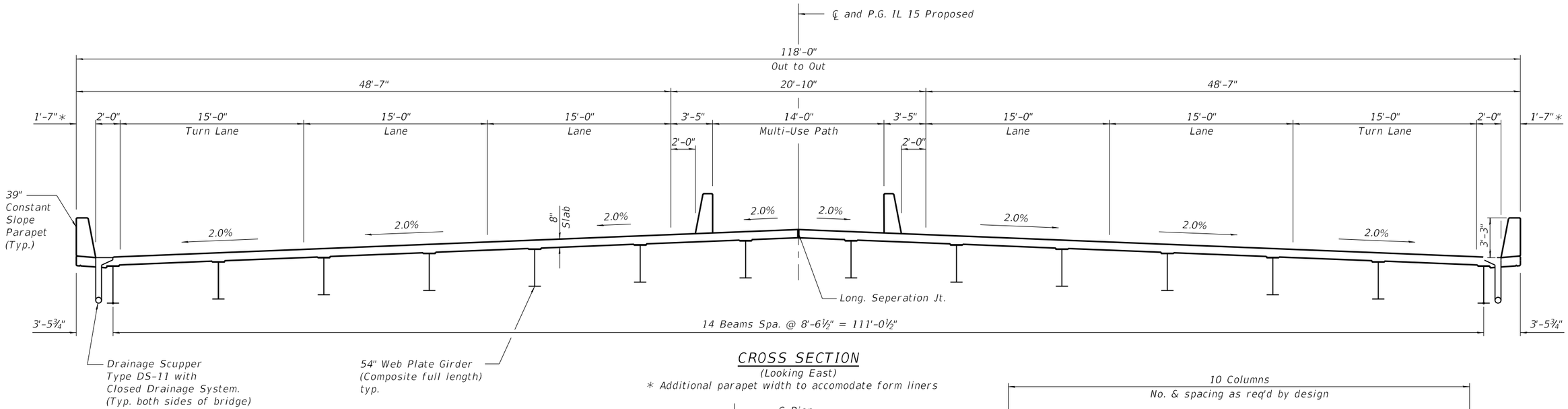
CMT
License No. 184-000613

USER NAME = Derek Cochran	DESIGNED -	REVISED -
	DRAWN -	REVISED -
PLOT SCALE = 40:0.0000 ':" / in.	CHECKED -	REVISED -
PLOT DATE = 2/22/2022 (5:13:45 PM)	DATE -	REVISED -

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

SCALE: | SHEET OF SHEETS | STA. | TO STA.

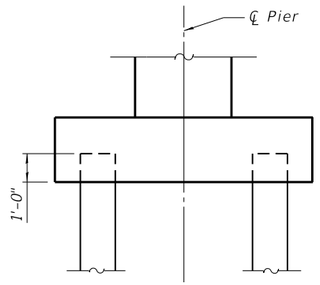
F.A. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
		CONTRACT NO.		
		ILLINOIS	FED. AID PROJECT	



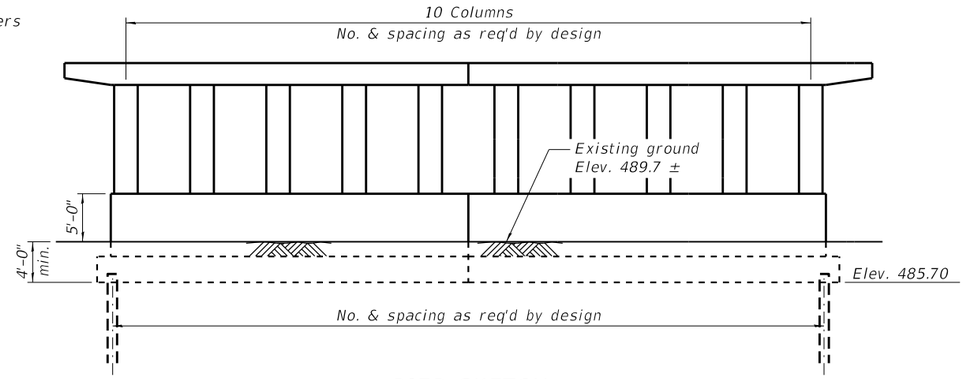
CROSS SECTION

(Looking East)

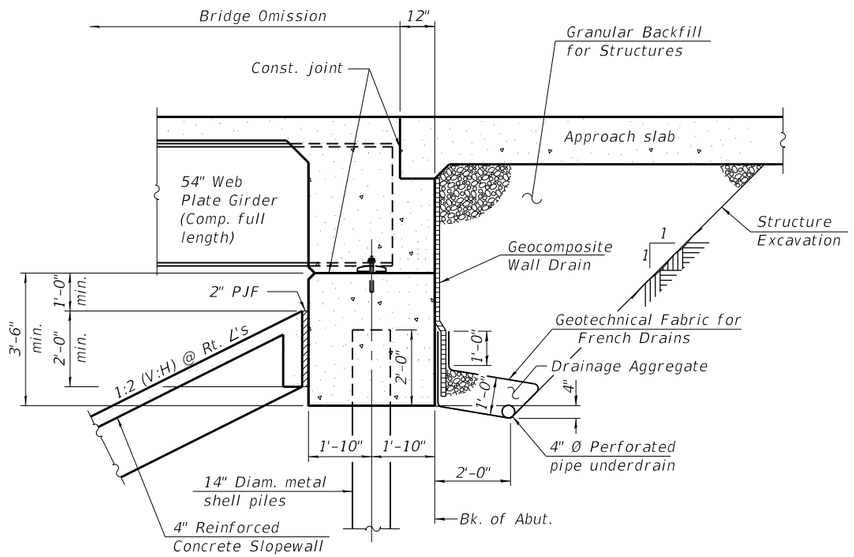
* Additional parapet width to accomodate form liners



SECTION THRU PIER FOOTING

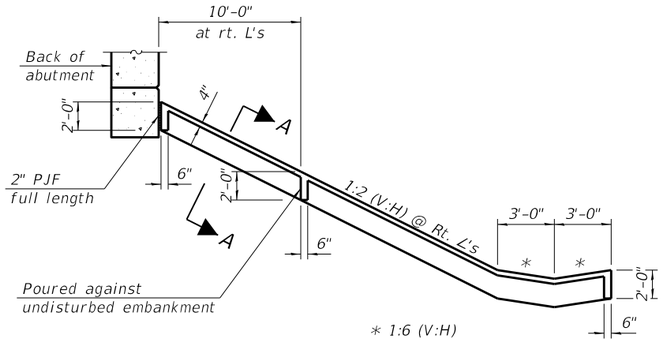


PIER SKETCH



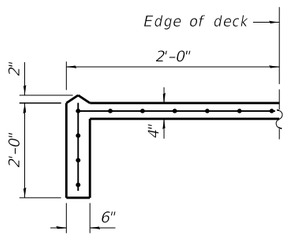
SECTION THRU INTEGRAL ABUTMENT

(Horiz. dim. @ Rt. ℄'s)



* 1:6 (V:H)

SECTION B-B



SECTION A-A

GENERAL PLAN
IL 15 BRIDGE OVER F.A.I. 57/64
F.A.P. RTE 821 - SEC. XX-X
JEFFERSON COUNTY
STATION 529+60.23
STRUCTURE NO. 041-0025

MODEL: Default
FILE NAME: I:\IDOT\2006610\Drawstructures\TSL_001-GPE IL 15 SN-002.dgn

CMT
License No. 184-000613

USER NAME = Derek Cochran	DESIGNED -	REVISED -	
	DRAWN -	REVISED -	
PLOT SCALE = 0:2.0000 '=' / in.	CHECKED -	REVISED -	
PLOT DATE = 2/22/2022 (5:11:33 PM)	DATE -	REVISED -	

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

SCALE: | SHEET OF SHEETS | STA. | TO STA.

F.A. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
		CONTRACT NO.		
ILLINOIS	FED. AID PROJECT			

EXHBIT D

BORING LOGS

Illinois Department of Transportation
Division of Highways

SOIL BORING LOG

Date 10/12/21

ROUTE FAP 821 **DESCRIPTION** I-57 / I-64 Interchange at IL-15 **LOGGED BY** KEG

SECTION (41-3HB-1) I **LOCATION** Mt. Vernon, Illinois

COUNTY Jefferson **DRILLING METHOD** HSA **HAMMER TYPE** Auto

STRUCT. NO. 041-0025
Station 772+07

BORING NO. ST-1
Station 528+39.52
Offset 43.9 ft RT
Ground Surface Elev. 492.50 ft

Surface Water Elev. _____ ft
Stream Bed Elev. _____ ft

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

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Description
	3			SILTY CLAY LOAM - Brown, gray and black, with lignite stains and coal fragments
	3 6	-	28	
489.5				
	1			SILTY CLAY - Gray, medium-stiff
	3 4	2.0 P	21	
-5				
	1			becomes stiff, brown and gray, with lignite stains and weathered sandstone fragments
	3 5	2.4 B	18	
484.5				
	1			SHALEY CLAY - Gray and brown orange, stiff, with lignite stains
	3 6	1.3 B	22	
-10				
481.2	13			
	50/3" -	2.5 P	21	SANDSTONE - Brown and gray, poorly cemented, highly weathered
479.5				
	25			SANDY SHALE - Brown, gray and black, soft
478.0	33 55	-	10	
-15				SHALE - Brown and gray, moderately hard
	23			becomes soft
	50/4" -	-	10	
	18			
	50/3" -	-	10	
472.5				
-20				

Borehole continued with rock coring.

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer)
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206)

Illinois Department of Transportation
Division of Highways

ROCK CORE LOG

Date 10/12/21

ROUTE FAP 821 **DESCRIPTION** I-57 / I-64 Interchange at IL-15 **LOGGED BY** KEG

SECTION (41-3HB-1) I **LOCATION** Mt. Vernon, Illinois

COUNTY Jefferson **CORING METHOD** NX

STRUCT. NO. 041-0025
Station 772+07

BORING NO. ST-1
Station 528+39.52
Offset 43.9 ft RT
Ground Surface Elev. 492.50 ft

CORING BARREL TYPE & SIZE
Core Diameter in
Top of Rock Elev. 478.00 ft
Begin Core Elev. 472.50 ft

	DEPTH (ft)	CORE (#)	RECOVERY (%)	R.Q.D. (%)	CORE TIME (min/ft)	STRENGTH (tsf)
SHALE - Gray, soft	472.50	1	50	18	2.26	
becomes weathered		2	100	66	3.6	
becomed moderately hard	-25					
	467.00					
LIMESTONE - Gray, moderately hard		3	100	73	4	
	463.50					
SHALE - Gray, soft, highly weathered	-30					
becomes moderately hard		4	100	68	3.2	
	460.50					
LIMESTONE - Gray, moderately hard						
	459.00					
SHALE - Gray, Moderately Hard						
becomes soft and weathered	-35					
		5	95	60	5.89	
	-40					

Color pictures of the cores _____
Cores will be stored for examination until _____
The "Strength" column represents the uniaxial compressive strength of the core sample (ASTM D-2938)

Illinois Department of Transportation
Division of Highways

ROCK CORE LOG

Date 10/12/21

ROUTE FAP 821 **DESCRIPTION** I-57 / I-64 Interchange at IL-15 **LOGGED BY** KEG

SECTION (41-3HB-1) I **LOCATION** Mt. Vernon, Illinois

COUNTY Jefferson **CORING METHOD** NX

STRUCT. NO. 041-0025
Station 772+07

BORING NO. ST-1
Station 528+39.52
Offset 43.9 ft RT
Ground Surface Elev. 492.50 ft

CORING BARREL TYPE & SIZE

Core Diameter in
Top of Rock Elev. 478.00 ft
Begin Core Elev. 472.50 ft

DEPTH (ft)	CORE (#)	RECOVERY (%)	R.Q.D. (%)	CORE TIME (min/ft)	STRENGTH (tsf)
SHALE - Gray, Moderately Hard *(continued)*					
becomes moderately hard	6	100	86	2.2	
450.00					
LIMESTONE - Gray, moderately hard					664.5
-45					
446.17					
End of Boring					
-50					
-55					
-60					

Color pictures of the cores _____
Cores will be stored for examination until _____
The "Strength" column represents the uniaxial compressive strength of the core sample (ASTM D-2938)


JO37102.01
ST-1
RUN-1 TOP
RUN-1 BOTTOM
RUN-2 TOP
RUN-2 BOTTOM
RUN-3 TOP


JO37102.01
ST-1
RUN-3
BOTTOM
RUN-4
TOP
RUN-4
BOTTOM
RUN-5
TOP


JO37102.01
ST-1
RUN-5
BOTTOM
RUN-6
TOP
RUN-6
BOTTOM

Illinois Department of Transportation
Division of Highways

SOIL BORING LOG

Date 10/11/21

ROUTE FAP 821 **DESCRIPTION** I-57 / I-64 Interchange at IL-15 **LOGGED BY** KEG

SECTION (41-3HB-1) I **LOCATION** Mt. Vernon, Illinois

COUNTY Jefferson **DRILLING METHOD** HSA **HAMMER TYPE** Auto

STRUCT. NO. 041-0025
Station 772+07

BORING NO. ST-2
Station 528+23.85
Offset 42.5 ft LT
Ground Surface Elev. 492.26 ft

Surface Water Elev. ft
Stream Bed Elev. ft

Groundwater Elev.:
First Encounter 473.3 ft ▼
Upon Completion ft
After Hrs. ft

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Description
				SILTY CLAY - Gray and brown, medium-stiff
	2			
	3 5	1.1 B	27	
	2			no recovery
	3 4	-	-	
-5				
486.8				
	1			SHALEY CLAY - Brown Orange and gray, medium-stiff, with lignite stains
	2 6	1.7 B	23	
	1			becomes very stiff, with weathered sandstone fragments
	5 16	-	19	
-10				
	4			becomes hard, no more lignite stains and sandstone
	12 25	-	15	
	2			becomes brown and gray
	7 31	1.3 B	12	
-15				
476.8				
	14			SHALE - Brown and gray, soft
	42 50/3"	-	14	
▼	13			
	11 21	-	18	becomes wet and weathered
-20				

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Description
				SHALE - Brown and gray, soft *(continued)*
	18			becomes gray and moderately hard
	36 50/2"	-	15	
469.3				
	50/1" - -	-	-	LIMESTONE - Gray, moderately hard Poor Recovery
467.3				
-25				
				Auger Refusal at 25', boring terminated End of Boring
-30				
-35				
-40				

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer)
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206)

Illinois Department of Transportation
Division of Highways

SOIL BORING LOG

Date 10/11/21

ROUTE FAP 821 **DESCRIPTION** I-57 / I-64 Interchange at IL-15 **LOGGED BY** KEG

SECTION (41-3HB-1) I **LOCATION** Mt. Vernon, Illinois

COUNTY Jefferson **DRILLING METHOD** HSA **HAMMER TYPE** Auto

STRUCT. NO. 041-0025
Station 772+07

BORING NO. ST-3
Station 529+60.23
Offset 0.0 ft
Ground Surface Elev. 489.85 ft

Surface Water Elev. _____ ft
Stream Bed Elev. _____ ft

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

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	
				CLAY - Brown and gray, medium-stiff, with lignite stains and weathered sandstone fragments
	1			
	1 2	1.0 B	24	
486.8				
				SHALEY CLAY - Brown and gray, stiff, with lignite stains and gravel
	1			
	3 4	1.5 B	22	
-5				
	1			with weathered sandstone fragments
	5 8	2.0 B	21	
	3			becomes hard, no more lignite and sandstone
	14 28	-	16	
-10				
479.3				
				SHALE - Brown and gray, moderately hard
	19			
	50/3" -	-	12	
	50			becomes soft and highly weathered
	50/1" -	-	7	
-15				
474.3				
				Borehole continued with rock coring.
-20				

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer)
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206)

Illinois Department of Transportation
Division of Highways

ROCK CORE LOG

Date 10/11/21

ROUTE FAP 821 **DESCRIPTION** I-57 / I-64 Interchange at IL-15 **LOGGED BY** KEG

SECTION (41-3HB-1) I **LOCATION** Mt. Vernon, Illinois

COUNTY Jefferson **CORING METHOD** NX

STRUCT. NO. 041-0025
Station 772+07

BORING NO. ST-3
Station 529+60.23
Offset 0.0 ft
Ground Surface Elev. 489.85 ft

CORING BARREL TYPE & SIZE
Core Diameter in
Top of Rock Elev. 479.35 ft
Begin Core Elev. 474.35 ft

	DEPTH (ft)	CORE (#)	RECOVERY (%)	R.Q.D. (%)	CORE TIME (min/ft)	STRENGTH (tsf)
SHALE - Brown and gray, moderately hard	474.35	1	25	25	3.75	
becomes gray and moderately hard		2	100	93	2.6	333.5
-20						
becomes soft		3	100	81	2.4	
LIMESTONE - Gray, moderately hard	466.35					
-25						
SHALE - Gray, weathered, soft	463.02	4	100	60	2.6	
LIMESTONE - Gray, moderately hard	460.85					
SHALE - Gray, moderately hard	459.85					
-30						
LIMESTONE - Gray, moderately hard	458.85					
SHALE - Gray, moderately hard	458.02	5	78	53	5.6	
becomes soft						
-35						

Color pictures of the cores
Cores will be stored for examination until
The "Strength" column represents the uniaxial compressive strength of the core sample (ASTM D-2938)

Illinois Department of Transportation
Division of Highways

ROCK CORE LOG

Date 10/11/21

ROUTE FAP 821 **DESCRIPTION** I-57 / I-64 Interchange at IL-15 **LOGGED BY** KEG

SECTION (41-3HB-1) I **LOCATION** Mt. Vernon, Illinois

COUNTY Jefferson **CORING METHOD** NX

STRUCT. NO. 041-0025
Station 772+07

BORING NO. ST-3
Station 529+60.23
Offset 0.0 ft
Ground Surface Elev. 489.85 ft

CORING BARREL TYPE & SIZE
Core Diameter in
Top of Rock Elev. 479.35 ft
Begin Core Elev. 474.35 ft

	DEPTH (ft)	CORE (#)	RECOVERY (%)	R.Q.D. (%)	CORE TIME (min/ft)	STRENGTH (tsf)
SHALE - Gray, moderately hard *(continued)*						
		6	100	82	3	
	450.85					
LIMESTONE - Gray, moderately hard	-40					
	448.02					
End of Boring	-45					
	-50					
	-55					

Color pictures of the cores _____
Cores will be stored for examination until _____
The "Strength" column represents the uniaxial compressive strength of the core sample (ASTM D-2938)

JO37102.01

ST-3


JO37102.01
ST-3
RUN-3
BOTTOM
RUN-4
TOP
RUN-4
BOTTOM
RUN-5
TOP

JO37102.01

ST-3

Illinois Department of Transportation
Division of Highways

SOIL BORING LOG

Date 10/8/21

ROUTE FAP 821 **DESCRIPTION** I-57 / I-64 Interchange at IL-15 **LOGGED BY** KEG

SECTION (41-3HB-1) I **LOCATION** Mt. Vernon, Illinois

COUNTY Jefferson **DRILLING METHOD** HSA **HAMMER TYPE** Auto

STRUCT. NO. 041-0025
Station 772+07

BORING NO. ST-4
Station 530+96.30
Offset 43.2 ft RT
Ground Surface Elev. 494.47 ft

Surface Water Elev. _____ ft
Stream Bed Elev. _____ ft

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

	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
SILTY CLAY - Gray, stiff, with some sand		5		
492.5		5 5	4.0 P	20
CLAY - Brown and gray, stiff, with lighnite stains and some sand		3		
	-5	3 6	1.4 S	21
		1		
		4 6	2.1 B	18
486.5				
SHALE - Brown orange and gray, soft, weathered with encrusted sandstone fragments		1		
		3 6	2.6 B	24
	-10			
484.0				
SHALEY CLAY - Gray and brown, hard, with weathered sandstone fragments		4		
		12 28	-	16
481.5				
SHALE - Brown and gray, soft, with encrusted sandstone fragments		11		
		33 50/5"	-	15
479.5	-15			
Borehole continued with rock coring.				
	-20			

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer)
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206)

Illinois Department of Transportation
Division of Highways

ROCK CORE LOG

Date 10/8/21

ROUTE FAP 821 **DESCRIPTION** I-57 / I-64 Interchange at IL-15 **LOGGED BY** KEG

SECTION (41-3HB-1) I **LOCATION** Mt. Vernon, Illinois

COUNTY Jefferson **CORING METHOD** NX

STRUCT. NO. 041-0025
Station 772+07

BORING NO. ST-4
Station 530+96.30
Offset 43.2 ft RT
Ground Surface Elev. 494.47 ft

CORING BARREL TYPE & SIZE
Core Diameter in
Top of Rock Elev. 481.47 ft
Begin Core Elev. 479.47 ft

		DEPTH (ft)	CORE (#)	RECOVERY (%)	R.Q.D. (%)	CORE TIME (min/ft)	STRENGTH (tsf)
SHALE - Gray, hard	479.47		1	82	72	5.6	
becomes brown, soft and weathered							
becomes moderately hard		-20					
becomes gray, soft and slightly weathered			2	100	82	4.4	
becomes moderately hard		-25					
			3	100	83	2.4	
	467.47						
LIMESTONE - gray, moderately hard, weathered							
becomes moderately hard, not weathered							
	464.47	-30					
SHALE - gray, soft, weathered			4	100	75	3.4	
	463.27						
LIMESTONE - gray, moderately hard	462.77						
SHALE - Gray, soft, weathered with encrusted limestone becomes moderately hard							
becomes hard		-35					

Color pictures of the cores _____
Cores will be stored for examination until _____
The "Strength" column represents the uniaxial compressive strength of the core sample (ASTM D-2938)

Illinois Department of Transportation
Division of Highways

ROCK CORE LOG

Date 10/8/21

ROUTE FAP 821 **DESCRIPTION** I-57 / I-64 Interchange at IL-15 **LOGGED BY** KEG

SECTION (41-3HB-1) I **LOCATION** Mt. Vernon, Illinois

COUNTY Jefferson **CORING METHOD** NX

STRUCT. NO. 041-0025
Station 772+07

BORING NO. ST-4
Station 530+96.30
Offset 43.2 ft RT
Ground Surface Elev. 494.47 ft

CORING BARREL TYPE & SIZE

Core Diameter in
Top of Rock Elev. 481.47 ft
Begin Core Elev. 479.47 ft

	DEPTH (ft)	CORE (#)	RECOVERY (%)	R.Q.D. (%)	CORE TIME (min/ft)	STRENGTH (tsf)
SHALE - Gray, soft, weathered *(continued)* becomes weathered and soft		5	100	60	4	
	456.47					
LIMESTONE - Gray, soft, weathered						
	454.47					
End of Boring	-40					
	-45					
	-50					
	-55					

Color pictures of the cores
Cores will be stored for examination until
The "Strength" column represents the uniaxial compressive strength of the core sample (ASTM D-2938)


JO37102.01
ST-4
RUN-1
TOP
RUN-1
BOTTOM
RUN-2
TOP


JO37102.01
ST-4
RUN-2
BOTTOM
RUN-3
TOP
RUN-3
BOTTOM
RUN-4
TOP


JO37102.01
ST-4
Run #4 continued...
RUN-4
BOTTOM
RUN-5
TOP

Illinois Department of Transportation
Division of Highways

SOIL BORING LOG

Date 10/12/21

ROUTE FAP 821 **DESCRIPTION** I-57 / I-64 Interchange at IL-15 **LOGGED BY** KEG

SECTION (41-3HB-1) I **LOCATION** Mt. Vernon, Illinois

COUNTY Jefferson **DRILLING METHOD** HSA **HAMMER TYPE** Auto

STRUCT. NO. 041-0025
Station 772+07

BORING NO. ST-5
Station 530+81.07
Offset 43.2 ft LT
Ground Surface Elev. 499.67 ft

Surface Water Elev. ft
Stream Bed Elev. ft

Groundwater Elev.:
First Encounter 490.7 ft ▼
Upon Completion ft
After Hrs. ft

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Description
499.5				TOPSOIL - 2"
	1			SHALEY CLAY - Brown and gray, medium-stiff, with lignite stains
	3 4	1.6 B	22	
	1			
	2 5	2.5 P	22	
-5				
	2			no more lignite stains, with weathered sandstone fragments
492.7	8 10	2.7 S	21	
				SHALE - gray, moderately hard
▼	3			
	9 17	-	27	4" of Coal seams at 9'
-10				
	26			becomes soft
	50/3" -	-	9	1" of sandstone seams at 11.5'
	33			
	50/1" -	-	7	
-15				
	38			
	50/3" -	-	6	
	22			
	49 50/2"	-	9	
-20				

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Description
479.2				LIMESTONE - gray, soft, weathered
	50/1" - -	-	-	Poor Recovery
477.7				Auger Refusal at 22, boring terminated
				End of Boring
-25				
-30				
-35				
-40				

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer)
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206)

Illinois Department of Transportation
Division of Highways

SOIL BORING LOG

Date 10/7/21

ROUTE FAP 821 **DESCRIPTION** I-57 / I-64 Interchange at IL-15 **LOGGED BY** KEG

SECTION (41-3HB-1) I **LOCATION** Mt. Vernon, Illinois

COUNTY Jefferson **DRILLING METHOD** HSA **HAMMER TYPE** Auto

STRUCT. NO. _____
Station _____

BORING NO. BM-03
Station 525+94.90
Offset 19.1 ft RT
Ground Surface Elev. 490.38 ft

Surface Water Elev. _____ ft
Stream Bed Elev. _____ ft

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

	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
TOPSOIL - 3" 490.1				
SILTY CLAY - Brown and gray, stiff, with lignite stains		WH		
		3 5	1.7 B	26
487.4				
CLAYEY SILT - Gray, medium-stiff, with lignite stains, with some sand		1		
485.9		2 4	0.9 B	24
SANDY SILTY CLAY - Brown orange, medium-stiff, with lignite stains	-5	1		
		3 4	0.8 B	22
481.4		1		
SHALEY CLAY - Brown and gray, stiff, with weathered sandstone fragments		5 8	2.6 B	20
479.4	-10			
SANDY CLAY - Brown and gray, medium-stiff, with lignite stains and weathered sandstone fragments		WH		
		1 6	0.7 B	23
476.9				
SHALEY CLAY - Brown, hard		5		
		15 20	-	19
475.4	-15			
End of Boring				
	-20			

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer)
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206)

Illinois Department of Transportation
Division of Highways

SOIL BORING LOG

Date 10/7/21

ROUTE FAP 821 **DESCRIPTION** I-57 / I-64 Interchange at IL-15 **LOGGED BY** KEG

SECTION (41-3HB-1) I **LOCATION** Mt. Vernon, Illinois

COUNTY Jefferson **DRILLING METHOD** HSA **HAMMER TYPE** Auto

STRUCT. NO. _____
Station _____

BORING NO. BM-03 ST
Station 525+94.90
Offset 19.1 ft RT
Ground Surface Elev. 490.38 ft

Surface Water Elev. _____ ft
Stream Bed Elev. _____ ft

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

	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
Shelby Tube #1 (24" Recovery) Wet Density=126 Dry Density=106			1.0	19
487.4				
Shelby Tube #2 (24" Recovery) Wet Density=129 Dry Density=108 LL=48% PL=15%			1.1	20
485.4	-5			
Shelby Tube #3 (24" Recovery) Wet Density=127 Dry Density=103			0.5	23
483.4				
Shelby Tube #4 (24" Recovery) Wet Density=128 Dry Density=105			0.6	22
481.4				
Shelby Tube #5 (24" Recovery) Wet Density=137 Dry Density=120	-10		0.7	15
479.4				
Shelby Tube #6 (24" Recovery) Wet Density=130 Dry Density=110			0.3	18
477.4				
Shelby Tube #7 (22" Recovery) Wet Density=132 Dry Density=113			0.6	17
475.4	-15			
End of Boring				
	-20			

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer)
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206)

Illinois Department of Transportation
Division of Highways

SOIL BORING LOG

Date 10/7/21

ROUTE FAP 821 **DESCRIPTION** I-57 / I-64 Interchange at IL-15 **LOGGED BY** KEG

SECTION (41-3HB-1) I **LOCATION** Mt. Vernon, Illinois

COUNTY Jefferson **DRILLING METHOD** HSA **HAMMER TYPE** Auto

STRUCT. NO. _____
Station _____

BORING NO. BM-04
Station 533+02.30
Offset 72.4 ft RT
Ground Surface Elev. 497.95 ft

Surface Water Elev. _____ ft
Stream Bed Elev. _____ ft

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

	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
TOPSOIL-3" 497.7				
SILTY CLAY - Gray and brown, stiff, with weathered sandstone fragments		2		
		4 4	2.0 P	19
with lignite stains		1		
		3 5	1.3 S	23
	-5			
		1		
		3 6	2.5 P	21
with some organics		1		
		4 7	2.0 B	21
	-10			
		1		
486.0		4 8	2.5 S	22
SHALEY CLAY-Gray and brown, stiff, with weathered sandstone fragments		7		
		50/2" -	-	15
483.0	-15			
End of Boring				
	-20			

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer)
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206)

Illinois Department of Transportation
Division of Highways

SOIL BORING LOG

Date 10/7/21

ROUTE FAP 821 **DESCRIPTION** I-57 / I-64 Interchange at IL-15 **LOGGED BY** KEG

SECTION (41-3HB-1) I **LOCATION** Mt. Vernon, Illinois

COUNTY Jefferson **DRILLING METHOD** HSA **HAMMER TYPE** Auto

STRUCT. NO. _____
Station _____

BORING NO. BM-04 ST
Station 533+02.30
Offset 72.4 ft RT
Ground Surface Elev. 497.95 ft

Surface Water Elev. _____ ft
Stream Bed Elev. _____ ft

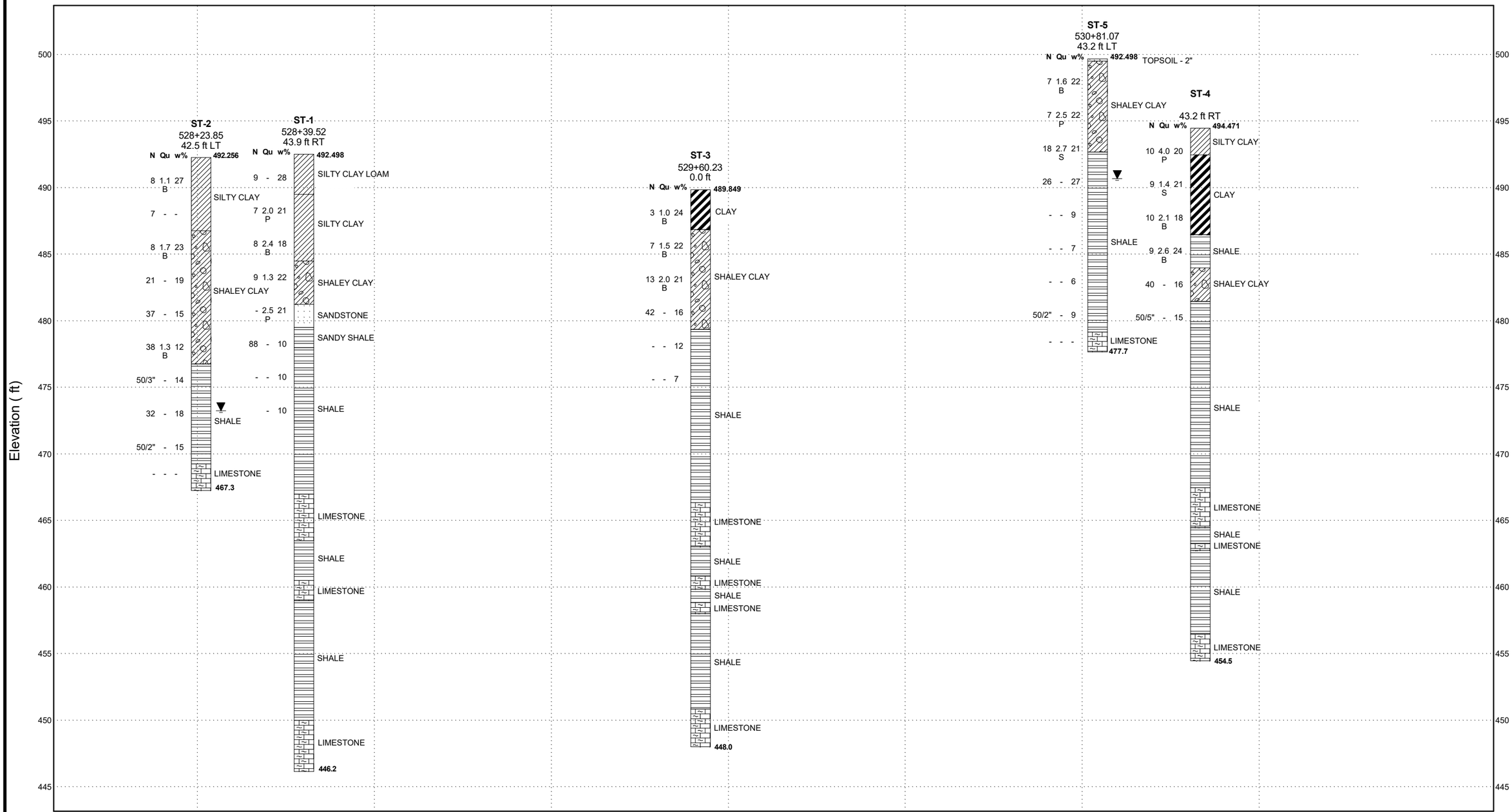
Groundwater Elev.:
First Encounter _____ ft
Upon Completion _____ ft
After _____ **Hrs.** _____ ft

	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
Shelby Tube #1 (24" Recovery) Wet Density=124 Dry Density=101			1.1	23
495.0				
Shelby Tube #2 (24" Recovery) Wet Density=127 Dry Density=105			0.8	21
493.0	-5			
Shelby Tube #3 (24" Recovery) Wet Density=129 Dry Density=107			0.7	21
491.0				
Shelby Tube #4 (24" Recovery) Wet Density=128 Dry Density=105			0.6	22
489.0				
Shelby Tube #5 (24" Recovery) Wet Density=128 Dry Density=106	-10		0.7	21
487.0				
Shelby Tube #6 (24" Recovery) Wet Density=128 Dry Density=105			0.6	22
485.0				
Shelby Tube #7 (16.5" Recovery) Wet Density=132 Dry Density=116			0.8	14
483.0	-15			
End of Boring	-20			

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer)
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206)

EXHIBIT E

SUBSURFACE PROFILE



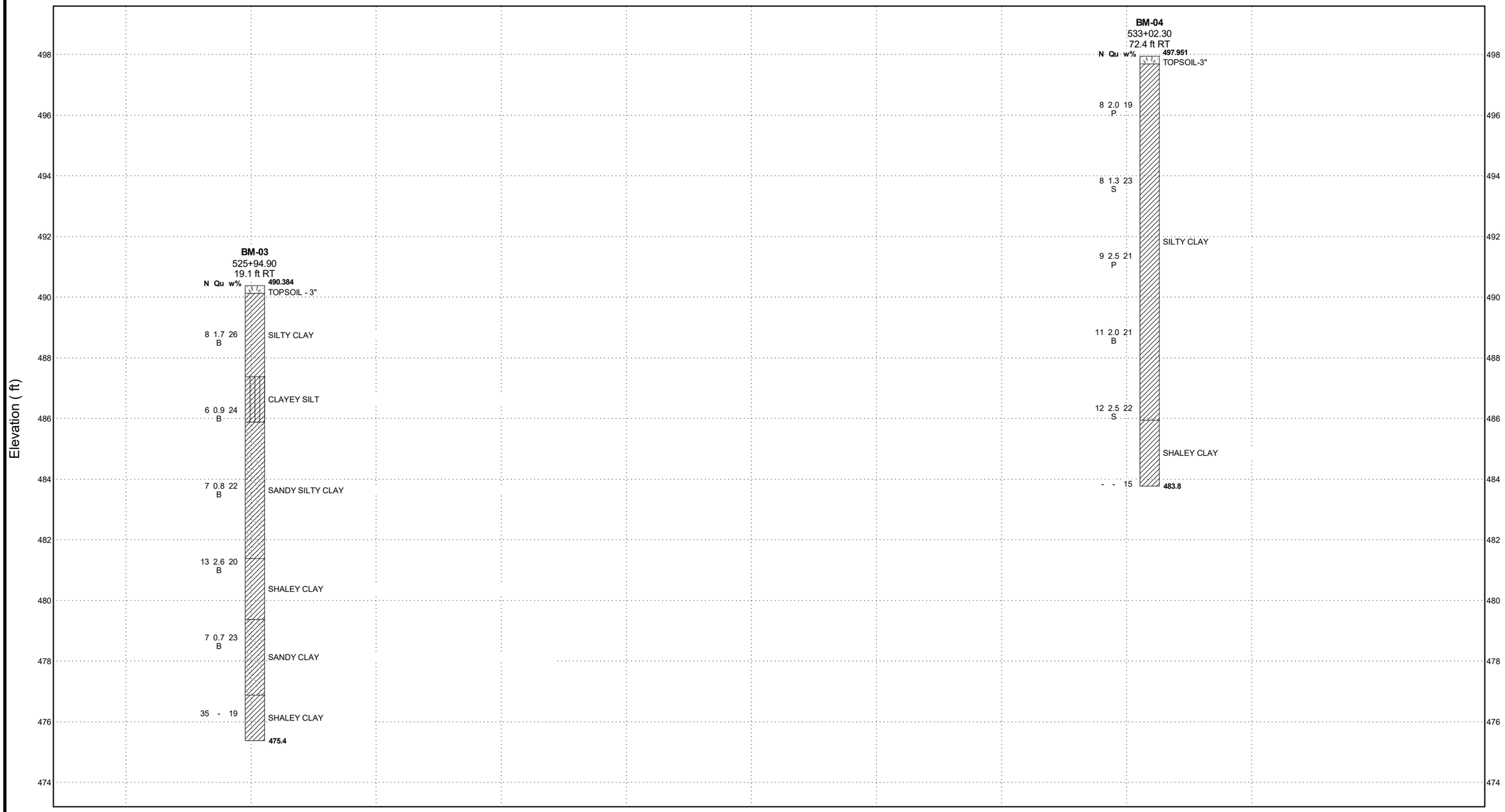
NOT TO HORIZONTAL SCALE

Illinois Department of Transportation
Division of Highways

SUBSURFACE DATA PROFILE

Route: FAP 821
Section: (41-3HB-1) I
County: Jefferson

PRINTERMOD2 11X17 20-1066.00 I-57_64 INTERCHANGE AT IL-15.GPJ IL_DOT.GDT 1/4/22



NOT TO HORIZONTAL SCALE

Illinois Department of Transportation
Division of Highways

SUBSURFACE DATA PROFILE

Route: FAP 821
Section: (41-3HB-1) I
County: Jefferson

EXHIBIT F

SETTLEMENT CALCULATIONS

Kaskaskia
Engineering Group, LLC
208 E. Main Street
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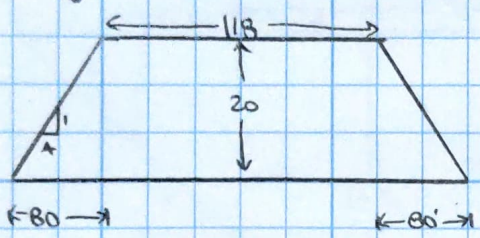
Belleville, Illinois 62220
618.233.5877 phone
618.233.5977 fax
www.kaskaskiaeng.com

Project Title: I-57/64 Int. at IL-15 Sheet: 1 of 3
Project Number: 20-1066.00
Calculated By: TG Date: 2/24/2022
Checked By: MDM Date: 2/24/2022
Comments: West Abutment (BM-3)

Fill Weight



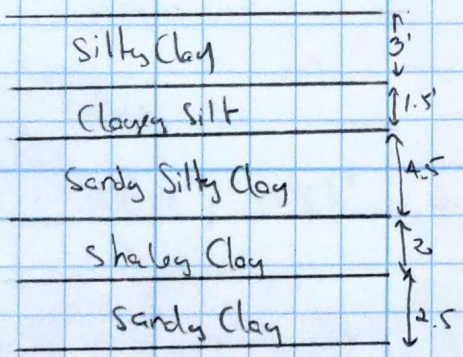
$A_{fill} = \frac{118 + 278}{2}(20) = 3960\ ft^2$

$\gamma_{fill} = 125\ pcf$, $L = 500\ ft$ approx

$P_{fill} = A_{fill} \times \gamma_{fill} \times L$

$= 3960 \times 125 \times 500 = 247500000\ lb$

Settlement Calculations



Soft layer = 13.5'

Consolidation test Results (Boring BM-03ST)

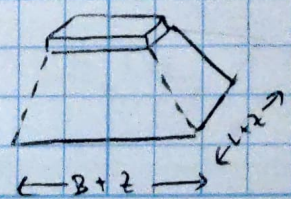
$\gamma_d = 99\ pcf$ $C_c = 0.12$
$w = 24.9\%$ $C_v = 0.03$
$\gamma = \gamma_d(1+w)$ $e_o = 0.69$
$\gamma = 123\ pcf$ $P_c = 2800\ psf$

Layer	Δz (ft)	z (ft)	P_o (psf)	ΔP (psf)	$P_o + \Delta P$ (psf)	OCR	Case	Sp (in)
1	3	1.5	184.5	1765.72	1950.22	15.18	OC-I	0.65
2	3	4.5	553.5	1736.58	2290.09	5.06	OC-I	0.39
3	3	7.5	922.5	1708.18	2630.68	3.04	OC-I	0.29
4	4.5	11.25	1383.75	1673.66	3057.41	2.02	OC-II	0.44
								$\Sigma = 1.78$

$S_p = 1.78\ in$

Stress Distribution 2:1 → example

$\Delta P = \frac{P}{(B+z)(L+z)}$



$L = 500ft$
$B = 278$

$\Delta P_1 = \frac{247500000}{(278+1.5)(500+1.5)} = 1765.72\ psf$

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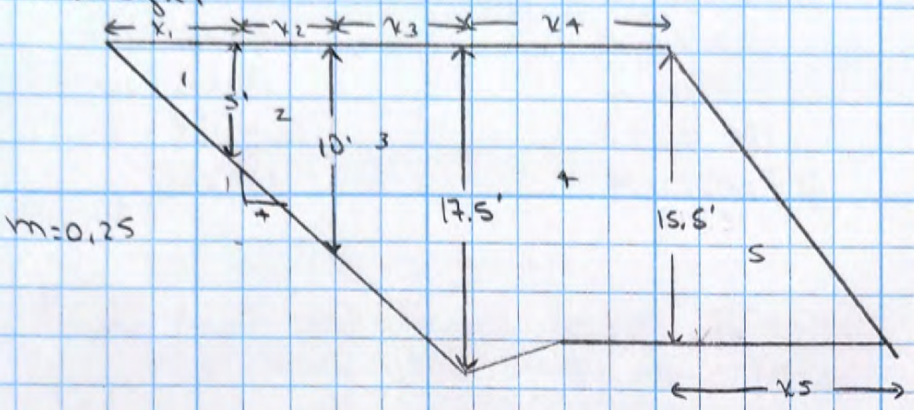
Project Title: I-57/64 Int. at IL-15 Sheet: 2 of 3
Project Number: 20-1066.00
Calculated By: TG Date: 1/19/2022
Checked By: MDM Date: 2/24/2022
Comments:

Fill weight



$x_1 = \frac{5}{0.25} = 20$ $\quad x_3 = \frac{17.5}{0.25} - 40 = 30'$ $\quad x_5 = \frac{15.5}{0.25} = 62'$

$x_2 = \frac{10}{0.25} - 20 = 20$ $\quad x_4 = 86.13 - 30 - 20 - 20 = 16.13$

Areas

$A_1 = \frac{20 \times 5}{2} = 50\ ft^2$ $\quad A_2 = \frac{(5+10)(20)}{2} = 150\ ft^2$

$A_3 = \frac{(10+17.5)(20)}{2} = 275\ ft^2$ $\quad A_4 = \frac{(15.5+17.5)(16.3)}{2} = 268.95$

$A_5 = \frac{15.5}{2}(62) = 480.5\ ft^2$

$A_{fill} = A_1 + A_2 + A_3 + A_4 + A_5 = 1224.45\ ft^2$

$\gamma_{fill} = 125\ pcf$, $L = 300\ ft$

$P_{fill} = A_{fill} \times \gamma_{fill} \times L = 1224.45 \times 125 \times 300 = 45{,}916{,}875\ lb$

Settlement Calculations

Soft layer = 12'

Silty Clay 12'

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Project Title: I-57/64 Int at IL-15 Sheet: 3 of 3
Project Number: 20-1066.00
Calculated By: TG Date: 1/14/2022
Checked By: MDM Date: 2/24/2022
Comments:

Consolidation test Results (Boring BM-043T)

$\gamma_d = 103.1$ pcf
$w = 21.6\%$
$\gamma = \gamma_d(1+w)$
$\gamma = 125$ pcf

$e_o = 0.162$
$C_c = 0.11$
$C_r = 0.02$
$p'_c = 2800$ psf

Layer	Δz(ft)	z(ft)	P'_o(psf)	ΔP(psf)	$P'_o + \Delta P$(psf)	OCR	Case	Sp(in)
1	3	1.5	187.5	1912.53	2100.03	14.93	Case I	0.47
2	3	4.5	562.5	1824.93	2387.43	4.98	Case I	0.28
3	3	7.5	937.5	1743.82	2681.32	2.99	Case I	0.20
4	3	10.5	1312.5	1668.51	2981.01	2.13	Case II	0.21
								$\Sigma = 1.16$

Sp = 1.16 in

Stress distribution 2:1 Method

B = 78.13 ft
L = 300 ft

$$\Delta p_1 = \frac{459{,}16{,}875}{(78.13+1.5)(300+1.5)} = 1912.53 \text{ psf}$$

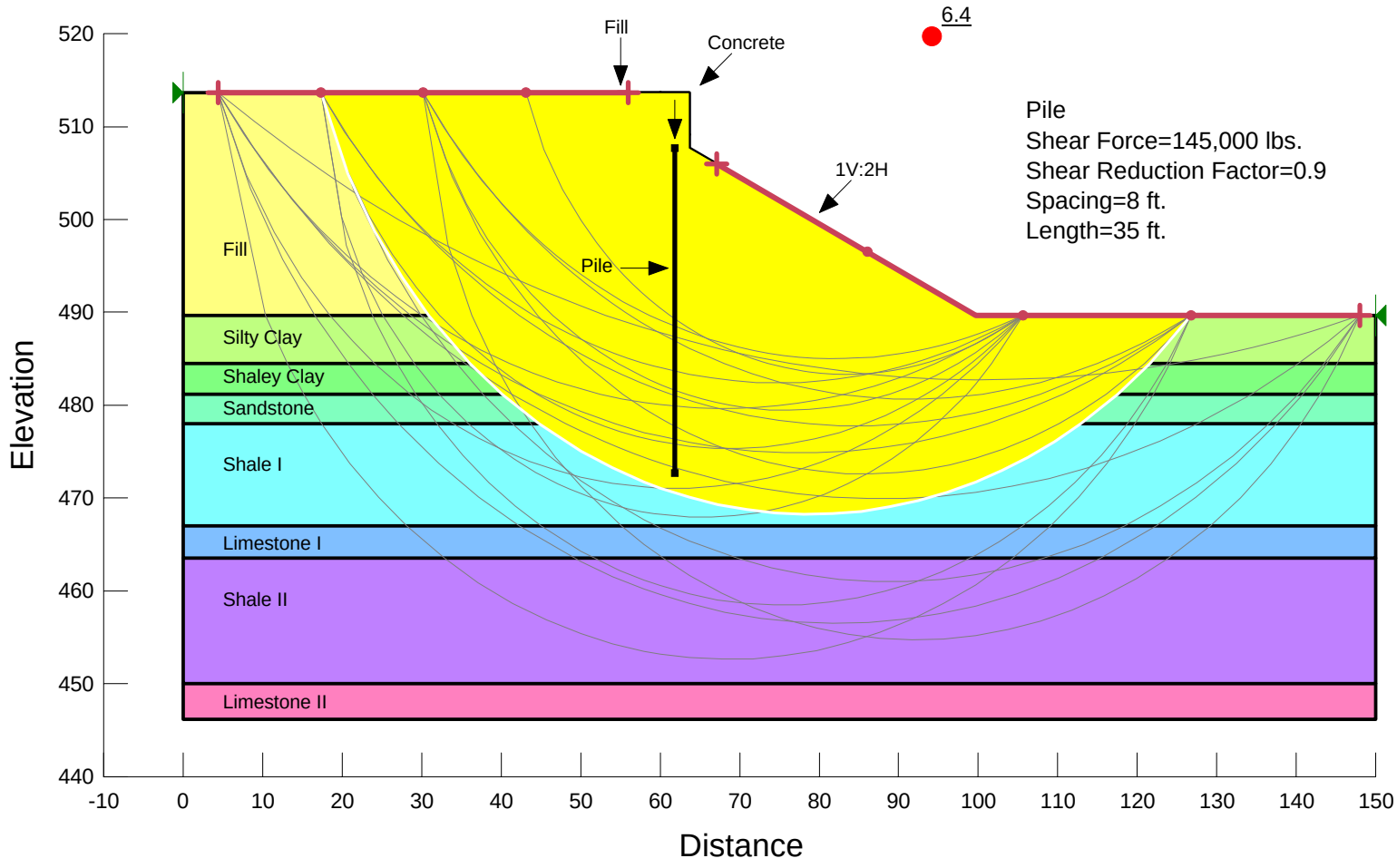
Boring BM-03 ST (West Abut)					
e1=	0.59		**av(1/psf)=**	2E-05	
p1=	500		**mv(1/psf)=**	1.183E-05	
e2=	0.56		**assumed k(ft/s)=**	3.34E-06	
p2=	2000		**Cv (in²/min)=**	3.91E+01	
Time Rate of consolidation					
Without wick drains					
		Cv (in²/min)=	39.078		
		H (ft)=	13.5		
	days	**months**	**years**		
t50	0.09	0.00	0.00		
t90	0.39	0.01	0.00		
With wick drains					
		Cv hor. (in²/min)=	7.82E+01		
		Triangular spacing(ft)=	5.0		
		de(ft)=	5.3		
	days	**months**	**years**		
t50	0.0	0.00	0.00		
t90	0.1	0.00	0.00		

Boring BM-04 ST (East Abut)					
e1=	0.54		**av(1/psf)=**	1.333E-05	
p1=	500		**mv(1/psf)=**	7.89E-06	
e2=	0.52		**assumed k(ft/s)=**	3.34E-06	
p2=	2000		**Cv (in²/min)=**	5.86E+01	
Time Rate of consolidation					
Without wick drains					
		Cv (in²/min)=	58.617		
		H (ft)=	12		
	days	**months**	**years**		
t50	0.05	0.00	0.00		
t90	0.20	0.01	0.00		
With wick drains					
		Cv hor. (in²/min)=	1.17E+02		
		Triangular spacing(ft)=	5.0		
		de(ft)=	5.3		
	days	**months**	**years**		
t50	0.0	0.00	0.00		
t90	0.0	0.00	0.00		

EXHIBIT G

SLOPE W SLOPE STABILITY ANALYSIS

I-57/64 Interchange
West Abutment (ST-1)
End-of-Construction (Undrained Analysis)



Name: Fill
Model: Mohr-Coulomb
Unit Weight: 125 pcf
Cohesion': 1,500 psf
Phi': 0 °

Name: Silty Clay
Model: Mohr-Coulomb
Unit Weight: 120 pcf
Cohesion': 2,200 psf
Phi': 0 °

Name: Shaley Clay
Model: Mohr-Coulomb
Unit Weight: 125 pcf
Cohesion': 1,300 psf
Phi': 0 °

Name: Sandstone
Model: Mohr-Coulomb
Unit Weight: 130 pcf
Cohesion': 3,500 psf
Phi': 0 °

Name: Shale I
Model: Mohr-Coulomb
Unit Weight: 130 pcf
Cohesion': 4,500 psf
Phi': 0 °

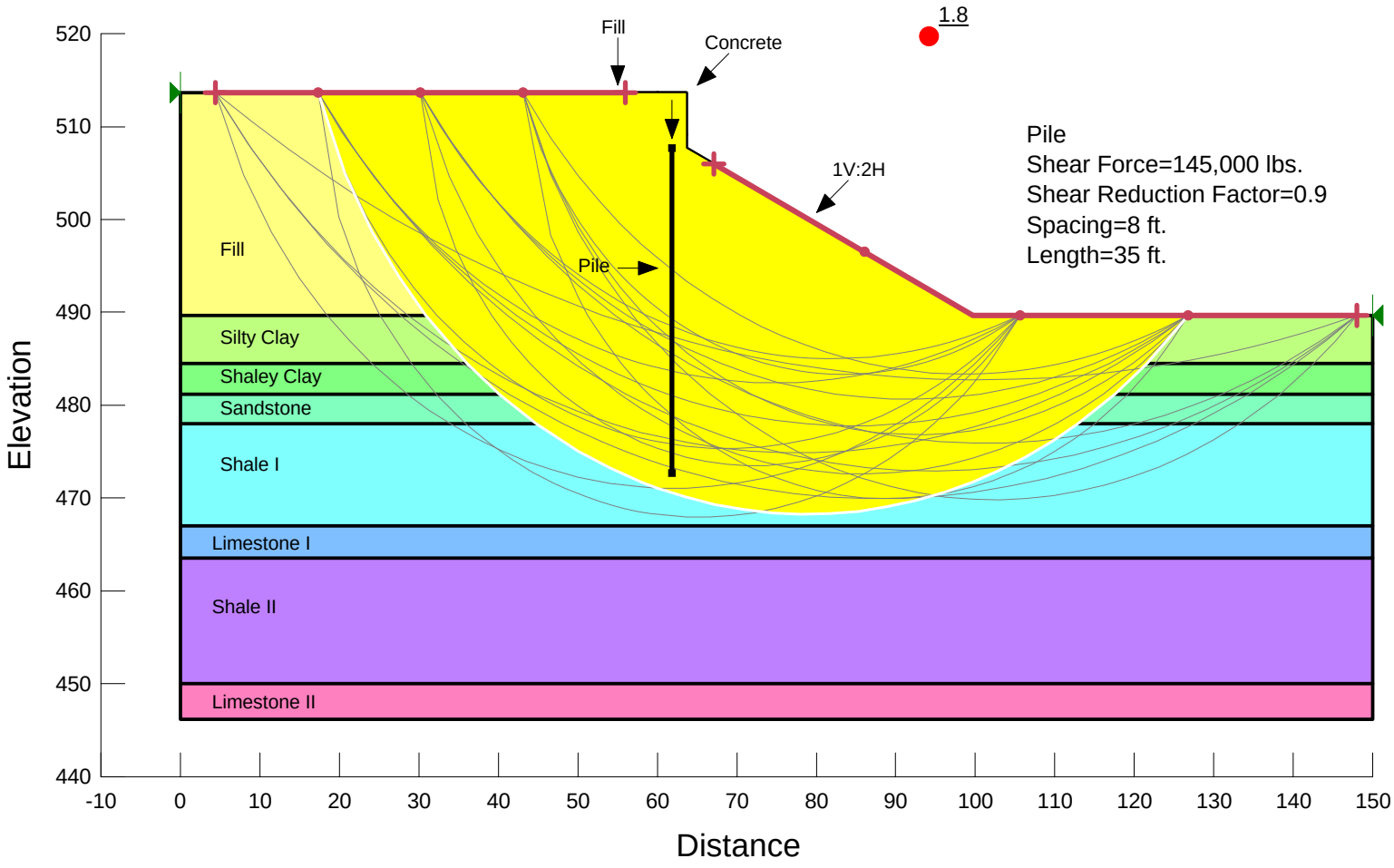
Name: Limestone I
Model: Mohr-Coulomb
Unit Weight: 150 pcf
Cohesion': 10,000 psf
Phi': 45 °

Name: Shale II
Model: Mohr-Coulomb
Unit Weight: 130 pcf
Cohesion': 4,500 psf
Phi': 0 °

Name: Limestone II
Model: Mohr-Coulomb
Unit Weight: 150 pcf
Cohesion': 10,000 psf
Phi': 45 °

Name: Concrete
Model: Mohr-Coulomb
Unit Weight: 150 pcf
Cohesion': 5,000 psf
Phi': 45 °

I-57/64 Interchange
West Abutment (ST-1)
Long Term (Drained Analysis)



Name: Fill
Model: Mohr-Coulomb
Unit Weight: 125 pcf
Cohesion': 100 psf
Phi': 26 °

Name: Silty Clay
Model: Mohr-Coulomb
Unit Weight: 120 pcf
Cohesion': 100 psf
Phi': 26 °

Name: Shaley Clay
Model: Mohr-Coulomb
Unit Weight: 125 pcf
Cohesion': 100 psf
Phi': 12 °

Name: Sandstone
Model: Mohr-Coulomb
Unit Weight: 130 pcf
Cohesion': 250 psf
Phi': 30 °

Name: Shale I
Model: Mohr-Coulomb
Unit Weight: 130 pcf
Cohesion': 250 psf
Phi': 12 °

Name: Limestone I
Model: Mohr-Coulomb
Unit Weight: 150 pcf
Cohesion': 10,000 psf
Phi': 45 °

Name: Shale II
Model: Mohr-Coulomb
Unit Weight: 130 pcf
Cohesion': 250 psf
Phi': 12 °

Name: Limestone II
Model: Mohr-Coulomb
Unit Weight: 150 pcf
Cohesion': 10,000 psf
Phi': 45 °

Name: Concrete
Model: Mohr-Coulomb
Unit Weight: 150 pcf
Cohesion': 5,000 psf
Phi': 45 °

Name: Fill
Model: Mohr-Coulomb
Unit Weight: 125 pcf
Cohesion': 1,500 psf
Phi': 0 °

Name: Clay
Model: Mohr-Coulomb
Unit Weight: 120 pcf
Cohesion': 1,750 psf
Phi': 0 °

Name: Shaley Clay
Model: Mohr-Coulomb
Unit Weight: 125 pcf
Cohesion': 2,600 psf
Phi': 0 °

Name: Shale I
Model: Mohr-Coulomb
Unit Weight: 130 pcf
Cohesion': 4,500 psf
Phi': 0 °

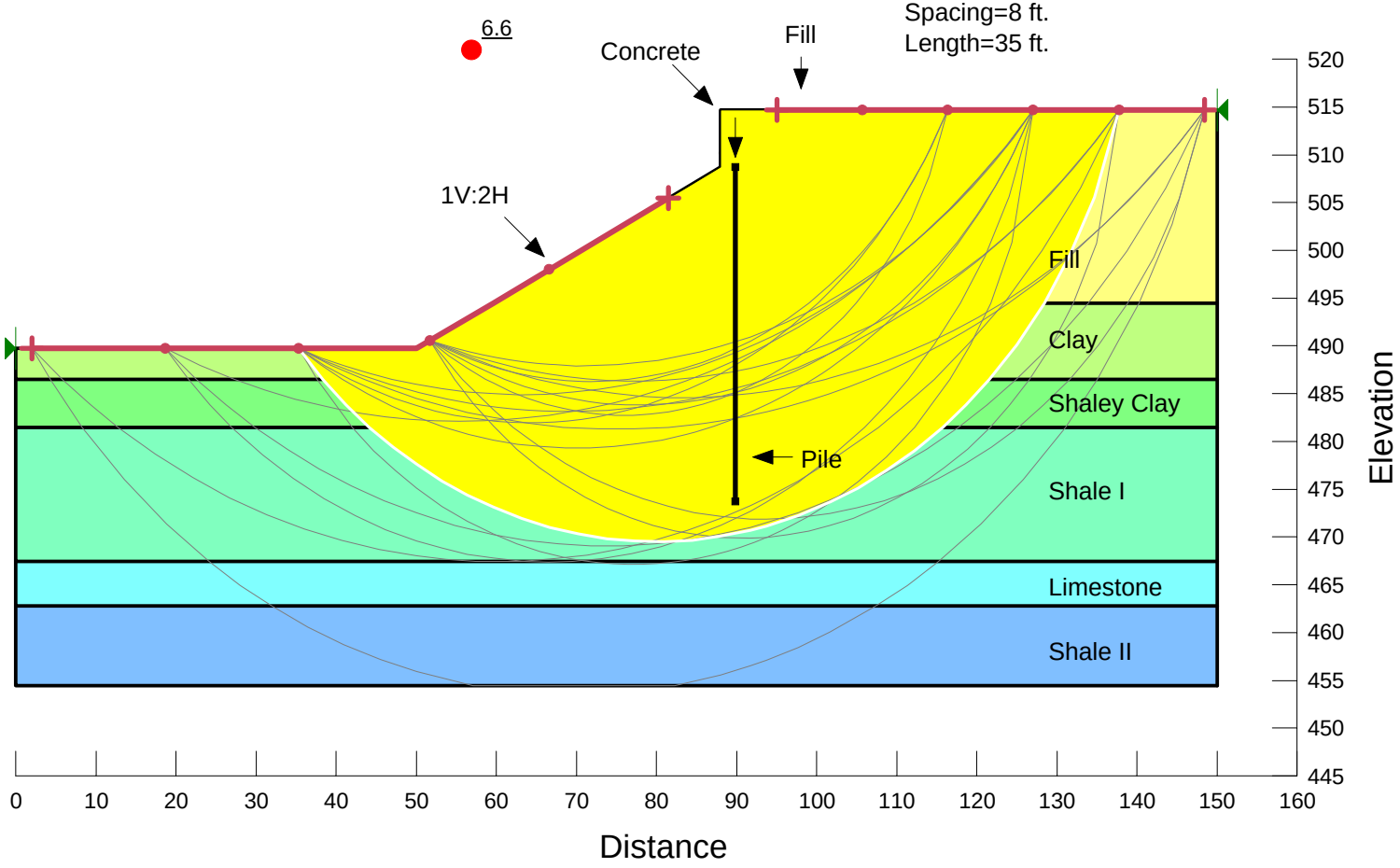
Name: Limestone
Model: Mohr-Coulomb
Unit Weight: 150 pcf
Cohesion': 10,000 psf
Phi': 45 °

Name: Shale II
Model: Mohr-Coulomb
Unit Weight: 130 pcf
Cohesion': 4,500 psf
Phi': 0 °

Name: Concrete
Model: Mohr-Coulomb
Unit Weight: 150 pcf
Cohesion': 5,000 psf
Phi': 45 °

I-57/64 Interchange
East Abutment (ST-4)
End-of-Construction (Undrained Analysis)

Pile
Shear Force=145,000 lbs.
Shear Reduction Factor=0.9
Spacing=8 ft.
Length=35 ft.



Name: Fill
Model: Mohr-Coulomb
Unit Weight: 125 pcf
Cohesion': 100 psf
Phi': 26 °

Name: Clay
Model: Mohr-Coulomb
Unit Weight: 120 pcf
Cohesion': 100 psf
Phi': 26 °

Name: Shaley Clay
Model: Mohr-Coulomb
Unit Weight: 125 pcf
Cohesion': 100 psf
Phi': 12 °

Name: Shale I
Model: Mohr-Coulomb
Unit Weight: 130 pcf
Cohesion': 250 psf
Phi': 12 °

Name: Limestone
Model: Mohr-Coulomb
Unit Weight: 150 pcf
Cohesion': 10,000 psf
Phi': 45 °

Name: Shale II
Model: Mohr-Coulomb
Unit Weight: 130 pcf
Cohesion': 250 psf
Phi': 12 °

Name: Concrete
Model: Mohr-Coulomb
Unit Weight: 150 pcf
Cohesion': 5,000 psf
Phi': 45 °

I-57/64 Interchange
East Abutment (ST-4)
Long Term (Drained Analysis)

Pile
Shear Force=145,000 lbs.
Shear Reduction Factor=0.9
Spacing=8 ft.
Length=35 ft.

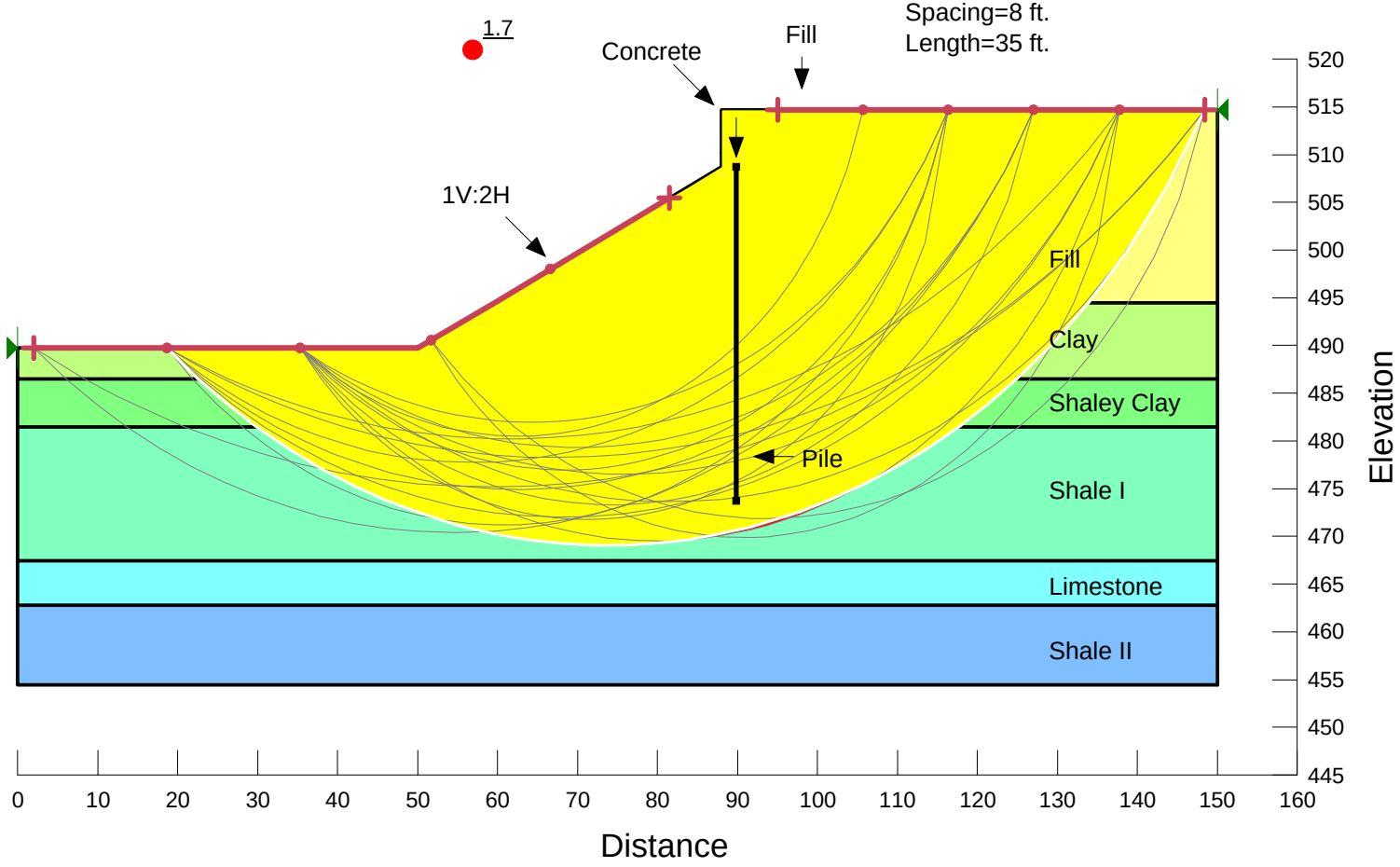


EXHIBIT H

BEARING RESISTANCE CALCULATIONS

Kaskaskia
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208 E. Main Street
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Belleville, Illinois 62220
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Project Title: I-57/64 Interchange Sheet: 1 of 2
Project Number: 20-1066.00
Calculated By: Jacob Stauffer Date: 1/14/2022
Checked By: MDM Date: 1/14/2022
Comments:

Bearing Capacity for Continuous Foundations (Terzaghi)

Pier 1 (GSE = 489.7 ft)

$$q_{ult.} = c' N_s + \sigma'_{z0} N_q + 0.5 \gamma' B N_\gamma$$

$$\sigma'_{z0} = \gamma D_f$$

Bearing Calculated for Clay (Based on ST-3)

$c' = 1{,}500$ psf
$\phi' = 0$
$\gamma' = \gamma = 120$ pcf
$D_f = 4$ ft
$B = 8$ ft

Table 6.1 <
$N_c = 5.7$
$N_q = 1.0$
$N_\gamma = 0.0$

$$q_{ult.} = (1{,}500\ psf)(5.7) + (120\ pcf)(4\ ft)(1.0) + 0.5(120\ pcf)(8\ ft)(0.0)$$

$$q_{ult.} = 8550\ psf + 480\ psf = 9{,}030\ psf$$

$$q_{allowable} = \frac{q_{ult.}}{\text{Factor of Safety}} = \frac{9{,}030\ psf}{2.0} = 4515\ psf$$

$$\boxed{q_{allowable} = 4{,}500\ psf}$$

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Project Title: I-57/64 Interchange Sheet: 2 of 2
Project Number: 20-1066.00
Calculated By: Jacob Stauffer Date: 1/14/2022
Checked By: MDM Date: 1/14/2022
Comments:

Sliding Bearing Resistance

Pier 1

Sliding Bearing Resistance = $\frac{1}{2}\sigma_v$ or Cohesion
* use lesser of the two values

$\sigma_v = \gamma D$

$\gamma = 120$ pcf
$D = 4$ ft
Cohesion = 1,500 psf

$\frac{1}{2}\sigma_v = \frac{1}{2}(120\ pcf)(4\ ft) = 240$ psf

$240\ psf < 1,500\ psf$

Sliding Bearing Resistance = 240 psf

EXHIBIT I

PILE LENGTH/PILE TYPE

Illinois Department of Transportation

IDOT STATIC METHOD OF ESTIMATING PILE LENGTH

SUBSTRUCTURE========== West Abutment
REFERENCE BORING ========== ST-1
LRFD or ASD or SEISMIC ========== LRFD
PILE CUTOFF ELEV. ========== 507.62 ft
GROUND SURFACE ELEV. AGAINST PILE DURING DRIVING = 505.62 ft
GEOTECHNICAL LOSS TYPE (None, Scour, Liquef., DD) ===== None
BOTTOM ELEV. OF SCOUR, LIQUEF., or DD ========== ft
TOP ELEV. OF LIQUEF. (so layers above apply DD) ========== ft

TOTAL FACTORED SUBSTRUCTURE LOAD ========== 6100 kips
TOTAL LENGTH OF SUBSTRUCTURE (along skew)========= 118.00 ft
NUMBER OF ROWS OF PILES PER SUBSTRUCTURE ====== 1
Approx. Factored Loading Applied per pile at 8 ft. Cts ========== 413.56 KIPS
Approx. Factored Loading Applied per pile at 3 ft. Cts ========== 155.08 KIPS

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

Maximum Nominal Req'd Bearing of Pile	Maximum Nominal Req.d Bearing of Boring	Maximum Factored Resistance Available in Boring	Maximum Pile Driveable Length in Boring
335 KIPS	**323** KIPS	**178** KIPS	**29** FT.

PILE TYPE AND SIZE ========== Steel HP 10 X 42
Plugged Pile Perimeter========== 3.300 FT. Unplugged Pile Perimeter========== 4.858 FT.
Plugged Pile End Bearing Area========== 0.680 SQFT. Unplugged Pile End Bearing Area======== 0.086 SQFT.

BOT. OF LAYER ELEV. (FT.)	LAYER THICK. (FT.)	UNCONF. COMPR. STRENGTH (TSF.)	S.P.T. N VALUE (BLOWS)	GRANULAR OR ROCK LAYER DESCRIPTION	NOMINAL PLUGGED SIDE RESIST. (KIPS)	NOMINAL PLUGGED END BRG. RESIST. (KIPS)	NOMINAL PLUGGED TOTAL RESIST. (KIPS)	NOMINAL UNPLUG'D SIDE RESIST. (KIPS)	NOMINAL UNPLUG'D END BRG. RESIST. (KIPS)	NOMINAL UNPLUG'D TOTAL RESIST. (KIPS)	NOMINAL REQ'D BEARING (KIPS)	FACTORED GEOTECH. LOSS FROM SCOUR or DD (KIPS)	FACTORED GEOTECH. LOSS LOAD FROM DD (KIPS)	FACTORED RESISTANCE AVAILABLE (KIPS)	ESTIMATED PILE LENGTH (FT.)
492.50	13.12	1.50			41.6		***55.9***	61.3		63.1	56	0	0	31	15
489.50	3.00	1.50			9.5	14.3	***70.2***	14.0	1.8	77.7	70	0	0	39	18
488.00	1.50	2.00			5.8	19.1	***76.0***	8.5	2.4	86.2	76	0	0	42	20
486.50	1.50	2.00			5.8	19.1	***85.6***	8.5	2.4	95.2	86	0	0	47	21
485.00	1.50	2.40			6.5	22.9	***92.1***	9.5	2.9	104.7	92	0	0	51	23
484.50	0.50	2.40			2.2	22.9	***83.7***	3.2	2.9	106.6	84	0	0	46	23
482.85	1.65	1.30			4.7	12.4	***88.5***	7.0	1.6	113.6	88	0	0	49	25
481.20	1.65	1.30			4.7	12.4	218.5	7.0	1.6	***136.4***	136	0	0	75	26
480.20	1.00			Sandstone	68.5	137.7	287.0	100.9	17.4	***237.3***	237	0	0	130	27.4
479.50	0.70			Sandstone	48.0	137.7	***282.0***	70.6	17.4	301.2	282	0	0	155	28.1
478.50	1.00			Shale	41.1	84.8	***323.1***	60.5	10.7	361.7	323	0	0	178	29.1
477.50	1.00			Shale	41.1	84.8	***364.3***	60.5	10.7	422.2	~~364~~	~~0~~	~~0~~	~~200~~	~~30.1~~
476.50	1.00			Shale	41.1	84.8	***405.4***	60.5	10.7	482.7	~~405~~	~~0~~	~~0~~	~~223~~	~~31.1~~
475.50	1.00			Shale	41.1	84.8	***446.5***	60.5	10.7	543.3	~~446~~	~~0~~	~~0~~	~~246~~	~~32.1~~
474.50	1.00			Shale	41.1	84.8	***487.6***	60.5	10.7	603.8	~~488~~	~~0~~	~~0~~	~~268~~	~~33.1~~
473.50	1.00			Shale	41.1	84.8	***528.7***	60.5	10.7	664.3	~~529~~	~~0~~	~~0~~	~~291~~	~~34.1~~
472.50	1.00			Shale	41.1	84.8	***569.8***	60.5	10.7	724.8	~~570~~	~~0~~	~~0~~	~~313~~	~~35.1~~
471.50	1.00			Shale	41.1	84.8	***610.9***	60.5	10.7	785.3	~~611~~	~~0~~	~~0~~	~~336~~	~~36.1~~
470.50	1.00			Shale	41.1	84.8	***652.0***	60.5	10.7	845.9	~~652~~	~~0~~	~~0~~	~~359~~	~~37.1~~
469.50	1.00			Shale	41.1	84.8	***693.1***	60.5	10.7	906.4	~~693~~	~~0~~	~~0~~	~~381~~	~~38.1~~
468.50	1.00			Shale	41.1	84.8	***734.2***	60.5	10.7	966.9	~~734~~	~~0~~	~~0~~	~~404~~	~~39.1~~
467.50	1.00			Shale	41.1	84.8	***775.3***	60.5	10.7	1027.4	~~775~~	~~0~~	~~0~~	~~426~~	~~40.1~~
467.00	0.50			Shale	20.6	84.8	***880.6***	30.3	10.7	1068.4	~~881~~	~~0~~	~~0~~	~~484~~	~~40.6~~
466.00	1.00			Limestone	82.2	169.5	***962.9***	121.0	21.5	1189.4	~~963~~	~~0~~	~~0~~	~~530~~	~~41.6~~
465.00	1.00			Limestone	82.2	169.5	***1045.1***	121.0	21.5	1310.5	~~1045~~	~~0~~	~~0~~	~~575~~	~~42.6~~
464.00	1.00			Limestone	82.2	169.5	***1127.3***	121.0	21.5	1431.5	~~1127~~	~~0~~	~~0~~	~~620~~	~~43.6~~
463.50	0.50			Limestone		169.5			21.5						

Illinois Department of Transportation

IDOT STATIC METHOD OF ESTIMATING PILE LENGTH

SUBSTRUCTURE========== West Abutment
REFERENCE BORING ========== ST-1
LRFD or ASD or SEISMIC ========== LRFD
PILE CUTOFF ELEV. ========== 507.62 ft
GROUND SURFACE ELEV. AGAINST PILE DURING DRIVING = 505.62 ft
GEOTECHNICAL LOSS TYPE (None, Scour, Liquef., DD) ===== DD
BOTTOM ELEV. OF SCOUR, LIQUEF., or DD ========== 481.20 ft
TOP ELEV. OF LIQUEF. (so layers above apply DD) ========== ft

TOTAL FACTORED SUBSTRUCTURE LOAD ========== 6100 kips
TOTAL LENGTH OF SUBSTRUCTURE (along skew)========= 118.00 ft
NUMBER OF ROWS OF PILES PER SUBSTRUCTURE ====== 1
Approx. Factored Loading Applied per pile at 8 ft. Cts ========== 413.56 KIPS
Approx. Factored Loading Applied per pile at 3 ft. Cts ========== 155.08 KIPS

PILE TYPE AND SIZE ========== Steel HP 10 X 42
Plugged Pile Perimeter========== 3.300 FT. Unplugged Pile Perimeter========== 4.858 FT.
Plugged Pile End Bearing Area========== 0.680 SQFT. Unplugged Pile End Bearing Area======== 0.086 SQFT.

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

Maximum Nominal Req'd Bearing of Pile	Maximum Nominal Req.d Bearing of Boring	Maximum Factored Resistance Available in Boring	Maximum Pile Driveable Length in Boring
335 KIPS	**323** KIPS	**44** KIPS	**29** FT.

BOT. OF LAYER ELEV. (FT.)	LAYER THICK. (FT.)	UNCONF. COMPR. STRENGTH (TSF.)	S.P.T. N VALUE (BLOWS)	GRANULAR OR ROCK LAYER DESCRIPTION	NOMINAL PLUGGED SIDE RESIST. (KIPS)	NOMINAL PLUGGED END BRG. RESIST. (KIPS)	NOMINAL PLUGGED TOTAL RESIST. (KIPS)	NOMINAL UNPLUG'D SIDE RESIST. (KIPS)	NOMINAL UNPLUG'D END BRG. RESIST. (KIPS)	NOMINAL UNPLUG'D TOTAL RESIST. (KIPS)	NOMINAL REQ'D BEARING (KIPS)	FACTORED GEOTECH. LOSS FROM SCOUR or DD (KIPS)	FACTORED GEOTECH. LOSS LOAD FROM DD (KIPS)	FACTORED RESISTANCE AVAILABLE (KIPS)	ESTIMATED PILE LENGTH (FT.)
492.50	13.12	1.50			41.6		***55.9***	61.3		63.1	56	23	46	-38	15
489.50	3.00	1.50			9.5	14.3	***70.2***	14.0	1.8	77.7	70	28	56	-46	18
488.00	1.50	2.00			5.8	19.1	***76.0***	8.5	2.4	86.2	76	31	63	-52	20
486.50	1.50	2.00			5.8	19.1	***85.6***	8.5	2.4	95.2	86	34	69	-57	21
485.00	1.50	2.40			6.5	22.9	***92.1***	9.5	2.9	104.7	92	38	76	-64	23
484.50	0.50	2.40			2.2	22.9	***83.7***	3.2	2.9	106.6	84	39	79	-72	23
482.85	1.65	1.30			4.7	12.4	***88.5***	7.0	1.6	113.6	88	42	84	-77	25
481.20	1.65	1.30			4.7	12.4	218.5	7.0	1.6	***136.4***	136	44	89	-59	26
480.20	1.00			Sandstone	68.5	137.7	287.0	100.9	17.4	***237.3***	237	44	89	-3	27.4
479.50	0.70			Sandstone	48.0	137.7	***282.0***	70.6	17.4	301.2	282	44	89	22	28.1
478.50	1.00			Shale	41.1	84.8	***323.1***	60.5	10.7	361.7	323	44	89	44	29.1
477.50	1.00			Shale	41.1	84.8	***364.3***	60.5	10.7	422.2	~~364~~	~~44~~	~~89~~	~~67~~	~~30.1~~
476.50	1.00			Shale	41.1	84.8	***405.4***	60.5	10.7	482.7	~~405~~	~~44~~	~~89~~	~~89~~	~~31.1~~
475.50	1.00			Shale	41.1	84.8	***446.5***	60.5	10.7	543.3	~~446~~	~~44~~	~~89~~	~~112~~	~~32.1~~
474.50	1.00			Shale	41.1	84.8	***487.6***	60.5	10.7	603.8	~~488~~	~~44~~	~~89~~	~~135~~	~~33.1~~
473.50	1.00			Shale	41.1	84.8	***528.7***	60.5	10.7	664.3	~~529~~	~~44~~	~~89~~	~~157~~	~~34.1~~
472.50	1.00			Shale	41.1	84.8	***569.8***	60.5	10.7	724.8	~~570~~	~~44~~	~~89~~	~~180~~	~~35.1~~
471.50	1.00			Shale	41.1	84.8	***610.9***	60.5	10.7	785.3	~~611~~	~~44~~	~~89~~	~~202~~	~~36.1~~
470.50	1.00			Shale	41.1	84.8	***652.0***	60.5	10.7	845.9	~~652~~	~~44~~	~~89~~	~~225~~	~~37.1~~
469.50	1.00			Shale	41.1	84.8	***693.1***	60.5	10.7	906.4	~~693~~	~~44~~	~~89~~	~~248~~	~~38.1~~
468.50	1.00			Shale	41.1	84.8	***734.2***	60.5	10.7	966.9	~~734~~	~~44~~	~~89~~	~~270~~	~~39.1~~
467.50	1.00			Shale	41.1	84.8	***775.3***	60.5	10.7	1027.4	~~775~~	~~44~~	~~89~~	~~293~~	~~40.1~~
467.00	0.50			Shale	20.6	84.8	***880.6***	30.3	10.7	1068.4	~~881~~	~~44~~	~~89~~	~~351~~	~~40.6~~
466.00	1.00			Limestone	82.2	169.5	***962.9***	121.0	21.5	1189.4	~~963~~	~~44~~	~~89~~	~~396~~	~~41.6~~
465.00	1.00			Limestone	82.2	169.5	***1045.1***	121.0	21.5	1310.5	~~1045~~	~~44~~	~~89~~	~~441~~	~~42.6~~
464.00	1.00			Limestone	82.2	169.5	***1127.3***	121.0	21.5	1431.5	~~1127~~	~~44~~	~~89~~	~~486~~	~~43.6~~
463.50	0.50			Limestone		169.5			21.5						

Illinois Department of Transportation

IDOT STATIC METHOD OF ESTIMATING PILE LENGTH

SUBSTRUCTURE========== Pier 1
REFERENCE BORING ========== ST-3
LRFD or ASD or SEISMIC ========== LRFD
PILE CUTOFF ELEV. ========== 487.70 ft
GROUND SURFACE ELEV. AGAINST PILE DURING DRIVING = 485.70 ft
GEOTECHNICAL LOSS TYPE (None, Scour, Liquef., DD) ===== None
BOTTOM ELEV. OF SCOUR, LIQUEF., or DD ========== ft
TOP ELEV. OF LIQUEF. (so layers above apply DD) ========== ft

TOTAL FACTORED SUBSTRUCTURE LOAD ========== 13400 kips
TOTAL LENGTH OF SUBSTRUCTURE (along skew)========= 118.00 ft
NUMBER OF ROWS OF PILES PER SUBSTRUCTURE ====== 2
Approx. Factored Loading Applied per pile at 8 ft. Cts ========== 454.24 KIPS
Approx. Factored Loading Applied per pile at 3 ft. Cts ========== 170.34 KIPS

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

Maximum Nominal Req'd Bearing of Pile	Maximum Nominal Req.d Bearing of Boring	Maximum Factored Resistance Available in Boring	Maximum Pile Driveable Length in Boring
335 KIPS	**314** KIPS	**172** KIPS	**13** FT.

PILE TYPE AND SIZE ========== Steel HP 10 X 42
Plugged Pile Perimeter========== 3.300 FT. Unplugged Pile Perimeter========== 4.858 FT.
Plugged Pile End Bearing Area========== 0.680 SQFT. Unplugged Pile End Bearing Area======== 0.086 SQFT.

BOT. OF LAYER ELEV. (FT.)	LAYER THICK. (FT.)	UNCONF. COMPR. STRENGTH (TSF.)	S.P.T. N VALUE (BLOWS)	GRANULAR OR ROCK LAYER DESCRIPTION	NOMINAL PLUGGED SIDE RESIST. (KIPS)	NOMINAL PLUGGED END BRG. RESIST. (KIPS)	NOMINAL PLUGGED TOTAL RESIST. (KIPS)	NOMINAL UNPLUG'D SIDE RESIST. (KIPS)	NOMINAL UNPLUG'D END BRG. RESIST. (KIPS)	NOMINAL UNPLUG'D TOTAL RESIST. (KIPS)	NOMINAL REQ'D BEARING (KIPS)	FACTORED GEOTECH. LOSS FROM SCOUR or DD (KIPS)	FACTORED GEOTECH. LOSS LOAD FROM DD (KIPS)	FACTORED RESISTANCE AVAILABLE (KIPS)	ESTIMATED PILE LENGTH (FT.)
483.80	1.90	1.50			6.0		25.1	8.9		***11.3***	11	0	0	6	4
481.30	2.50	2.00			9.6	19.1	34.7	14.1	2.4	***25.4***	25	0	0	14	6
479.30	2.00	2.00			7.7	19.1	108.1	11.3	2.4	***45.1***	45	0	0	25	8
478.30	1.00			Shale	41.1	84.8	149.2	60.5	10.7	***105.6***	106	0	0	58	9.4
477.30	1.00			Shale	41.1	84.8	190.3	60.5	10.7	***166.1***	166	0	0	91	10.4
476.30	1.00			Shale	41.1	84.8	231.4	60.5	10.7	***226.6***	227	0	0	125	11.4
475.30	1.00			Shale	41.1	84.8	***272.5***	60.5	10.7	287.1	273	0	0	150	12.4
474.30	1.00			Shale	41.1	84.8	***313.6***	60.5	10.7	347.7	314	0	0	172	13.4
473.30	1.00			Shale	41.1	84.8	***354.7***	60.5	10.7	408.2	~~355~~	~~0~~	~~0~~	~~195~~	~~14.4~~
472.30	1.00			Shale	41.1	84.8	***395.8***	60.5	10.7	468.7	~~396~~	~~0~~	~~0~~	~~218~~	~~15.4~~
471.30	1.00			Shale	41.1	84.8	***436.9***	60.5	10.7	529.2	~~437~~	~~0~~	~~0~~	~~240~~	~~16.4~~
470.30	1.00			Shale	41.1	84.8	***478.0***	60.5	10.7	589.7	~~478~~	~~0~~	~~0~~	~~263~~	~~17.4~~
469.30	1.00			Shale	41.1	84.8	***519.2***	60.5	10.7	650.3	~~519~~	~~0~~	~~0~~	~~286~~	~~18.4~~
468.30	1.00			Shale	41.1	84.8	***560.3***	60.5	10.7	710.8	~~560~~	~~0~~	~~0~~	~~308~~	~~19.4~~
467.30	1.00			Shale	41.1	84.8	***601.4***	60.5	10.7	771.3	~~601~~	~~0~~	~~0~~	~~331~~	~~20.4~~
466.30	1.00			Shale	41.1	84.8	***727.2***	60.5	10.7	842.5	~~727~~	~~0~~	~~0~~	~~400~~	~~21.4~~
465.30	1.00			Limestone	82.2	169.5	***809.4***	121.0	21.5	963.6	~~809~~	~~0~~	~~0~~	~~445~~	~~22.4~~
464.30	1.00			Limestone	82.2	169.5	***891.7***	121.0	21.5	1084.6	~~892~~	~~0~~	~~0~~	~~490~~	~~23.4~~
463.30	1.00			Limestone	82.2	169.5	***973.9***	121.0	21.5	1205.7	~~974~~	~~0~~	~~0~~	~~536~~	~~24.4~~
463.00	0.30			Limestone	24.7	169.5	***913.8***	36.3	21.5	1231.3	~~914~~	~~0~~	~~0~~	~~503~~	~~24.7~~
462.00	1.00			Shale	41.1	84.8	***954.9***	60.5	10.7	1291.8	~~955~~	~~0~~	~~0~~	~~525~~	~~25.7~~
461.00	1.00			Shale	41.1	84.8	***996.0***	60.5	10.7	1352.3	~~996~~	~~0~~	~~0~~	~~548~~	~~26.7~~
460.85	0.15			Shale		84.8			10.7						

Illinois Department of Transportation

IDOT STATIC METHOD OF ESTIMATING PILE LENGTH

SUBSTRUCTURE========== East Abutment
REFERENCE BORING ========== ST-4
LRFD or ASD or SEISMIC ========== LRFD
PILE CUTOFF ELEV. ========== 508.53 ft
GROUND SURFACE ELEV. AGAINST PILE DURING DRIVING = 506.53 ft
GEOTECHNICAL LOSS TYPE (None, Scour, Liquef., DD) ===== None
BOTTOM ELEV. OF SCOUR, LIQUEF., or DD ========== ft
TOP ELEV. OF LIQUEF. (so layers above apply DD) ========== ft

TOTAL FACTORED SUBSTRUCTURE LOAD ========== 6100 kips
TOTAL LENGTH OF SUBSTRUCTURE (along skew)========= 118.00 ft
NUMBER OF ROWS OF PILES PER SUBSTRUCTURE ====== 1
Approx. Factored Loading Applied per pile at 8 ft. Cts ========== 413.56 KIPS
Approx. Factored Loading Applied per pile at 3 ft. Cts ========== 155.08 KIPS

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

Maximum Nominal Req'd Bearing of Pile	Maximum Nominal Req.d Bearing of Boring	Maximum Factored Resistance Available in Boring	Maximum Pile Driveable Length in Boring
335 KIPS	**331** KIPS	**182** KIPS	**29** FT.

PILE TYPE AND SIZE ========== Steel HP 10 X 42
Plugged Pile Perimeter========== 3.300 FT. Unplugged Pile Perimeter========== 4.858 FT.
Plugged Pile End Bearing Area========== 0.680 SQFT. Unplugged Pile End Bearing Area======== 0.086 SQFT.

BOT. OF LAYER ELEV. (FT.)	LAYER THICK. (FT.)	UNCONF. COMPR. STRENGTH (TSF.)	S.P.T. N VALUE (BLOWS)	GRANULAR OR ROCK LAYER DESCRIPTION	NOMINAL PLUGGED SIDE RESIST. (KIPS)	NOMINAL PLUGGED END BRG. RESIST. (KIPS)	NOMINAL PLUGGED TOTAL RESIST. (KIPS)	NOMINAL UNPLUG'D SIDE RESIST. (KIPS)	NOMINAL UNPLUG'D END BRG. RESIST. (KIPS)	NOMINAL UNPLUG'D TOTAL RESIST. (KIPS)	NOMINAL REQ'D BEARING (KIPS)	FACTORED GEOTECH. LOSS FROM SCOUR or DD (KIPS)	FACTORED GEOTECH. LOSS LOAD FROM DD (KIPS)	FACTORED RESISTANCE AVAILABLE (KIPS)	ESTIMATED PILE LENGTH (FT.)
494.47	12.06	1.50			38.3		76.4	56.4		***61.2***	61	0	0	34	14
492.47	2.00	4.00	10		12.5	38.1	***64.1***	18.4	4.8	76.5	64	0	0	35	16
490.47	2.00	1.40			6.1	13.3	***70.2***	8.9	1.7	85.4	70	0	0	39	18
488.47	2.00	1.40			6.1	13.3	***82.9***	8.9	1.7	95.1	83	0	0	46	20
486.47	2.00	2.10			7.9	20.0	***95.6***	11.7	2.5	107.4	96	0	0	53	22
484.97	1.50	2.60			6.8	24.8	***102.5***	10.1	3.1	117.5	102	0	0	56	24
483.97	1.00	2.60			4.6	24.8	167.0	6.7	3.1	***131.8***	132	0	0	72	25
482.97	1.00			Shale	41.1	84.8	208.1	60.5	10.7	***192.3***	192	0	0	106	25.6
481.97	1.00			Shale	41.1	84.8	***249.2***	60.5	10.7	252.8	249	0	0	137	26.6
480.97	1.00			Shale	41.1	84.8	***290.3***	60.5	10.7	313.4	290	0	0	160	27.6
479.97	1.00			Shale	41.1	84.8	***331.4***	60.5	10.7	373.9	331	0	0	182	28.6
478.97	1.00			Shale	41.1	84.8	***372.5***	60.5	10.7	434.4	~~373~~	~~0~~	~~0~~	~~205~~	~~29.6~~
477.97	1.00			Shale	41.1	84.8	***413.6***	60.5	10.7	494.9	~~414~~	~~0~~	~~0~~	~~228~~	~~30.6~~
476.97	1.00			Shale	41.1	84.8	***454.7***	60.5	10.7	555.4	~~455~~	~~0~~	~~0~~	~~250~~	~~31.6~~
475.97	1.00			Shale	41.1	84.8	***495.9***	60.5	10.7	616.0	~~496~~	~~0~~	~~0~~	~~273~~	~~32.6~~
474.97	1.00			Shale	41.1	84.8	***537.0***	60.5	10.7	676.5	~~537~~	~~0~~	~~0~~	~~295~~	~~33.6~~
473.97	1.00			Shale	41.1	84.8	***578.1***	60.5	10.7	737.0	~~578~~	~~0~~	~~0~~	~~318~~	~~34.6~~
472.97	1.00			Shale	41.1	84.8	***619.2***	60.5	10.7	797.5	~~619~~	~~0~~	~~0~~	~~341~~	~~35.6~~
471.97	1.00			Shale	41.1	84.8	***660.3***	60.5	10.7	858.0	~~660~~	~~0~~	~~0~~	~~363~~	~~36.6~~
470.97	1.00			Shale	41.1	84.8	***701.4***	60.5	10.7	918.6	~~701~~	~~0~~	~~0~~	~~386~~	~~37.6~~
469.97	1.00			Shale	41.1	84.8	***742.5***	60.5	10.7	979.1	~~743~~	~~0~~	~~0~~	~~408~~	~~38.6~~
468.97	1.00			Shale	41.1	84.8	***783.6***	60.5	10.7	1039.6	~~784~~	~~0~~	~~0~~	~~431~~	~~39.6~~
467.97	1.00			Shale	41.1	84.8	***824.7***	60.5	10.7	1100.1	~~825~~	~~0~~	~~0~~	~~454~~	~~40.6~~
467.47	0.50			Shale	20.6	84.8	***930.0***	30.3	10.7	1141.1	~~930~~	~~0~~	~~0~~	~~512~~	~~41.1~~
466.47	1.00			Limestone	82.2	169.5	***1012.2***	121.0	21.5	1262.2	~~1012~~	~~0~~	~~0~~	~~557~~	~~42.1~~
465.47	1.00			Limestone	82.2	169.5	***1094.5***	121.0	21.5	1383.2	~~1094~~	~~0~~	~~0~~	~~602~~	~~43.1~~
464.47	1.00			Limestone		169.5			21.5						

Illinois Department of Transportation

IDOT STATIC METHOD OF ESTIMATING PILE LENGTH

SUBSTRUCTURE========== East Abutment
REFERENCE BORING ========== ST-4
LRFD or ASD or SEISMIC ========== LRFD
PILE CUTOFF ELEV. ========== 508.53 ft
GROUND SURFACE ELEV. AGAINST PILE DURING DRIVING = 506.53 ft
GEOTECHNICAL LOSS TYPE (None, Scour, Liquef., DD) ===== DD
BOTTOM ELEV. OF SCOUR, LIQUEF., or DD ========== 486.50 ft
TOP ELEV. OF LIQUEF. (so layers above apply DD) ========== ft

TOTAL FACTORED SUBSTRUCTURE LOAD ========== 6100 kips
TOTAL LENGTH OF SUBSTRUCTURE (along skew)========= 118.00 ft
NUMBER OF ROWS OF PILES PER SUBSTRUCTURE ====== 1
Approx. Factored Loading Applied per pile at 8 ft. Cts ========== 413.56 KIPS
Approx. Factored Loading Applied per pile at 3 ft. Cts ========== 155.08 KIPS

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

Maximum Nominal Req'd Bearing of Pile	Maximum Nominal Req.d Bearing of Boring	Maximum Factored Resistance Available in Boring	Maximum Pile Driveable Length in Boring
335 KIPS	**331** KIPS	**78** KIPS	**29** FT.

PILE TYPE AND SIZE ========== Steel HP 10 X 42
Plugged Pile Perimeter========== 3.300 FT. Unplugged Pile Perimeter========== 4.858 FT.
Plugged Pile End Bearing Area========== 0.680 SQFT. Unplugged Pile End Bearing Area======== 0.086 SQFT.

BOT. OF LAYER ELEV. (FT.)	LAYER THICK. (FT.)	UNCONF. COMPR. STRENGTH (TSF.)	S.P.T. N VALUE (BLOWS)	GRANULAR OR ROCK LAYER DESCRIPTION	NOMINAL PLUGGED SIDE RESIST. (KIPS)	NOMINAL PLUGGED END BRG. RESIST. (KIPS)	NOMINAL PLUGGED TOTAL RESIST. (KIPS)	NOMINAL UNPLUG'D SIDE RESIST. (KIPS)	NOMINAL UNPLUG'D END BRG. RESIST. (KIPS)	NOMINAL UNPLUG'D TOTAL RESIST. (KIPS)	NOMINAL REQ'D BEARING (KIPS)	FACTORED GEOTECH. LOSS FROM SCOUR or DD (KIPS)	FACTORED GEOTECH. LOSS LOAD FROM DD (KIPS)	FACTORED RESISTANCE AVAILABLE (KIPS)	ESTIMATED PILE LENGTH (FT.)
494.47	12.06	1.50			38.3		76.4	56.4		***61.2***	61	21	42	-30	14
492.47	2.00	4.00	10		12.5	38.1	***64.1***	18.4	4.8	76.5	64	28	56	-49	16
490.47	2.00	1.40			6.1	13.3	***70.2***	8.9	1.7	85.4	70	31	63	-55	18
488.47	2.00	1.40			6.1	13.3	***82.9***	8.9	1.7	95.1	83	35	69	-58	20
486.47	2.00	2.10			7.9	20.0	***95.6***	11.7	2.5	107.4	96	35	69	-51	22
484.97	1.50	2.60			6.8	24.8	***102.5***	10.1	3.1	117.5	102	35	69	-48	24
483.97	1.00	2.60			4.6	24.8	167.0	6.7	3.1	***131.8***	132	35	69	-31	25
482.97	1.00			Shale	41.1	84.8	208.1	60.5	10.7	***192.3***	192	35	69	2	25.6
481.97	1.00			Shale	41.1	84.8	***249.2***	60.5	10.7	252.8	249	35	69	33	26.6
480.97	1.00			Shale	41.1	84.8	***290.3***	60.5	10.7	313.4	290	35	69	56	27.6
479.97	1.00			Shale	41.1	84.8	***331.4***	60.5	10.7	373.9	331	35	69	78	28.6
478.97	1.00			Shale	41.1	84.8	***372.5***	60.5	10.7	434.4	~~373~~	~~35~~	~~69~~	~~101~~	~~29.6~~
477.97	1.00			Shale	41.1	84.8	***413.6***	60.5	10.7	494.9	~~414~~	~~35~~	~~69~~	~~124~~	~~30.6~~
476.97	1.00			Shale	41.1	84.8	***454.7***	60.5	10.7	555.4	~~455~~	~~35~~	~~69~~	~~146~~	~~31.6~~
475.97	1.00			Shale	41.1	84.8	***495.9***	60.5	10.7	616.0	~~496~~	~~35~~	~~69~~	~~169~~	~~32.6~~
474.97	1.00			Shale	41.1	84.8	***537.0***	60.5	10.7	676.5	~~537~~	~~35~~	~~69~~	~~191~~	~~33.6~~
473.97	1.00			Shale	41.1	84.8	***578.1***	60.5	10.7	737.0	~~578~~	~~35~~	~~69~~	~~214~~	~~34.6~~
472.97	1.00			Shale	41.1	84.8	***619.2***	60.5	10.7	797.5	~~619~~	~~35~~	~~69~~	~~237~~	~~35.6~~
471.97	1.00			Shale	41.1	84.8	***660.3***	60.5	10.7	858.0	~~660~~	~~35~~	~~69~~	~~259~~	~~36.6~~
470.97	1.00			Shale	41.1	84.8	***701.4***	60.5	10.7	918.6	~~701~~	~~35~~	~~69~~	~~282~~	~~37.6~~
469.97	1.00			Shale	41.1	84.8	***742.5***	60.5	10.7	979.1	~~743~~	~~35~~	~~69~~	~~304~~	~~38.6~~
468.97	1.00			Shale	41.1	84.8	***783.6***	60.5	10.7	1039.6	~~784~~	~~35~~	~~69~~	~~327~~	~~39.6~~
467.97	1.00			Shale	41.1	84.8	***824.7***	60.5	10.7	1100.1	~~825~~	~~35~~	~~69~~	~~350~~	~~40.6~~
467.47	0.50			Shale	20.6	84.8	***930.0***	30.3	10.7	1141.1	~~930~~	~~35~~	~~69~~	~~408~~	~~41.1~~
466.47	1.00			Limestone	82.2	169.5	***1012.2***	121.0	21.5	1262.2	~~1012~~	~~35~~	~~69~~	~~453~~	~~42.1~~
465.47	1.00			Limestone	82.2	169.5	***1094.5***	121.0	21.5	1383.2	~~1094~~	~~35~~	~~69~~	~~498~~	~~43.1~~
464.47	1.00			Limestone		169.5			21.5						

EXHIBIT J

DRILLED SHAFT CALCUATIONS

Illinois Department of Transportation

DRILLED SHAFT AXIAL CAPACITY IN ROCK - DOLOMITE, LIMESTONE, SANDSTONE, AND HARD SHALE

STRUCTURE ========== SN 041-0023
SUBSTRUCTURE & REFERENCE BORING ========== W. Abutment - Boring ST-1
GROUND SURFACE ELEVATION ========== 516.07 FT
GROUND WATER ELEVATION ========== FT
ESTIMATED TOP OF ROCK ELEVATION ========== 481.20 FT
DRILLED SHAFT DIAMETER IN ROCK ========== 36 IN.
FACTORED AXIAL LOAD ========== 6100 KIPS
DRILLED SHAFT CONCRETE STRENGTH, f'c ========== 3.5 KSI

FOUNDATION REDUNDANCY ========== REDUNDANT

Drilled Shaft Dia.'s for Design Table

36	IN.
42	IN,
48	IN.
60	IN.
	IN.
	IN.

SOCKET DEPTH (FT)	TIP ELEV. (FT)	LAYER THICK. (FT)	UNCONFINED COMPRESSIVE STRENGTH (q_u) (KSF)	ROCK TYPE	GSI	ROCK CONDITION	RQD (%)	JOINT TYPE	ROCK INTACT OR TIGHTLY JOINTED?	SIDE RESISTANCE NOM. RESIST. (KIPS)	Σ NOM. RESIST. (KIPS)	Σ FACT. RESIST. (KIPS)	SIDE RESISTANCE SETTLEMENT Q_{C1} (KIPS)	w_{C1} (IN.)	w_{Rn} (IN.)	AVG. q_u W/IN 2 - SHAFT DIA. (KSF)	TIP RESISTANCE NOM. RESIST. (KIPS)	TIP RESISTANCE FACT. RESIST. (KIPS)	TIP RESISTANCE SETTL. w_{Rn} (IN.)	COMBINED SIDE & TIP RESISTANCE R_P/R_n	COMBINED SIDE & TIP RESISTANCE NOM. RESIST. (KIPS)	COMBINED SIDE & TIP RESISTANCE FACT. RESIST. (KIPS)	COMBINED SIDE & TIP RESISTANCE SETTLEMENT Q_{C1} (KIPS)	w_{C1} (IN.)	w_{Rn} (IN.)
1.70	479.50	1.70	700.0	Sandstone	70	Fractured	40	Open	No	179	179	98	169	0.012	0.020	105.0	1702	851	2.136	0.08	195	106	178	0.012	0.020
3.00	478.20	1.30	105.0	Shale	35	Normal	40	Open	No	183	362	199	203	0.021	0.196	105.0	367	184	0.462	0.29	509	273	220	0.021	0.188
4.00	477.20	1.00	105.0	Shale	35	Normal	40	Open	No	141	502	276	230	0.027	0.358	105.0	373	186	0.462	0.35	772	411	252	0.027	0.344
5.00	476.20	1.00	105.0	Shale	35	Normal	40	Open	No	141	643	354	258	0.033	0.528	105.0	379	189	0.496	0.38	1004	533	283	0.033	0.486
6.00	475.20	1.00	105.0	Shale	35	Normal	40	Open	No	141	783	431	285	0.038	0.700	105.0	384	192	0.488	0.37	1041	553	314	0.038	0.503
7.00	474.20	1.00	105.0	Shale	35	Normal	40	Open	No	141	924	508	312	0.043	0.867	105.0	390	195	0.513	0.36	1086	578	345	0.043	0.522
8.00	473.20	1.00	105.0	Shale	35	Normal	40	Open	No	141	1065	586	340	0.047	1.030	105.0	395	198	0.504	0.35	1137	606	376	0.048	0.543
9.00	472.20	1.00	105.0	Shale	35	Normal	40	Open	No	141	1205	663	368	0.052	1.186	105.0	400	200	0.530	0.34	1192	636	406	0.053	0.564
10.00	471.20	1.00	105.0	Shale	35	Normal	40	Open	No	141	1346	740	395	0.056	1.335	171.0	539	270	0.606	0.38	1420	754	442	0.057	0.650
11.00	470.20	1.00	105.0	Shale	35	Normal	40	Open	No	141	1486	818	423	0.060	1.478	253.5	693	347	0.661	0.42	1633	863	484	0.062	0.685
12.00	469.20	1.00	105.0	Shale	35	Normal	40	Open	No	141	1627	895	451	0.064	1.614	336.0	836	418	0.613	0.47	1791	943	532	0.066	0.654
13.00	468.20	1.00	105.0	Shale	35	Normal	40	Open	No	141	1768	972	479	0.068	1.743	393.8	935	467	0.558	0.49	1890	993	585	0.071	0.601
14.00	467.20	1.00	105.0	Shale	35	Normal	40	Open	No	141	1908	1050	506	0.072	1.866	393.8	944	472	0.583	0.48	1949	1025	617	0.075	0.617
15.20	466.00	1.20	105.0	Shale	35	Normal	40	Open	No	169	2077	1142	540	0.077	2.006	393.8	955	477	0.569	0.47	2021	1064	655	0.080	0.636
16.20	465.00	1.00	600.0	Limestone	70	Normal	73	Open	No	308	2385	1312	642	0.060	1.256	352.5	3455	1728	2.461	0.40	3998	2118	710	0.062	1.206
17.20	464.00	1.00	600.0	Limestone	70	Normal	73	Open	No	308	2693	1481	749	0.055	0.948	352.5	3473	1737	2.461	0.30	3869	2069	804	0.056	0.913
18.20	463.00	1.00	600.0	Limestone	70	Normal	73	Open	No	308	3001	1651	862	0.054	0.781	270.0	2840	1420	2.595	0.20	3735	2018	899	0.055	0.761
18.70	462.50	0.50	600.0	Limestone	70	Normal	73	Open	No	154	3155	1735	920	0.054	0.724	228.8	2513	1256	2.542	0.16	3758	2037	952	0.055	0.708
19.70	461.50	1.00	105.0	Shale	35	Normal	40	Open	No	141	3296	1813	949	0.057	0.769	228.8	712	356	0.716	0.16	3931	2130	981	0.058	0.753
20.70	460.50	1.00	105.0	Shale	35	Normal	40	Open	No	141	3437	1890	977	0.059	0.813	228.8	718	359	0.734	0.16	4104	2224	1009	0.060	0.798
21.70	459.50	1.00	105.0	Shale	35	Normal	40	Open	No	141	3577	1967	1006	0.062	0.858	228.8	725	362	0.735	0.16	4276	2317	1038	0.063	0.843
23.20	458.00	1.50	600.0	Limestone	70	Normal	73	Open	No	462	4039	2222	1189	0.065	0.717	105.0	1484	742	1.990	0.09	4460	2432	1208	0.065	0.709
24.20	457.00	1.00	105.0	Shale	35	Normal	40	Open	No	141	4180	2299	1217	0.067	0.754	105.0	475	237	0.633	0.09	4618	2518	1236	0.068	0.746
25.20	456.00	1.00	105.0	Shale	35	Normal	40	Open	No	141	4320	2376	1245	0.070	0.791	105.0	479	240	0.657	0.10	4777	2605	1263	0.071	0.783
26.20	455.00	1.00	105.0	Shale	35	Normal	40	Open	No	141	4461	2454	1273	0.073	0.827	105.0	484	242	0.639	0.10	4934	2690	1291	0.073	0.821
27.20	454.00	1.00	105.0	Shale	35	Normal	40	Open	No	141	4602	2531	1301	0.076	0.864	187.5	676	338	0.773	0.11	5177	2819	1321	0.076	0.857
28.20	453.00	1.00	105.0	Shale	35	Normal	40	Open	No	141	4742	2608	1329	0.078	0.901	270.0	845	422	0.793	0.13	5461	2968	1353	0.079	0.893
29.20	452.00	1.00	105.0	Shale	35	Normal	40	Open	No	141	4883	2686	1356	0.081	0.938	352.5	1001	500	0.770	0.16	5819	3154	1386	0.082	0.930
30.20	451.00	1.00	105.0	Shale	35	Normal	40	Open	No	141	5024	2763	1384	0.084	0.975	435.0	1148	574	0.631	0.20	5756	3108	1424	0.086	0.863
31.20	450.00	1.00	105.0	Shale	35	Normal	40	Open	No	141	5164	2840	1412	0.087	1.012										
32.20	449.00	1.00	105.0	Shale	35	Normal	40	Open	No	141	5305	2918	1440	0.090	1.049										
33.20	448.00	1.00	600.0	Limestone	70	Normal	73	Open	No	308	5613	3087	1562	0.092	0.959										
34.20	447.00	1.00	600.0	Limestone	70	Normal	73	Open	No	308	5921	3257	1686	0.095	0.892										
35.20	446.00	1.00	600.0	Limestone	70	Normal	73	Open	No	308	6229	3426	1812	0.098	0.841										
36.20	445.00	1.00	600.0	Limestone	70	Normal	73	Open	No	308	6537	3595	1940	0.101	0.802										

Drilled Shaft Design Table for W. Abutment - Boring ST-1

Estimated Top of Rock Elevation: 481.20

SOCKET DEPTH (FT)	TIP ELEV. (FT)	NOMINAL SHAFT RESIST. (KIPS)	FACTORED SHAFT RESIST. (KIPS)	RESIST. METHOD	SETTLEMENT DATA		
					Q_{C1} (KIPS)	w_{C1} (IN.)	w_{Rn} (IN.)
36 in. Diameter Drilled Shaft							
1.7	479.5	1702	851	TIP	--	--	2.136
3	478.2	509	273	SIDE + TIP	220	0.021	0.188
4	477.2	772	411	SIDE + TIP	252	0.027	0.344
5	476.2	1004	533	SIDE + TIP	283	0.033	0.486
6	475.2	1041	553	SIDE + TIP	314	0.038	0.503
7	474.2	1086	578	SIDE + TIP	345	0.043	0.522
8	473.2	1137	606	SIDE + TIP	376	0.048	0.543
9	472.2	1205	663	SIDE	368	0.052	1.186
10	471.2	1420	754	SIDE + TIP	442	0.057	0.650
11	470.2	1633	863	SIDE + TIP	484	0.062	0.685
12	469.2	1791	943	SIDE + TIP	532	0.066	0.654
13	468.2	1890	993	SIDE + TIP	585	0.071	0.601
14	467.2	1949	1025	SIDE + TIP	617	0.075	0.617
15.2	466	2077	1142	SIDE	540	0.077	2.006
16.2	465	3998	2118	SIDE + TIP	710	0.062	1.206
17.2	464	3869	2069	SIDE + TIP	804	0.056	0.913
18.2	463	3735	2018	SIDE + TIP	899	0.055	0.761
18.7	462.5	3758	2037	SIDE + TIP	952	0.055	0.708
19.7	461.5	3931	2130	SIDE + TIP	981	0.058	0.753
20.7	460.5	4104	2224	SIDE + TIP	1009	0.060	0.798
21.7	459.5	4276	2317	SIDE + TIP	1038	0.063	0.843
23.2	458	4460	2432	SIDE + TIP	1208	0.065	0.709
24.2	457	4618	2518	SIDE + TIP	1236	0.068	0.746
25.2	456	4777	2605	SIDE + TIP	1263	0.071	0.783
26.2	455	4934	2690	SIDE + TIP	1291	0.073	0.821
27.2	454	5177	2819	SIDE + TIP	1321	0.076	0.857
28.2	453	5461	2968	SIDE + TIP	1353	0.079	0.893
29.2	452	5819	3154	SIDE + TIP	1386	0.082	0.930
30.2	451	5756	3108	SIDE + TIP	1424	0.086	0.863
31.2	450	5164	2840	SIDE	1412	0.087	1.012
32.2	449	5305	2918	SIDE	1440	0.090	1.049
33.2	448	5613	3087	SIDE	1562	0.092	0.959
34.2	447	5921	3257	SIDE	1686	0.095	0.892
35.2	446	6229	3426	SIDE	1812	0.098	0.841
36.2	445	6537	3595	SIDE	1940	0.101	0.802
42 in. Diameter Drilled Shaft							
1.7	479.5	2317	1159	TIP	--	--	2.491
3	478.2	621	332	SIDE + TIP	257	0.022	0.216
4	477.2	951	505	SIDE + TIP	294	0.029	0.397
5	476.2	1246	660	SIDE + TIP	332	0.035	0.564
6	475.2	1289	683	SIDE + TIP	368	0.041	0.582
7	474.2	1340	710	SIDE + TIP	405	0.046	0.601
8	473.2	1397	741	SIDE + TIP	441	0.052	0.621
9	472.2	1661	879	SIDE + TIP	483	0.057	0.716
10	471.2	1919	1011	SIDE + TIP	529	0.062	0.767
11	470.2	2126	1117	SIDE + TIP	582	0.067	0.759
12	469.2	2263	1186	SIDE + TIP	637	0.072	0.726
13	468.2	2330	1222	SIDE + TIP	674	0.076	0.742
14	467.2	2398	1259	SIDE + TIP	712	0.080	0.758
15.2	466	2519	1321	SIDE + TIP	775	0.086	0.726
16.2	465	5294	2786	SIDE + TIP	847	0.066	1.377
17.2	464	4601	2458	SIDE + TIP	932	0.058	1.052
18.2	463	4466	2408	SIDE + TIP	1041	0.056	0.873
18.7	462.5	4490	2429	SIDE + TIP	1101	0.056	0.810
19.7	461.5	4698	2541	SIDE + TIP	1135	0.059	0.861
20.7	460.5	4906	2653	SIDE + TIP	1169	0.062	0.911
21.7	459.5	5113	2765	SIDE + TIP	1203	0.065	0.962
23.2	458	5309	2890	SIDE + TIP	1396	0.065	0.804
24.2	457	5499	2993	SIDE + TIP	1429	0.068	0.845
25.2	456	5688	3096	SIDE + TIP	1462	0.071	0.886
26.2	455	5975	3248	SIDE + TIP	1499	0.074	0.926
27.2	454	6303	3420	SIDE + TIP	1538	0.077	0.965
28.2	453	6696	3625	SIDE + TIP	1580	0.080	1.003
29.2	452	6971	3762	SIDE + TIP	1625	0.083	1.000
30.2	451	5861	3223	SIDE	1597	0.084	1.101
31.2	450	6025	3314	SIDE	1630	0.087	1.142
32.2	449	6189	3404	SIDE	1664	0.090	1.183
33.2	448	6548	3602	SIDE	1805	0.091	1.075
34.2	447	6908	3799	SIDE	1949	0.094	0.994
35.2	446	7267	3997	SIDE	2097	0.097	0.931
36.2	445	7627	4195	SIDE	2248	0.100	0.882
48 in. Diameter Drilled Shaft							
1.7	479.5	3027	1513	TIP	--	--	2.834
3	478.2	740	394	SIDE + TIP	293	0.023	0.244
4	477.2	1143	605	SIDE + TIP	337	0.030	0.450
5	476.2	1511	797	SIDE + TIP	380	0.037	0.642
6	475.2	1558	823	SIDE + TIP	423	0.043	0.660
7	474.2	1615	854	SIDE + TIP	465	0.049	0.680
8	473.2	1912	1008	SIDE + TIP	513	0.055	0.781
9	472.2	2212	1162	SIDE + TIP	565	0.061	0.845
10	471.2	2463	1290	SIDE + TIP	622	0.066	0.855
11	470.2	2635	1378	SIDE + TIP	680	0.071	0.837
12	469.2	2710	1418	SIDE + TIP	724	0.076	0.854
13	468.2	2787	1460	SIDE + TIP	767	0.081	0.871
14	467.2	2901	1519	SIDE + TIP	819	0.086	0.866
15.2	466	3105	1620	SIDE + TIP	924	0.092	0.754
16.2	465	6143	3071	TIP	--	--	3.183
17.2	464	5378	2869	SIDE + TIP	1060	0.061	1.192
18.2	463	5228	2814	SIDE + TIP	1183	0.058	0.986
18.7	462.5	5251	2836	SIDE + TIP	1250	0.057	0.915
19.7	461.5	5497	2968	SIDE + TIP	1289	0.060	0.971
20.7	460.5	5742	3100	SIDE + TIP	1328	0.063	1.027
21.7	459.5	5857	3162	SIDE + TIP	1367	0.066	1.055
23.2	458	6187	3363	SIDE + TIP	1582	0.066	0.902
24.2	457	6409	3483	SIDE + TIP	1620	0.069	0.947
25.2	456	6740	3658	SIDE + TIP	1664	0.072	0.990
26.2	455	7112	3853	SIDE + TIP	1709	0.075	1.032
27.2	454	7544	4079	SIDE + TIP	1757	0.078	1.074
28.2	453	8073	4353	SIDE + TIP	1809	0.081	1.114
29.2	452	6511	3581	SIDE	1769	0.082	1.188
30.2	451	6698	3684	SIDE	1807	0.085	1.233
31.2	450	6886	3787	SIDE	1845	0.087	1.277
32.2	449	7073	3890	SIDE	1883	0.090	1.321
33.2	448	7484	4116	SIDE	2041	0.091	1.196
34.2	447	7895	4342	SIDE	2204	0.093	1.101
35.2	446	8305	4568	SIDE	2371	0.096	1.027
36.2	445	8716	4794	SIDE	2542	0.099	0.969
60 in. Diameter Drilled Shaft							
1.7	479.5	4729	2365	TIP	--	--	3.540
3	478.2	1020	510	TIP	--	--	0.768
4	477.2	1568	826	SIDE + TIP	422	0.032	0.554
5	476.2	2104	1105	SIDE + TIP	478	0.040	0.798
6	475.2	2452	1284	SIDE + TIP	537	0.047	0.908
7	474.2	2824	1475	SIDE + TIP	601	0.054	0.990
8	473.2	3152	1643	SIDE + TIP	669	0.061	1.026
9	472.2	3388	1764	SIDE + TIP	736	0.067	1.033
10	471.2	3476	1811	SIDE + TIP	792	0.073	1.051
11	470.2	3567	1860	SIDE + TIP	848	0.079	1.070
12	469.2	3721	1940	SIDE + TIP	910	0.085	1.076
13	468.2	3993	2077	SIDE + TIP	995	0.091	1.030
14	467.2	4122	2145	SIDE + TIP	1059	0.096	1.031
15.2	466	4242	2210	SIDE + TIP	1126	0.102	1.052
16.2	465	8524	4262	TIP	--	--	4.143
17.2	464	7475	3737	TIP	--	--	4.182
18.2	463	6847	3674	SIDE + TIP	1468	0.062	1.215
18.7	462.5	6861	3693	SIDE + TIP	1549	0.061	1.125
19.7	461.5	7186	3868	SIDE + TIP	1598	0.064	1.193
20.7	460.5	7329	3945	SIDE + TIP	1647	0.067	1.224
21.7	459.5	7418	3993	SIDE + TIP	1697	0.070	1.244
23.2	458	8155	4414	SIDE + TIP	1959	0.069	1.099
24.2	457	8615	4656	SIDE + TIP	2016	0.072	1.149
25.2	456	9128	4924	SIDE + TIP	2075	0.075	1.199
26.2	455	9718	5231	SIDE + TIP	2138	0.078	1.247
27.2	454	7670	4218	SIDE	2078	0.078	1.344
28.2	453	7904	4347	SIDE	2125	0.081	1.397
29.2	452	8138	4476	SIDE	2173	0.084	1.450
30.2	451	8373	4605	SIDE	2220	0.087	1.503
31.2	450	8607	4734	SIDE	2268	0.090	1.556
32.2	449	8841	4863	SIDE	2316	0.093	1.609
33.2	448	9355	5145	SIDE	2506	0.093	1.450
34.2	447	9868	5428	SIDE	2701	0.094	1.328
35.2	446	10382	5710	SIDE	2902	0.095	1.232
36.2	445	10895	5992	SIDE	3108	0.098	1.155

Illinois Department of Transportation

DRILLED SHAFT AXIAL CAPACITY IN ROCK - DOLOMITE, LIMESTONE, SANDSTONE, AND HARD SHALE

STRUCTURE ========== SN 041-0023
SUBSTRUCTURE & REFERENCE BORING ======= Pier - Boring ST-3
GROUND SURFACE ELEVATION ========== 489.70 FT
GROUND WATER ELEVATION ========== FT
ESTIMATED TOP OF ROCK ELEVATION ========= 479.35 FT
DRILLED SHAFT DIAMETER IN ROCK ========== 36 IN.
FACTORED AXIAL LOAD ========== 13400 KIPS
DRILLED SHAFT CONCRETE STRENGTH, f'c ===== 3.5 KSI

FOUNDATION REDUNDANCY ===: REDUNDANT

Drilled Shaft Dia.'s for Design Table

36	IN.
42	IN,
48	IN.
60	IN.
	IN.
	IN.

SOCKET DEPTH (FT)	TIP ELEV. (FT)	LAYER THICK. (FT)	UNCONFINED COMPRESSIVE STRENGTH (q_u) (KSF)	ROCK TYPE	GSI	ROCK CONDITION	RQD (%)	JOINT TYPE	ROCK INTACT OR TIGHTLY JOINTED?	SIDE RESISTANCE						AVG. q_u W/IN 2 - SHAFT DIA. (KSF)	TIP RESISTANCE			COMBINED SIDE & TIP RESISTANCE					
										NOM. RESIST. (KIPS)	Σ NOM. RESIST. (KIPS)	Σ FACT. RESIST. (KIPS)	SETTLEMENT							R_P/R_n	NOM. RESIST. (KIPS)	FACT. RESIST. (KIPS)	SETTLEMENT		
													Q_{C1} (KIPS)	w_{C1} (IN.)	w_{Rn} (IN.)								Q_{C1} (KIPS)	w_{C1} (IN.)	w_{Rn} (IN.)
1.00	478.35	1.00	105.0	Shale	35	Normal	25	Open	Yes	141	141	77	27	0.016	5.287	105.0	232	116	0.282	0.87	266	135	40	0.016	0.292
2.00	477.35	1.00	105.0	Shale	35	Normal	25	Open	Yes	141	281	155	54	0.039	5.403	105.0	242	121	0.287	0.77	313	160	85	0.039	0.311
3.00	476.35	1.00	105.0	Shale	35	Normal	25	Open	Yes	141	422	232	81	0.053	5.470	105.0	251	126	0.317	0.69	364	188	123	0.053	0.334
4.00	475.35	1.00	105.0	Shale	35	Fractured	25	Open	Yes	43	465	256	108	0.063	4.350	105.0	260	130	0.320	0.63	416	216	158	0.063	0.357
5.00	474.35	1.00	105.0	Shale	35	Fractured	25	Open	Yes	43	509	280	135	0.070	3.676	105.0	1856	928	2.367	0.83	2237	1138	191	0.071	2.353
6.00	473.35	1.00	105.0	Shale	35	Normal	25	Open	Yes	141	649	357	162	0.077	4.011	105.0	1856	928	2.356	0.80	2313	1179	223	0.078	2.362
7.00	472.35	1.00	105.0	Shale	35	Normal	93	Open	Yes	141	790	434	189	0.082	4.255	105.0	1856	928	2.379	0.78	2388	1221	254	0.083	2.371
8.00	471.35	1.00	105.0	Shale	35	Normal	93	Open	Yes	141	931	512	217	0.087	4.442	254.2	4491	2246	4.840	0.81	4874	2484	297	0.089	4.262
9.00	470.35	1.00	105.0	Shale	35	Normal	93	Open	Yes	141	1071	589	244	0.092	4.589	403.3	7127	3564	6.302	0.82	6011	3059	347	0.094	4.373
10.00	469.35	1.00	105.0	Shale	35	Normal	93	Open	Yes	141	1212	666	271	0.096	4.710	552.5	9763	4882	6.698	0.84	7652	3887	410	0.099	4.439
11.00	468.35	1.00	105.0	Shale	35	Normal	93	Open	Yes	141	1352	744	299	0.100	4.810	597.3	10554	5277	6.663	0.84	8493	4314	456	0.103	4.522
12.00	467.35	1.00	105.0	Shale	35	Normal	93	Open	Yes	141	1493	821	326	0.103	4.896	597.3	10554	5277	6.682	0.83	8735	4442	487	0.107	4.616
13.00	466.35	1.00	105.0	Shale	35	Normal	81	Open	Yes	141	1634	898	353	0.107	4.969	679.3	12004	6002	6.326	0.84	10382	5273	555	0.112	4.646
14.00	465.35	1.00	1000.0	Limestone	70	Normal	81	Open	Yes	308	1942	1068	485	0.061	1.739	597.3	10554	5277	6.772	0.56	4449	2322	569	0.063	1.651
15.00	464.35	1.00	1000.0	Limestone	70	Normal	81	Open	Yes	308	2250	1237	624	0.053	1.056	530.1	9368	4684	6.886	0.37	3553	1889	683	0.055	1.012
16.00	463.35	1.00	1000.0	Limestone	70	Normal	81	Open	Yes	308	2558	1407	773	0.053	0.770	418.3	7391	3696	6.549	0.23	3323	1789	817	0.054	0.746
16.30	463.05	0.30	1000.0	Limestone	70	Normal	81	Open	Yes	92	2650	1458	820	0.053	0.715	373.5	6600	3300	6.241	0.20	3309	1787	860	0.054	0.695
17.30	462.05	1.00	105.0	Shale	35	Fractured	60	Open	Yes	50	2701	1485	848	0.056	0.735	373.5	6600	3300	6.273	0.20	3372	1821	889	0.057	0.715
18.45	460.90	1.15	105.0	Shale	35	Fractured	60	Open	Yes	58	2758	1517	881	0.059	0.756	373.5	6600	3300	6.316	0.20	3443	1859	922	0.061	0.738
19.45	459.90	1.00	1000.0	Limestone	70	Normal	60	Open	Yes	308	3066	1687	1043	0.062	0.623	224.3	3964	1982	4.587	0.13	3511	1909	1075	0.063	0.612
20.45	458.90	1.00	105.0	Shale	35	Normal	60	Open	Yes	141	3207	1764	1071	0.065	0.665	224.3	3964	1982	4.584	0.13	3679	2000	1103	0.066	0.654
21.25	458.10	0.80	1000.0	Limestone	70	Normal	60	Open	Yes	246	3453	1899	1208	0.067	0.590	105.0	1856	928	2.471	0.09	3804	2075	1234	0.068	0.582
22.25	457.10	1.00	105.0	Shale	35	Normal	53	Open	Yes	141	3594	1977	1236	0.070	0.627	105.0	1856	928	2.444	0.09	3964	2162	1261	0.071	0.619
23.25	456.10	1.00	105.0	Shale	35	Normal	53	Open	Yes	141	3735	2054	1264	0.073	0.664	224.3	3964	1982	4.656	0.11	4176	2275	1292	0.074	0.656
24.25	455.10	1.00	105.0	Shale	35	Normal	53	Open	Yes	141	3875	2131	1291	0.076	0.702	373.5	6600	3300	6.449	0.13	4431	2409	1326	0.077	0.692
25.25	454.10	1.00	105.0	Shale	35	Normal	53	Open	Yes	141	4016	2209	1319	0.079	0.739	522.7	9236	4618	7.183	0.15	4743	2572	1362	0.081	0.728
26.25	453.10	1.00	105.0	Shale	35	Normal	53	Open	Yes	141	4157	2286	1347	0.082	0.777										
27.25	452.10	1.00	105.0	Shale	35	Normal	82	Open	Yes	141	4297	2363	1375	0.085	0.815										
28.45	450.90	1.20	105.0	Shale	35	Normal	82	Open	Yes	169	4466	2456	1408	0.089	0.861										
29.45	449.90	1.00	1000.0	Limestone	70	Normal	82	Open	Yes	308	4774	2626	1582	0.093	0.763										
30.45	448.90	1.00	1000.0	Limestone	70	Normal	82	Open	Yes	308	5082	2795	1763	0.098	0.693										
31.25	448.10	0.80	1000.0	Limestone	70	Normal	82	Open	Yes	246	5329	2931	1913	0.102	0.650										

Drilled Shaft Design Table for Pier - Boring ST-3

Estimated Top of Rock Elevation: 479.35

SOCKET DEPTH (FT)	TIP ELEV. (FT)	NOMINAL SHAFT RESIST. (KIPS)	FACTORED SHAFT RESIST. (KIPS)	RESIST. METHOD	SETTLEMENT DATA		
					Q_{C1} (KIPS)	w_{C1} (IN.)	w_{Rn} (IN.)
36 in. Diameter Drilled Shaft							
1	478.35	266	135	SIDE + TIP	40	0.016	0.292
2	477.35	313	160	SIDE + TIP	85	0.039	0.311
3	476.35	422	232	SIDE	81	0.053	5.470
4	475.35	465	256	SIDE	108	0.063	4.350
5	474.35	2237	1138	SIDE + TIP	191	0.071	2.353
6	473.35	2313	1179	SIDE + TIP	223	0.078	2.362
7	472.35	2388	1221	SIDE + TIP	254	0.083	2.371
8	471.35	4874	2484	SIDE + TIP	297	0.089	4.262
9	470.35	7127	3564	TIP	--	--	6.302
10	469.35	9763	4882	TIP	--	--	6.698
11	468.35	10554	5277	TIP	--	--	6.663
12	467.35	10554	5277	TIP	--	--	6.682
13	466.35	12004	6002	TIP	--	--	6.326
14	465.35	10554	5277	TIP	--	--	6.772
15	464.35	9368	4684	TIP	--	--	6.886
16	463.35	7391	3696	TIP	--	--	6.549
16.3	463.05	6600	3300	TIP	--	--	6.241
17.3	462.05	6600	3300	TIP	--	--	6.273
18.45	460.9	6600	3300	TIP	--	--	6.316
19.45	459.9	3964	1982	TIP	--	--	4.587
20.45	458.9	3964	1982	TIP	--	--	4.584
21.25	458.1	3804	2075	SIDE + TIP	1234	0.068	0.582
22.25	457.1	3964	2162	SIDE + TIP	1261	0.071	0.619
23.25	456.1	4176	2275	SIDE + TIP	1292	0.074	0.656
24.25	455.1	6600	3300	TIP	--	--	6.449
25.25	454.1	9236	4618	TIP	--	--	7.183
26.25	453.1	4157	2286	SIDE	1347	0.082	0.777
27.25	452.1	4297	2363	SIDE	1375	0.085	0.815
28.45	450.9	4466	2456	SIDE	1408	0.089	0.861
29.45	449.9	4774	2626	SIDE	1582	0.093	0.763
30.45	448.9	5082	2795	SIDE	1763	0.098	0.693
31.25	448.1	5329	2931	SIDE	1913	0.102	0.650
42 in. Diameter Drilled Shaft							
1	478.35	356	180	SIDE + TIP	43	0.013	0.340
2	477.35	411	210	SIDE + TIP	100	0.040	0.360
3	476.35	492	271	SIDE	94	0.055	6.352
4	475.35	543	299	SIDE	126	0.067	5.051
5	474.35	593	326	SIDE	158	0.076	4.268
6	473.35	3060	1557	SIDE + TIP	266	0.084	2.747
7	472.35	5934	3013	SIDE + TIP	316	0.091	4.730
8	471.35	8676	4338	TIP	--	--	6.926
9	470.35	11752	5876	TIP	--	--	7.710
10	469.35	12674	6337	TIP	--	--	7.770
11	468.35	12674	6337	TIP	--	--	7.792
12	467.35	14366	7183	TIP	--	--	7.723
13	466.35	15749	7875	TIP	--	--	7.489
14	465.35	14366	7183	TIP	--	--	7.796
15	464.35	12059	6030	TIP	--	--	7.899
16	463.35	8984	4492	TIP	--	--	7.213
16.3	463.05	8061	4031	TIP	--	--	6.841
17.3	462.05	8061	4031	TIP	--	--	6.852
18.45	460.9	8061	4031	TIP	--	--	6.885
19.45	459.9	4986	2493	TIP	--	--	5.001
20.45	458.9	4986	2493	TIP	--	--	5.033
21.25	458.1	4525	2464	SIDE + TIP	1423	0.069	0.661
22.25	457.1	4986	2493	TIP	--	--	5.026
23.25	456.1	8061	4031	TIP	--	--	6.984
24.25	455.1	11136	5568	TIP	--	--	8.046
25.25	454.1	4685	2577	SIDE	1517	0.079	0.840
26.25	453.1	4849	2667	SIDE	1550	0.082	0.882
27.25	452.1	5013	2757	SIDE	1583	0.085	0.924
28.45	450.9	5210	2866	SIDE	1623	0.089	0.974
29.45	449.9	5570	3063	SIDE	1821	0.092	0.857
30.45	448.9	5929	3261	SIDE	2028	0.097	0.773
31.25	448.1	6217	3419	SIDE	2200	0.101	0.721
48 in. Diameter Drilled Shaft							
1	478.35	458	231	SIDE + TIP	45	0.009	0.388
2	477.35	523	266	SIDE + TIP	114	0.039	0.409
3	476.35	591	303	SIDE + TIP	169	0.058	0.432
4	475.35	660	340	SIDE + TIP	219	0.071	0.456
5	474.35	730	378	SIDE + TIP	265	0.081	0.480
6	473.35	1100	566	SIDE + TIP	322	0.090	0.676
7	472.35	10328	5164	TIP	--	--	7.501
8	471.35	13843	6921	TIP	--	--	8.552
9	470.35	14897	7449	TIP	--	--	8.696

Illinois Department of Transportation

DRILLED SHAFT AXIAL CAPACITY IN ROCK - DOLOMITE, LIMESTONE, SANDSTONE, AND HARD SHALE

STRUCTURE ========== SN 041-0023
SUBSTRUCTURE & REFERENCE BORING ======= E. Abutment - Boring ST-4
GROUND SURFACE ELEVATION ========== 516.96 FT
GROUND WATER ELEVATION ========== FT
ESTIMATED TOP OF ROCK ELEVATION ========= 481.50 FT
DRILLED SHAFT DIAMETER IN ROCK ========== 36 IN.
FACTORED AXIAL LOAD ========== 6100 KIPS
DRILLED SHAFT CONCRETE STRENGTH, f'c ===== 3.5 KSI

FOUNDATION REDUNDANCY ===: REDUNDANT

Drilled Shaft Dia.'s for Design Table

36	IN.
42	IN,
48	IN.
60	IN.
	IN.
	IN.

SOCKET DEPTH (FT)	TIP ELEV. (FT)	LAYER THICK. (FT)	UNCONFINED COMPRESSIVE STRENGTH (q_u) (KSF)	ROCK TYPE	GSI	ROCK CONDITION	RQD (%)	JOINT TYPE	ROCK INTACT OR TIGHTLY JOINTED?	SIDE RESISTANCE NOM. RESIST. (KIPS)	Σ NOM. RESIST. (KIPS)	Σ FACT. RESIST. (KIPS)	SETTLEMENT Q_{C1} (KIPS)	SETTLEMENT w_{C1} (IN.)	SETTLEMENT w_{Rn} (IN.)	AVG. q_u W/IN 2 - SHAFT DIA. (KSF)	TIP RESISTANCE NOM. RESIST. (KIPS)	TIP RESISTANCE FACT. RESIST. (KIPS)	TIP RESISTANCE SETTL. w_{Rn} (IN.)	COMBINED SIDE & TIP RESISTANCE R_P/R_n	COMBINED SIDE & TIP RESISTANCE NOM. RESIST. (KIPS)	COMBINED SIDE & TIP RESISTANCE FACT. RESIST. (KIPS)	COMBINED SIDE & TIP RESISTANCE SETTLEMENT Q_{C1} (KIPS)	COMBINED SIDE & TIP RESISTANCE SETTLEMENT w_{C1} (IN.)	COMBINED SIDE & TIP RESISTANCE SETTLEMENT w_{Rn} (IN.)
1.00	480.50	1.00	105.0	Shale	35	Normal	72	Open	Yes	141	141	77	27	0.016	5.287	105.0	358	179	0.439	0.91	395	199	40	0.016	0.448
2.00	479.50	1.00	105.0	Shale	35	Normal	72	Open	Yes	141	281	155	54	0.039	5.403	105.0	364	182	0.440	0.83	439	223	85	0.039	0.460
3.00	478.50	1.00	105.0	Shale	35	Normal	72	Open	Yes	141	422	232	81	0.053	5.470	105.0	369	185	0.465	0.76	485	248	123	0.053	0.474
4.00	477.50	1.00	105.0	Shale	35	Normal	72	Open	Yes	141	562	309	108	0.063	5.517	105.0	375	188	0.465	0.70	534	275	158	0.063	0.491
5.00	476.50	1.00	105.0	Shale	35	Normal	72	Open	Yes	141	703	387	135	0.070	5.552	105.0	1856	928	2.367	0.83	2238	1138	191	0.071	2.354
6.00	475.50	1.00	105.0	Shale	35	Normal	72	Open	Yes	141	844	464	162	0.077	5.582	105.0	1856	928	2.356	0.80	2313	1179	223	0.078	2.363
7.00	474.50	1.00	105.0	Shale	35	Normal	72	Open	Yes	141	984	541	189	0.082	5.606	105.0	1856	928	2.379	0.78	2389	1221	254	0.083	2.372
8.00	473.50	1.00	105.0	Shale	35	Normal	82	Open	Yes	141	1125	619	217	0.087	5.628	254.2	4491	2246	5.734	0.79	5369	2741	284	0.088	5.434
9.00	472.50	1.00	105.0	Shale	35	Normal	82	Open	Yes	141	1266	696	244	0.092	5.646	403.3	7127	3564	7.722	0.80	6268	3197	328	0.093	5.427
10.00	471.50	1.00	105.0	Shale	35	Normal	82	Open	Yes	141	1406	773	271	0.096	5.664	552.5	9763	4882	8.643	0.81	7487	3814	378	0.098	5.407
11.00	470.50	1.00	105.0	Shale	35	Normal	82	Open	Yes	141	1547	851	299	0.100	5.679	701.7	12399	6200	8.566	0.83	9288	4721	442	0.103	5.366
12.00	469.50	1.00	105.0	Shale	35	Normal	82	Open	Yes	141	1687	928	326	0.103	5.694	701.7	12399	6200	8.592	0.82	9423	4796	473	0.107	5.395
13.00	468.50	1.00	105.0	Shale	35	Normal	83	Open	Yes	141	1828	1005	353	0.107	5.708	776.3	13717	6859	8.186	0.83	10771	5477	530	0.112	5.377
14.00	467.50	1.00	1000.0	Shale	35	Normal	83	Open	Yes	308	2136	1175	477	0.138	4.916	627.1	11081	5541	6.668	0.78	9794	5004	704	0.145	4.647
15.00	466.50	1.00	1000.0	Limestone	70	Normal	83	Open	Yes	308	2444	1344	613	0.077	1.855	477.9	8445	4223	6.798	0.47	4588	2416	697	0.079	1.784
16.00	465.50	1.00	1000.0	Limestone	70	Normal	83	Open	Yes	308	2752	1514	758	0.066	1.152	328.8	5809	2905	5.842	0.27	3791	2033	810	0.067	1.119
17.00	464.50	1.00	1000.0	Limestone	70	Normal	83	Open	Yes	308	3060	1683	913	0.063	0.848	179.6	3173	1587	3.835	0.17	3676	1991	951	0.065	0.830
18.20	463.30	1.20	105.0	Shale	35	Fractured	75	Open	Yes	66	3126	1719	947	0.067	0.876	179.6	3173	1587	3.848	0.17	3757	2035	985	0.068	0.859
18.70	462.80	0.50	1000.0	Limestone	70	Normal	75	Open	Yes	154	3280	1804	1028	0.067	0.781	105.0	1856	928	2.429	0.13	3788	2058	1062	0.068	0.768
19.70	461.80	1.00	105.0	Shale	35	Normal	75	Open	Yes	141	3421	1881	1056	0.070	0.830	209.4	3701	1850	4.447	0.15	4006	2174	1094	0.072	0.815
20.70	460.80	1.00	105.0	Shale	35	Normal	75	Open	Yes	141	3561	1959	1085	0.073	0.879	358.6	6337	3168	6.626	0.17	4270	2313	1128	0.075	0.862
21.70	459.80	1.00	105.0	Shale	35	Fractured	75	Open	Yes	55	3616	1989	1113	0.077	0.899										
22.70	458.80	1.00	105.0	Shale	35	Fractured	60	Open	Yes	50	3666	2017	1141	0.080	0.917										
23.70	457.80	1.00	105.0	Shale	35	Fractured	60	Open	Yes	50	3717	2044	1169	0.083	0.935										
25.00	456.50	1.30	105.0	Shale	35	Fractured	60	Open	Yes	65	3782	2080	1206	0.087	0.957										
26.00	455.50	1.00	1000.0	Limestone	35	Fractured	60	Open	Yes	110	3892	2141	1352	0.097	0.880										
27.00	454.50	1.00	1000.0	Limestone	35	Fractured	60	Open	Yes	110	4002	2201	1501	0.107	0.818										

Drilled Shaft Design Table for E. Abutment - Boring ST-4

Estimated Top of Rock Elevation: 481.50

SOCKET DEPTH (FT)	TIP ELEV. (FT)	NOMINAL SHAFT RESIST. (KIPS)	FACTORED SHAFT RESIST. (KIPS)	RESIST. METHOD	SETTLEMENT DATA		
					Q_{C1} (KIPS)	w_{C1} (IN.)	w_{Rn} (IN.)
36 in. Diameter Drilled Shaft							
1	480.5	395	199	SIDE + TIP	40	0.016	0.448
2	479.5	439	223	SIDE + TIP	85	0.039	0.460
3	478.5	485	248	SIDE + TIP	123	0.053	0.474
4	477.5	562	309	SIDE	108	0.063	5.517
5	476.5	2238	1138	SIDE + TIP	191	0.071	2.354
6	475.5	2313	1179	SIDE + TIP	223	0.078	2.363
7	474.5	2389	1221	SIDE + TIP	254	0.083	2.372
8	473.5	5369	2741	SIDE + TIP	284	0.088	5.434
9	472.5	7127	3564	TIP	--	--	7.722
10	471.5	9763	4882	TIP	--	--	8.643
11	470.5	12399	6200	TIP	--	--	8.566
12	469.5	12399	6200	TIP	--	--	8.592
13	468.5	13717	6859	TIP	--	--	8.186
14	467.5	11081	5541	TIP	--	--	6.668
15	466.5	8445	4223	TIP	--	--	6.798
16	465.5	5809	2905	TIP	--	--	5.842
17	464.5	3676	1991	SIDE + TIP	951	0.065	0.830
18.2	463.3	3757	2035	SIDE + TIP	985	0.068	0.859
18.7	462.8	3788	2058	SIDE + TIP	1062	0.068	0.768
19.7	461.8	4006	2174	SIDE + TIP	1094	0.072	0.815
20.7	460.8	6337	3168	TIP	--	--	6.626
21.7	459.8	3616	1989	SIDE	1113	0.077	0.899
22.7	458.8	3666	2017	SIDE	1141	0.080	0.917
23.7	457.8	3717	2044	SIDE	1169	0.083	0.935
25	456.5	3782	2080	SIDE	1206	0.087	0.957
26	455.5	3892	2141	SIDE	1352	0.097	0.880
27	454.5	4002	2201	SIDE	1501	0.107	0.818
42 in. Diameter Drilled Shaft							
1	480.5	530	267	SIDE + TIP	43	0.013	0.523
2	479.5	582	295	SIDE + TIP	100	0.040	0.535
3	478.5	636	325	SIDE + TIP	146	0.056	0.549
4	477.5	693	356	SIDE + TIP	188	0.067	0.566
5	476.5	820	451	SIDE	158	0.076	6.449
6	475.5	3061	1557	SIDE + TIP	266	0.084	2.748
7	474.5	6725	3419	SIDE + TIP	303	0.090	6.106
8	473.5	8676	4338	TIP	--	--	8.196
9	472.5	11752	5876	TIP	--	--	9.430
10	471.5	14827	7413	TIP	--	--	9.741
11	470.5	14827	7413	TIP	--	--	9.769
12	469.5	16365	8182	TIP	--	--	9.636
13	468.5	16365	8182	TIP	--	--	9.698
14	467.5	13289	6645	TIP	--	--	7.893
15	466.5	10214	5107	TIP	--	--	7.588
16	465.5	7139	3569	TIP	--	--	6.356
17	464.5	4414	2386	SIDE + TIP	1102	0.067	0.953
18.2	463.3	4678	2339	TIP	--	--	4.772
18.7	462.8	4678	2339	TIP	--	--	4.822
19.7	461.8	7754	3877	TIP	--	--	7.123
20.7	460.8	4155	2285	SIDE	1249	0.075	1.008
21.7	459.8	4219	2320	SIDE	1282	0.078	1.030
22.7	458.8	4278	2353	SIDE	1315	0.081	1.050
23.7	457.8	4336	2385	SIDE	1348	0.085	1.069
25	456.5	4412	2427	SIDE	1391	0.089	1.093
26	455.5	4541	2498	SIDE	1559	0.098	1.002
27	454.5	4669	2568	SIDE	1729	0.108	0.928
48 in. Diameter Drilled Shaft							
1	480.5	685	345	SIDE + TIP	45	0.009	0.597
2	479.5	746	378	SIDE + TIP	114	0.039	0.610
3	478.5	808	412	SIDE + TIP	169	0.058	0.625
4	477.5	873	447	SIDE + TIP	219	0.071	0.642
5	476.5	940	483	SIDE + TIP	265	0.081	0.660
6	475.5	1410	723	SIDE + TIP	310	0.090	1.020
7	474.5	10328	5164	TIP	--	--	8.659
8	473.5	13843	6921	TIP	--	--	10.104
9	472.5	17357	8679	TIP	--	--	10.718
10	471.5	17357	8679	TIP	--	--	10.763
11	470.5	19115	9557	TIP	--	--	10.808
12	469.5	19115	9557	TIP	--	--	10.845
13	468.5	19115	9557	TIP	--	--	10.882
14	467.5	15600	7800	TIP	--	--	8.943
15	466.5	12085	6043	TIP	--	--	8.289
16	465.5	8571	4285	TIP	--	--	6.855
17	464.5	5187	2798	SIDE + TIP	1254	0.069	1.076
18.2	463.3	9274	4637	TIP	--	--	7.473
18.7	462.8	9274	4637	TIP	--	--	7.613
19.7	461.8	4561	2509	SIDE	1376	0.074	1.077
20.7	460.8	4748	2612	SIDE	1414	0.078	1.139
21.7	459.8	4822	2652	SIDE	1451	0.081	1.163
22.7	458.8	4889	2689	SIDE	1489	0.084	1.185
23.7	457.8	4956	2726	SIDE	1527	0.087	1.206
25	456.5	5043	2774	SIDE	1576	0.091	1.231
26	455.5	5190	2854	SIDE	1763	0.101	1.126
27	454.5	5337	2935	SIDE	1954	0.110	1.041
60 in. Diameter Drilled Shaft							
1	480.5	993	497	TIP	--	--	0.774
2	479.5	1134	573	SIDE + TIP	139	0.037	0.761
3	478.5	1214	616	SIDE + TIP	214	0.059	0.777
4	477.5	1786	907	SIDE + TIP	280	0.076	1.141
5	476.5	2303	1170	SIDE + TIP	354	0.088	1.329
6	475.5	2791	1418	SIDE + TIP	431	0.099	1.439
7	474.5	3258	1656	SIDE + TIP	513	0.108	1.484
8	473.5	22727	11364	TIP	--	--	12.398
9	472.5	24924	12462	TIP	--	--	12.674
10	471.5	24924	12462	TIP	--	--	12.734
11	470.5	24924	12462	TIP	--	--	12.750
12	469.5	24924	12462	TIP	--	--	12.796
13	468.5	24924	12462	TIP	--	--	12.827
14	467.5	20531	10265	TIP	--	--	10.620
15	466.5	16137	8069	TIP	--	--	9.502
16	465.5	16137	8069	TIP	--	--	9.726
17	464.5	16137	8069	TIP	--	--	9.978
18.2	463.3	5210	2866	SIDE	1526	0.078	1.410
18.7	462.8	5467	3007	SIDE	1648	0.076	1.252
19.7	461.8	5701	3136	SIDE	1694	0.079	1.328
20.7	460.8	5936	3265	SIDE	1741	0.083	1.403
21.7	459.8	6027	3315	SIDE	1788	0.086	1.432
22.7	458.8	6111	3361	SIDE	1835	0.089	1.458
23.7	457.8	6195	3407	SIDE	1881	0.092	1.482
25	456.5	6304	3467	SIDE	1942	0.097	1.512
26	455.5	6487	3568	SIDE	2171	0.106	1.379
27	454.5	6671	3669	SIDE	2403	0.116	1.270