SCI ENGINEERING, INC.
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Structure Geotechnical Report

BRIDGE STRUCTURE REPLACEMENT
SOUTHBOUND IL - ROUTE 111 (FAP ROUTE 582) OVER CAHOKIA CANAL
MADISON COUNTY, ILLINOIS
SECTION: 6-23B-I
STRUCTURE NO. SB 060-0347 (PROPOSED)
STRUCTURE NO. SB 060-0127 (EXISTING)

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October 25, 2021
Revised April 19, 2022

Prepared for:
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Exp. 11/30/2023

SCI No. 2020-0172.12

LICENSED PROFESSIONAL ENGINEER
THOMAS
JOSEPH CASEY
062-061853
STATE OF ILLINOIS
4/19/2022

Thomas Casey

SCI ENGINEERING, INC.
EARTH • SCIENCE • SOLUTIONS
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CONSTRUCTION SERVICES

April 19, 2022

Larry Gowler, P.E., S.E.
HMG Engineers, Inc
9360 Holy Cross Lane
Breese, Illinois 62230

RE: Structure Geotechnical Report
Bridge Structure Replacement
Southbound IL - Route 111 (FAP Route 582) over Cahokia Canal
Madison County, Illinois
Section: 6-23B-I
Structure no. SB 060-0347 (Proposed)
Structure no. SB 060-0127 (Existing)
SCI No.: 2020-0172.12

Dear Larry Gowler:

Enclosed is our *Structure Geotechnical Report (SGR)*, dated October 2021. This report should be read in its entirety, and our recommendations considered in the design and construction of the proposed bridge. Please call if you have any questions.

Respectfully,

SCI ENGINEERING, INC.

Prakash Paudel, E.I.
Staff Engineer

Thomas J. Casey, P.E.
Chief Geotechnical Engineer

PP/TJC/snp/tlw

Enclosure

\\SCISTCFPS01\Projects\2020\2020-0172 PTB 194, Item 59\GS\12 WO9 IL-111 over Cahokia Canal\Report\20.0172. 12 IL-111 over Cahokia Canal SGR.docx

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BRIDGE STRUCTURE REPLACEMENT
SOUTHBOUND IL - ROUTE 111 (FAP ROUTE 582) OVER CAHOKIA CANAL
MADISON COUNTY, ILLINOIS
SECTION: 6-23B-I
STRUCTURE NO. SB 060-0347 (PROPOSED)
STRUCTURE NO. SB 060-0127 (EXISTING)

1.0 PROJECT DESCRIPTION

The geotechnical study summarized in this report was performed for the proposed replacement of the southbound structure that carries Illinois Route 111 over the Cahokia Canal in Madison County, Illinois. TS&L plans were not available at the time of the writing of this report. Based on the preliminary TS&L provided, the proposed structure will be a two-lane, three-span structure with a back-to-back abutment length of approximately 372.5 feet and an out-to-out deck width of approximately 39 feet. We anticipate minimal cuts and fills will be required at the abutments. The end slopes will have inclinations of 3 horizontal to 1 vertical (3H:1V) and capped with stone riprap used for slope protection. The location of the site is shown on the *Vicinity and Topographic Map*, Figure 1.

2.0 SUBSURFACE EXPLORATION

2.1 Area Geology

The project is located approximately 4.7 miles east of the Mississippi River in the floodplain known locally as the American Bottoms. Physiographically, the project is located in the Springfield Plain, Till Plains Section, and Central Lowland Province. The soils in the immediate area were formed in alluvial sediment on bottomlands known as the Cahokia Alluvium.

According to Surficial Geology of Monks Mound Quadrangle, Madison and St. Clair Counties, Illinois 2007 and Bedrock Geologic Map, Monks Mound Quadrangle, Madison and St. Clair Counties, Illinois 2001, the near-surface soils are of the Cahokia Formation that mainly consist of gray to brown, and soft to stiff, silty, clay loam, as well as silty clay, and silt with occasional fine sand lenses that were probably deposited in the floodplain of Mississippi River dating back to the Hudson Episode. Underlying the Cahokia Alluvium is the undifferentiated Chesterian Series unit that is mainly comprised of shale and limestone with shale being the dominant lithology in this unit. The shales are typically dark gray to medium gray and the limestone has fossiliferous shale partings along with light gray, fossiliferous packstones, and grainstones.

2.2 Exploration Procedures

Two standard penetration test (SPT) borings, designated B-1 and B-2 were drilled near the proposed abutment and pier locations, as shown on the *Aerial Photograph*, Figure-2 and *Site Plan*, Figure 3. The boring locations were selected and staked in the field by SCI personnel, however the elevations were estimated from publicly available topographical data. The stations and offsets were estimated from the preliminary TS&L plans provided and included in Appendix E. The field exploration was performed in general accordance with procedures outlined in the *2020 IDOT Geotechnical Manual*.

Personnel from SCI were with the drill rig to supervise drilling, log the borings, and perform field unconfined compressive strength tests of the borings. A CME 550X all-terrain-mounted drill rig equipped with both hollow stem augers and mud-rotary was used to advance the borings. SPTs were performed with a split-spoon sampler at 2½-foot intervals to 30 feet, and at 5-foot intervals thereafter to the termination depth of the borings. Relatively undisturbed Shelby tube samples were collected at selected intervals in lieu of SPT samples for additional testing. The unconfined compressive strength of the cohesive soils was determined with a Rimac test apparatus. A pocket penetrometer was used to measure the compressive strength if the soils were not conducive to Rimac testing. The borings were drilled to refusal per IDOT specifications to depths of 113.8 to 121.3 feet below the existing ground surface. While auger refusal did not occur in any of the borings, split spoon sampler refusal did occur within the shale bedrock in all of the soil test borings, as detailed on the appended boring logs. Split-spoon sampler refusal is a designation applied to any material that results in SPT N-values in excess of 100 blows per foot (bpf) or 50 blows over less than 6 inches of advancement.

2.3 Subsurface Conditions

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 on the Boring Logs in Appendix A. The generalized soil profile is included on the *Subsurface Profile*, Figure 4.

The borings encountered 8.0 to 10.5 feet of fill consisting of brown and gray silt, silty clay, and clay loam. Below the fill, the natural soils generally consisted of interbedded layers of gray clays (A-6 and A-7) and silts (A-4) containing varying amounts of sand and shell to a nominal depth of 43 feet below the ground surface. Beneath the very soft silts and clays, the profile becomes gray, fine to coarse sand with various amounts of fine gravel, until bedrock was encountered at depths ranging from 113 to 116 feet (El. 302 to 299). In general, the natural cohesive soils were very soft to soft in consistency, with a majority of the N-values (the sum of the second and third blow count numbers in each sampling interval from the

SPT) ranging between 1 to 3 blows per foot (bpf) with an average of 2 bpf. Unconfined compressive strengths obtained from Rimac ranged between 0.1 to 0.6 tons per square foot (tsf) with an average of 0.4 tsf. The sand soils were generally loose to dense, with a majority of the N-values ranging between 6 to 43 bpf with an average of 20 bpf. As an exception, a medium stiff clay layer was encountered between a depth of 67 and 72 feet in boring B-1. Moisture contents in the native soil samples ranged from 17 to 69 percent, with an average of approximately 38 percent.

In general, bedrock consisted of interbedded layers of weathered limestone and shale and extended to boring termination depths ranging from 113.8 to 121.3 feet. Table 2.1 presents a summary of the depth and elevation of the top of bedrock that was first encountered in each of the borings.

Table 2.1 – Summary of Bedrock Elevations

Boring	Ground Surface Elevation (ft)	Depth to Bedrock (ft)	Top of Bedrock Elevation (ft)
B-1	±415	113	302
B-2	±415	116	299

2.4 Groundwater Conditions

Groundwater levels observed at the time of drilling are summarized in Table 2.2. It should be noted that the groundwater level is subject to seasonal and climatic variations, the water level in the adjacent canal, and other factors; and may be present at different depths in the future. In addition, without extended periods of observation, measurement of the true groundwater levels may not be possible.

Table 2.2 – Summary of Approximate Groundwater Levels

Boring	Ground Surface Elevation (ft)	Depth to Groundwater during drilling (ft)	Groundwater Elevation during drilling (ft)
B-1	±415	21	±394
B-2	±415	35	±380

3.0 GEOTECHNICAL EVALUATIONS

In order to provide design recommendations for founding the structure, we performed the following evaluations based on all available data collected and reviewed at the time of this report. This information includes subsurface explorations performed by SCI, existing plans, and communications with HMG personnel familiar with the project.

3.1 Seismic Considerations

3.1.1 Design Earthquake

Ground shaking at the foundation of structures and liquefaction of the soil under the foundation are the principle seismic hazards to be considered in design of earthquake-resistant structures. Soil liquefaction is possible within loose sand and low plastic silt deposits below the groundwater table. Liquefaction occurs when a rapid development in water pressure, caused by the ground motion, pushes sand particles apart, resulting in a loss of strength and later densification as the water pressure dissipates. This loss of strength can cause bearing capacity failure while the densification can cause excessive settlement. Potential earthquake damage can be mitigated by structural and/or geotechnical measures or procedures common to earthquake resistant design.

For the purposes of seismic design the bridge has been classified as *Regular* and *Essential*. According to the Illinois Department of Transportation Bridge Manual 2012 edition, the structure should be designed to a design earthquake with a 7 percent Probability of Exceedance (PE) over a 75-year exposure period (i.e. a 1,000-year design earthquake). The design earthquake has a Moment Magnitude (Mw) of 7.7 and a site coefficient (A_s) of 0.25g, as determined from data provided by the United States Geological Survey (USGS) National Seismic Hazard Mapping Project and procedures outlined in the All Geotechnical Manual Users (AGMU) 10.1, *Liquefaction Analysis Procedure*.

3.1.2 Site Class Determination

The seismic site soil classification for the bridge site was determined from the design earthquake data, the subsurface data, and the procedures described in AGMU Memo 09.1, *Seismic Site Class Definition,* of the IDOT Bridge Manual Design Guides. The Site Class was evaluated using methods defined as B and C, which include evaluating the SPT N-values and undrained shear strength, S_u. The following results were calculated:

- Method B using N_{ch}: 25 bpf (Site Class D)
- Method C using S_u: 1,333 psf (Site Class D)

Based on the span and overall bridge lengths and the guidelines in the AGMU, we recommend that Site Class D be used for the project. Based on Table 3.15.2-1 the Seismic Performance Zone is 2. Seismic design parameters for the site are summarized in Table 3.1.

Table 3.1 – Seismic Design Parameters

Seismic Design Parameters	
Site Class	D
PGA	0.17
Spectral Acceleration at 0.2 sec. (S_S)	0.35g
Spectral Acceleration at 1.0 sec.(S_1)	0.10g
F_{pga}	1.45
F_a	1.52
F_v	2.40
Site Coefficient (As)	0.25
Design Spectral Acceleration at 0.2 sec. (S_{DS})	0.53g
Design Spectral Acceleration at 1.0 sec.(S_{D1})	0.24g
Seismic Design Category	B
Seismic Performance Zone	2

3.1.3 Liquefaction Potential Analysis

The liquefaction potential analysis for the site was conducted using field and laboratory data and the techniques outlined in AGMU 10.1. The average seasonal groundwater elevation used in the analysis was estimated from the end of boring conditions and the seasonal weather conditions. Based on our analyses, a majority of the soils observed have sufficient strength and/or a plasticity index that make the threat of liquefaction minimal during the design earthquake. The detailed input parameters and results of the Liquefaction Analyses are provided in Appendix B. While the amount of seismically induced settlement is dependent on the magnitude and distance from the seismic event, SCI estimates that the impacts from the design earthquake will be negligible.

3.2 Abutment and Pier Settlement

Based on the anticipation of minor grade changes at the abutments, settlement is anticipated to be minimal and not influence the construction of the structures. It is assumed that no grade changes will occur at the interior bents, thus minimal settlement is anticipated. Therefore, the effects of down drag on axial pile capacity should be neglected.

3.3 Bridge Approach Slabs

Based on available information, the bridge approach slabs will likely bear on either newly-placed or recompacted existing, low plastic structural fill. In evaluating the bearing resistance of the slabs, we recommend using a modulus of subgrade reaction of 100 pounds per square inch per inch of deflection (pci).

3.4 Slope Stability

As minimal grade changes are anticipated and the existing slopes appear to be performing satisfactorily, a rigorous slope stability analysis was not performed. If significant grade changes or changes in slope geometry are planned, the need for a slope stability analysis should be evaluated.

3.5 Scour

The pile capacity is dependent on the scour elevation and suitable protection should be provided to the foundation elements. Per IDOT Bridge Manual Section 2.3.6.3.2, open abutments protected with class RR4 or RR5, stone dumped riprap, should set the design scour elevation at the bottom of the abutment. Based on the provided TS&L, the design scour elevations for the 100-year and 200-year events for the abutment and interior bents are shown in Table 3.2 below.

Table 3.2 – Summary of Design Scour Elevations

Event	Design Scour Elevation (ft)				Item 113
	N. Abutment	Pier 1	Pier 2	S. Abutment	
Q100	407.5	390.3	390.3	407.0	5
Q200	407.5	390.3	390.3	407.0	
Design	407.5	390.3	390.3	407.0	
Check	407.5	390.3	390.3	407.0	

3.6 Bridge Foundations

The foundation supporting the proposed bridge must provide sufficient support to resist dead and live loads, including seismic loads. Preliminary structure loads are provided in Table 3.3 below. Several potential foundation options were considered for supporting the new bridge structure that included driven steel H-Piles, metal shell piles, drilled shafts, and shallow foundations. Shallow foundations are not recommended due to the relatively soft consistency of the shallow subsurface conditions encountered. Drilled shaft foundations were determined to be too costly, given the size of the proposed structure. SCI should be contacted for additional recommendations if drilled shafts will be considered. Driven steel H-piles and metal shell piles are feasibly for use on the project. Design information for both driven steel pile options is included in Appendix C for feasibility review.

Table 3.3 – Preliminary Structure Loads

Location	P (kips)
Abutments	1,700
Interior Piers	3,000

For the driven steel foundation options, we recommend a minimum of two index piles be installed to verify the length of the piles. One index pile should be installed at each side of the canal in the general areas of the abutments to help verify the pile length. Recommendations for all the potential foundation options are provided below.

3.6.1 Driven Steel Piles

The structural capacity of driven piles depends on the allowable stress and cross sectional areas of steel and concrete. The pile recommendations in this report assume that Steel H-piles will conform to ASHTO M270 Grade 50 (ASTM 709 Gr 50) or equivalent with a minimum yield stress of 50 kips per square inch (ksi) and metal shell piles will conform to ASTM A252 grade 3 (or equivalent) with a minimum yield stress of 45 ksi.

Based on the most current IDOT Bridge Manual, All Geotechnical Manual User Memorandums (AGMUs), and Guide Bridge Special Provisions (GBSP), a geotechnical resistance factor (φ_G) of 0.55 was used for the design of the driven pile foundations. Geotechnical losses due to down-drag are not considered for the seismic pile design. Geotechnical losses associated with scour were also not considered since scour at the pier locations has not been determined yet; and it is anticipated that scour will be reduced to above the proposed soil surface by using class A4 riprap at the abutments. During the seismic event the Bridge Manual allows the use of a Geotechnical Resistance Factor (φ_G) of 1.0.

All estimates of capacity were calculated using the "Modified IDOT Static Method" spreadsheet associated with the IDOT Bridge Manual, and appropriate AGMUs and GMSPs, and assume construction verification will follow the "WSDOT" formula outlined in Section 512 of the most current IDOT Standard Specifications for Road and Bridge construction. The top elevations of the piles (pile cutoff elevations) were obtained from information provided by HMG. The tip elevations were calculated from the Modified IDOT Static Method spreadsheets based on the available factored resistance. It should be noted that the Static Pile Tables for Pier 1 and Pier 2 were the compilation of data from the nearby borings to provide the best engineering estimate for the design.

A summary of the design capacities, or factored resistance available (R_F), seismic factored resistance (R_{Fseis}), and nominal required bearing (R_N) as well as estimated pile lengths, is presented in Appendix C for each H-pile size. It should be noted that H-piles driven into limestone/shale may run shorter than the IDOT spreadsheet predicts. The estimated pile lengths should be adjusted based on the index pile results.

We recommend a minimum driven pile center to center spacing of three pile diameters, as recommended by the IDOT Bridge Manual. The maximum spacing shall be limited to 3.5 times the effective footing thickness plus 1 foot, but not to exceed 8 feet. Once the final spacing is determined, the piles should be evaluated for group effects.

With the exception of H-piles driven to bedrock, "hard driving" conditions are not likely to occur, therefore, pile shoes are not required. For the pier location, some variations in the soil were present between the borings that may affect pile installation operations. Pre-drilling for the piles is also not anticipated.

3.7 Lateral Pile Response

A representation of the shaft response under lateral loading exceeding 3 kips per pile is required for design of the bridge superstructure per Section 3.10.1.10 of the 2012 Bridge Manual. The lateral response can be developed by modeling the soil/shaft interaction with the computer program LPILE. Discrete elements are used in LPILE to represent the shaft and non-linear soil using springs. The non-linear soil springs are commonly referred to as P-Y curves. Tables for the pier and abutment locations summarizing approximate soil and rock parameters for the LPILE analyses are included in Appendix D (Reference: LPILE User's Manual, Ensoft, Inc., 2019).

3.8 Cofferdam For Pier Construction

A Type 2 cofferdam will be required for the construction of the interior bent pile supported foundations. The top elevation of the cell should be set 3-feet above the estimated surface water elevation (ESWE), which is estimated at 408.6, so that construction isn't impacted by fluctuations of water levels within the canal. The river bottom is near elevation 395.0 and the anticipated top of rock is near 300, so rock is not anticipated to impact the cofferdam installation.

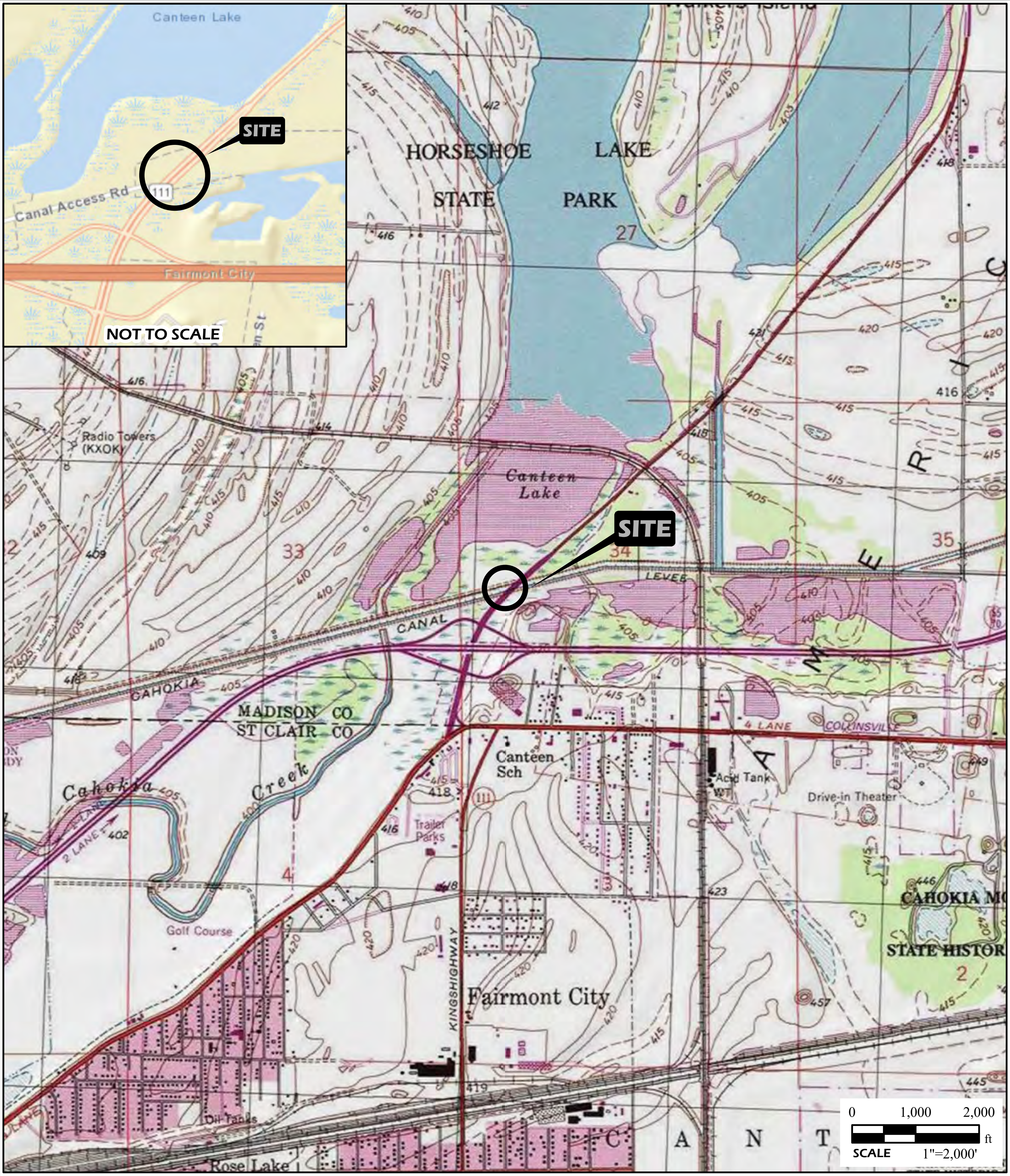
We anticipate that soft and silty soils will likely makeup the subgrade within the cofferdam and are prone to piping and loosening under differential head conditions. A preliminary sealcoat analysis awas performed to determine the likelihood of needing a sealcoat for construction. The analysis was based on preliminary data from the TS&L and IDOT form BBS-148, which is included in Appendix D. Based on this analysis, a seal coat will be required. A detailed sealcoat and bracing design should be performed based on the final configuration of piles and foundation and cofferdam sizing.

4.0 CONSTRUCTION CONSIDERATIONS

The 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. For the driven steel piles, cofferdams will likely be required for the two interior piers in order to construct the pile caps. The cofferdam should be properly designed and submitted for review by IDOT prior to construction. The cost of the cofferdams may indicate that the feasibility of drilled shaft foundations may need to be revisited for the interior piers for this project. However, recommendations are provided for preferred H-pile option at the pier foundations and the abutments.

5.0 LIMITATIONS

The recommendations provided herein are for the exclusive use of HMG. and IDOT. They are specific only to the project described, and are based on subsurface information obtained at two boring locations within the bridge area, our understanding of the project as described herein, and geotechnical engineering practice consistent with the standard of care. No other warranty is expressed or implied. SCI should be contacted if conditions encountered during construction are not consistent with those described.



PROJECT NAME	GENERAL NOTES/LEGEND
SOUTHBOND IL-ROUTE 111 (FAP ROUTE 582) OVER CAHOKIA CANAL MADISON COUNTY, ILLINOIS	USGS TOPOGRAPHIC MAP MONKS MOUND, ILLINOIS QUADRANGLE DATED 1954, PHOTO REVISED 19993 10' CONTOURS
VICINITY AND TOPOGRAPHIC MAP	STREET MAP HTTP://GOTO.ARCGISONLINE.COM/MAPS/WORLD_STREET_MAP

DRAWN BY	RCV	DATE	JOB NUMBER
CHECKED BY	TJC	04/2022	2020-0172.12

N
W E
S

FIGURE
1

PROJECT NAME

SOUTHBOND IL-ROUTE 111
(FAP ROUTE 582) OVER CAHOKIA CANAL
MADISON COUNTY, ILLINOIS

AERIAL PHOTOGRAPH

DRAWN BY	RCV	DATE	JOB NUMBER
CHECKED BY	TJC	04/2022	2020-0172.12

GENERAL NOTES/LEGEND

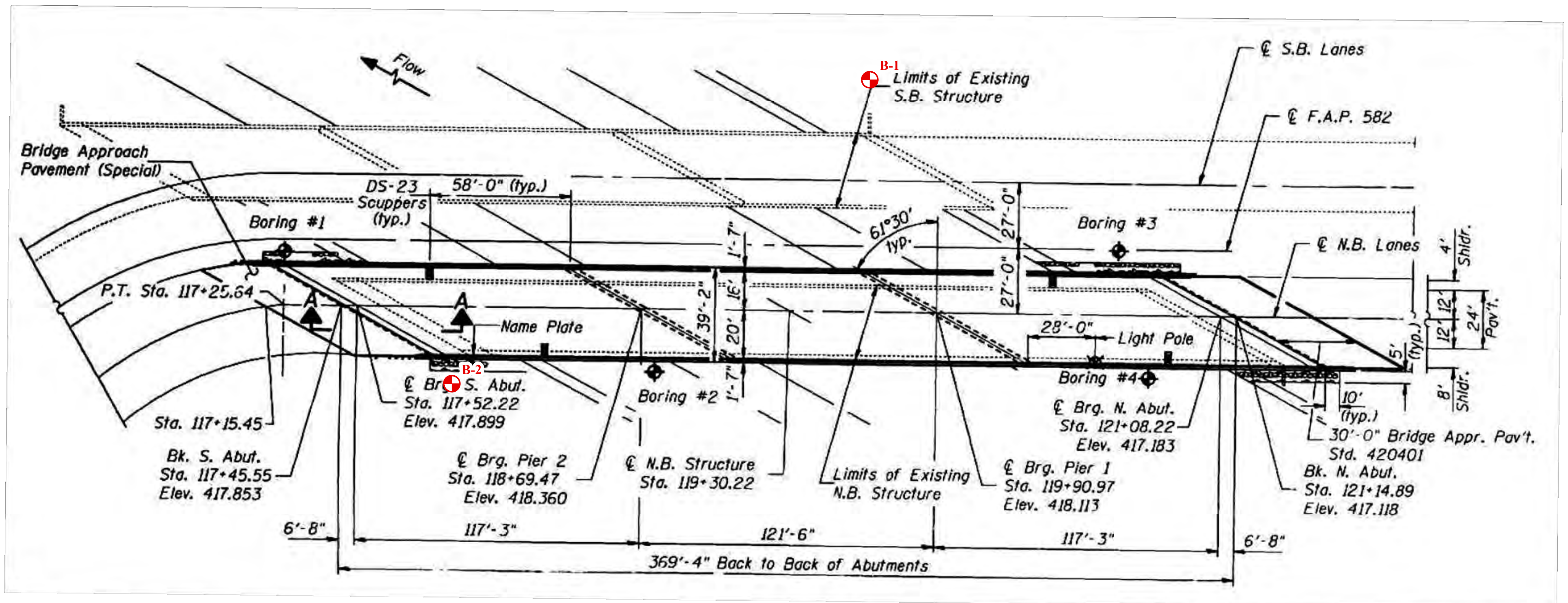
APPROXIMATE SOIL BORING LOCATIONS

AERIAL PHOTOGRAPH OBTAINED FROM ARCGIS ONLINE, WORLD IMAGERY.

DIMENSIONS AND LOCATIONS ARE APPROXIMATE; ACTUAL MAY VARY. DRAWING SHALL NOT BE USED OUTSIDE THE CONTEXT OF THE REPORT FOR WHICH IT WAS GENERATED.

N W E S

FIGURE 2



0 25 50 ft
SCALE 1"=50'

GENERAL NOTES/LEGEND

APPROXIMATE SOIL BORING LOCATIONS

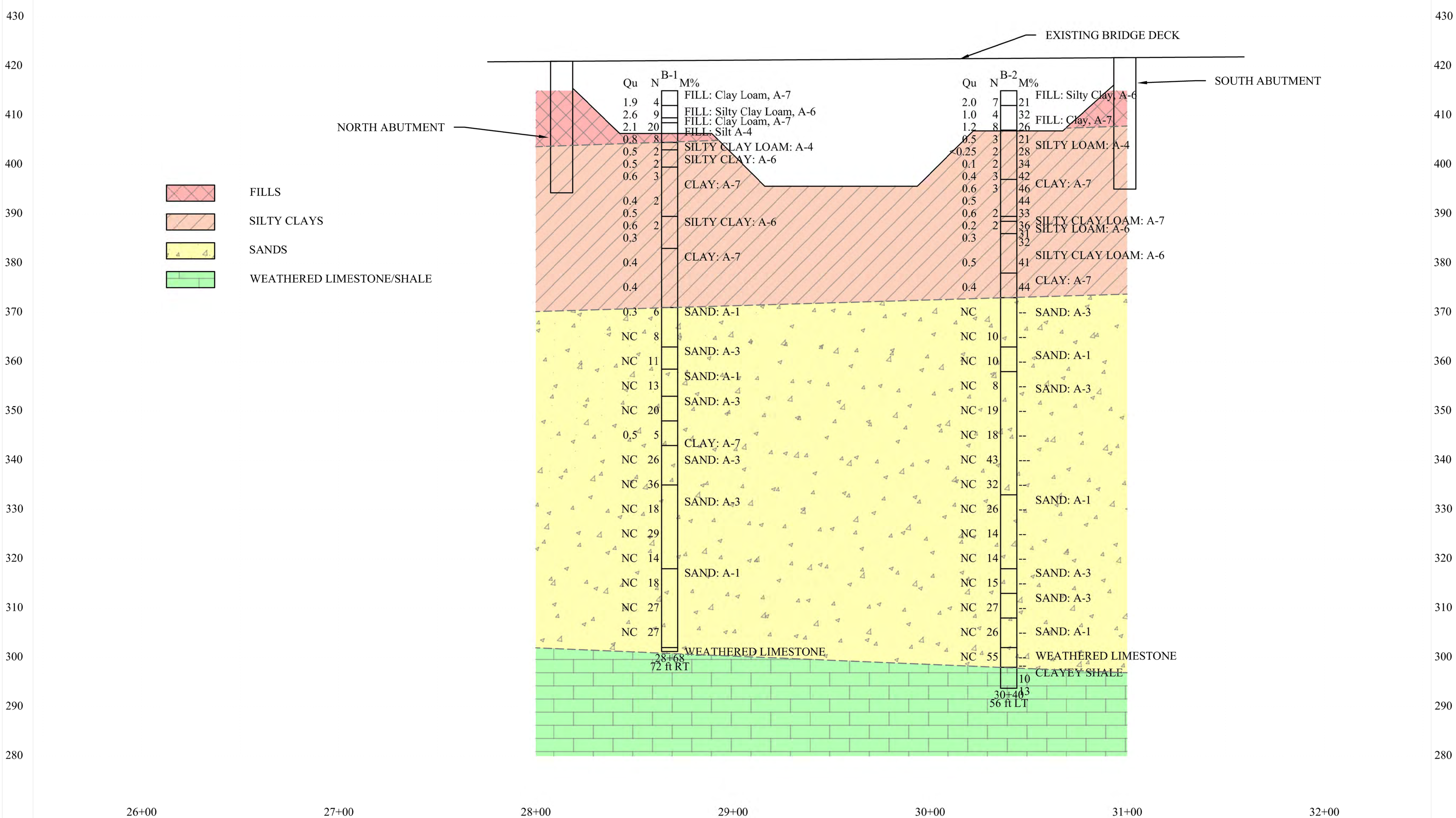
PLANS DATED 5/10/2001.

DIMENSIONS AND LOCATIONS ARE APPROXIMATE; ACTUAL MAY VARY. DRAWING SHALL NOT BE USED OUTSIDE THE CONTEXT OF THE REPORT FOR WHICH IT WAS GENERATED.

PROJECT NAME
SOUTHBOND IL-ROUTE 111
(FAP ROUTE 582) OVER CAHOKIA CANAL
MADISON COUNTY, ILLINOIS

SITE PLAN

JOB NUMBER 2020-0172.12
DATE 04/2022
DRAWN BY RCV
CHECKED BY TJC
FIGURE 3



General Notes/Legend

VARIATIONS IN SUBSURFACE CONDITIONS MAY AND LIKELY EXIST BETWEEN BORINGS. DASHED HORIZONS ARE INTERPRETED AND ARE SHOWN FOR ILLUSTRATION ONLY.

PROJECT NAME

SOUTHBOUND IL-ROUTE 111 (FAP ROUTE 582) OVER CAHOKIA CANAL MADISON COUNTY, ILLINOIS

SUBSURFACE PROFILE

SCALE 1" = 20' V 1" = 50' H

JOB NUMBER 2020-0172.12

DATE 04/2022

DRAWN BY RCV

CHECKED BY TJC

FIGURE 4

APPENDIX A

Illinois Department of Transportation

Division of Highways
SCI Engineering

SOIL BORING LOG

Date 8/9,10,11/2021

ROUTE Route 111 **DESCRIPTION** IL Route 111 over Cahokia Canal **LOGGED BY** SCI

SECTION 6-1BR **LOCATION** Madison County, Illinois
Lat 38.66569 **Long** -90.09075

COUNTY Madison **DRILLING METHOD** CME 550 w/HSA, Mud Rotary **HAMMER TYPE** Automatic

STRUCT. NO.	060-0127
Station	
BORING NO.	B-1
Station	230+49
Offset	90 ft LT
Ground Surface Elev.	415.0 ft
Surface Water Elev.	N/A ft
Stream Bed Elev.	395.8 ft
Groundwater Elev.:	
First Encounter	394.0 ft ▼
Upon Completion	21.0 ft ▽
After ___ Hrs.	N/A ft

Description	Elev. (ft)	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
FILL: Brown, CLAY LOAM (A-7), moist, soft			1 1 3	1.9 B/20	19
FILL: Gray, SILTY CLAY LOAM (A-6), moist, stiff	412.0	-5	1 3 6	2.6 S/15	20
FILL: Gray, CLAY LOAM (A-7), moist	409.5				
FILL: Gray, SILT (A-4), moist, very stiff	408.5		1 8 12	2.1 S/15	17
		-10	1 4 4	0.8 S/10	23
SILTY CLAY LOAM: Gray, moist, (A-4) *Grain Size Analysis performed*	404.5		WOH 1 1	0.5 B/20	32
SILTY CLAY: Gray, trace shells, moist, very soft, (A-6)	403.0	-15	1 1 1	0.5 P	34
CLAY: Gray, moist, soft, (A-7)	399.5		1 1 2	0.6 B/20	24
		-20	ST		
CLAY: Gray, moist, soft, (A-7) *(continued)* ▼					
Very soft, with silty loam deposit, trace shells			1 1 1	0.4 B/20	29
		-25	WOH WOH WOH	0.5 B/20	33
SILTY CLAY: Gray, trace shells, moist, very soft, (A-6)	389.5		WOH 1 1	0.6 B/20	30
		-30	WOH WOH WOH	0.3 B/20	34
CLAY: Gray, trace shells, moist, very soft, (A-7)	383.0	-35	WOH WOH WOH	0.4 B/20	52
		-40	WOH WOH WOH	0.4 B/20	64

Illinois Department of Transportation

Division of Highways
SCI Engineering

SOIL BORING LOG

Date 8/9,10,11/2021

ROUTE Route 111 **DESCRIPTION** IL Route 111 over Cahokia Canal **LOGGED BY** SCI

SECTION 6-1BR **LOCATION** Madison County, Illinois
Lat 38.66569 **Long** -90.09075

COUNTY Madison **DRILLING METHOD** CME 550 w/HSA, Mud Rotary **HAMMER TYPE** Automatic

STRUCT. NO. 060-0127
Station

BORING NO. B-1
Station 230+49
Offset 90 ft LT
Ground Surface Elev. 415.0 ft

Surface Water Elev. N/A ft
Stream Bed Elev. 395.8 ft

Groundwater Elev.:
First Encounter 394.0 ft ▼
Upon Completion 21.0 ft ▽
After ___ **Hrs.** N/A ft

Description	Elev. (ft)	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
CLAY: Gray, trace shells, moist, very soft, (A-7) *(continued)*					
	371.0				
SAND: Gray, fine to coarse grained, moist, loose, (A-1) *Grain Size Analysis performed*		-45	4 3 3	0.3 S/15	69
		-50	3 4 4	NC	--
	363.0				
SAND: Gray, fine to coarse grained, moist, medium dense, (A-3)		-55	5 7 4	NC	--
	358.5				
SAND: Gray, fine to coarse grained, trace fine gravel, moist, medium dense, (A-1)		-60	5 5 8	NC	--
SAND: Gray, fine to coarse grained, trace fine gravel, moist, medium dense, (A-1) *(continued)*					
	353.0				
SAND: Gray, fine to coarse grained, trace fine gravel, moist, medium dense, (A-3) *Grain Size Analysis performed*		-65	10 10 10	NC	--
	348.0				
CLAY: Gray, trace wood, moist, medium stiff, (A-7)		-70	WOH 2 3	0.5 B/20	40
	343.0				
SAND: Gray, fine to coarse grained, moist, medium dense, (A-3)		-75	8 11 15	NC	--
Fine grained, trace organics, dense	335.0	-80	9 17 19	NC	--

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer)
AASHTO Classifications are based on visual classifications unless otherwise noted

Illinois Department of Transportation

Division of Highways
SCI Engineering

SOIL BORING LOG

Date 8/9,10,11/2021

ROUTE	Route 111	**DESCRIPTION**	IL Route 111 over Cahokia Canal	**LOGGED BY**	SCI
SECTION	6-1BR	**LOCATION**	Madison County, Illinois, **Lat** 38.66569 **Long** -90.09075		
COUNTY	Madison	**DRILLING METHOD**	CME 550 w/HSA, Mud Rotary	**HAMMER TYPE**	Automatic

STRUCT. NO.	060-0127
Station	
BORING NO.	B-1
Station	230+49
Offset	90 ft LT
Ground Surface Elev.	415.0 ft

Surface Water Elev.	N/A ft
Stream Bed Elev.	395.8 ft
Groundwater Elev.:	
First Encounter	394.0 ft ▼
Upon Completion	21.0 ft ▽
After ___ Hrs.	N/A ft

Description	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
SAND: Gray, fine to coarse grained, trace organics, moist, dense, (A-3) *(continued)*				
Medium dense, no organics	-85	7 9 9	NC	--
Trace fine gravel	-90	12 12 17	NC	--
Fine grained, trace coarse gravel	-95	8 7 7	NC	--
318.0				
SAND: Gray, fine to coarse grained, trace fine to coarse gravel, moist, medium dense, (A-1)	-100	8 9 9	NC	--

Description	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
SAND: Gray, fine to coarse grained, trace fine to coarse gravel, moist, medium dense, (A-1) *(continued)*				
	-105	25 15 12	NC	--
	-110	12 12 15	NC	--
302.0				
WEATHERED LIMESTONE: Gray *No recovery.*		50/3.5"		--
301.2				
Boring terminated at 113.8 feet. Borehole grouted upon completion.	-115			
	-120			

Illinois Department of Transportation

Division of Highways
SCI Engineering

SOIL BORING LOG

Date 8/912,12/2021

ROUTE Route 111 **DESCRIPTION** IL Route 111 over Cahokia Canal **LOGGED BY** SCI

SECTION 6-1BR **LOCATION** Madison County, Illinois
Lat 38.66512 **Long** -90.09088

COUNTY Madison **DRILLING METHOD** CME 550 w/HSA, Mud Rotary **HAMMER TYPE** Automatic

STRUCT. NO. 060-0244
Station 119+30.22

BORING NO. B-2
Station 228+39
Offset 36 ft RT
Ground Surface Elev. 415.0 ft

Surface Water Elev. N/A ft
Stream Bed Elev. 395.8 ft

Groundwater Elev.:
First Encounter 380.0 ft ▼
Upon Completion 35.0 ft ▽
After ___ **Hrs.** N/A ft

Description	Elev.	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
FILL: Brown and gray, SILTY CLAY (A-6), moist, medium stiff			2 4 3	2.0 P	21
FILL: Gray, CLAY (A-7), moist, soft	412.0	-5	WOH 2 2	1.0 S/10	32
With sandy clay loam			1 3 5	1.2 B/20	26
SILTY LOAM: Gray, moist, soft, (A-4) *Grain Size Analysis performed*	407.0	-10	1 1 2	0.5 P	21
			WOH 1 1	<0.25 P	28
		-15	WOH 1 1	0.1 S/15	34
			WOH 1 2	0.4 S/15	42
CLAY: Gray, moist, soft, (A-7)	397.0	-20	1 1 2	0.6 B/20	46

Description	Elev.	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
CLAY: Gray, moist, soft, (A-7) *(continued)*			WOH WOH 1	0.5 B/20	44
		-25	WOH 1 1	0.6 B/20	33
SILTY CLAY LOAM: Gray, moist, (A-7)	389.5				
SILTY LOAM: Gray, very soft, moist, (A-6) *Grain Size Analysis performed*	388.5		WOH 1 1	0.2 B/20	36 31
SILTY CLAY LOAM: Gray, moist, very soft, (A-6)	386.0	-30	1 WOH 1	0.3 B/20	32
With silty loam		▼ -35	WOR WOH 1	0.5 B/20	41
CLAY: Gray, moist, very soft, (A-7)	378.0	-40	WOR WOH 1	0.4 B/20	44

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer)
AASHTO Classifications are based on visual classifications unless otherwise noted **BBS, form 137 (Rev. 8-99)**

Illinois Department of Transportation
Division of Highways
SCI Engineering

SOIL BORING LOG

Date 8/912,12/2021

ROUTE Route 111 **DESCRIPTION** IL Route 111 over Cahokia Canal **LOGGED BY** SCI

SECTION 6-1BR **LOCATION** Madison County, Illinois **Lat** 38.66512 **Long** -90.09088

COUNTY Madison **DRILLING METHOD** CME 550 w/HSA, Mud Rotary **HAMMER TYPE** Automatic

STRUCT. NO. 060-0244
Station 119+30.22

BORING NO. B-2
Station 228+39
Offset 36 ft RT
Ground Surface Elev. 415.0 ft

Surface Water Elev. N/A ft
Stream Bed Elev. 395.8 ft

Groundwater Elev.:
First Encounter 380.0 ft ▼
Upon Completion 35.0 ft ▽
After ____ **Hrs.** N/A ft

Description	Elev.	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
CLAY: Gray, moist, very soft, (A-7) *(continued)*					
Very soft, trace shells and wood	373.0				
SAND: Gray, fine to coarse grained, moist, loose, (A-3)					
Grain Size Analysis performed		-45	WOH WOH 1	NC	--
Trace wood		-50	1 3 7	NC	--
	363.0				
SAND: Gray, fine to coarse grained, moist, loose, (A-1)					
Grain Size Analysis performed		-55	2 4 6	NC	--
	358.0				
SAND: Gray, fine to coarse grained, moist, medium dense, (A-3)					
Grain Size Analysis performed		-60	6 4 4	NC	--

Description	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
SAND: Gray, fine to coarse grained, moist, medium dense, (A-3) *(continued)*				
	-65	8 11 8	NC	--
Fine grained, dense	-70	6 8 10	NC	--
Medium dense	-75	12 18 25	NC	---
	-80	13 14 18	NC	--

Illinois Department of Transportation

Division of Highways
SCI Engineering

SOIL BORING LOG

Date 8/912,12/2021

ROUTE Route 111 **DESCRIPTION** IL Route 111 over Cahokia Canal **LOGGED BY** SCI

SECTION 6-1BR **LOCATION** Madison County, Illinois **Lat** 38.66512 **Long** -90.09088

COUNTY Madison **DRILLING METHOD** CME 550 w/HSA, Mud Rotary **HAMMER TYPE** Automatic

STRUCT. NO. 060-0244
Station 119+30.22

BORING NO. B-2
Station 228+39
Offset 36 ft RT
Ground Surface Elev. 415.0 ft

Surface Water Elev. N/A ft
Stream Bed Elev. 395.8 ft

Groundwater Elev.:
First Encounter 380.0 ft ▼
Upon Completion 35.0 ft ▽
After ___ **Hrs.** N/A ft

Description	Elev.	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
SAND: Gray, fine to coarse grained, moist, medium dense, (A-3) *(continued)* Trace organics	333.0				
SAND: Gray, fine to coarse grained, moist, medium dense, (A-1)		-85	19 15 11	NC	--
		-90	5 6 8	NC	--
Trace fine gravel		-95	8 9 5	NC	--
	318.0				
SAND: Gray, fine to coarse grained, trace fine gravel, moist, medium dense, (A-3)		-100	1 6 9	NC	--

Description	Elev.	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
SAND: Gray, fine to coarse grained, trace fine gravel, moist, medium dense, (A-3) *(continued)*	313.0				
SAND: Gray, coarse grained, trace coarse gravel, moist, medium dense, (A-3)		-105	5 12 15	NC	--
	308.0				
SAND: Gray, fine to coarse grained, with fine gravel, trace coarse gravel, moist, very dense, (A-1)		-110	4 10 16	NC	--
With gravel and cobbles	302.0				
WEATHERED LIMESTONE		-115	22 34 21	NC	--
			50/1."		--
	298.0				
CLAYEY SHALE: Gray, with sand		-120	50/3" 50/0.5"		10

Illinois Department of Transportation

Division of Highways
SCI Engineering

SOIL BORING LOG

Date 8/912,12/2021

ROUTE Route 111 **DESCRIPTION** IL Route 111 over Cahokia Canal **LOGGED BY** SCI

SECTION 6-1BR **LOCATION** Madison County, Illinois
Lat 38.66512 **Long** -90.09088

COUNTY Madison **DRILLING METHOD** CME 550 w/HSA, Mud Rotary **HAMMER TYPE** Automatic

STRUCT. NO. 060-0244
Station 119+30.22

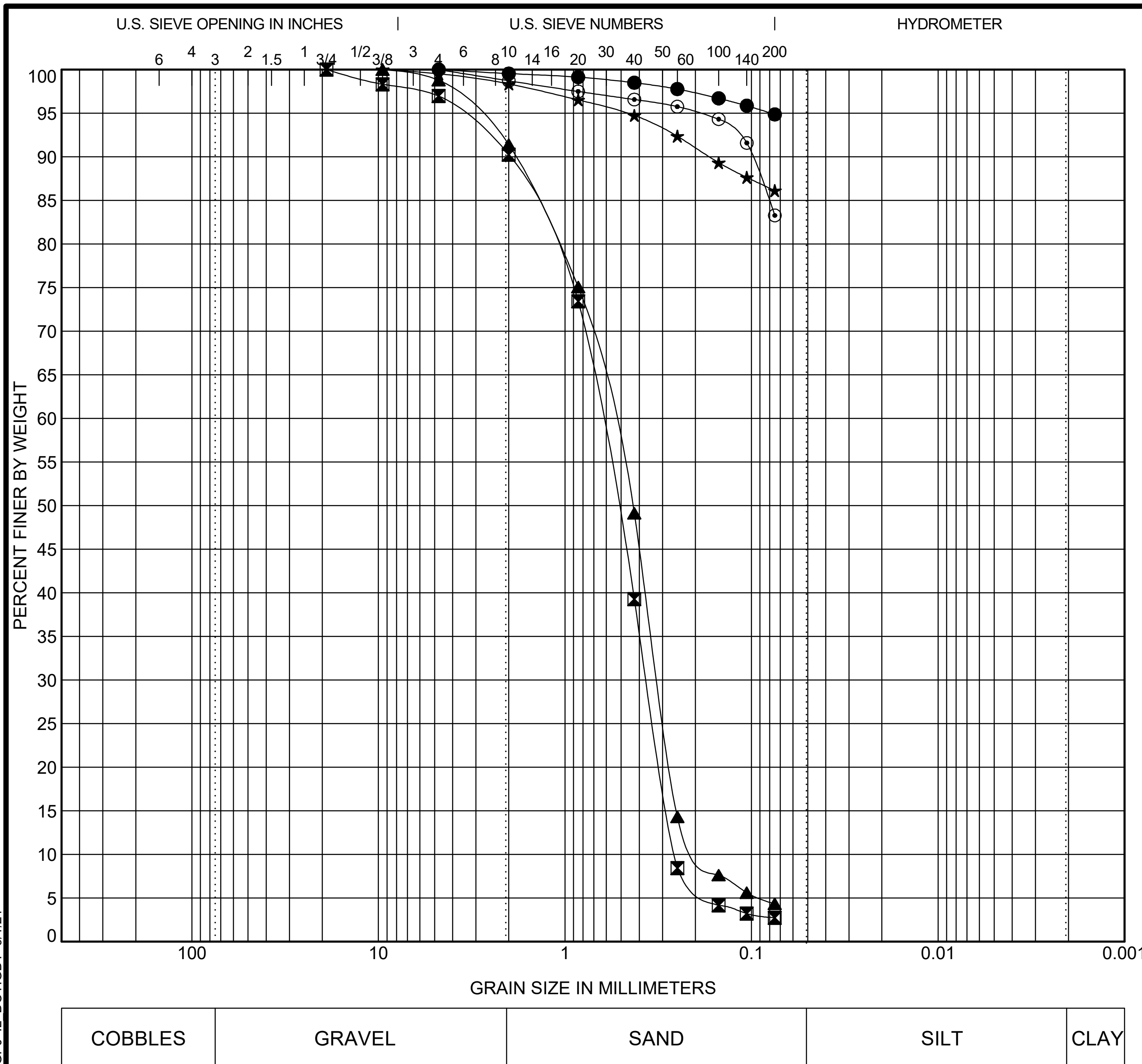
BORING NO. B-2
Station 228+39
Offset 36 ft RT
Ground Surface Elev. 415.0 ft

Surface Water Elev. N/A ft
Stream Bed Elev. 395.8 ft

Groundwater Elev.:
First Encounter 380.0 ft ▼
Upon Completion 35.0 ft ▽
After ____ **Hrs.** N/A ft

Description	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
CLAYEY SHALE: Gray, with sand *(continued)*				
293.8		50/2" 50/1"		13
Boring terminated at 121.3 feet. Borehole grouted upon completion.				
	-125			
	-130			
	-135			
	-140			

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
-145			
-150			
-155			
-160			



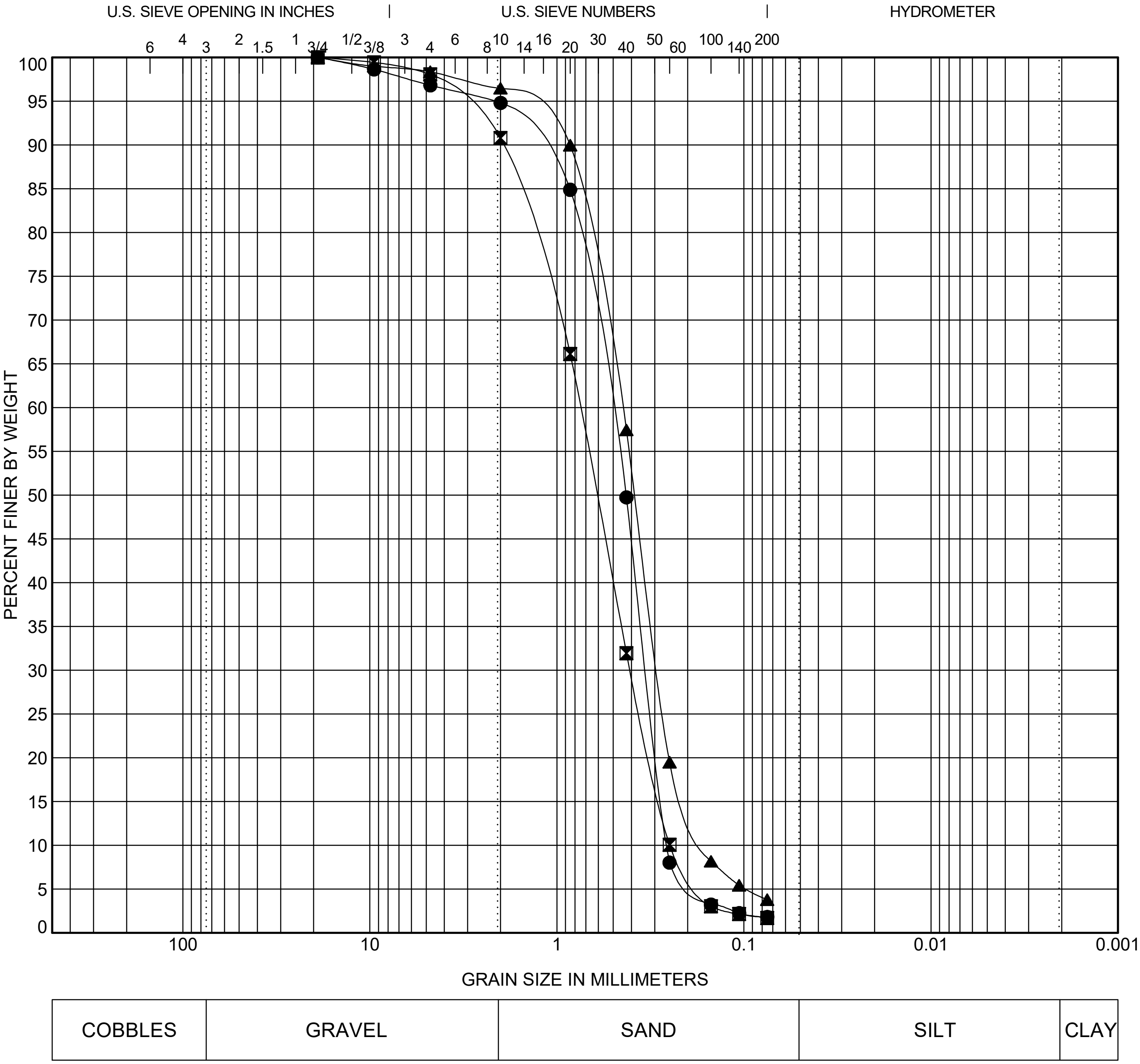
Specimen Identification			Classification	LL	PL	PI	Cc	Cu
●	B-1	11.0	SILTY CLAY LOAM					
⧗	B-1	43.5	SAND				0.79	2.52
▲	B-1	63.5	SAND				0.99	3.16
★	B-2	8.5	SILTY LOAM					
⊙	B-2	26.0	SILTY LOAM					

Specimen Identification			D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	B-1	11.0	4.75				0.5	4.7	94.9	
⧗	B-1	43.5	19	0.647	0.362	0.257	9.8	87.5	2.7	
▲	B-1	63.5	9.5	0.568	0.318	0.18	8.6	87.1	4.3	
★	B-2	8.5	9.5				1.6	12.2	86.1	
⊙	B-2	26.0	4.75				1.3	15.4	83.3	

Illinois Department of Transportation
Division of Highways
SCI Engineering, Inc.

GRAIN SIZE DISTRIBUTION - IDH

Route: Route 111
Section:
County: Madison



	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	**B-2**	**43.5**	**SAND**				**0.82**	**2.03**
⊠	**B-2**	**53.5**	**SAND**				**0.88**	**3.02**
▲	**B-2**	**58.5**	**SAND**				**1.15**	**2.75**

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**B-2**	**43.5**	**19**	**0.52**	**0.331**	**0.256**	**5.2**	**93.0**	**1.8**	
⊠	**B-2**	**53.5**	**19**	**0.751**	**0.405**	**0.249**	**9.2**	**89.1**	**1.7**	
▲	**B-2**	**58.5**	**19**	**0.449**	**0.29**	**0.163**	**3.5**	**92.7**	**3.8**	

Illinois Department of Transportation
Division of Highways
SCI Engineering, Inc.

GRAIN SIZE DISTRIBUTION - IDH

Route: Route 111
Section:
County: Madison

APPENDIX B

S C I L I Q U E F A C T I O N A N A L Y S I S

Modified from I.D.O.T. Bureau of Bridges and Structures FOUNDATIONS AND GEOTECHNICAL UNIT

Modified 6/14/2013

REFERENCE BORING NUMBER ==================================== B-1
ELEVATION OF BORING GROUND SURFACE ======================== 415.00 FT.
DEPTH TO GROUNDWATER - DURING DRILLING ===================== 21.00 FT. (Below Boring Ground Surface)
DEPTH TO GROUNDWATER - DURING EARTHQUAKE ================== 10.00 FT. (Below Finished Grade Cut or Fill Surface)
PEAK HORIZ. GROUND SURFACE ACCELERATION COEFFICIENT (As) ===== 0.371
EARTHQUAKE MOMENT MAGNITUDE ============================== 5.1
FINISHED GRADE FILL OR CUT FROM BORING SURFACE ============== 0.00 FT.
HAMMER EFFICIENCY== 73 %
BOREHOLE DIAMETER=== 6 IN.
SAMPLING METHOD== Sampler w/out Liners

EQ MAGNITUDE SCALING FACTOR
(MSF) = **2.362**

AVG. SHEAR WAVE VELOCITY (top 40')
$V^*_{s,40'}$ = **326** FT./SEC.

PGA CALCULATOR
Earthquake Moment Magnitude = 5.1
Source-To-Site Distance, R (km) = 10
Ground Motion Prediction Equations = NMSZ
PGA = **0.256**

	DATA REQUIRED							CONDITIONS DURING DRILLING					CONDITIONS DURING EARTHQUAKE							
	BORING DATA																			
ELEV. OF SAMPLE (FT.)	BORING SAMPLE DEPTH (FT.)	SPT N VALUE (BLOWS)	UNCONF. COMPR. STR., Q_u (TSF.)	% FINES < #200 (%)	PLAST. INDEX PI	LIQUID LIMIT LL	MOIST. CONTENT w_c (%)	EFFECTIVE UNIT WT. (KCF.)	EFFECTIVE VERT. STRESS (KSF.)	CORR. SPT N VALUE $(N_1)_{60}$	EQUIV. CLN. SAND SPT N VALUE $(N_1)_{60cs}$	CRR RESIST. MAG 7.5 $CRR_{7.5}$	EFFECTIVE UNIT WT. (KCF.)	EFFECTIVE VERT. STRESS (KSF.)	TOTAL VERT. STRESS (KSF.)	OVER-BURDEN CORR. FACT. (Ks)	CORR. RESIST. $CRR_{7.5}$ CRR	SOIL MASS PART. FACTOR (r_d)	EQ INDUCED CSR	FACTOR OF SAFETY * CRR/CSR
412.5	2.5	4	1.9				14	0.129	0.323	6.859	6.859	0.087	0.129	0.323	0.323	1.490	**0.305**	0.935	**0.225**	**N.L. (1)**
410	5	9	2.6					0.133	0.655	14.222	14.222	0.152	0.133	0.655	0.655	1.354	**0.487**	0.865	**0.209**	**N.L. (1)**
407.5	7.5	20	2.1					0.130	0.980	32.283	32.283	0.817	0.130	0.980	0.980	1.331	**2.569**	0.792	**0.191**	**N.L. (1)**
405	10	8	0.8					0.119	1.278	11.182	11.182	0.124	0.119	1.278	1.278	1.129	**0.330**	0.718	**0.173**	**N.L. (1)**
402	13	2	0.5	70				0.114	1.620	2.731	8.277	0.098	0.052	1.434	1.621	1.090	**0.253**	0.632	**0.172**	**1.471 (C)**
400	15	2	0.5	70				0.114	1.848	2.666	8.199	0.098	0.052	1.538	1.850	1.073	**0.247**	0.578	**0.168**	**1.470 (C)**
397.5	17.5	3	0.6	70				0.116	2.138	3.852	9.623	0.110	0.054	1.673	2.141	1.056	**0.274**	0.516	**0.159**	**1.723 (C)**
395	20	2	0.5	70				0.114	2.423	2.467	7.960	0.096	0.052	1.803	2.427	1.036	**0.234**	0.460	**0.149**	**1.570 (C)**
392.5	22.5	2	0.5	70				0.051	2.550	2.437	7.924	0.095	0.051	1.930	2.710	1.021	**0.230**	0.412	**0.140**	**1.643 (C)**
390	25	2	0.6	70				0.053	2.683	2.398	7.877	0.095	0.053	2.063	2.999	1.006	**0.225**	0.371	**0.130**	**1.731 (C)**
387.5	27.5	2	0.3	70				0.046	2.798	2.362	7.834	0.095	0.046	2.178	3.270	0.994	**0.222**	0.337	**0.122**	**1.820 (C)**
385	30	2	0.4	70				0.049	2.920	2.321	7.785	0.094	0.049	2.300	3.548	0.982	**0.218**	0.309	**0.115**	**1.896 (C)**
380	35	6						0.057	3.205	6.669	6.669	0.085	0.057	2.585	4.145	0.959	**0.193**	0.268	**0.104**	**1.856 (C)**
375	40	8						0.059	3.500	8.512	8.512	0.100	0.059	2.880	4.752	0.934	**0.221**	0.243	**0.096**	**2.302 (C)**
370	45	11						0.062	3.810	11.195	11.195	0.124	0.062	3.190	5.374	0.907	**0.265**	0.227	**0.092**	**2.880 (C)**
365	50	13						0.063	4.125	12.666	12.666	0.137	0.063	3.505	6.001	0.883	**0.286**	0.217	**0.090**	**3.178 (D)**
360	55	20						0.067	4.460	19.180	19.180	0.205	0.067	3.840	6.648	0.842	**0.409**	0.211	**0.088**	**4.648 (D)**
355	60	5						0.055	4.735	4.487	4.487	0.068	0.055	4.115	7.235	0.876	**0.141**	0.207	**0.088**	**1.602 (C)**
350	65	26						0.069	5.080	23.489	23.489	0.265	0.069	4.460	7.892	0.791	**0.494**	0.202	**0.086**	**5.744 (D)**
345	70	26						0.069	5.425	22.342	22.342	0.247	0.069	4.805	8.549	0.777	**0.453**	0.195	**0.084**	**5.393 (D)**
340	75	36						0.073	5.790	30.863	30.863	0.543	0.073	5.170	9.226	0.724	**0.929**	0.188	**0.081**	**N.L. (3)**
335	80	18						0.066	6.120	13.614	13.614	0.146	0.066	5.500	9.868	0.785	**0.271**	0.181	**0.078**	**3.474 (C)**
330	85	29						0.071	6.475	22.032	22.032	0.242	0.071	5.855	10.535	0.732	**0.419**	0.174	**0.076**	**5.513 (D)**
325	90	14						0.064	6.795	9.825	9.825	0.112	0.064	6.175	11.167	0.782	**0.206**	0.167	**0.073**	**2.822 (C)**
320	95	18						0.066	7.125	12.201	12.201	0.133	0.066	6.505	11.809	0.760	**0.239**	0.160	**0.070**	**3.414 (C)**
315	100	27						0.070	7.475	17.717	17.717	0.189	0.070	6.855	12.471	0.720	**0.321**	0.153	**0.067**	**4.791 (D)**
310	105	27						0.070	7.825	16.164	16.164	0.172	0.070	7.205	13.133	0.719	**0.292**	0.146	**0.064**	**4.563 (D)**
305	110	100	5					0.079	8.220	59.219	59.219	0.394	0.079	7.600	13.840	0.600	**0.559**	0.139	**0.061**	**N.L. (3)**

* FACTOR OF SAFETY DESCRIPTIONS
N.L. (1) = NOT LIQUEFIABLE, ABOVE EQ GROUND WATER ELEVATION
N.L. (2) = NOT LIQUEFIABLE, PI $\geq$ 12 OR w_c/LL $\leq$ 0.85
N.L. (3) = NOT LIQUEFIABLE, $(N_1)_{60}$ > 25
(C) = CONTRACTIVE SOIL TYPES
(D) = DILATIVE SOIL TYPES

S C I   L I Q U E F A C T I O N   A N A L Y S I S

Modified from I.D.O.T. Bureau of Bridges and Structures FOUNDATIONS AND GEOTECHNICAL UNIT — Modified 6/14/2013

REFERENCE BORING NUMBER ==================================== B-2
ELEVATION OF BORING GROUND SURFACE ========================= 415.00 FT.
DEPTH TO GROUNDWATER - DURING DRILLING ====================== 21.00 FT. (Below Boring Ground Surface)
DEPTH TO GROUNDWATER - DURING EARTHQUAKE ================== 10.00 FT. (Below Finished Grade Cut or Fill Surface)
PEAK HORIZ. GROUND SURFACE ACCELERATION COEFFICIENT (As) ===== 0.371
EARTHQUAKE MOMENT MAGNITUDE ============================== 5.1
FINISHED GRADE FILL OR CUT FROM BORING SURFACE ============== 0.00 FT.
HAMMER EFFICIENCY== 73 %
BOREHOLE DIAMETER=== 6 IN.
SAMPLING METHOD=== Sampler w/out Liners

EQ MAGNITUDE SCALING FACTOR
(MSF) = **2.362**

AVG. SHEAR WAVE VELOCITY (top 40')
$V^*_{s,40'}$ = **273** FT./SEC.

PGA CALCULATOR
Earthquake Moment Magnitude = 5.1
Source-To-Site Distance, R (km) = 10
Ground Motion Prediction Equations = NMSZ
PGA = **0.256**

	DATA REQUIRED / BORING DATA							CONDITIONS DURING DRILLING					CONDITIONS DURING EARTHQUAKE							
ELEV. OF SAMPLE (FT.)	BORING SAMPLE DEPTH (FT.)	SPT N VALUE (BLOWS)	UNCONF. COMPR. STR., Q_u (TSF.)	% FINES < #200 (%)	PLAST. INDEX PI	LIQUID LIMIT LL	MOIST. CONTENT w_c (%)	EFFECTIVE UNIT WT. (KCF.)	EFFECTIVE VERT. STRESS (KSF.)	CORR. SPT N VALUE $(N_1)_{60}$	EQUIV. CLN. SAND SPT N VALUE $(N_1)_{60cs}$	CRR RESIST. MAG 7.5 $CRR_{7.5}$	EFFECTIVE UNIT WT. (KCF.)	EFFECTIVE VERT. STRESS (KSF.)	TOTAL VERT. STRESS (KSF.)	OVER-BURDEN CORR. FACT. (Ks)	CORR. RESIST. $CRR_{7.5}$ CRR	SOIL MASS PART. FACTOR (r_d)	EQ INDUCED CSR	FACTOR OF SAFETY * CRR/CSR
412.5	2.5	7	2					0.130	0.325	12.144	12.144	0.133	0.130	0.325	0.325	1.500	**0.469**	0.911	**0.220**	**N.L. (1)**
410	5	4	1					0.122	0.630	6.195	6.195	0.081	0.122	0.630	0.630	1.287	**0.247**	0.821	**0.198**	**N.L. (1)**
407.5	7.5	8	1.2					0.124	0.940	11.434	11.434	0.126	0.124	0.940	0.940	1.216	**0.362**	0.731	**0.176**	**N.L. (1)**
405	10	3	0.5					0.114	1.225	4.252	4.252	0.067	0.114	1.225	1.225	1.116	**0.176**	0.645	**0.156**	**N.L. (1)**
402	13	2	0.3	70				0.108	1.549	2.778	8.334	0.099	0.046	1.363	1.550	1.103	**0.257**	0.551	**0.151**	**1.702 (C)**
400	15	2	0.1	70				0.098	1.745	2.730	8.275	0.098	0.036	1.435	1.747	1.090	**0.253**	0.495	**0.145**	**1.745 (C)**
397.5	17.5	3	0.4	70				0.111	2.023	3.949	9.739	0.111	0.049	1.558	2.026	1.073	**0.281**	0.432	**0.136**	**2.066 (C)**
395	20	3	0.6	70				0.116	2.313	3.784	9.541	0.109	0.054	1.693	2.317	1.053	**0.271**	0.379	**0.125**	**2.168 (C)**
392.5	22.5	2	0.5	70				0.051	2.440	2.491	7.989	0.096	0.051	1.820	2.600	1.034	**0.234**	0.334	**0.115**	**2.035 (C)**
390	25	2	0.6	70				0.053	2.573	2.449	7.939	0.095	0.053	1.953	2.889	1.018	**0.229**	0.297	**0.106**	**2.160 (C)**
387.5	27.5	2	0.2	70				0.042	2.678	2.416	7.900	0.095	0.042	2.058	3.150	1.007	**0.226**	0.267	**0.099**	**2.283 (C)**
385	30	2	0.3	70				0.046	2.793	2.377	7.852	0.095	0.046	2.173	3.421	0.995	**0.222**	0.243	**0.092**	**2.413 (C)**
380	35	2	0.5					0.051	3.048	2.286	2.286	0.054	0.051	2.428	3.988	0.973	**0.125**	0.209	**0.083**	**1.506 (C)**
375	40	2	0.4					0.049	3.293	2.204	2.204	0.054	0.049	2.673	4.545	0.955	**0.122**	0.187	**0.077**	**1.584 (C)**
370	45	10						0.061	3.598	10.530	10.530	0.118	0.061	2.978	5.162	0.923	**0.257**	0.174	**0.073**	**3.521 (C)**
365	50	10						0.061	3.903	10.079	10.079	0.114	0.061	3.283	5.779	0.904	**0.243**	0.166	**0.071**	**3.423 (C)**
360	55	10						0.061	4.208	9.657	9.657	0.110	0.061	3.588	6.396	0.886	**0.231**	0.162	**0.069**	**3.348 (C)**
355	60	8						0.059	4.503	7.417	7.417	0.091	0.059	3.883	7.003	0.878	**0.189**	0.159	**0.069**	**2.739 (C)**
350	65	19						0.067	4.838	17.133	17.133	0.182	0.067	4.218	7.650	0.827	**0.356**	0.155	**0.068**	**5.235 (D)**
345	70	18						0.066	5.168	15.383	15.383	0.164	0.066	4.548	8.292	0.817	**0.316**	0.148	**0.065**	**4.862 (D)**
340	75	43						0.074	5.538	39.494	39.494	0.106	0.074	4.918	8.974	0.714	**0.178**	0.141	**0.062**	**N.L. (3)**
335	80	32						0.071	5.893	26.593	26.593	0.328	0.071	5.273	9.641	0.737	**0.570**	0.134	**0.059**	**N.L. (3)**
330	85	26						0.069	6.238	20.077	20.077	0.216	0.069	5.618	10.298	0.751	**0.384**	0.127	**0.056**	**6.857 (D)**
325	90	14						0.064	6.558	10.082	10.082	0.114	0.064	5.938	10.930	0.787	**0.212**	0.120	**0.053**	**4.000 (C)**
320	95	14						0.064	6.878	9.739	9.739	0.111	0.064	6.258	11.562	0.780	**0.204**	0.113	**0.050**	**4.080 (C)**
315	100	15						0.065	7.203	9.887	9.887	0.112	0.065	6.583	12.199	0.770	**0.204**	0.106	**0.047**	**4.340 (C)**
310	105	27						0.070	7.553	16.649	16.649	0.177	0.070	6.933	12.861	0.724	**0.303**	0.099	**0.044**	**6.886 (D)**
305	110	26						0.069	7.898	13.628	13.628	0.147	0.069	7.278	13.518	0.731	**0.253**	0.092	**0.041**	**6.171 (C)**
300	115	55						0.077	8.283	28.080	28.080	0.372	0.077	7.663	14.215	0.642	**0.565**	0.085	**0.038**	**N.L. (3)**
295	120	100	5					0.079	8.678	51.769	51.769	0.322	0.079	8.058	14.922	0.586	**0.446**	0.078	**0.035**	**N.L. (3)**

* FACTOR OF SAFETY DESCRIPTIONS
N.L. (1) = NOT LIQUEFIABLE, ABOVE EQ GROUND WATER ELEVATION
N.L. (2) = NOT LIQUEFIABLE, PI ≥ 12 OR w_c/LL ≤ 0.85
N.L. (3) = NOT LIQUEFIABLE, $(N_1)_{60}$ > 25
(C) = CONTRACTIVE SOIL TYPES
(D) = DILATIVE SOIL TYPES

APPENDIX C

Illinois Department of Transportation

IDOT STATIC METHOD OF ESTIMATING PILE LENGTH

SUBSTRUCTURE===================================== N Abutment
REFERENCE BORING ================================= B-1
LRFD or ASD or SEISMIC ============================== LRFD
PILE CUTOFF ELEV. =================================== 408.50 ft
GROUND SURFACE ELEV. AGAINST PILE DURING DRIVING = 407.50 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 ============== 1700 kips
TOTAL LENGTH OF SUBSTRUCTURE (along skew)========== 75.00 ft
NUMBER OF ROWS OF PILES PER SUBSTRUCTURE ======= 1
Approx. Factored Loading Applied per pile at 8 ft. Cts =========== 181.33 KIPS
Approx. Factored Loading Applied per pile at 3 ft. Cts =========== 68.00 KIPS

PILE TYPE AND SIZE ============= Metal Shell 14"Φ w/.25" walls
Pile Perimeter============================== 3.665 FT.
Pile End Bearing Area========================== 1.069 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
459 KIPS	**344** KIPS	**189** KIPS	**62** 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 SIDE RESIST. (KIPS)	NOMINAL END BRG. RESIST. (KIPS)	NOMINAL TOTAL RESIST. (KIPS)	NOMINAL REQ'D BEARING (KIPS)	FACTORED GEOTECH. LOSS FROM SCOUR or DD (KIPS)	FACTORED GEOTECH. LOSS LOAD FROM DD (KIPS)	FACTORED RESISTANCE AVAILABLE (KIPS)	ESTIMATED PILE LENGTH (FT.)
405.50	2.00	0.50			4.5		10.3	10	0	0	6	3
403.00	2.50	0.50			5.6	5.9	17.1	17	0	0	9	6
400.50	2.50	0.60			6.6	7.0	22.5	23	0	0	12	8
398.00	2.50	0.50			5.6	5.9	26.9	27	0	0	15	11
395.50	2.50	0.40			4.6	4.7	32.7	33	0	0	18	13
392.00	3.50	0.50			7.8	5.9	41.7	42	0	0	23	17
389.50	2.50	0.60			6.6	7.0	44.7	45	0	0	25	19
387.00	2.50	0.30			3.5	3.5	49.4	49	0	0	27	22
382.00	5.00	0.40			9.1	4.7	58.5	58	0	0	32	27
377.00	5.00	0.40			9.1	4.7	66.4	66	0	0	37	32
372.00	5.00	0.30			6.9	3.5	123.7	124	0	0	68	37
367.00	5.00		8	Medium Sand	13.5	53.8	157.4	157	0	0	87	42
362.00	5.00		11	Medium Sand	18.6	74.0	189.4	189	0	0	104	47
357.00	5.00		13	Medium Sand	21.9	87.5	258.4	258	0	0	142	52
352.00	5.00		20	Medium Sand	33.7	134.6	163.4	163	0	0	90	57
347.00	5.00	0.50	5		11.2	5.9	343.7	344	0	0	189	62
342.00	5.00		26	Medium Sand	44.0	175.0	455.0	455	0	0	250	67
339.50	2.50		36	Fine Sand	30.8	242.3	485.8	~~486~~	~~0~~	~~0~~	~~267~~	~~69~~
337.00	2.50		36	Fine Sand	30.8	242.3	469.4	~~469~~	~~0~~	~~0~~	~~258~~	~~72~~
332.00	5.00		18	Medium Sand	30.4	121.1	398.8	399	0	0	219	77
332.00	5.00		29	Medium Sand	50.6	195.2	476.3	~~476~~	~~0~~	~~0~~	~~262~~	~~77~~
327.00	5.00		14	Medium Sand	23.6	94.2	499.9	~~500~~	~~0~~	~~0~~	~~275~~	~~82~~
322.00	5.00		18	Medium Sand	30.4	121.1	590.9	~~591~~	~~0~~	~~0~~	~~325~~	~~87~~
317.00	5.00		27	Medium Sand	46.0	181.7	636.9	~~637~~	~~0~~	~~0~~	~~350~~	~~92~~
312.00	5.00		27	Medium Sand	46.0	181.7	1174.2	~~1174~~	~~0~~	~~0~~	~~646~~	~~97~~
308.00	4.00		100	Medium Sand	305.7	672.9	1479.9	~~1480~~	~~0~~	~~0~~	~~814~~	~~101~~
307.00	1.00			Limestone	461.4	672.9	1941.4	~~1941~~	~~0~~	~~0~~	~~1068~~	~~101.5~~
306.00	1.00			Limestone	461.4	672.9	2402.8	~~2403~~	~~0~~	~~0~~	~~1322~~	~~102.5~~
305.00	1.00			Limestone	461.4	672.9	2527.8	~~2528~~	~~0~~	~~0~~	~~1390~~	~~103.5~~
304.00	1.00			Shale	230.7	336.5	2758.5	~~2759~~	~~0~~	~~0~~	~~1517~~	~~104.5~~
303.00	1.00			Shale	230.7	336.5	2989.2	~~2989~~	~~0~~	~~0~~	~~1644~~	~~105.5~~
302.00	1.00			Shale	230.7	336.5	3220.0	~~3220~~	~~0~~	~~0~~	~~1771~~	~~106.5~~
301.00	1.00			Shale	230.7	336.5	3450.7	~~3451~~	~~0~~	~~0~~	~~1898~~	~~107.5~~
300.00	1.00			Shale	230.7	336.5	3681.4	~~3681~~	~~0~~	~~0~~	~~2025~~	~~108.5~~
299.00	1.00			Shale	230.7	336.5	3912.1	~~3912~~	~~0~~	~~0~~	~~2152~~	~~109.5~~
298.00	1.00			Shale	230.7	336.5	4142.9	~~4143~~	~~0~~	~~0~~	~~2279~~	~~110.5~~
297.00	1.00			Shale	230.7	336.5	4373.6	~~4374~~	~~0~~	~~0~~	~~2405~~	~~111.5~~
296.00	1.00			Shale		336.5						

Pile Design Table for N Abutment utilizing Boring #B-1

	Nominal Required Bearing (Kips)	Seismic Resistance Available (Kips)	Estimated Pile Length (Ft.)
Metal Shell 12"Φ w/.25" walls			
	56	56	32
	99	99	37
	126	126	42
	139	139	57
	273	273	62
	378	378	72
	330	330	77
Metal Shell 14"Φ w/.25" walls			
	66	66	32
	124	124	37
	157	157	42
	163	163	57
	344	344	62
Metal Shell 14"Φ w/.312" walls			
	66	66	32
	124	124	37
	157	157	42
	163	163	57
	344	344	62
	469	469	72
	399	399	77
	500	500	82
Metal Shell 16"Φ w/.312" walls			
	68	68	27
	76	76	32
	150	150	37
	188	188	57
	421	421	62
	471	471	77
	591	591	82
Metal Shell 16"Φ w/.375" walls			
	68	68	27
	76	76	32
	150	150	37
	188	188	57
	421	421	62
	471	471	77
	591	591	82
	705	705	87
	758	758	92
Steel HP 8 X 36			
	49	49	57
	78	78	62
	86	86	77
	102	102	82
	116	116	87
	123	123	92
	162	162	97
	226	226	101
	286	286	102

	Nominal Required Bearing (Kips)	Seismic Resistance Available (Kips)	Estimated Pile Length (Ft.)
Steel HP 10 X 42			
	61	61	57
	97	97	62
	126	126	72
	110	110	77
	130	130	82
	151	151	87
	159	159	92
	200	200	97
	280	280	101
	335	335	102
Steel HP 10 X 57			
	62	62	57
	100	100	62
	128	128	72
	113	113	77
	133	133	82
	155	155	87
	163	163	92
	209	209	97
	289	289	101
	454	454	103
Steel HP 12 X 53			
	68	68	37
	74	74	57
	116	116	62
	133	133	67
	150	150	72
	138	138	77
	164	164	82
	192	192	87
	202	202	92
	240	240	97
	336	336	101
	418	418	102
Steel HP 12 X 63			
	48	48	32
	69	69	37
	75	75	57
	119	119	62
	136	136	67
	154	154	72
	140	140	77
	166	166	82
	195	195	87
	205	205	92
	248	248	97
	346	346	101
	497	497	103
Steel HP 12 X 74			
	49	49	32
	70	70	37
	76	76	57
	121	121	62
	139	139	67
	156	156	72
	142	142	77
	168	168	82
	198	198	87
	208	208	92
	255	255	97
	353	353	101
	589	589	103

	Nominal Required Bearing (Kips)	Seismic Resistance Available (Kips)	Estimated Pile Length (Ft.)
Steel HP 12 X 84			
	49	49	32
	71	71	37
	77	77	57
	123	123	62
	141	141	67
	158	158	72
	144	144	77
	171	171	82
	201	201	87
	211	211	92
	261	261	97
	359	359	101
	664	664	105
Steel HP 14 X 73			
	57	57	32
	85	85	37
	89	89	57
	141	141	62
	161	161	67
	182	182	72
	171	171	77
	204	204	82
	232	232	87
	249	249	92
	294	294	97
	409	409	101
	578	578	102
Steel HP 14 X 89			
	58	58	32
	86	86	37
	90	90	57
	144	144	62
	166	166	67
	186	186	72
	174	174	77
	207	207	82
	236	236	87
	254	254	92
	304	304	97
	420	420	101
	705	705	103
Steel HP 14 X 102			
	59	59	32
	87	87	37
	91	91	57
	147	147	62
	169	169	67
	188	188	72
	176	176	77
	209	209	82
	239	239	87
	256	256	92
	312	312	97
	428	428	101
	810	810	105
Steel HP 14 X 117			
	59	59	32
	88	88	37
	92	92	57
	150	150	62
	173	173	67
	192	192	72
	178	178	77
	212	212	82
	243	243	87
	260	260	92
	322	322	97
	439	439	101
	929	929	107
Precast 14"x 14"			
	63	63	22
	74	74	27
	85	85	32
	157	157	37
	200	200	42

Pile Design Table for N Abutment utilizing Boring #B-1

	Nominal Required Bearing (Kips)	Seismic Resistance Available (Kips)	Estimated Pile Length (Ft.)
Metal Shell 12"Φ w/.25" walls			
	56	56	32
	99	99	37
	126	126	42
	139	139	57
	273	273	62
	378	378	72
	330	330	77
Metal Shell 14"Φ w/.25" walls			
	66	66	32
	124	124	37
	157	157	42
	163	163	57
	344	344	62
Metal Shell 14"Φ w/.312" walls			
	66	66	32
	124	124	37
	157	157	42
	163	163	57
	344	344	62
	469	469	72
	399	399	77
	500	500	82
Metal Shell 16"Φ w/.312" walls			
	68	68	27
	76	76	32
	150	150	37
	188	188	57
	421	421	62
	471	471	77
	591	591	82
Metal Shell 16"Φ w/.375" walls			
	68	68	27
	76	76	32
	150	150	37
	188	188	57
	421	421	62
	471	471	77
	591	591	82
	705	705	87
	758	758	92
Steel HP 8 X 36			
	49	49	57
	78	78	62
	86	86	77
	102	102	82
	116	116	87
	123	123	92
	162	162	97
	226	226	101
	286	286	102

	Nominal Required Bearing (Kips)	Seismic Resistance Available (Kips)	Estimated Pile Length (Ft.)
Steel HP 10 X 42			
	61	61	57
	97	97	62
	126	126	72
	110	110	77
	130	130	82
	151	151	87
	159	159	92
	200	200	97
	280	280	101
	335	335	102
Steel HP 10 X 57			
	62	62	57
	100	100	62
	128	128	72
	113	113	77
	133	133	82
	155	155	87
	163	163	92
	209	209	97
	289	289	101
	454	454	103
Steel HP 12 X 53			
	68	68	37
	74	74	57
	116	116	62
	133	133	67
	150	150	72
	138	138	77
	164	164	82
	192	192	87
	202	202	92
	240	240	97
	336	336	101
	418	418	102
Steel HP 12 X 63			
	48	48	32
	69	69	37
	75	75	57
	119	119	62
	136	136	67
	154	154	72
	140	140	77
	166	166	82
	195	195	87
	205	205	92
	248	248	97
	346	346	101
	497	497	103
Steel HP 12 X 74			
	49	49	32
	70	70	37
	76	76	57
	121	121	62
	139	139	67
	156	156	72
	142	142	77
	168	168	82
	198	198	87
	208	208	92
	255	255	97
	353	353	101
	589	589	103

	Nominal Required Bearing (Kips)	Seismic Resistance Available (Kips)	Estimated Pile Length (Ft.)
Steel HP 12 X 84			
	49	49	32
	71	71	37
	77	77	57
	123	123	62
	141	141	67
	158	158	72
	144	144	77
	171	171	82
	201	201	87
	211	211	92
	261	261	97
	359	359	101
	664	664	105
Steel HP 14 X 73			
	57	57	32
	85	85	37
	89	89	57
	141	141	62
	161	161	67
	182	182	72
	171	171	77
	204	204	82
	232	232	87
	249	249	92
	294	294	97
	409	409	101
	578	578	102
Steel HP 14 X 89			
	58	58	32
	86	86	37
	90	90	57
	144	144	62
	166	166	67
	186	186	72
	174	174	77
	207	207	82
	236	236	87
	254	254	92
	304	304	97
	420	420	101
	705	705	103
Steel HP 14 X 102			
	59	59	32
	87	87	37
	91	91	57
	147	147	62
	169	169	67
	188	188	72
	176	176	77
	209	209	82
	239	239	87
	256	256	92
	312	312	97
	428	428	101
	810	810	105
Steel HP 14 X 117			
	59	59	32
	88	88	37
	92	92	57
	150	150	62
	173	173	67
	192	192	72
	178	178	77
	212	212	82
	243	243	87
	260	260	92
	322	322	97
	439	439	101
	929	929	107
Precast 14"x 14"			
	63	63	22
	74	74	27
	85	85	32
	157	157	37
	200	200	42

IDOT STATIC METHOD OF ESTIMATING PILE LENGTH

Illinois Department of Transportation

SUBSTRUCTURE==================================== Pier 2 (Est)
REFERENCE BORING ================================ B-1
LRFD or ASD or SEISMIC ============================== LRFD
PILE CUTOFF ELEV. =================================== 392.30 ft
GROUND SURFACE ELEV. AGAINST PILE DURING DRIVING = 391.30 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 ============== 3000 kips
TOTAL LENGTH OF SUBSTRUCTURE (along skew)========== 75.00 ft
NUMBER OF ROWS OF PILES PER SUBSTRUCTURE ======= 1
Approx. Factored Loading Applied per pile at 8 ft. Cts =========== 320.00 KIPS
Approx. Factored Loading Applied per pile at 3 ft. Cts =========== 120.00 KIPS

PILE TYPE AND SIZE ============= Metal Shell 14"Φ w/.25" walls
Pile Perimeter============================== 3.665 FT.
Pile End Bearing Area========================== 1.069 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
459 KIPS	**369** KIPS	**203** KIPS	**60** 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 SIDE RESIST. (KIPS)	NOMINAL END BRG. RESIST. (KIPS)	NOMINAL TOTAL RESIST. (KIPS)	NOMINAL REQ'D BEARING (KIPS)	FACTORED GEOTECH. LOSS FROM SCOUR or DD (KIPS)	FACTORED GEOTECH. LOSS LOAD FROM DD (KIPS)	FACTORED RESISTANCE AVAILABLE (KIPS)	ESTIMATED PILE LENGTH (FT.)
387.80	3.50	0.50			7.8		***14.9***	15	0	0	8	5
385.30	2.50	0.60			6.6	7.0	***17.9***	18	0	0	10	7
382.80	2.50	0.30			3.5	3.5	***22.6***	23	0	0	12	10
377.80	5.00	0.40			9.1	4.7	***31.7***	32	0	0	17	15
372.80	5.00	0.40			9.1	4.7	***39.6***	40	0	0	22	20
367.80	5.00	0.30			6.9	3.5	***96.9***	97	0	0	53	25
362.80	5.00		8	Medium Sand	13.5	53.8	***130.6***	131	0	0	72	30
357.80	5.00		11	Medium Sand	18.6	74.0	***162.6***	163	0	0	89	35
352.80	5.00		13	Medium Sand	21.9	87.5	***231.6***	232	0	0	127	40
347.80	5.00		20	Medium Sand	33.7	134.6	***136.6***	137	0	0	75	45
342.80	5.00	0.50	5		11.2	5.9	***316.9***	317	0	0	174	50
337.80	5.00		26	Medium Sand	44.0	175.0	***428.2***	428	0	0	236	55
335.30	2.50		36	Fine Sand	30.8	242.3	***459.0***	459	0	0	252	57
332.80	2.50		36	Fine Sand	30.8	242.3	***368.6***	369	0	0	203	60
327.80	5.00		18	Medium Sand	30.4	121.1	***473.0***	~~473~~	~~*0*~~	~~*0*~~	~~*260*~~	~~*65*~~
325.30	2.50		29	Medium Sand	25.3	195.2	***498.3***	~~498~~	~~*0*~~	~~*0*~~	~~*274*~~	~~*67*~~
322.80	2.50		29	Medium Sand	25.3	195.2	***422.6***	423	0	0	232	70
317.80	5.00		14	Medium Sand	23.6	94.2	***473.1***	~~473~~	~~*0*~~	~~*0*~~	~~*260*~~	~~*75*~~
312.80	5.00		18	Medium Sand	30.4	121.1	***564.1***	~~564~~	~~*0*~~	~~*0*~~	~~*310*~~	~~*80*~~
307.80	5.00		27	Medium Sand	46.0	181.7	***610.1***	~~610~~	~~*0*~~	~~*0*~~	~~*336*~~	~~*85*~~
302.80	5.00		27	Medium Sand	46.0	181.7	***1147.4***	~~1147~~	~~*0*~~	~~*0*~~	~~*631*~~	~~*90*~~
298.80	4.00		100	Medium Sand	305.7	672.9	***1453.1***	~~1453~~	~~*0*~~	~~*0*~~	~~*799*~~	~~*94*~~
297.80	1.00			Limestone	461.4	672.9	***1914.6***	~~1915~~	~~*0*~~	~~*0*~~	~~*1053*~~	~~*94.5*~~
296.80	1.00			Limestone	461.4	672.9	***2376.0***	~~2376~~	~~*0*~~	~~*0*~~	~~*1307*~~	~~*95.5*~~
295.80	1.00			Limestone	461.4	672.9	***2501.0***	~~2501~~	~~*0*~~	~~*0*~~	~~*1376*~~	~~*96.5*~~
294.80	1.00			Shale	230.7	336.5	***2731.7***	~~2732~~	~~*0*~~	~~*0*~~	~~*1502*~~	~~*97.5*~~
293.80	1.00			Shale	230.7	336.5	***2962.5***	~~2962~~	~~*0*~~	~~*0*~~	~~*1629*~~	~~*98.5*~~
292.80	1.00			Shale	230.7	336.5	***3193.2***	~~3193~~	~~*0*~~	~~*0*~~	~~*1756*~~	~~*99.5*~~
291.80	1.00			Shale	230.7	336.5	***3423.9***	~~3424~~	~~*0*~~	~~*0*~~	~~*1883*~~	~~*100.5*~~
290.80	1.00			Shale	230.7	336.5	***3654.6***	~~3655~~	~~*0*~~	~~*0*~~	~~*2010*~~	~~*101.5*~~
289.80	1.00			Shale	230.7	336.5	***3885.3***	~~3885~~	~~*0*~~	~~*0*~~	~~*2137*~~	~~*102.5*~~
288.80	1.00			Shale	230.7	336.5	***4116.1***	~~4116~~	~~*0*~~	~~*0*~~	~~*2264*~~	~~*103.5*~~
287.80	1.00			Shale	230.7	336.5	***4346.8***	~~4347~~	~~*0*~~	~~*0*~~	~~*2391*~~	~~*104.5*~~
286.80	1.00			Shale		336.5						

Pile Design Table for Pier 2 (Est) utilizing Boring #B-1

	Nominal Required Bearing (Kips)	Factored Resistance Available (Kips)	Estimated Pile Length (Ft.)
Metal Shell 12"Φ w/.25" walls			
	116	64	45
	250	138	50
	301	166	60
Metal Shell 14"Φ w/.25" walls			
	137	75	45
	317	174	50
	369	203	60
Metal Shell 14"Φ w/.312" walls			
	137	75	45
	317	174	50
	369	203	60
	423	232	70
	473	260	75
	564	310	80
Metal Shell 16"Φ w/.312" walls			
	157	86	45
	391	215	50
	441	243	60
	498	274	70
	561	308	75
Metal Shell 16"Φ w/.375" walls			
	157	86	45
	391	215	50
	441	243	60
	498	274	70
	561	308	75
	674	371	80
	727	400	85
Steel HP 8 X 36			
	143	79	90

	Nominal Required Bearing (Kips)	Factored Resistance Available (Kips)	Estimated Pile Length (Ft.)
Steel HP 10 X 42			
	178	98	90
Steel HP 10 X 57			
	388	214	95
Steel HP 12 X 53			
	213	117	90
Steel HP 12 X 63			
	183	101	85
	221	122	90
	497	273	96
Steel HP 12 X 74			
	185	102	85
	228	125	90
	589	324	96

	Nominal Required Bearing (Kips)	Factored Resistance Available (Kips)	Estimated Pile Length (Ft.)
Steel HP 12 X 84			
	188	103	85
	234	128	90
	664	365	98
Steel HP 14 X 73			
	217	119	85
	261	144	90
	578	318	96
Steel HP 14 X 89			
	203	112	80
	221	121	85
	271	149	90
	705	388	96
Steel HP 14 X 102			
	206	113	80
	223	123	85
	279	153	90
	810	445	98
Steel HP 14 X 117			
	209	115	80
	227	125	85
	288	159	90
	929	511	100
Precast 14"x 14"			
	166	91	30

Pile Design Table for Pier 2 (Est) utilizing Boring #B-1

	Nominal Required Bearing (Kips)	Seismic Resistance Available (Kips)	Estimated Pile Length (Ft.)
Metal Shell 12"Φ w/.25" walls			
	116	116	45
	250	250	50
	301	301	60
Metal Shell 14"Φ w/.25" walls			
	97	97	25
	131	131	30
	137	137	45
	317	317	50
	369	369	60
Metal Shell 14"Φ w/.312" walls			
	97	97	25
	131	131	30
	137	137	45
	317	317	50
	369	369	60
	423	423	70
	473	473	75
	564	564	80
Metal Shell 16"Φ w/.312" walls			
	120	120	25
	157	157	45
	391	391	50
	441	441	60
	498	498	70
	561	561	75
Metal Shell 16"Φ w/.375" walls			
	120	120	25
	157	157	45
	391	391	50
	441	441	60
	498	498	70
	561	561	75
	674	674	80
	727	727	85
Steel HP 8 X 36			
	110	110	85
	143	143	90
	286	286	95

	Nominal Required Bearing (Kips)	Seismic Resistance Available (Kips)	Estimated Pile Length (Ft.)
Steel HP 10 X 42			
	115	115	75
	135	135	80
	144	144	85
	178	178	90
	335	335	95
Steel HP 10 X 57			
	118	118	75
	139	139	80
	147	147	85
	186	186	90
	454	454	96
Steel HP 12 X 53			
	115	115	57
	120	120	60
	131	131	70
	145	145	75
	165	165	80
	179	179	85
	213	213	90
	418	418	95
Steel HP 12 X 63			
	119	119	57
	123	123	60
	132	132	70
	147	147	75
	168	168	80
	183	183	85
	221	221	90
	497	497	96
Steel HP 12 X 74			
	111	111	55
	121	121	57
	124	124	60
	134	134	70
	149	149	75
	171	171	80
	185	185	85
	228	228	90
	589	589	96

	Nominal Required Bearing (Kips)	Seismic Resistance Available (Kips)	Estimated Pile Length (Ft.)
Steel HP 12 X 84			
	114	114	55
	124	124	57
	126	126	60
	136	136	70
	152	152	75
	173	173	80
	188	188	85
	234	234	90
	664	664	98
Steel HP 14 X 73			
	109	109	50
	129	129	55
	140	140	57
	145	145	60
	161	161	65
	162	162	70
	182	182	75
	200	200	80
	217	217	85
	261	261	90
	578	578	96
Steel HP 14 X 89			
	112	112	50
	133	133	55
	144	144	57
	148	148	60
	164	164	70
	184	184	75
	203	203	80
	221	221	85
	271	271	90
	705	705	96
Steel HP 14 X 102			
	114	114	50
	136	136	55
	147	147	57
	150	150	60
	167	167	70
	187	187	75
	206	206	80
	223	223	85
	279	279	90
	810	810	98
Steel HP 14 X 117			
	116	116	50
	139	139	55
	151	151	57
	152	152	60
	169	169	70
	190	190	75
	209	209	80
	227	227	85
	288	288	90
	929	929	100
Precast 14"x 14"			
	50	50	20
	123	123	25
	166	166	30

Illinois Department of Transportation

IDOT STATIC METHOD OF ESTIMATING PILE LENGTH

SUBSTRUCTURE===================================== Pier 2 (Est)
REFERENCE BORING ================================ B-2
LRFD or ASD or SEISMIC ============================== LRFD
PILE CUTOFF ELEV. ================================== 392.30 ft
GROUND SURFACE ELEV. AGAINST PILE DURING DRIVING = 391.30 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 ============== 3000 kips
TOTAL LENGTH OF SUBSTRUCTURE (along skew)========= 75.00 ft
NUMBER OF ROWS OF PILES PER SUBSTRUCTURE ======= 1
Approx. Factored Loading Applied per pile at 8 ft. Cts ============ 320.00 KIPS
Approx. Factored Loading Applied per pile at 3 ft. Cts ============ 120.00 KIPS

PILE TYPE AND SIZE ============= Metal Shell 14"Φ w/.25" walls
Pile Perimeter============================== 3.665 FT.
Pile End Bearing Area========================== 1.069 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
459 KIPS	**237** KIPS	**131** KIPS	**45** 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 SIDE RESIST. (KIPS)	NOMINAL END BRG. RESIST. (KIPS)	NOMINAL TOTAL RESIST. (KIPS)	NOMINAL REQ'D BEARING (KIPS)	FACTORED GEOTECH. LOSS FROM SCOUR or DD (KIPS)	FACTORED GEOTECH. LOSS LOAD FROM DD (KIPS)	FACTORED RESISTANCE AVAILABLE (KIPS)	ESTIMATED PILE LENGTH (FT.)
387.80	3.50	0.60			9.2		***11.6***	12	0	0	6	5
385.30	2.50	0.20			2.4	2.3	***15.1***	15	0	0	8	7
382.80	2.50	0.30			3.5	3.5	***20.9***	21	0	0	12	10
377.80	5.00	0.50			11.2	5.9	***30.9***	31	0	0	17	15
372.80	5.00	0.40			9.1	4.7	***42.1***	42	0	0	23	20
367.80	5.00		1	Medium Sand	1.7	6.7	***104.3***	104	0	0	57	25
362.80	5.00		10	Medium Sand	16.9	67.3	***121.2***	121	0	0	67	30
357.80	5.00		10	Medium Sand	16.9	67.3	***124.6***	125	0	0	69	35
352.80	5.00		8	Medium Sand	13.5	53.8	***212.1***	212	0	0	117	40
347.80	5.00		19	Medium Sand	32.1	127.9	***237.5***	237	0	0	131	45
342.80	5.00		18	Medium Sand	30.4	121.1	***436.1***	436	0	0	240	50
341.80	1.00		43	Fine Sand	16.5	289.4	***452.6***	453	0	0	249	51
340.80	1.00		43	Fine Sand	16.5	289.4	***469.1***	~~469~~	~~0~~	~~0~~	~~258~~	~~52~~
339.80	1.00		43	Fine Sand	16.5	289.4	***485.6***	~~486~~	~~0~~	~~0~~	~~267~~	~~53~~
338.80	1.00		43	Fine Sand	16.5	289.4	***502.1***	~~502~~	~~0~~	~~0~~	~~276~~	~~54~~
337.80	1.00		43	Fine Sand	16.5	289.4	***444.6***	445	0	0	245	55
332.80	5.00		32	Medium Sand	58.2	215.3	***462.4***	~~462~~	~~0~~	~~0~~	~~254~~	~~60~~
327.80	5.00		26	Medium Sand	44.0	175.0	***425.6***	426	0	0	234	65
322.80	5.00		14	Medium Sand	23.6	94.2	***449.2***	449	0	0	247	70
317.80	5.00		14	Medium Sand	23.6	94.2	***479.6***	~~480~~	~~0~~	~~0~~	~~264~~	~~75~~
312.80	5.00		15	Medium Sand	25.3	100.9	***585.6***	~~586~~	~~0~~	~~0~~	~~322~~	~~80~~
307.80	5.00		27	Medium Sand	46.0	181.7	***625.0***	~~625~~	~~0~~	~~0~~	~~344~~	~~85~~
302.80	5.00		26	Medium Sand	44.0	175.0	***864.1***	~~864~~	~~0~~	~~0~~	~~475~~	~~90~~
298.74	4.06		55	Sandy Gravel	210.8	370.1	***1377.7***	~~1378~~	~~0~~	~~0~~	~~758~~	~~94~~
297.74	1.00			Limestone	461.4	672.9	***1839.1***	~~1839~~	~~0~~	~~0~~	~~1012~~	~~94.6~~
296.74	1.00			Limestone	461.4	672.9	***1964.1***	~~1964~~	~~0~~	~~0~~	~~1080~~	~~95.6~~
295.74	1.00			Shale	230.7	336.5	***2194.8***	~~2195~~	~~0~~	~~0~~	~~1207~~	~~96.6~~
294.74	1.00			Shale	230.7	336.5	***2425.5***	~~2426~~	~~0~~	~~0~~	~~1334~~	~~97.6~~
293.74	1.00			Shale	230.7	336.5	***2656.3***	~~2656~~	~~0~~	~~0~~	~~1461~~	~~98.6~~
292.74	1.00			Shale	230.7	336.5	***2887.0***	~~2887~~	~~0~~	~~0~~	~~1588~~	~~99.6~~
291.74	1.00			Shale	230.7	336.5	***3117.7***	~~3118~~	~~0~~	~~0~~	~~1715~~	~~100.6~~
290.74	1.00			Shale	230.7	336.5	***3348.4***	~~3348~~	~~0~~	~~0~~	~~1842~~	~~101.6~~
289.74	1.00			Shale	230.7	336.5	***3579.2***	~~3579~~	~~0~~	~~0~~	~~1969~~	~~102.6~~
288.74	1.00			Shale	230.7	336.5	***3809.9***	~~3810~~	~~0~~	~~0~~	~~2095~~	~~103.6~~
287.74	1.00			Shale	230.7	336.5	***4040.6***	~~4041~~	~~0~~	~~0~~	~~2222~~	~~104.6~~
286.74	1.00			Shale	230.7	336.5	***4271.3***	~~4271~~	~~0~~	~~0~~	~~2349~~	~~105.6~~
285.74	1.00			Shale	230.7	336.5	***4502.1***	~~4502~~	~~0~~	~~0~~	~~2476~~	~~106.6~~
284.74	1.00			Shale		336.5						

Pile Design Table for Pier 2 (Est) utilizing Boring #B-2

	Nominal Required Bearing (Kips)	Factored Resistance Available (Kips)	Estimated Pile Length (Ft.)
Metal Shell 12"Φ w/.25" walls			
	189	104	45
	338	186	50
Metal Shell 14"Φ w/.25" walls			
	212	117	40
	237	131	45
Metal Shell 14"Φ w/.312" walls			
	212	117	40
	237	131	45
	426	234	65
	449	247	70
	480	264	75
Metal Shell 16"Φ w/.312" walls			
	151	83	35
	263	145	40
	291	160	45
	502	276	65
	529	291	70
	565	311	75
Metal Shell 16"Φ w/.375" walls			
	151	83	35
	263	145	40
	291	160	45
	502	276	65
	529	291	70
	565	311	75
	699	384	80
	743	409	85
Steel HP 8 X 36			
	280	154	95

	Nominal Required Bearing (Kips)	Factored Resistance Available (Kips)	Estimated Pile Length (Ft.)
Steel HP 10 X 42			
	162	89	90
Steel HP 10 X 57			
	440	242	97
Steel HP 12 X 53			
	417	229	95
Steel HP 12 X 63			
	493	271	96
Steel HP 12 X 74			
	551	303	97

	Nominal Required Bearing (Kips)	Factored Resistance Available (Kips)	Estimated Pile Length (Ft.)
Steel HP 12 X 84			
	662	364	99
Steel HP 14 X 73			
	209	115	85
	236	130	90
	578	318	96
Steel HP 14 X 89			
	213	117	85
	242	133	90
	705	388	98
Steel HP 14 X 102			
	215	118	85
	247	136	90
	810	445	100
Steel HP 14 X 117			
	202	111	80
	219	120	85
	253	139	90
	929	511	101
Precast 14"x 14"			
	159	87	35

Pile Design Table for Pier 2 (Est) utilizing Boring #B-2

	Nominal Required Bearing (Kips)	Seismic Resistance Available (Kips)	Estimated Pile Length (Ft.)
Metal Shell 12"Φ w/.25" walls			
	100	100	35
	166	166	40
	189	189	45
	338	338	50
Metal Shell 14"Φ w/.25" walls			
	104	104	25
	121	121	30
	125	125	35
	212	212	40
	237	237	45
Metal Shell 14"Φ w/.312" walls			
	104	104	25
	121	121	30
	125	125	35
	212	212	40
	237	237	45
	426	426	65
	449	449	70
	480	480	75
Metal Shell 16"Φ w/.312" walls			
	49	49	20
	130	130	25
	149	149	30
	151	151	35
	263	263	40
	291	291	45
	502	502	65
	529	529	70
	565	565	75
Metal Shell 16"Φ w/.375" walls			
	49	49	20
	130	130	25
	149	149	30
	151	151	35
	263	263	40
	291	291	45
	502	502	65
	529	529	70
	565	565	75
	699	699	80
	743	743	85
Steel HP 8 X 36			
	106	106	85
	130	130	90
	286	286	96

	Nominal Required Bearing (Kips)	Seismic Resistance Available (Kips)	Estimated Pile Length (Ft.)
Steel HP 10 X 42			
	107	107	75
	132	132	80
	138	138	85
	162	162	90
	335	335	95
Steel HP 10 X 57			
	110	110	75
	135	135	80
	142	142	85
	167	167	90
	454	454	98
Steel HP 12 X 53			
	105	105	55
	122	122	60
	122	122	65
	127	127	70
	135	135	75
	158	158	80
	173	173	85
	194	194	90
	418	418	96
Steel HP 12 X 63			
	108	108	55
	123	123	65
	129	129	70
	136	136	75
	162	162	80
	176	176	85
	199	199	90
	497	497	97
Steel HP 12 X 74			
	110	110	55
	125	125	65
	131	131	70
	138	138	75
	164	164	80
	178	178	85
	203	203	90
	589	589	98

	Nominal Required Bearing (Kips)	Seismic Resistance Available (Kips)	Estimated Pile Length (Ft.)
Steel HP 12 X 84			
	112	112	55
	127	127	65
	133	133	70
	141	141	75
	166	166	80
	181	181	85
	207	207	90
	664	664	100
Steel HP 14 X 73			
	113	113	52
	128	128	55
	148	148	60
	152	152	65
	158	158	70
	168	168	75
	192	192	80
	209	209	85
	236	236	90
	578	578	96
Steel HP 14 X 89			
	118	118	52
	131	131	55
	151	151	60
	154	154	65
	160	160	70
	170	170	75
	195	195	80
	213	213	85
	242	242	90
	705	705	98
Steel HP 14 X 102			
	108	108	50
	121	121	52
	134	134	55
	153	153	60
	156	156	65
	163	163	70
	172	172	75
	198	198	80
	215	215	85
	247	247	90
	810	810	100
Steel HP 14 X 117			
	112	112	50
	125	125	52
	137	137	55
	156	156	60
	159	159	65
	165	165	70
	175	175	75
	202	202	80
	219	219	85
	253	253	90
	929	929	101
Precast 14"x 14"			
	54	54	20
	133	133	25
	154	154	30
	159	159	35

Illinois Department of Transportation

IDOT STATIC METHOD OF ESTIMATING PILE LENGTH

SUBSTRUCTURE==================================== S Abutment
REFERENCE BORING ================================ B-2
LRFD or ASD or SEISMIC ============================== LRFD
PILE CUTOFF ELEV. ================================== 408.00 ft
GROUND SURFACE ELEV. AGAINST PILE DURING DRIVING = 407.00 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 ============== 1700 kips
TOTAL LENGTH OF SUBSTRUCTURE (along skew)========== 75.00 ft
NUMBER OF ROWS OF PILES PER SUBSTRUCTURE ======= 1
Approx. Factored Loading Applied per pile at 8 ft. Cts =========== 181.33 KIPS
Approx. Factored Loading Applied per pile at 3 ft. Cts =========== 68.00 KIPS

PILE TYPE AND SIZE ============= Metal Shell 12"Φ w/.25" walls
Pile Perimeter============================= 3.142 FT.
Pile End Bearing Area========================= 0.785 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
392 KIPS	**333** KIPS	**183** KIPS	**77** 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 SIDE RESIST. (KIPS)	NOMINAL END BRG. RESIST. (KIPS)	NOMINAL TOTAL RESIST. (KIPS)	NOMINAL REQ'D BEARING (KIPS)	FACTORED GEOTECH. LOSS FROM SCOUR or DD (KIPS)	FACTORED GEOTECH. LOSS LOAD FROM DD (KIPS)	FACTORED RESISTANCE AVAILABLE (KIPS)	ESTIMATED PILE LENGTH (FT.)
404.50	2.50	1.00			8.7		***19.1***	19	0	0	10	4
402.00	2.50	1.20			10.1	10.3	***23.1***	23	0	0	13	6
399.25	2.75	0.50			5.3	4.3	***28.4***	28	0	0	16	9
396.75	2.50	0.50			4.8	4.3	***29.7***	30	0	0	16	11
394.25	2.50	0.10			1.0	0.9	***33.3***	33	0	0	18	14
391.75	2.50	0.40			3.9	3.4	***39.0***	39	0	0	21	16
389.25	2.50	0.60			5.6	5.2	***43.8***	44	0	0	24	19
386.75	2.50	0.50			4.8	4.3	***49.4***	49	0	0	27	21
383.25	3.50	0.60			7.9	5.2	***53.9***	54	0	0	30	25
380.75	2.50	0.20			2.0	1.7	***56.8***	57	0	0	31	27
378.25	2.50	0.30			3.0	2.6	***61.5***	61	0	0	34	30
373.25	5.00	0.50			9.6	4.3	***70.2***	70	0	0	39	35
368.25	5.00	0.40			7.8	3.4	***79.5***	79	0	0	44	40
363.25	5.00		1	Medium Sand	1.4	4.9	***125.4***	125	0	0	69	45
358.25	5.00		10	Medium Sand	14.5	49.4	***139.9***	140	0	0	77	50
353.25	5.00		10	Medium Sand	14.5	49.4	***144.5***	144	0	0	79	55
348.25	5.00		8	Medium Sand	11.6	39.6	***210.4***	210	0	0	116	60
346.25	2.00		19	Medium Sand	11.0	93.9	***221.4***	221	0	0	122	62
344.25	2.00		19	Medium Sand	11.0	93.9	***232.4***	232	0	0	128	64
342.25	2.00		19	Medium Sand	11.0	93.9	***238.4***	238	0	0	131	66
340.25	2.00		18	Medium Sand	10.4	89.0	***248.9***	249	0	0	137	68
338.25	2.00		18	Medium Sand	10.4	89.0	***382.9***	383	0	0	211	70
337.25	1.00		43	Fine Sand	14.1	212.6	***313.0***	313	0	0	172	71
335.25	2.00		43	Fine Sand	28.3	212.6	***281.9***	282	0	0	155	73
333.25	2.00		43	Fine Sand	28.3	212.6	***310.2***	310	0	0	171	75
331.25	2.00		32	Fine Sand	17.8	158.2	***333.0***	333	0	0	183	77
329.25	2.00		32	Fine Sand	17.8	158.2	***410.1***	~~410~~	~~*0*~~	~~*0*~~	~~*226*~~	~~*79*~~
328.25	1.00		32	Fine Sand	8.9	158.2	***414.0***	~~414~~	~~*0*~~	~~*0*~~	~~*228*~~	~~*80*~~
332.25	5.00		26	Medium Sand	37.7	128.5	***392.4***	~~392~~	~~*0*~~	~~*0*~~	~~*216*~~	~~*76*~~
327.25	5.00		14	Medium Sand	20.2	69.2	***412.6***	~~413~~	~~*0*~~	~~*0*~~	~~*227*~~	~~*81*~~
322.25	5.00		14	Medium Sand	20.2	69.2	***437.8***	~~438~~	~~*0*~~	~~*0*~~	~~*241*~~	~~*86*~~
317.25	5.00		15	Medium Sand	21.7	74.2	***518.8***	~~519~~	~~*0*~~	~~*0*~~	~~*285*~~	~~*91*~~
312.25	5.00		27	Medium Sand	39.5	133.5	***553.4***	~~553~~	~~*0*~~	~~*0*~~	~~*304*~~	~~*96*~~
307.25	5.00		26	Medium Sand	37.7	128.5	***734.4***	~~734~~	~~*0*~~	~~*0*~~	~~*404*~~	~~*101*~~
303.25	4.00		55	Sandy Gravel	178.0	271.9	***1134.9***	~~1135~~	~~*0*~~	~~*0*~~	~~*624*~~	~~*105*~~
302.25	1.00			Limestone	395.5	494.4	***1530.4***	~~1530~~	~~*0*~~	~~*0*~~	~~*842*~~	~~*105.8*~~
301.25	1.00			Limestone	395.5	494.4	***1678.7***	~~1679~~	~~*0*~~	~~*0*~~	~~*923*~~	~~*106.8*~~
300.25	1.00			Shale	197.8	247.2	***1876.5***	~~1877~~	~~*0*~~	~~*0*~~	~~*1032*~~	~~*107.8*~~
299.25	1.00			Shale	197.8	247.2	***2074.3***	~~2074~~	~~*0*~~	~~*0*~~	~~*1141*~~	~~*108.8*~~
298.25	1.00			Shale	197.8	247.2	***2272.0***	~~2272~~	~~*0*~~	~~*0*~~	~~*1250*~~	~~*109.8*~~
297.25	1.00			Shale	197.8	247.2	***2469.8***	~~2470~~	~~*0*~~	~~*0*~~	~~*1358*~~	~~*110.8*~~
296.25	1.00			Shale	197.8	247.2	***2667.6***	~~2668~~	~~*0*~~	~~*0*~~	~~*1467*~~	~~*111.8*~~
295.25	1.00			Shale	98.9	247.2	***2766.4***	~~2766~~	~~*0*~~	~~*0*~~	~~*1522*~~	~~*112.8*~~

Pile Design Table for S Abutment utilizing Boring #B-2

	Nominal Required Bearing (Kips)	Seismic Resistance Available (Kips)	Estimated Pile Length (Ft.)
Metal Shell 12"Φ w/.25" walls			
	61	61	30
	70	70	35
	79	79	40
	125	125	45
	140	140	50
	144	144	55
	210	210	60
	221	221	62
	232	232	64
	249	249	68
	282	282	73
	310	310	75
	333	333	77
Metal Shell 14"Φ w/.25" walls			
	67	67	27
	73	73	30
	83	83	35
	94	94	40
	156	156	45
	173	173	50
	176	176	55
	264	264	60
	277	277	62
	289	289	64
	308	308	68
Metal Shell 14"Φ w/.312" walls			
	67	67	27
	73	73	30
	83	83	35
	94	94	40
	156	156	45
	173	173	50
	176	176	55
	264	264	60
	277	277	62
	289	289	64
	308	308	68
	342	342	73
	375	375	75
	471	471	76
	403	403	77
	504	504	79
	508	508	80
	495	495	81
	525	525	86
Metal Shell 16"Φ w/.312" walls			
	68	68	21
	73	73	25
	77	77	27

	Nominal Required Bearing (Kips)	Seismic Resistance Available (Kips)	Estimated Pile Length (Ft.)
Steel HP 10 X 42			
	67	67	45
	70	70	55
	91	91	60
	93	93	62
	96	96	64
	98	98	68
	102	102	73
	108	108	75
	125	125	76
	114	114	77
	138	138	79
	138	138	80
	130	130	81
	136	136	86
	160	160	91
	167	167	96
	204	204	101
	268	268	105
	335	335	106
Steel HP 10 X 57			
	53	53	40
	69	69	45
	72	72	55
	92	92	60
	96	96	62
	98	98	64
	101	101	68
	105	105	73
	111	111	75
	128	128	76
	117	117	77
	141	141	79
	142	142	80
	133	133	81
	139	139	86
	164	164	91
	171	171	96
	209	209	101
	277	277	105
	454	454	108
Steel HP 12 X 53			
	63	63	40
	85	85	45
	87	87	55
	108	108	60
	112	112	62
	116	116	64
	124	124	68
	129	129	73

	Nominal Required Bearing (Kips)	Seismic Resistance Available (Kips)	Estimated Pile Length (Ft.)
Steel HP 12 X 84			
	65	65	40
	89	89	45
	91	91	55
	114	114	60
	118	118	62
	122	122	64
	130	130	68
	134	134	73
	142	142	75
	163	163	76
	149	149	77
	177	177	79
	180	180	80
	168	168	81
	176	176	86
	213	213	91
	221	221	96
	259	259	101
	344	344	105
Steel HP 14 X 73			
	64	64	30
	72	72	35
	75	75	40
	106	106	45
	108	108	55
	131	131	60
	136	136	62
	141	141	64
	150	150	68
	160	160	73
	169	169	75
	193	193	76
	177	177	77
	204	204	79
	208	208	80
	199	199	81
	208	208	86
	252	252	91
	264	264	96
	297	297	101
	391	391	105
	578	578	107
Steel HP 14 X 89			
	65	65	30
	72	72	35
	76	76	40
	108	108	45
	109	109	55

84	84	30
95	95	35
108	108	40
189	189	45
208	208	50
210	210	55
322	322	60
337	337	62
352	352	64
371	371	68
407	407	73
444	444	75
554	554	76
477	477	77
606	606	79
609	609	80
581	581	81
617	617	86

Metal Shell 16"Φ w/.375" walls

68	68	21
73	73	25
77	77	27
84	84	30
95	95	35
108	108	40
189	189	45
208	208	50
210	210	55
322	322	60
337	337	62
352	352	64
371	371	68
407	407	73
444	444	75
554	554	76
477	477	77
606	606	79
609	609	80
581	581	81
617	617	86
751	751	91

Steel HP 8 X 36

55	55	55
69	69	60
71	71	62

136	136	75
157	157	76
143	143	77
169	169	79
172	172	80
162	162	81
169	169	86
204	204	91
211	211	96
244	244	101
321	321	105
418	418	106

Steel HP 12 X 63

63	63	40
86	86	45
88	88	55
111	111	60
115	115	62
119	119	64
127	127	68
130	130	73
137	137	75
158	158	76
144	144	77
173	173	79
176	176	80
163	163	81
171	171	86
206	206	91
214	214	96
250	250	101
331	331	105
497	497	107

Steel HP 12 X 74

64	64	40
87	87	45
90	90	55
112	112	60
116	116	62
121	121	64
128	128	68
132	132	73
140	140	75
161	161	76
147	147	77

134	134	60
139	139	62
144	144	64
153	153	68
162	162	73
171	171	75
196	196	76
180	180	77
208	208	79
212	212	80
202	202	81
211	211	86
256	256	91
268	268	96
303	303	101
403	403	105
705	705	108

Steel HP 14 X 102

66	66	30
73	73	35
76	76	40
109	109	45
111	111	55
135	135	60
140	140	62
145	145	64
154	154	68
165	165	73
173	173	75
198	198	76
182	182	77
211	211	79
214	214	80
204	204	81
214	214	86
259	259	91
272	272	96
308	308	101
411	411	105

Steel HP 14 X 117

67	67	30
74	74	35
77	77	40
111	111	45

Pile Design Table for S Abutment utilizing Boring #B-2

	Nominal Required Bearing (Kips)	Seismic Resistance Available (Kips)	Estimated Pile Length (Ft.)
Metal Shell 12"Φ w/.25" walls			
	61	61	30
	70	70	35
	79	79	40
	125	125	45
	140	140	50
	144	144	55
	210	210	60
	221	221	62
	232	232	64
	249	249	68
	282	282	73
	310	310	75
	333	333	77
Metal Shell 14"Φ w/.25" walls			
	67	67	27
	73	73	30
	83	83	35
	94	94	40
	156	156	45
	173	173	50
	176	176	55
	264	264	60
	277	277	62
	289	289	64
	308	308	68
Metal Shell 14"Φ w/.312" walls			
	67	67	27
	73	73	30
	83	83	35
	94	94	40
	156	156	45
	173	173	50
	176	176	55
	264	264	60
	277	277	62
	289	289	64
	308	308	68
	342	342	73
	375	375	75
	471	471	76
	403	403	77
	504	504	79
	508	508	80
	495	495	81
	525	525	86
Metal Shell 16"Φ w/.312" walls			
	68	68	21
	73	73	25
	77	77	27

	Nominal Required Bearing (Kips)	Seismic Resistance Available (Kips)	Estimated Pile Length (Ft.)
Steel HP 10 X 42			
	67	67	45
	70	70	55
	91	91	60
	93	93	62
	96	96	64
	98	98	68
	102	102	73
	108	108	75
	125	125	76
	114	114	77
	138	138	79
	138	138	80
	130	130	81
	136	136	86
	160	160	91
	167	167	96
	204	204	101
	268	268	105
	335	335	106
Steel HP 10 X 57			
	53	53	40
	69	69	45
	72	72	55
	92	92	60
	96	96	62
	98	98	64
	101	101	68
	105	105	73
	111	111	75
	128	128	76
	117	117	77
	141	141	79
	142	142	80
	133	133	81
	139	139	86
	164	164	91
	171	171	96
	209	209	101
	277	277	105
	454	454	108
Steel HP 12 X 53			
	63	63	40
	85	85	45
	87	87	55
	108	108	60
	112	112	62
	116	116	64
	124	124	68
	129	129	73

	Nominal Required Bearing (Kips)	Seismic Resistance Available (Kips)	Estimated Pile Length (Ft.)
Steel HP 12 X 84			
	65	65	40
	89	89	45
	91	91	55
	114	114	60
	118	118	62
	122	122	64
	130	130	68
	134	134	73
	142	142	75
	163	163	76
	149	149	77
	177	177	79
	180	180	80
	168	168	81
	176	176	86
	213	213	91
	221	221	96
	259	259	101
	344	344	105
Steel HP 14 X 73			
	64	64	30
	72	72	35
	75	75	40
	106	106	45
	108	108	55
	131	131	60
	136	136	62
	141	141	64
	150	150	68
	160	160	73
	169	169	75
	193	193	76
	177	177	77
	204	204	79
	208	208	80
	199	199	81
	208	208	86
	252	252	91
	264	264	96
	297	297	101
	391	391	105
	578	578	107
Steel HP 14 X 89			
	65	65	30
	72	72	35
	76	76	40
	108	108	45
	109	109	55

84	84	30
95	95	35
108	108	40
189	189	45
208	208	50
210	210	55
322	322	60
337	337	62
352	352	64
371	371	68
407	407	73
444	444	75
554	554	76
477	477	77
606	606	79
609	609	80
581	581	81
617	617	86
Metal Shell 16"Φ w/.375" walls		
68	68	21
73	73	25
77	77	27
84	84	30
95	95	35
108	108	40
189	189	45
208	208	50
210	210	55
322	322	60
337	337	62
352	352	64
371	371	68
407	407	73
444	444	75
554	554	76
477	477	77
606	606	79
609	609	80
581	581	81
617	617	86
751	751	91
Steel HP 8 X 36		
55	55	55
69	69	60
71	71	62

136	136	75
157	157	76
143	143	77
169	169	79
172	172	80
162	162	81
169	169	86
204	204	91
211	211	96
244	244	101
321	321	105
418	418	106
Steel HP 12 X 63		
63	63	40
86	86	45
88	88	55
111	111	60
115	115	62
119	119	64
127	127	68
130	130	73
137	137	75
158	158	76
144	144	77
173	173	79
176	176	80
163	163	81
171	171	86
206	206	91
214	214	96
250	250	101
331	331	105
497	497	107
Steel HP 12 X 74		
64	64	40
87	87	45
90	90	55
112	112	60
116	116	62
121	121	64
128	128	68
132	132	73
140	140	75
161	161	76
147	147	77

134	134	60
139	139	62
144	144	64
153	153	68
162	162	73
171	171	75
196	196	76
180	180	77
208	208	79
212	212	80
202	202	81
211	211	86
256	256	91
268	268	96
303	303	101
403	403	105
705	705	108
Steel HP 14 X 102		
66	66	30
73	73	35
76	76	40
109	109	45
111	111	55
135	135	60
140	140	62
145	145	64
154	154	68
165	165	73
173	173	75
198	198	76
182	182	77
211	211	79
214	214	80
204	204	81
214	214	86
259	259	91
272	272	96
308	308	101
411	411	105
Steel HP 14 X 117		
67	67	30
74	74	35
77	77	40
111	111	45

APPENDIX D

Appendix D - L-Pile Parameters

North. Abutment B-1

Depth (ft)	Elevation (ft)	Abbreviated Soil Description	Effective Unit Weight (pcf)	Cohesion (psf)	Phi (degrees)	Soil Modulus Parameter (pci)	E_{50}
0 to 36.4	407.4 to 371	Soft Clay (without free water)	115	200	--	30	0.02
36.4 to 105.4	371 to 302	Submerged Medium DenseSand	45	--	30	60	--
105.4+	< 302	Weathered Limestone/Shale	130	5000	44	2000	0.004

Pier 1 B-1 (Est)

Depth (ft)	Elevation (ft)	Abbreviated Soil Description	Effective Unit Weight (pcf)	Cohesion (psf)	Phi (degrees)	Soil Modulus Parameter (pci)	E_{50}
0 to 20.8	391.8 to 371	Soft Clay (without free water)	115	200	--	30	0.02
20.8 to 89.8	371 to 302	Submerged Medium DenseSand	45	--	30	60	--
89.8+	< 302	Weathered Limestone/Shale	130	5000	44	2000	0.004

Pier 2 B-2 (Est)

Depth (ft)	Elevation (ft)	Abbreviated Soil Description	Effective Unit Weight (pcf)	Cohesion (psf)	Phi (degrees)	Soil Modulus Parameter (pci)	E_{50}
0 to 18.8	391.8 to 373	Soft Clay (without free water)	115	200	--	30	0.02
18.8 to 92.3	373 to 299.5	Submerged Medium DenseSand	45	--	30	60	--
92.3+	< 299.5	Weathered Limestone/Shale	130	5000	44	2000	0.004

South Abutment B-2

Depth (ft)	Elevation (ft)	Abbreviated Soil Description	Effective Unit Weight (pcf)	Cohesion (psf)	Phi (degrees)	Soil Modulus Parameter (pci)	E_{50}
0 to 34.4	407.4 to 373	Soft Clay (without free water)	115	200	--	30	0.02
34.4 to 107.9	373 to 299.5	Submerged Medium DenseSand	45	--	30	60	--
107.9+	< 299.5	Weathered Limestone/Shale	130	5000	44	2000	0.004

SEALCOAT ANALYSIS

Illinois Department of Transportation

INPUT DATA:

SEALCOAT THICKNESS ==========================	4.75	FT.
COFFERDAM DESIGN WATER ELEVATION ==========	411.6	FT.
STREAMBED ELEVATION ========================	395.3	FT.
BOTTOM OF FOOTING ELEVATION ================	391.3	FT.
BOTTOM OF SHEETING TIP ELEVATION ===========	350	FT.
SHEET PILING WEIGHT =========================	22.00	LBS./SQ.FT.
MISCELLANEOUS WEIGHT (WALES, STRUTS, ETC.) ===	8586.00	LBS.
COFFERDAM WIDTH ===========================	11.00	FT.
COFFERDAM LENGTH ==========================	86.00	FT.
FOOTING WIDTH ==============================	10.00	FT.
FOOTING LENGTH =============================	85.00	FT.
NUMBER OF PILES IN COFFERDAM ================	11	
PILE LENGTH BELOW TOP OF SEAL================	95.00	FT.
EDGE OF FOOTING TO EDGE OF FOUNDATION PILES =	1.25	FT.
INPUT H-PILE SECTION, OR PILE DIAMETER =========	MS 14x0.312	

ASSUMED PARAMETERS:

SEALCOAT CONCRETE UNIT WT.:
150 PCF.
BUOYANT SOIL UNIT WT.:
40 PCF.
SEALCOAT BOND TO THE SHEETING:
7 PSI.
SEALCOAT BOND TO THE PILES:
7 PSI.
FRICTION OF SOIL ON SHEETING:
150 PSF.
FRICTION OF SOIL ON FOUNDATION PILES:
150 PSF.

RESULTING FORCES:

I ***HYDROSTATIC BUOYANCY FORCE:*** ===> ***1460.28*** ***KIPS***

II ***SEALCOAT CONCRETE WEIGHT:*** ===> ***665.62*** ***KIPS***

III ***SHEET PILING RESISTANCE (Smallest of a+b+c, or d):*** ===> ***928.87*** ***KIPS***

a) WEIGHT OF SHEET PILING == 262.91 KIPS
b) MISCELLANEOUS WEIGHT ATTACHED TO SHEET PILING (WALES, STRUTS, BRACING, ETC.) ============ 8.59 KIPS
c) SOIL FRICTION ON SHEET PILING === 1318.23 KIPS
d) SEALCOAT BOND TO SHEET PILING == 928.87 KIPS

IV ***FOUNDATION PILING RESISTANCE (Smallest of a+b, or c):*** ===> ***193.29*** ***KIPS***

a) WEIGHT OF FOUNDATION PILING === -36.15 KIPS
b) PULLOUT RESISTANCE OF FOUNDATION PILING (SMALLEST OF 1, OR 2 + 3): 546.51 KIPS
1 SOIL FRICTION ON ALL INDIVIDUAL PILES -- 546.51 KIPS
2 SOIL FRICTION ALONG PERIMETER OF PILE GROUP -- ###### KIPS
3 WEIGHT OF SOIL CONTAINED IN PILE GROUP --- ###### KIPS
c) SEALCOAT BOND TO FOUNDATION PILING == 193.29 KIPS

FACTOR OF SAFETY = RESISTING FORCES (II + III + IV) / BUOYANT FORCE (I) = 1788 kips / 1460 kips = 1.22 OK

APPENDIX E

BENCHMARK:

BM1: Top of Barrier
SB 111 Sta 226+79.48,
74.93' Lt
El 418.86

BM2: Top of Wingwall
SB 111 Sta 231+85.67,
22.06' Rt
El 418.06

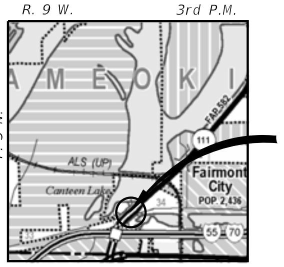
EXISTING STRUCTURE: SN 060-0127

Constructed in 1961 as FA Route 132, Section 6-23B at Sta 29+44.1. The existing structure consists of a 3-span continuous steel girder superstructure with a 7" cast-in-place concrete deck and HMA overlay, and a substructure of reinforced concrete piers on timber pile supported footings and concrete pile bent abutments. Back to back of abutment length is 318'-8" and out to out width of the deck is 36'-4". The structure is skewed at 61°-30'.

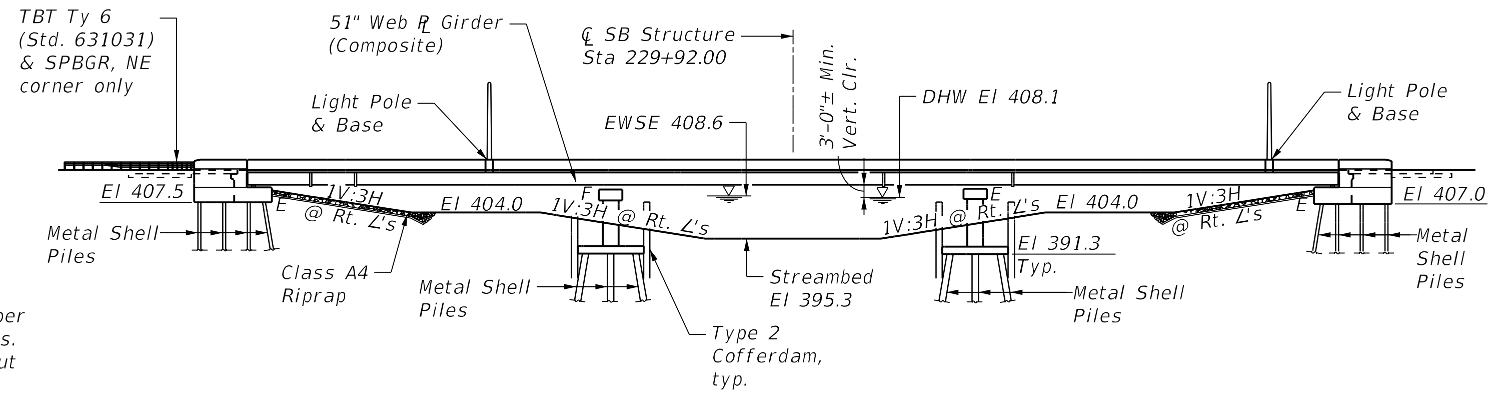
The structure is to be removed and replaced, including removal of the existing concrete pier footings to allow construction of the proposed pier footings.

Traffic is to be detoured on the adjacent structure and crossovers.

SALVAGE: No salvage



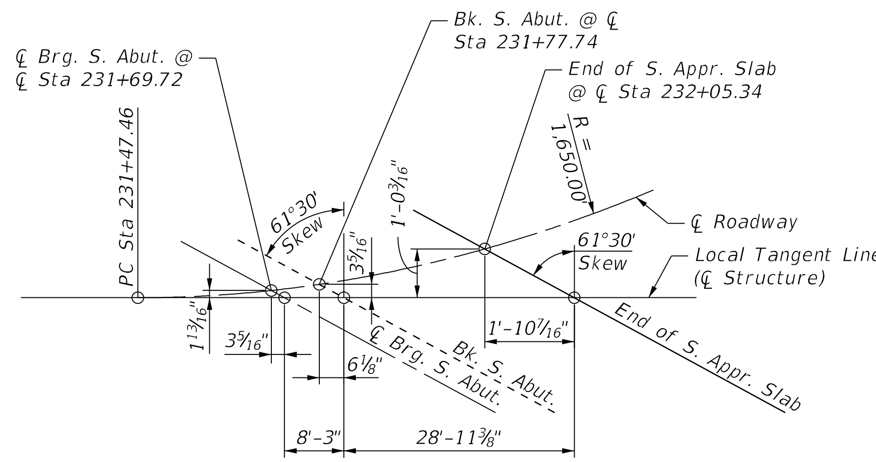
LOCATION SKETCH



ELEVATION

HIGHWAY CLASSIFICATION

SB FAP Rte 582 - IL Rte 111
Functional Class: Other Principal Arterial
ADT: 5,300 (2019); 5,880 (2042)
ADTT: 775 (2019); 860 (2042)
DHV: 588 (2042)
Design Speed: 55 mph
Posted Speed: 55 mph
One-Way Traffic
Directional Distribution: 50/50



℄ OFFSET SKETCH AT S. ABUT.

DESIGN SCOUR ELEVATION TABLE

Event/Limit State	Design Scour Elevations (ft.) N. Abut.	Pier 1	Pier 2	S. Abut.	Item 113
Q100	407.5	390.3	390.3	407.0	5
Q200	407.5	390.3	390.3	407.0	
Design	407.5	390.3	390.3	407.0	
Check	407.5	390.3	390.3	407.0	

WATERWAY INFORMATION

Drainage Area = 105.5 Sq. Mi.
Existing Overtopping El = 416.4 at S. Abut.
Proposed Overtopping El = 416.4 at S. Abut.

Flood Event	Freq. Yr.	Q C.F.S.	Opening Sq Ft Exist.	Opening Sq Ft Prop.	Nat. H.W.E.	Head - Ft Exist.	Head - Ft Prop.	Headwater El Exist.	Headwater El Prop.
	10	2,600	511	842	408.1	0.5	0.2	408.6	408.3
Design	50	2,600	511	842	408.1	0.5	0.2	408.6	408.3
Base	100	2,600	511	842	408.1	0.5	0.2	408.6	408.3
Scour Design Check	200	2,600	511	842	408.1	0.5	0.2	408.6	408.3
Overtopping Existing	NA	-	-	-	-	-	-	-	-
Overtopping Proposed	NA	-	-	-	-	-	-	-	-
Max. Calc.	500	2,600	511	842	408.1	0.5	0.2	408.6	408.3

10 Year Velocity through Existing Bridge = 5.98 ft/s
10 Year Velocity through Proposed Bridge = 3.40 ft/s

DESIGN SPECIFICATIONS

2020 AASHTO LRFD
Bridge Design Specifications
LOADING HL-93
Allow 50 p.s.f. for future wearing surface

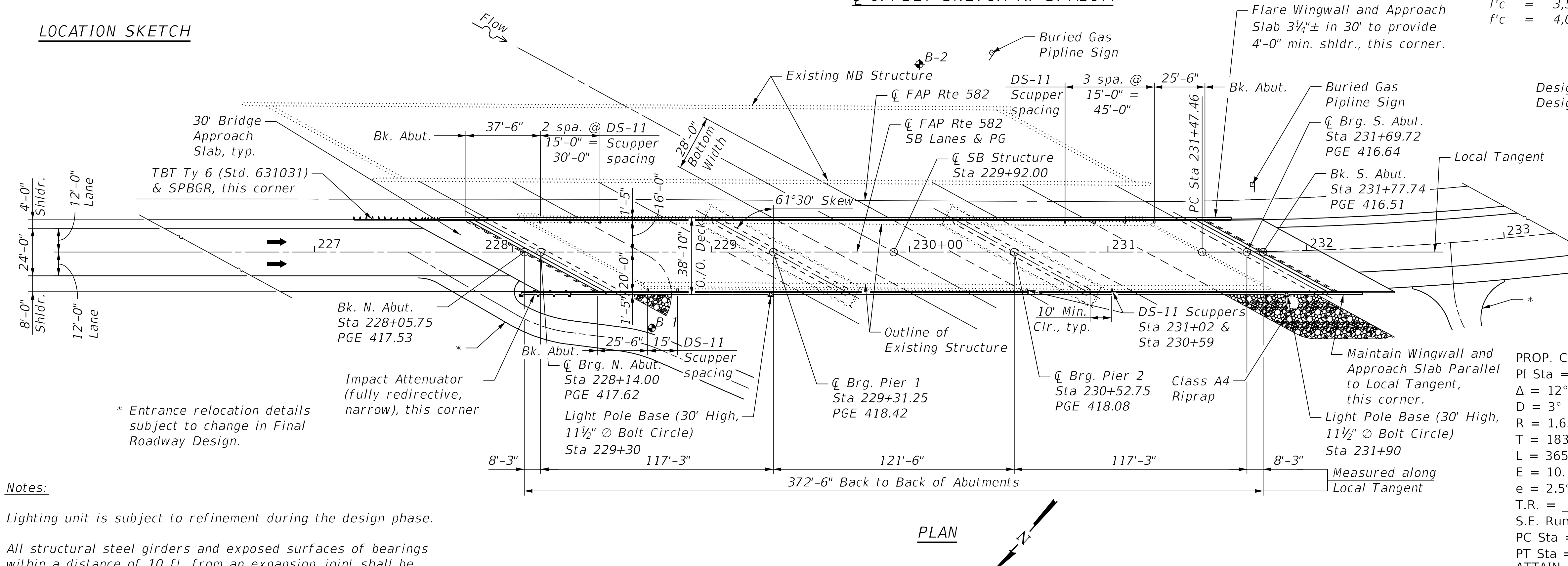
DESIGN STRESSES

FIELD UNITS

f'c = 3,500 psi
f'c = 4,000 psi (Superstructure Concrete)
fy = 60,000 psi (reinf.)
fy = 50,000 psi (M270 Gr. 50)

SEISMIC DATA

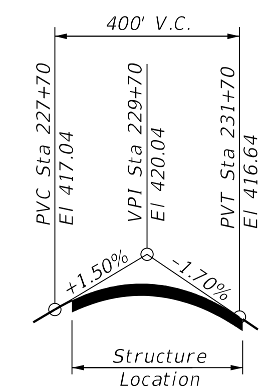
Seismic Performance Zone (SPZ): 2
Design Spectral Acceleration at 1.0 sec. (S_{D1}): = 0.237 g
Design Spectral Acceleration at 0.2 sec. (S_{DS}): = 0.535 g
Soil Site Class = D



PLAN

* Entrance relocation details subject to change in Final Roadway Design.

PROP. CURVE PR_BL_SB111
PI Sta = 233+31.14
Δ = 12° 42' 16" (LT)
D = 3° 28' 21"
R = 1,650.00'
T = 183.68'
L = 365.86'
E = 10.19'
e = 2.5%
T.R. = ____
S.E. Run = ____
PC Sta = 231+47.46
PT Sta = 235+13.32
ATTAIN SE Sta 230+70
to Sta 231+74



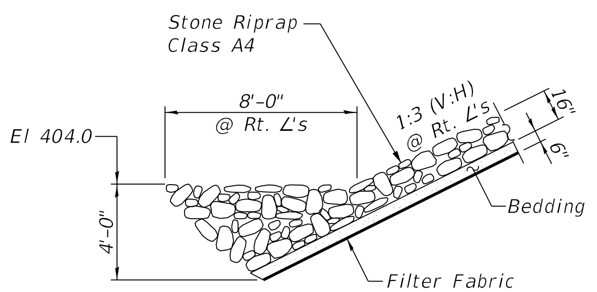
PROFILE GRADE
(Along ℄ SB FAP 582)

GENERAL PLAN
SOUTHBOUND IL RTE 111
OVER CAHOKIA CANAL
FAP RTE 582 - SECTION 6-23B-I
MADISON COUNTY
STATION 229+92.00
STRUCTURE NO. 060-0347

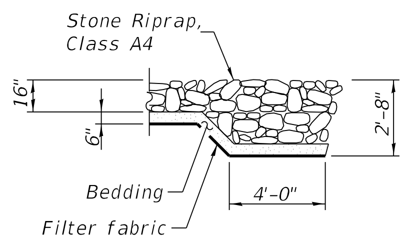
Notes:

Lighting unit is subject to refinement during the design phase.

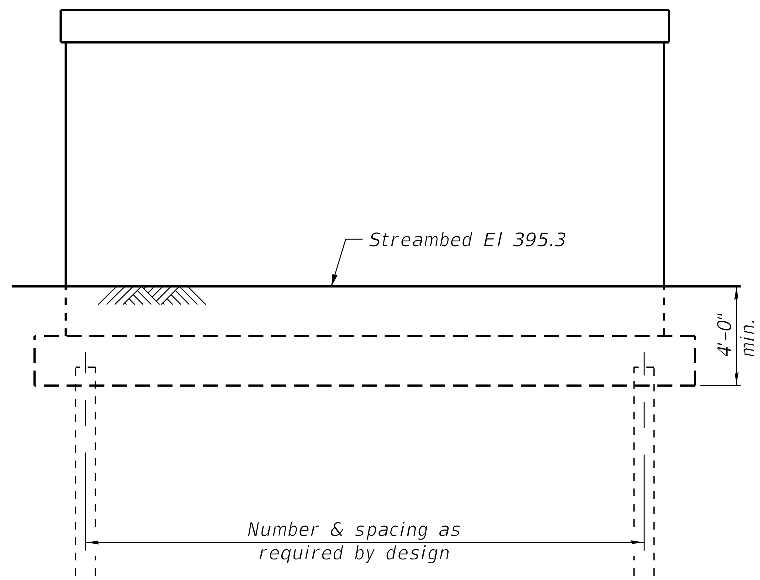
All structural steel girders and exposed surfaces of bearings within a distance of 10 ft. from an expansion joint shall be metallized and shop painted (System #3), Gray Color.



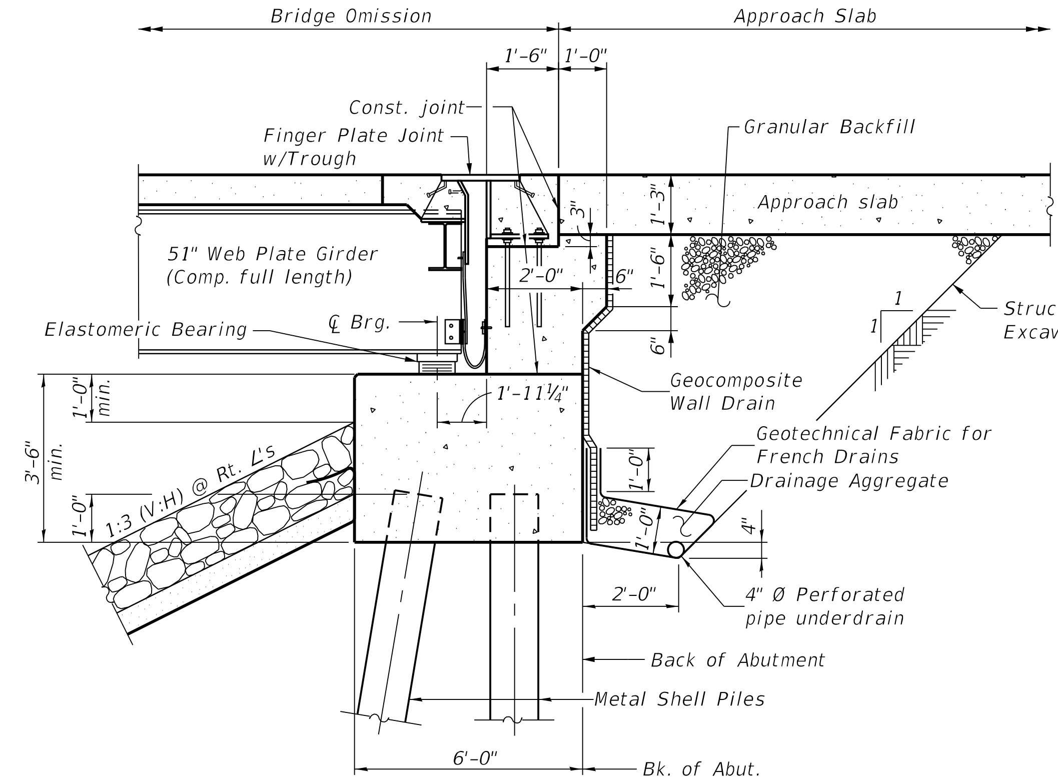
RIPRAP TOE DETAIL



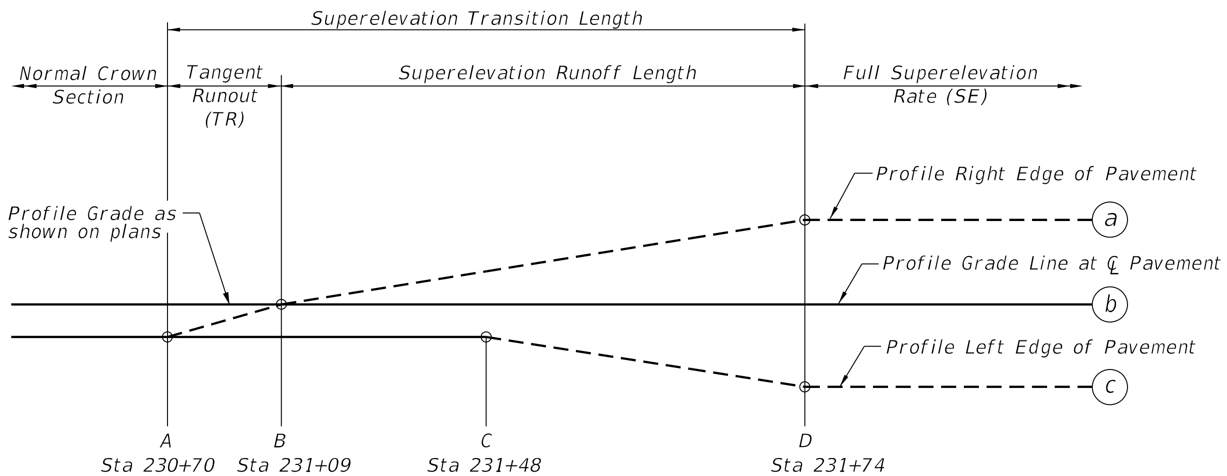
RIPRAP FLANK DETAIL



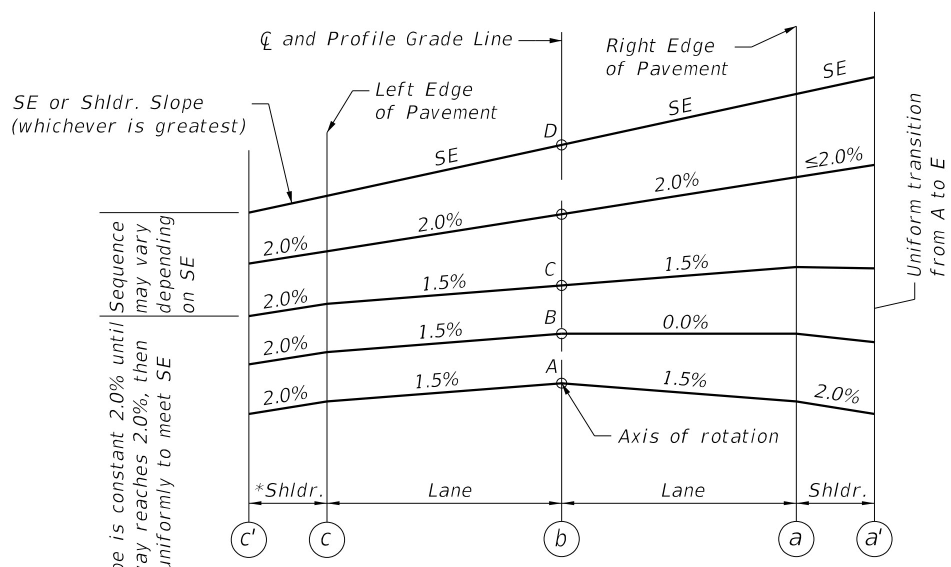
PIER SKETCH



SECTION THRU PILE SUPPORTED STUB ABUTMENT
(Horiz. dim. @ Rt. ∠'s)

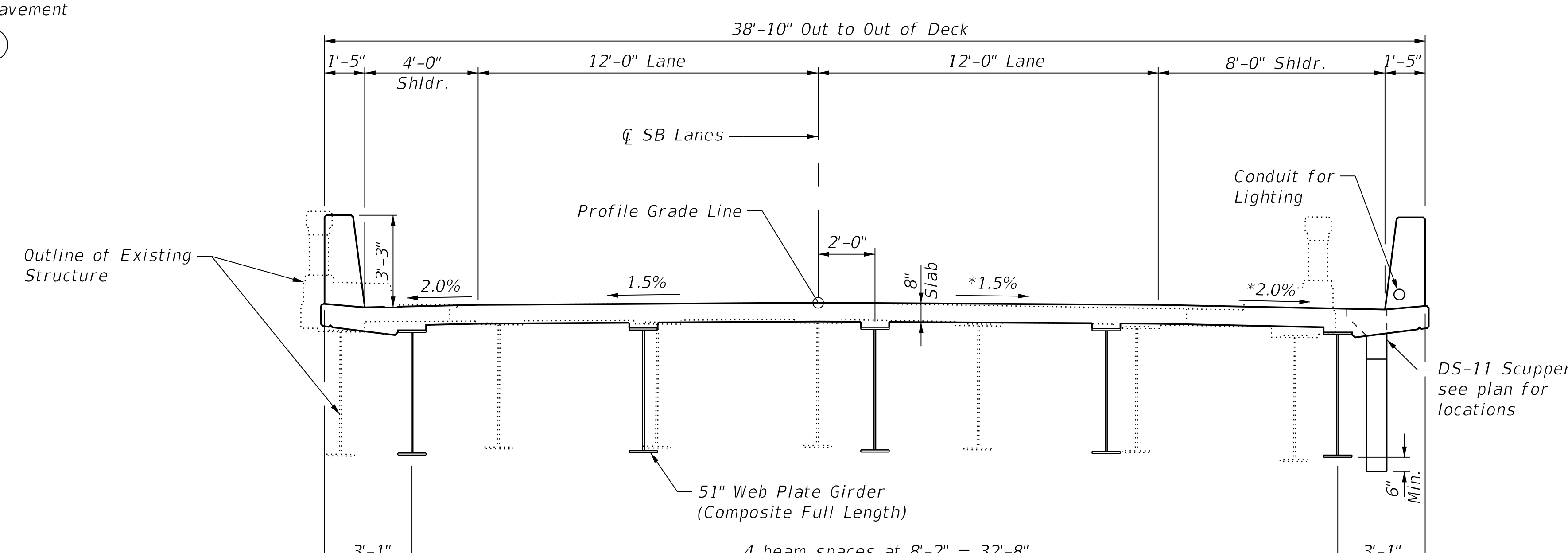


(a')(c') Profile Edge of Shoulder not shown above for clarity.



AXIS OF ROTATION ABOUT CENTERLINE

METHOD OF ATTAINING SUPERELEVATION



* Typical cross slopes shown. Will vary in SE transition area.

TYPICAL PROPOSED BRIDGE CROSS SECTION
(Looking South/Upstation)

GENERAL PLAN
SOUTHBOUND IL RTE 111
OVER CAHOKIA CANAL
FAP RTE 582 - SECTION 6-23B-I
MADISON COUNTY
STATION 229+92.00
STRUCTURE NO. 060-0347

MODEL: Default
FILE NAME: H:\8066 IDOT Dist8 PTB194 059\8066 090 SN0600127\CADD Sheets\D876H49-SN0600127-TSL2.dgn

HMG ENGINEERS, HMG ENGINEERS, INC. 9360 HOLY CROSS LANE BREESE, ILLINOIS 62230 (618) 526-9611	USER NAME = klaux	DESIGNED -	REVISED -	STATE OF ILLINOIS DEPARTMENT OF TRANSPORTATION
		DRAWN -	REVISED -	
	PLOT SCALE = 4.0000 ' / in.	CHECKED -	REVISED -	
	PLOT DATE = 4/14/2022	DATE -	REVISED -	

GENERAL PLAN

SCALE: | SHEET 2 OF 2 SHEETS | STA. | TO STA.

F.A.P. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
582	6-23B-I	MADISON	__	

CONTRACT NO. 76H49

ILLINOIS | FED. AID PROJECT

Important Information about Your

Geotechnical Engineering Report

Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes.

While you cannot eliminate all such risks, you can manage them. The following information is provided to help.

Geotechnical Services Are Performed for Specific Purposes, Persons, and Projects

Geotechnical engineers structure their services to meet the specific needs of their clients. A geotechnical engineering study conducted for a civil engineer may not fulfill the needs of a construction contractor or even another civil engineer. Because each geotechnical engineering study is unique, each geotechnical engineering report is unique, prepared *solely* for the client. No one except you should rely on your geotechnical engineering report without first conferring with the geotechnical engineer who prepared it. *And no one — not even you* — should apply the report for any purpose or project except the one originally contemplated.

Read the Full Report

Serious problems have occurred because those relying on a geotechnical engineering report did not read it all. Do not rely on an executive summary. Do not read selected elements only.

A Geotechnical Engineering Report Is Based on A Unique Set of Project-Specific Factors

Geotechnical engineers consider a number of unique, project-specific factors when establishing the scope of a study. Typical factors include: the client's goals, objectives, and risk management preferences; the general nature of the structure involved, its size, and configuration; the location of the structure on the site; and other planned or existing site improvements, such as access roads, parking lots, and underground utilities. Unless the geotechnical engineer who conducted the study specifically indicates otherwise, do not rely on a geotechnical engineering report that was:

- not prepared for you,
- not prepared for your project,
- not prepared for the specific site explored, or
- completed before important project changes were made.

Typical changes that can erode the reliability of an existing geotechnical engineering report include those that affect:

- the function of the proposed structure, as when it's changed from a parking garage to an office building, or from a light industrial plant to a refrigerated warehouse,
- elevation, configuration, location, orientation, or weight of the proposed structure,
- composition of the design team, or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project changes—even minor ones—and request an assessment of their impact. *Geotechnical engineers cannot accept responsibility or liability for problems that occur because their reports do not consider developments of which they were not informed.*

Subsurface Conditions Can Change

A geotechnical engineering report is based on conditions that existed at the time the study was performed. *Do not rely on a geotechnical engineering report* whose adequacy may have been affected by: the passage of time; by man-made events, such as construction on or adjacent to the site; or by natural events, such as floods, earthquakes, or groundwater fluctuations. *Always* contact the geotechnical engineer before applying the report to determine if it is still reliable. A minor amount of additional testing or analysis could prevent major problems.

Most Geotechnical Findings Are Professional Opinions

Site exploration identifies subsurface conditions only at those points where subsurface tests are conducted or samples are taken. Geotechnical engineers review field and laboratory data and then apply their professional judgment to render an opinion about subsurface conditions throughout the site. Actual subsurface conditions may differ—sometimes significantly—from those indicated in your report. Retaining the geotechnical engineer who developed your report to provide construction observation is the most effective method of managing the risks associated with unanticipated conditions.

A Report's Recommendations Are *Not* Final

Do not overrely on the construction recommendations included in your report. *Those recommendations are not final,* because geotechnical engineers develop them principally from judgment and opinion. Geotechnical engineers can finalize their recommendations only by observing actual subsurface conditions revealed during construction. *The geotechnical engineer who developed your report cannot assume responsibility or liability for the report's recommendations if that engineer does not perform construction observation.*

A Geotechnical Engineering Report Is Subject to Misinterpretation

Other design team members' misinterpretation of geotechnical engineering reports has resulted in costly problems. Lower that risk by having your geotechnical engineer confer with appropriate members of the design team after submitting the report. Also retain your geotechnical engineer to review pertinent elements of the design team's plans and specifications. Contractors can also misinterpret a geotechnical engineering report. Reduce that risk by having your geotechnical engineer participate in prebid and preconstruction conferences, and by providing construction observation.

Do Not Redraw the Engineer's Logs

Geotechnical engineers prepare final boring and testing logs based upon their interpretation of field logs and laboratory data. To prevent errors or omissions, the logs included in a geotechnical engineering report should *never* be redrawn for inclusion in architectural or other design drawings. Only photographic or electronic reproduction is acceptable, *but recognize that separating logs from the report can elevate risk.*

Give Contractors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can make contractors liable for unanticipated subsurface conditions by limiting what they provide for bid preparation. To help prevent costly problems, give contractors the complete geotechnical engineering report, *but* preface it with a clearly written letter of transmittal. In that letter, advise contractors that the report was not prepared for purposes of bid development and that the report's accuracy is limited; encourage them to confer with the geotechnical engineer who prepared the report (a modest fee may be required) and/or to conduct additional study to obtain the specific types of information they need or prefer. A prebid conference can also be valuable. *Be sure contractors have sufficient time* to perform additional study. Only then might you be in a position to give contractors the best information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions.

Read Responsibility Provisions Closely

Some clients, design professionals, and contractors do not recognize that geotechnical engineering is far less exact than other engineering disciplines. This lack of understanding has created unrealistic expectations that have led to disappointments, claims, and disputes. To help reduce the risk of such outcomes, geotechnical engineers commonly include a variety of explanatory provisions in their reports. Sometimes labeled "limitations" many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely.* Ask questions. Your geotechnical engineer should respond fully and frankly.

Geoenvironmental Concerns Are Not Covered

The equipment, techniques, and personnel used to perform a *geoenvironmental* study differ significantly from those used to perform a *geotechnical* study. For that reason, a geotechnical engineering report does not usually relate any geoenvironmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated environmental problems have led to numerous project failures.* If you have not yet obtained your own geoenvironmental information, ask your geotechnical consultant for risk management guidance. *Do not rely on an environmental report prepared for someone else.*

Obtain Professional Assistance To Deal with Mold

Diverse strategies can be applied during building design, construction, operation, and maintenance to prevent significant amounts of mold from growing on indoor surfaces. To be effective, all such strategies should be devised for the *express purpose* of mold prevention, integrated into a comprehensive plan, and executed with diligent oversight by a professional mold prevention consultant. Because just a small amount of water or moisture can lead to the development of severe mold infestations, a number of mold prevention strategies focus on keeping building surfaces dry. While groundwater, water infiltration, and similar issues may have been addressed as part of the geotechnical engineering study whose findings are conveyed in this report, the geotechnical engineer in charge of this project is not a mold prevention consultant; ***none of the services performed in connection with the geotechnical engineer's study were designed or conducted for the purpose of mold prevention. Proper implementation of the recommendations conveyed in this report will not of itself be sufficient to prevent mold from growing in or on the structure involved.***

Rely, on Your ASFE-Member Geotechncial Engineer for Additional Assistance

Membership in ASFE/The Best People on Earth exposes geotechnical engineers to a wide array of risk management techniques that can be of genuine benefit for everyone involved with a construction project. Confer with your ASFE-member geotechnical engineer for more information.

ASFE
THE BEST PEOPLE ON EARTH

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