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Final Structure Geotechnical Report

BRIDGE REPLACEMENT
IL- ROUTE 154 (F.A.P. ROUTE 845) OVER REND LAKE
FRANKLIN COUNTY, ILLINOIS
SECTION: 112 (RS-4, BLP-1); 112B-4
STATION 362+00.00
STRUCTURE NO. 028-0052 (PROPOSED)

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July 5, 2024

Prepared for:
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Exp: 11/30/2025

LICENSED PROFESSIONAL ENGINEER
THOMAS
JOSEPH CASEY
062-061853
STATE OF ILLINOIS

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7/5/2024

SCI No. 2020-0532.10

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CONSTRUCTION SERVICES

July 5, 2024

Stephen Alsbury, P.E., S.E.
ABNA Engineering, Inc.
140 Lindell Boulevard
St. Louis, Missouri 63108

RE: Final Structure Geotechnical Report
Bridge Replacement
IL-Route 154 (F.A.P. Route 845) over Rend Lake
Franklin County, Illinois
Section: 112 (RS-4, BLP-1); 112B-4
Structure No. 028-0052 (Proposed)
SCI No.: 2020-0532.10

Dear Stephen Alsbury:

Enclosed is our *Final Structure Geotechnical Report (SGR)*, dated July 5, 2024. 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/mas

Enclosure
Geotechnical Report

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1.0 PROJECT DESCRIPTION

The geotechnical study summarized in this report was performed for the proposed replacement of the structure that carries Illinois Route 154 over Rend Lake in Franklin County, Illinois. The existing structure, built back in 1966, is a two-lane, two-way bridge. The structure consists of a five-span reinforced concrete deck on steel beams supported by deep foundations bearing on rock. The approximate length of the structure measured back-to-back of the abutments is 292 feet and the deck width measures is 36 feet out-to-out. The existing end slopes have inclinations of 3⅓ horizontal to 1 vertical (3⅓H:1V). The location of the site is shown on the *Vicinity and Topographic Map*, Figure 1.

Based on the *TS&L* dated June 28, 2024, and the *Plan and Profile Sheets*, prepared by ABNA Engineering, Inc. (ABNA), and dated February 16, 2023, the proposed structure will be a two-lane, three-span structure with a back-to-back abutment length of approximately 304 feet and an out-to-out deck width of approximately 55 feet. As such, the new structure will consist of two abutments and two central piers. The new structure will be raised by approximately 4 feet above the existing bridge deck elevation. We anticipate minimal fills on the order of 5 feet or less will be required at the abutments. The most recent aerial imagery of the site is shown on *Aerial Photograph*, Figure 2, and the proposed construction is shown on *Site Plan*, Figure 3.

2.0 SUBSURFACE EXPLORATION

2.1 Area Geology

According to *Quaternary Geology of Illinois*, modified from Hansel and Johnson 1996, the project is located in the Till Plain Section of Glassford Formation. According to the *Bedrock Geologic Map of Illinois,* dated 2005, the bedrock geology at this site consists of Bond Formation that dates back to Pennsylvanian (Kasimovian) Geologic age. Sandstone, shale, and limestone form the major lithologic constituents, while coal forms the minor lithologic constituent of this formation. Shale is usually silty and carbonaceous while limestone can be shaly or argillaceous. The thickness of this formation in southern Illinois may be up to 350 feet. Based on the available information from the past boring logs, the bedrock at this site consists of sandstone or shale.

2.2 Exploration Procedures

Two standard penetration test (SPT) borings, designated B-12 and B-13 were drilled near the proposed pier locations, as shown on Figure 2 and 3. The boring locations were selected and staked in the field by SCI personnel, and the elevations, stations, and offsets were estimated from the available topographic information. The SCI boring logs are shown in Appendix A-1. To supplement the two SCI borings, two borings (designated as S-1 and S-2) were drilled by IDOT in April 2020 near the proposed abutment locations and are shown in Appendix A-2. The stations and offsets were estimated from the TS&L plans provided and included in Appendix H. The field exploration was performed in general accordance with procedures outlined in the *2020 IDOT Geotechnical Manual*.

An SCI personnel was with the drill rig to supervise drilling, log the borings, and perform field unconfined compressive strength tests of the soil samples. A CME 45 or CME 75 all-terrain-mounted drill rig equipped with hollow stem augers and mud-rotary was used to advance the borings. SPTs were performed with a split-spoon sampler at 5-foot intervals down to the termination depth of the borings. Relatively undisturbed Shelby tube samples were collected at selected intervals 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 auger refusal, per IDOT specifications, to depths of 48.7 to 78.5 feet (approximate elevation (El.) 347.5 to 377.3) below the existing bridge deck. Auger refusal is the designation applied to any material which cannot be further penetrated by a standard power auger without extraordinary effort.

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-1 and A-2. The generalized soil profile is included on the *Subsurface Profile,* Figure 4.

2.3.1 Abutment Borings

Existing pavement was encountered in both abutment borings and consisted of 1.5 to 2.5 inches of Hot Mix Asphalt (HMA) over 10 to 18 inches of Portland Cement Concrete (PCC). The natural soil profile in S-1 generally consisted of soft to stiff clay to silty clay loam (A-6 or A-7) down to the top of weathered sandstone at a depth of 32 feet (approximate El. 393.4). The soil profile in S-2 consisted of soft to stiff clay to silty clay loam (A-6 or A-7) to a depth of 69.5 feet (approximate El. 356.4), followed by loose and coarse sand to a depth of 74.5 (approximate El. 351.4). The sand layer was underlain by stiff silty loam, judged to be glacial till to the top of hard clay shale. The unconfined compressive strength (Qu) in the cohesive samples ranged from 0.2 to 3.3 tons per square foot (tsf), with an average of approximately 1.5 tsf, while the Standard Penetration Test (SPT) N-values ranged from 2 to 38 blows per foot (bpf), with an average of 9 bpf. The Qu and N-values classify the soils as soft to stiff, and medium stiff in overall consistency. Moisture contents in the cohesive samples ranged from 14 to 29 percent, averaging approximately 21 percent. The SPT N-value of the sand layer encountered in S-2 was 2, which describes it as very loose in relative density.

The borings were continued with rock coring for both locations to a depth of 10.3 feet in S-1 and 9.1 feet in S-2. The core samples recovered from S-1 generally consisted of low strength, medium grained sandstone. The core recovery ranged from 40 to 73 percent and the Rock Quality Designation (RQD) ranged from 0 to 10 percent, classifying it as 'poor'. An unconfined compression test (Qu) of a 1.78 inches diameter and 3.8 inches long core sample at 43.8 feet (approximate El. 381.6) was 59.6 tsf. The core samples recovered from S-2 consisted of dry, gray, and moderately hard clay shale, with the strength observed to be increasing with depth. The core recovery ranged from 88 to 97 percent. Rock Qu, determined from the specimens with length (L) to Diameter (D) ratio smaller than the recommended 2:1, ranged from 66.7 to 130.3 tsf. As such, the actual strength may vary.

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 – Abutment Borings

Boring	Approximate Pavement Surface Elevation (feet)	Depth to Bedrock (feet)	Approximate Top of Bedrock Elevation (feet)
S-1	425.4	32.0	393.4
S-2	425.9	84.5	341.4

2.3.2 Pier Borings

The interior pier borings, B-12 and B-13, were drilled through the top of bridge deck and consisted of 1 inch of asphalt over 7 inches of concrete in B-12 and 6.5 inches of concrete in B-13.

The bottom of the lake was encountered at a depth of 31.7 feet in both borings. The subsurface profile of boring B-12 consisted of riprap to a depth of 8.3 feet from the bottom of the lake (approximate El. 386.0). The riprap was followed by loose sand (A-2) to an approximate elevation of 381.0. The sand layer was then followed by soft to medium stiff high plastic clay (A-7) to the top of shale bedrock at an elevation of 347.5. Auger refusal on shale was encountered at a depth of 79 feet below the top of bridge deck and 47.3 feet below the bottom of the lake (approximate El. 347). The subsurface profile of boring B-13 consisted of soft gravelly silt (A-4) to a depth of 5.8 feet from the bottom of the lake (approximate El. 388.5) followed by interbedded clay and sand layers to the top of shale at an elevation of 377.3. Auger refusal was encountered at a depth of 50 feet from the top of bridge deck and 18.5 feet from the bottom of lake (approximate El. 375.8).

The Qu values of the natural cohesive soils ranged from 0.2 to 2.1 tsf, with an average of 0.8 tsf, while SPT N-values ranged from 2 to 15 bpf, with an average of 9 bpf, classifying the soils as soft to stiff in consistency. The moisture contents ranged from 19 to 32 percent, averaging approximately 25 percent. The SPT N-values in sands ranged from 11 to 29 bpf, classifying as medium dense to dense in relative density.

Table 2.2 presents a summary of the depth and elevation of the top of bedrock that was first encountered in each of the borings.

Table 2.2 – Summary of Bedrock Elevations – Lake Borings

Boring	Approximate Pavement Surface Elevation (feet)	Depth to Bedrock (feet)	Approximate Top of Bedrock Elevation (feet)
B-12	426.0	78.5	347.5
B-13	426.0	48.7	377.3

2.4 Groundwater Conditions

Groundwater levels observed at the time of drilling are summarized in Table 2.3. It should be noted that the groundwater level is subject to seasonal and climatic variations, the surface water level in Rend Lake, 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 2.3 – Summary of Approximate Ground/Surface Water Levels

Boring	Approximate Pavement Surface Elevation (feet)	Depth to Groundwater/Surface Water During Drilling (feet)	Approximate Groundwater/Surface Water Elevation During Drilling (feet)
S-1	425.4	26	399.4
S-2	425.9	37	388.9
B-12	426.0	18.6	407.4
B-13	426.0	16.0	410.0

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 at pier locations by SCI and abutment locations by IDOT, existing plans, and communications with ABNA 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 4.9 and a site coefficient (A_s) of 0.30g, 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 Global 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 (bar): 28 bpf (Site Class D)
- Method C using S_u: 1.62 ksf (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 3. Seismic design parameters for the site are summarized in Table 3.1.

Table 3.1 – Seismic Design Parameters

Seismic Design Parameters	
Site Class	D
Site Coefficient (As)	0.300g
Design Spectral Acceleration at 0.2 sec. (S_{DS})	0.634g
Design Spectral Acceleration at 1.0 sec. (S_{D1})	0.314g
Seismic Design Category	C
Seismic Performance Zone	3

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 C. 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 Global Slope Stability

The global slope stability of both end-slopes was analyzed for end-of-construction (short-term), long-term, and seismic (pseudo-static) loading conditions. The analyses were conducted using limit equilibrium slope stability methods and the commercially available software program Slide 2018 (developed by Rocscience, Inc.). The analyses considered soil properties from the subsurface exploration data and the given slope geometries. To account for traffic loading, a surcharge load of 250 pounds per square foot (psf) was applied to the analyses. For the seismic evaluation, the peak ground acceleration (PGA) from the design earthquake along with procedures for seismic slope stability outlined in Federal Highway Administration (FHWA) publication FHWA-HI-99-012 *Geotechnical Earthquake Engineering* were utilized. Soil parameters used in the analyses and the results of the analyses are shown on the output plots in Appendix-D.

The Bishop method, as recommended by IDOT, with a circular mode of failure, was used to search for the critical factor of safety (FS). The required minimum factors of safety were obtained from Section 6.10.4 of the 2020 IDOT Geotechnical Manual for the global slope stability. The results of the global slope stability analyses are presented in Table 3.2 below. The analysis results indicate that the calculated factor of safety meets the required minimum factor of safety. Therefore, the end slopes will perform satisfactorily under short term, long term, and seismic conditions.

Table 3.2 – Summary of Estimated Global Slope Stability Factors of Safety

Analyzed End Slope	Short-Term Static Condition		Long-Term Static Condition		Seismic Condition	
	Required FOS	Estimated FOS	Required FOS	Estimated FOS	Required FOS	Estimated FOS
Northwest Abutment	1.50	1.50	1.50	1.68	1.00	1.00
Southeast Abutment	1.50	1.60	1.50	1.52	1.00	1.05

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 most recent TS&L, the design and check scour elevations are shown in Table 3.3.

Table 3.3 – Summary of Design Scour Elevations

Event/Limit State	Design Scour Elevation (ft)				Item 113
	SE Abutment	Pier 1	Pier 2	NW Abutment	
Q100	418.8	380.8	380.8	418.8	5
Q200	418.8	380.6	380.6	418.8	
Design	418.8	380.8	380.8	418.8	
Check	418.8	380.6	380.6	418.8	

3.6 Bridge Foundations

The foundation supporting the proposed bridge must provide sufficient support to resist dead and live loads, including seismic loads. Structural loads were not available at the time of the SGR. Therefore, we have assumed preliminary structure loads as shown in Table 3.4.

Table 3.4 – Preliminary Structure Loads

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

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. Driven steel H-piles and metal shell piles are determined to be suitable for the abutments, but not for the interior bents due to relatively shallow depth to bedrock. Therefore, drilled shafts socketed into bedrock were determined to be suitable for the interior pier locations. Design information for both driven steel pile options for the abutments is included in Appendix E-1 and the design information for the drilled shafts is included in Appendix E-2.

For the driven steel foundation options, we recommend a minimum of two test piles be installed to verify the length of the piles. One test pile should be installed at each side of the lake 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 neglected since the design scour elevation is at the ground surface elevation of the driven piles during driving (El. 418.8) for both 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 estimated from the available plans. The tip elevations were calculated from the Modified IDOT Static Method spreadsheets based on the available factored resistance.

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 E1 for each H-pile size. It should be noted that H-piles driven into both sandstone and shale may run shorter than the IDOT spreadsheet predicts. The estimated pile lengths should be adjusted based on the test pile results. The maximum nominal required bearing and the available maximum factored resistance for typical steel H-piles for the abutments are shown in Table 3.5.

Table 3.5 – Maximum Nominal and Factored Resistances for Driven Steel Piles

Abutment	Pile Size	Maximum Nominal Required Bearing, R_{Nmax} (kips)	Maximum Factored Resistance Available (kips)	Estimated Length of Pile at Refusal (feet)
NW Abutment	HP 12X74	589	324	83
	HP 14X89	705	388	83
	HP 14X117	929	511	86
	Metal Shell 14” dia w/0.25” walls	301	166	68
	Metal Shell 16” dia w/0.375” walls	573	315	73
SE Abutment	HP 12X74	522	287	30
	HP 14X89	705	388	31
	HP 14X117	929	511	33
	Metal Shell 14” dia w/0.25” walls	123	67	24
	Metal Shell 16” dia w/0.375” walls	144	79	24

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. Pre-drilling for the piles is also not anticipated.

3.6.2 Drilled Shafts

We anticipate that drilled shaft foundations will be suitable to support the interior piers. For the purpose of determining the economic feasibility for the drilled shaft option, the factored tip resistance and/or a factored skin friction are provided in the summary design tables detailed in Appendix E2. Drilled shafts should be spaced no closer than three shaft diameters, center to center. Due to the relatively soft/loose soils encountered below the bottom of the lake, permanent or temporary casing will likely be required in the soil to prevent collapsing of the side walls during installation. Drilled shafts for the interior bents should be socketed into bedrock. It is not anticipated that drilled shafts would be used at the abutment locations. The unit nominal and factored shaft resistances for both the piers are shown in Table 3.6. The factored values presented in Table 3.6 and Appendix E2 reflect a geotechnical resistance factor (φ_G) of 0.50 for both tip resistance and skin friction for Strength Limit State. For seismic considerations, a (φ_G) of 1.0 should be used to calculate the seismic factored resistance available (R_{fseis}).

Table 3.6 – Unit Nominal and Factored Side and Tip Resistances

Layer Elevations (feet)		Average Unit Nominal Side Resistance (ksf)	Average Unit Factored Side Resistance (ksf)	Average Unit Nominal Tip Resistance (ksf)	Average Unit Factored Tip Resistance (ksf)
Pier-1	**Pier-2**				
347.0 – 342.0	374.3 – 369.3	12.4	6.2	355.9	177.9
342.0 – 337.0	369.3 – 364.3	31.0	15.5	372.8	186.4
337.0 – 332.0	364.3 – 359.3	31.0	15.5	379.6	189.8
332.0 – 327.0	359.3 – 354.3	31.0	15.5	383.1	191.6

3.6.2.1 Drilled Shaft QA/QC and Construction Considerations

A construction method using a casing for the interior piers will be required due to relatively soft/loose soils were encountered during the investigation. The auger cuttings should be observed as the shafts are drilled to document that competent materials are present. QA/QC for the drilled shafts should include a combination of using a shaft inspection device (SID camera) to ensure the bottom is clean and the socket is uniform and stable. This will also verify that the estimated uplift capacities are present. Crosshole Sonic Logging (CSL) testing should be performed to verify the integrity of the concrete after placement.

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 F (Reference: LPILE User's Manual, Ensoft, Inc., 2019).

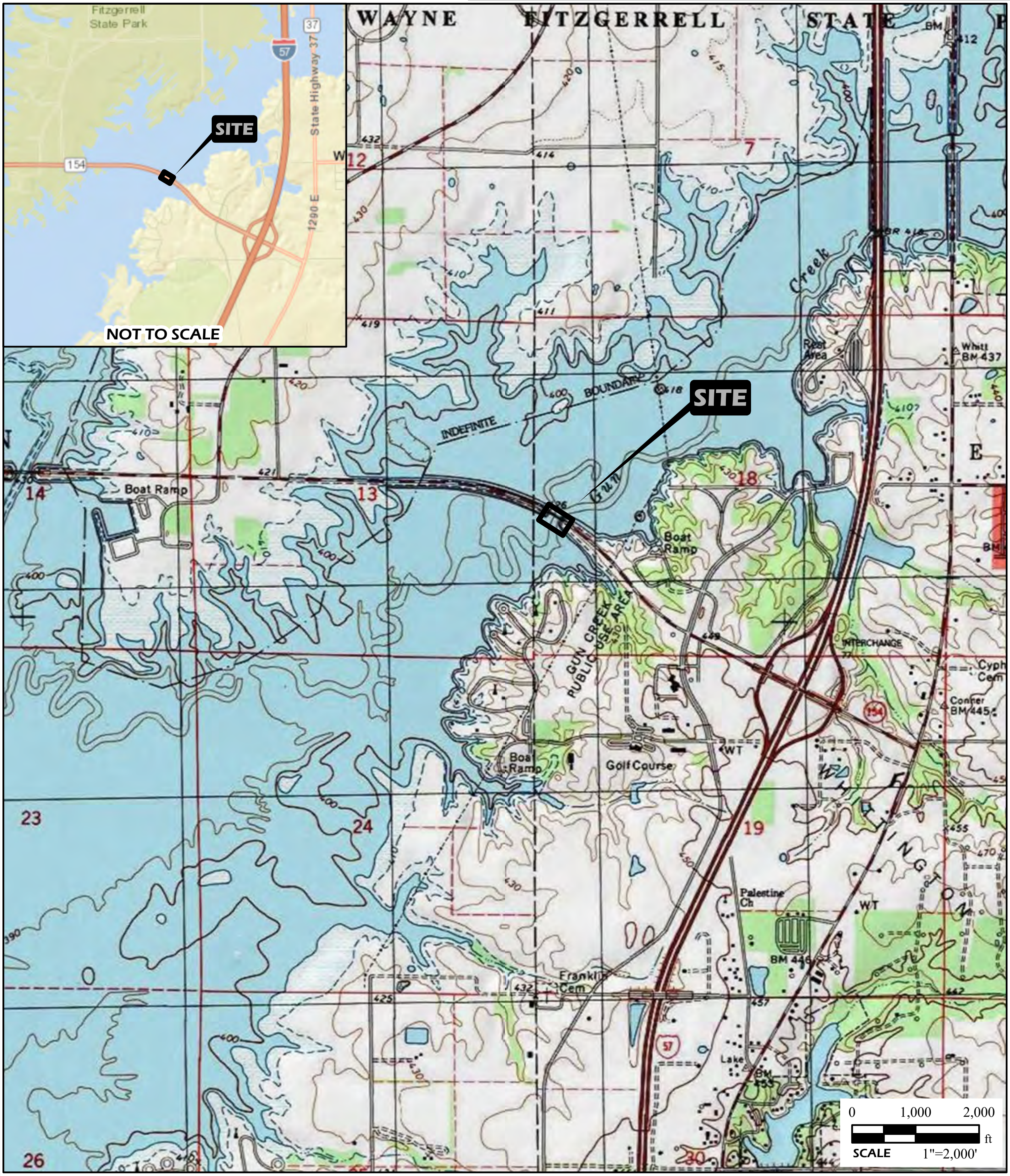
4.0 CONSTRUCTION CONSIDERATIONS

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. We understand that staged construction may be required for this project. We anticipate that temporary sheeting, including cantilever temporary sheet piling, will be feasible according to *Section 3.13.1 – Temporary Sheet Piling Design*. The temporary sheet pile will have an anticipated maximum retained height of 5 feet, and shall be embedded to a minimum depth of 4.0 feet with a minimum section modulus of 1.0 cubic inch per foot for planning purposes. The design of the temporary sheet pile is shown in Appendix G.

A Hydraulic No-Rise during construction shall be maintained. The existing substructure below ground is assumed to be removed using construction barges with excavators with concrete breakers and processors. Broken pieces of concrete are allowed to settle to the bottom of the lake prior to removal from the site. The use of cofferdams for pier removal will need to be approved to ensure the hydraulic no-rise condition will be met.

5.0 LIMITATIONS

The recommendations provided herein are for the exclusive use of ABNA and IDOT. They are specific only to the project described, and are based on subsurface information obtained at two boring locations drilled by SCI at the proposed bent locations and two boring locations drilled by IDOT near the proposed abutments, 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 PTB 195, ITEM 62 IL 154 AT REND LAKE (SGR) FRANKLIN COUNTY, ILLINOIS			**GENERAL NOTES/LEGEND** USGS TOPOGRAPHIC MAP REND LAKE DAM, ILLINOIS QUADRANGLE DATED 1998 PHOTO REVISED 2000 10' CONTOURS
VICINITY AND TOPOGRAPHIC MAP			STREET MAP HTTP://GOTO.ARCGISONLINE.COM/MAPS/WORLD_STREET_MAP
DRAWN BY JTM	**DATE**	**JOB NUMBER**	**FIGURE**
CHECKED BY PP	05/2023	2020-0532.10	1

SCI

GENERAL NOTES/LEGEND

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.

PROJECT NAME

PTB 195, ITEM 62 IL 154 AT REND LAKE (SGR)
FRANKLIN COUNTY, ILLINOIS

AERIAL PHOTOGRAPH

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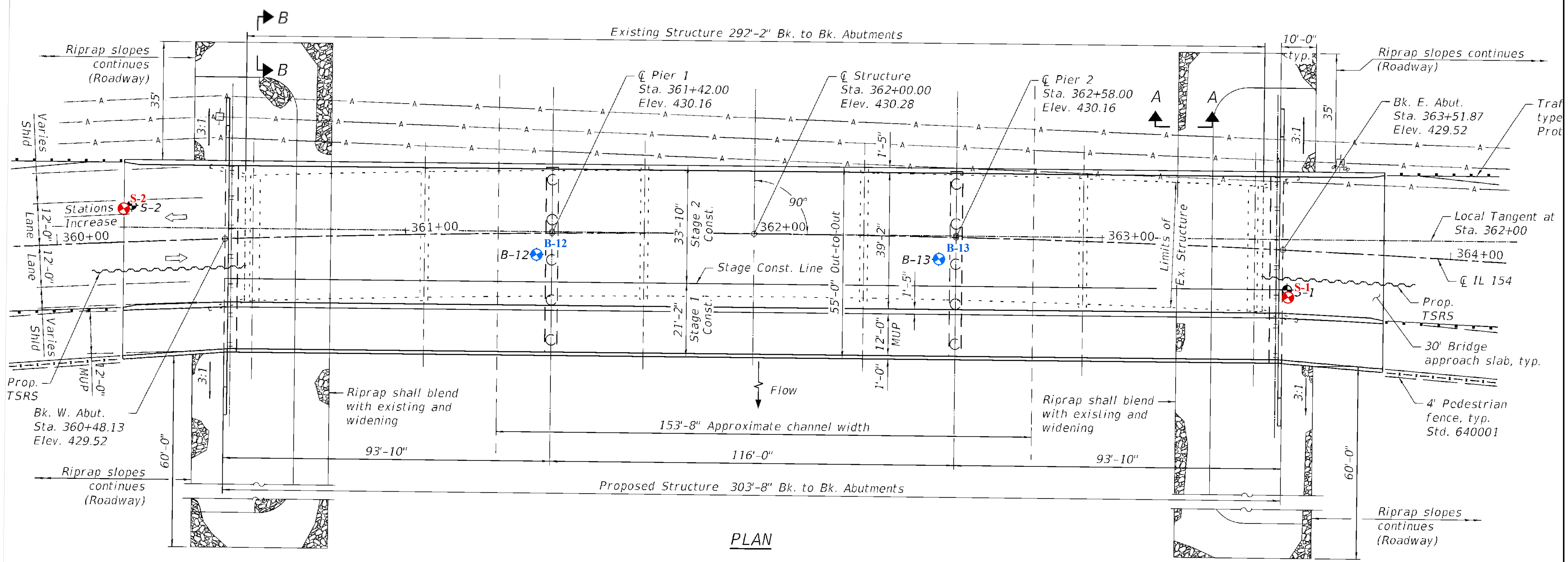
JOB NUMBER	2020-0532.10
DATE	05/2023
DRAWN BY	JTM
CHECKED BY	PP
FIGURE	2



(blue symbol)	APPROXIMATE SOIL BORING LOCATIONS (DRILLED BY SCI)
(red symbol)	APPROXIMATE SOIL BORING LOCATIONS (DRILLED BY OTHERS)

SCALE 1"=30' (0, 15, 30 ft)

GENERAL NOTES/LEGEND

SITE PLAN DATED 06/28/2024 ABNA.

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: PTB 195, ITEM 62 IL 154 AT REND LAKE (SGR) FRANKLIN COUNTY, ILLINOIS

SITE PLAN

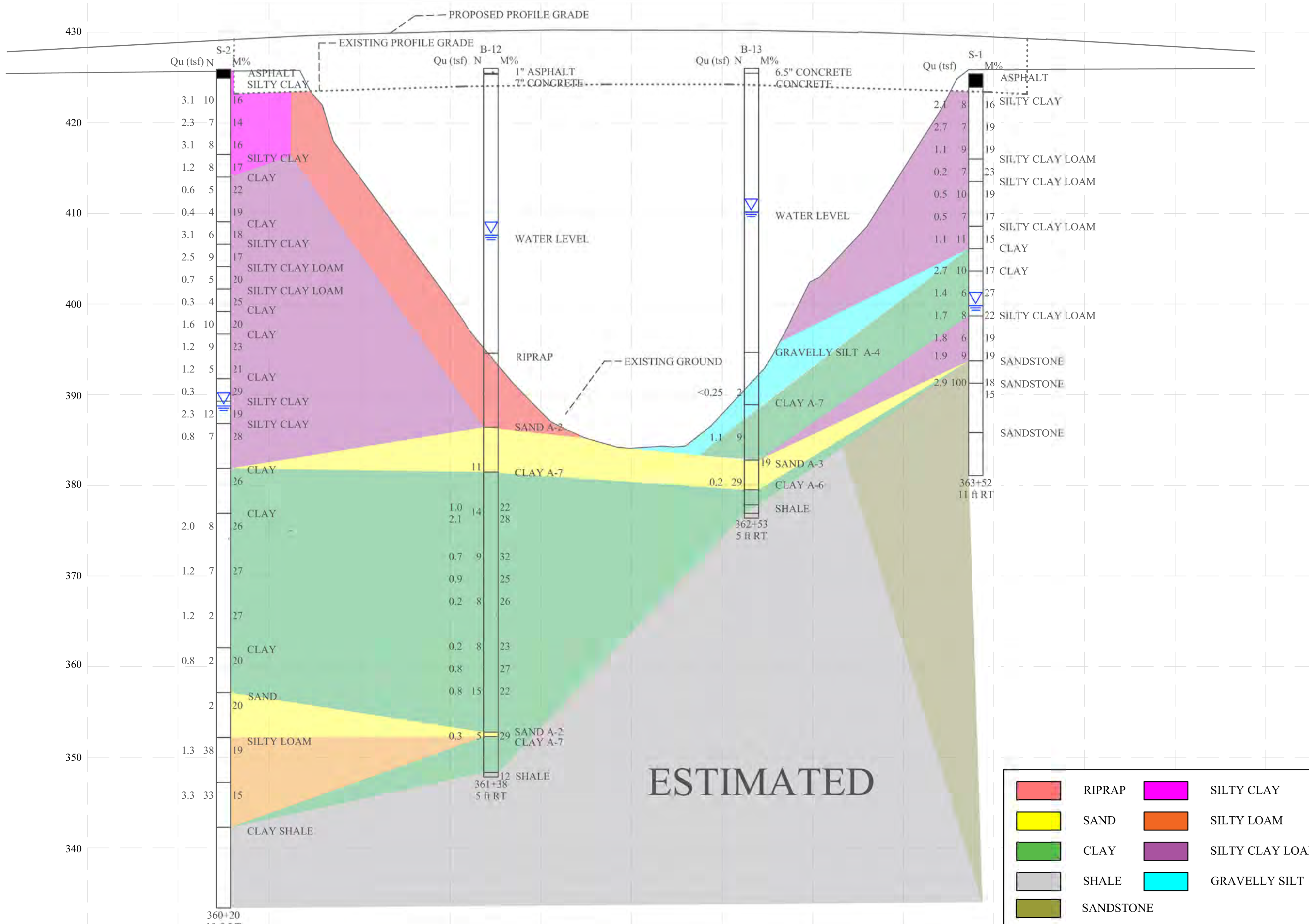
JOB NUMBER: 2020-0532.10

FIGURE DATE: 07/01/2024

DRAWN BY: JTM

CHECKED BY: PP

FIGURE: 3



RIPRAP | SILTY CLAY
SAND | SILTY LOAM
CLAY | SILTY CLAY LOAM
SHALE | GRAVELLY SILT
SANDSTONE

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

PTB 195, ITEM 62 IL 154 AT REND LAKE
(SGR)
FRANKLIN COUNTY, ILLINOIS

SUBSURFACE PROFILE

SCALE 1" = 10' V 1" = 40' H

JOB NUMBER 2020-0532.10

DATE 05/2023

DRAWN BY JTM

CHECKED BY PP

FIGURE 4

Appendix A-1

SCI ENGINEERING, INC.
130 Point West Boulevard
St. Charles, Missouri 63301
636-949-8200
www.sciengineering.com

BORING LOG LEGEND AND NOMENCLATURE

Depth is in feet below ground surface. **Elevation** is in feet mean sea level, site datum, or as otherwise noted.

Sample Type

- **SS** Split-spoon sample, disturbed, obtained by driving a 2-inch-O.D. split-spoon sampler (ASTM D 1586).
- **NX** Diamond core bit, nominal 2-inch-diameter rock sample (ASTM D 2113).
- **ST** Thin-walled (Shelby) tube sample, relatively undisturbed, obtained by pushing a 3-inch-diameter, tube (ASTM D 1587).
- **CS** Continuous sample tube system, relatively undisturbed, obtained by split-barrel sampler in conjunction with auger advancement.
- **SV** Shear vane, field test to determine strength of cohesive soil by pushing or driving a 2-inch-diameter vane, and then shearing by torquing soil in existing and remolded states (ASTM D 2573).
- **BS** Bag sample, disturbed, obtained from cuttings.

Recovery is expressed as a ratio of the length recovered to the total length pushed, driven, cored.

Blows Numbers indicate blows per 6 inches of split-spoon sampler penetration when driven with a 140-pound hammer falling freely 30 inches. The number of total blows obtained for the second and third 6-inch increments is the N value (Standard Penetration Test or SPT) in blows per foot (ASTM D 1586). Practical refusal is considered to be 50 or more blows without achieving 6 inches of penetration and is expressed as a ratio of 50 to actual penetration, e.g., 50/2 (50 blows for 2 inches).

For analysis, the N value is used when obtained by a cathead and rope system. When obtained by an automatic hammer, the N value may be increased by a factor of 1.3.

Vane Shear Strength is expressed as the peak strength (existing state) / the residual strength (remolded state).

Description indicates soil constituents and other classification characteristics (ASTM D 2488) and the Unified Soil Classification (ASTM D 2487). Secondary soil constituents (expressed as a percentage) are described as follows:

Trace	<5
Few	5-15
With	>15-30

Stratigraphic Breaks may be observed or interpreted and are indicated by a dashed line. Transition between described materials may be gradual.

Laboratory Test Results

- Natural moisture content (ASTM D 2216) in percent.
- Dry density in pounds per cubic foot (pcf).
- Hand penetrometer value of apparently intact cohesive sample in kips per square foot (ksf).
- Unconfined compressive strength (ASTM D 2166) in kips per square foot (ksf).
- Liquid and Plastic Limits (ASTM D 4318) in percent.

RQD (Rock Quality Designation) is the ratio between the total length of core segments 4 inches or more in length and the total length of core drilled. RQD (expressed as a percentage) indicates insitu rock quality as follows:

Excellent	90 to 100
Good	75 to 90
Fair	50 to 75
Poor	25 to 50
Very Poor	0 to 25

Illinois Department of Transportation

Division of Highways
SCI Engineering

SOIL BORING LOG

Date 02/28/23

ROUTE FAP Route 845 (IL-154) **DESCRIPTION** PTB 195 Item 62 IL 154 at Rend Lake **LOGGED BY** SCI

SECTION 112 (RS-4, BLP-1); 112B-4 **LOCATION** , **SEC.** 13, **TWP.** 5S, **RNG.** 2E
Lat 38.087832 **Long** -88.929427

COUNTY Franklin **DRILLING METHOD** CME 75 with HSA and Mud Rotary **HAMMER TYPE** Automatic

STRUCT. NO. 028-0052 (Proposed)
Station 362+0.00

BORING NO. B-12
Station 361+38
Offset 5 ft RT
Ground Surface Elev. 426 ft

Surface Water Elev. 407.4 ft
Stream Bed Elev. 394.3 ft

Groundwater Elev.:
First Encounter 407.4 ft
Upon Completion N/A ft
After N/A **Hrs.** N/A ft

Description	Elev.	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
1" ASPHALT	425.9				
7" CONCRETE	425.3				
		-5			
		-10			
		-15			
SURFACE WATER LEVEL	407.4				
		-20			

Description	Elev.	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
		-25			
		-30			
Riprap	394.3				
		-35			
	386.0	-40			

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 02/28/23

ROUTE FAP Route 845 (IL-154) **DESCRIPTION** IL 154 at Rend Lake **LOGGED BY** SCI

SECTION 112 (RS-4, BLP-1); 112B-4 **LOCATION** , **SEC.** 13, **TWP.** 5S, **RNG.** 2E
Lat 38.087832 **Long** -88.929427

COUNTY Franklin **DRILLING METHOD** CME 75 with HSA and Mud Rotary **HAMMER TYPE** Automatic

STRUCT. NO. 028-0052 (Proposed)
Station 362+0.00

BORING NO. B-12
Station 361+38
Offset 5 ft RT
Ground Surface Elev. 426 ft

Surface Water Elev. 407.4 ft
Stream Bed Elev. 394.3 ft

Groundwater Elev.:
First Encounter 407.4 ft
Upon Completion N/A ft
After N/A **Hrs.** N/A ft

Description	Elev.	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
MUDLINE SAND: Gray, loose, wet A-2					
Grain Size Analysis Test Performed	381.0	-45	2 5 6	NC	--
Switched to mud rotary CLAY: Gray, stiff, moist A-7 Becomes brown and gray *Unconfined Compressive Test Performed*			ST-1	1.0 S/3	22
Becomes gray		-50	4 6 8	2.1 B/20	28
Becomes gray and brown, wet		-55	4 4 5	0.7 S/20	32
Unconfined Compressive Test Performed			ST-2	0.9 S/2	25
Becomes gray, medium stiff		-60	3 4 4	0.2 B/20	26
CLAY: Gray, stiff, moist A-7 *(continued)*					
		-65	3 4 4	0.2 B/20	23
Unconfined Compressive Test Performed			ST-3	0.8 S/14	27
Becomes stiff		-70	4 7 8	0.8 B/20	22
SAND: Gray, loose, wet A-2 *Grain Size Analysis Test Performed*	352.0 351.5	-75	2 3 2	0.3 B/20	29
CLAY: Gray, medium stiff, wet A-7					
SHALE: Gray, hard	347.5 347.0		50/5"	NC	12
Auger refusal at 79 feet.		-80			

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 04/11/23

ROUTE FAP Route 845 (IL-154) **DESCRIPTION** IL 154 at Rend Lake **LOGGED BY** SCI

SECTION 112 (RS-4, BLP-1); 112B-4 **LOCATION** , **SEC.** 13, **TWP.** 5S, **RNG.** 2E
Lat 38.087671 **Long** -88.929083

COUNTY Franklin **DRILLING METHOD** CME 75 with HSA and Mud Rotary **HAMMER TYPE** Automatic

STRUCT. NO. N/A
Station N/A

BORING NO. B-13
Station 362+53
Offset 5 ft RT
Ground Surface Elev. 426 ft

Surface Water Elev. 410.0 ft
Stream Bed Elev. 394.3 ft

Groundwater Elev.:
First Encounter 410.0 ft
Upon Completion N/A ft
After N/A **Hrs.** N/A ft

Description	Elev.	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
6.5" CONCRETE	425.5				
		-5			
		-10			
		-15			
SURFACE WATER LEVEL	410.0				
		-20			

Description	Elev.	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
		-25			
		-30			
MUDLINE	394.3				
GRAVELLY SILT: Gray, soft, wet A-4					
		-35			
Percent passing the number 200 sieve: 66.5%			2 1 1	<0.25 P	19
CLAY: Reddish-brown and gray, stiff, moist A-7	388.5				
		-40			

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 04/11/23

ROUTE FAP Route 845 (IL-154) **DESCRIPTION** IL 154 at Rend Lake **LOGGED BY** SCI

SECTION 112 (RS-4, BLP-1); 112B-4 **LOCATION** , **SEC.** 13, **TWP.** 5S, **RNG.** 2E
Lat 38.087671 **Long** -88.929083

COUNTY Franklin **DRILLING METHOD** CME 75 with HSA and Mud Rotary **HAMMER TYPE** Automatic

STRUCT. NO. N/A
Station N/A

BORING NO. B-13
Station 362+53
Offset 5 ft RT
Ground Surface Elev. 426 ft

Surface Water Elev. 410.0 ft
Stream Bed Elev. 394.3 ft

Groundwater Elev.:
First Encounter 410.0 ft
Upon Completion N/A ft
After N/A **Hrs.** N/A ft

Description	Elev.	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
CLAY: Reddish-brown and gray, stiff, moist A-7 *(continued)*			2 4 5	1.1 S/20	23
	382.3				
SAND: Gray, medium dense, moist A-3		-45	12 18 11	NC	--
	379.0				
CLAY: Brown, soft, wet A-6			ST-1		
	377.3				
SHALE: Gray, hard					
	375.8	-50	50/2"		
Auger refusal at 50 feet.					
		-55			
		-60			

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)

Appendix A-2

Illinois Department of Transportation

Memorandum

To:	Carrie Nelsen	Attn: Dave Piche
From:	Keith Roberts	By: Aaron Hayes
Subject:	Boring Logs	
Date:	May 15, 2020	

IL 154 over Rend Lake
Structure 028-0052 (Ex.)
Section: 112B-3 (1966 plans)
Franklin County

Foundation boring logs have been obtained for the above listed structure and are attached. A liquefaction analysis should be completed once the proposed structure's final dimensions are determined.

Borings completed in 1963 before the existing structure was constructed have been attached for additional information regarding the depth to bedrock.

Attachments
AWH:ah

cc: Materials Geotechnical Unit\gINT\PROJECTS\Projects File\Franklin\Structures

Illinois Department of Transportation
Division of Highways
District 6

SOIL BORING LOG

Date 4/16/20

ROUTE IL 154 **DESCRIPTION** Bridge over Rend Lake **LOGGED BY** Lee Estel

SECTION 112B-3 (from 1966) **LOCATION** 0.9 miles West of I-57, **SEC.** 18, **TWP.** 5S, **RNG.** 3E, 3 **PM**

COUNTY Franklin **DRILLING METHOD** Hollow stem auger (8" O.D., 3.25" I.D.) **HAMMER TYPE** Auto SPT 140 lb

STRUCT. NO. 028-0052
Station 362+00

BORING NO. S-1
Station 363+52
Offset 11.0ft RT
Ground Surface Elev. 425.4 ft

Surface Water Elev. 408.8 ft
Stream Bed Elev. 385.3 ft

Groundwater Elev.:
▽ **First Encounter** 399.4 ft
Upon Completion ft
After Hrs. ft

Description	Elev.	DEPTH (ft)	BLOWS	UCS Qu (tsf)	MOIST (%)
Cored Pavement, 2.5" HMA over 18" PCC					
	423.69				
V. Stiff Brown, Moist SILTY CLAY			1 4 4	2.1 B	16
(Stiff)		-5	1 3 4	1.7 B	19
(Brown with specks of Black)			1 2 7	1.1 S	19
	415.90				
V. Soft Greyish Brown, Moist SILTY CLAY		-10	1 2 5	0.2 B	23
	413.40				
M. Stiff Brown, Moist SILTY CLAY LOAM			1 6 4	0.5 B	19
(Brown and Grey)		-15	1 3 4	0.5 S	17
	408.40				
Stiff Brown and Grey with specks of Red and Black, Moist SILTY CLAY LOAM			1 4 7	1.1 S	15
	405.90				
V. Stiff Blue Grey, Moist CLAY		-20	1		

Description	Elev.	DEPTH (ft)	BLOWS	UCS Qu (tsf)	MOIST (%)
V. Stiff Blue Grey, Moist CLAY *(continued)*			4 6	2.7 B	17
	403.40				
Stiff Blue Grey, Moist CLAY			1 2 4	1.4 B	27
(Brown) ▽		-25	1 3 5	1.7 B	22
	398.40				
Stiff Brown, Moist SILTY CLAY LOAM			1 2 4	1.8 B	19
		-30	1 4 5	1.9 B	19
	393.40				
V. Stiff Brown, Moist SANDSTONE			6 40 60	2.9 S	18
	390.90				
Hard Brown, Dry SANDSTONE		-35	100/3.25"		15
(Bore hole continued with rock coring.)					
Bottom of Hole @ 44.8 feet					
Benchmark referenced to BM 134, Cut Square in S.E. Parapet wall SN 028-0052; Elev: 427.32					
To convert "N" values to "N60", multiply by 1.5		-40			

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer, E-Estimated)
Abbreviations W.O.H - Sampler Advanced By Weight of Hammer, W.O.P - Advanced by Weight of Pipe, B.S. - Before Seating
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206) BBS, from 137 (Rev. 8-99)

Illinois Department of Transportation
Division of Highways
District 6

ROCK CORE LOG

Date 4/16/20

ROUTE IL 154 **DESCRIPTION** Bridge over Rend Lake **LOGGED BY** Lee Estel

SECTION 112B-3 (from 1966) **LOCATION** 0.9 miles West of I-57, **SEC.** 18, **TWP.** 5S, **RNG.** 3E, 3 **PM**

COUNTY Franklin **CORING METHOD** Conventional rotary with water

STRUCT. NO. 028-0052
Station 362+00

BORING NO. S-1
Station 363+52
Offset 11.0ft RT
Ground Surface Elev. 425.4 **ft**

CORING BARREL TYPE & SIZE NV3 5FT NWJ

Core Diameter 1.78 **in**
Top of Rock Elev. 393.40 **ft**
Begin Core Elev. 390.60 **ft**

Description	DEPTH (ft)	CORE (#)	RECOVERY (%)	R.Q.D. (%)	CORE TIME (min/ft)	STRENGTH (tsf)
Brown, Dry SANDSTONE, Medium Grained, Field Hardness: Low 34.8 to 38.7 ft depth (Field Hardness: Friable 38.7 to 39.2 ft depth) (Field Hardness: Low 39.2 to 44.8 ft depth)		1	73	0	10	
	-40	2	40	10	10	59.6
380.60	-45					
	-50					

Color pictures of the cores Yes, attached
Cores will be stored for examination until 5 Years after Construction
The "Strength" column represents the uniaxial compressive strength of the core sample (ASTM D-2938)
RQD is the ratio of the total length of sound core specimens >4" to total length of core run

Illinois Department of Transportation
District Nine Materials
Unconfined Compressive Strength

(IL 154)
Structure 028 - 0052 (Boring S-1)
Franklin County

Bottom →

Middle →

Top →

Boring #	Specimen#	Depth	Unconfined Compression
S-1	Test 1	43.8 ft	828 psi

Foundation Core Instructions
Use 1.78" for the diameter
3.8" is the length

$$\frac{\pi d^2}{4} = 2.487$$

Pounds divided by 2.487 = psi

Illinois Department of Transportation
Division of Highways
District 6

SOIL BORING LOG

Date 4/20/20

ROUTE IL 154 **DESCRIPTION** Bridge over Rend Lake **LOGGED BY** Lee Estel

SECTION 112B-3 (from 1966) **LOCATION** 0.9 miles West of I-57, **SEC.** 18, **TWP.** 5S, **RNG.** 3E, 3 **PM**

COUNTY Franklin **DRILLING METHOD** Hollow stem auger (8" O.D., 3.25" I.D.) **HAMMER TYPE** Auto SPT 140 lb

STRUCT. NO. 028-0052
Station 362+00

BORING NO. S-2
Station 360+20
Offset 10.0ft LT
Ground Surface Elev. 425.9 ft

Surface Water Elev. 408.8 ft
Stream Bed Elev. 385.3 ft

Groundwater Elev.:
▽ **First Encounter** 388.9 ft
Upon Completion ____ ft
After ____ **Hrs.** ____ ft

Description	Elev. (ft)	DEPTH (ft)	BLOWS	UCS Qu (tsf)	MOIST (%)
Cored Pavement, 1.5" HMA over 10" PCC	424.94				
V. Stiff Brown, Moist SILTY CLAY			2		
			5	3.1	16
			5	S	
		-5	1		
			3	2.3	14
			4	S	
			1		
			3	3.1	16
	416.40		5	S	
Stiff Brown, Moist SILTY CLAY		-10	1		
			4	1.2	17
	413.90		4	B	
M. Stiff Brown, Moist CLAY			1		
			2	0.6	22
			3	B	
		-15	1		
			1	0.7	19
	408.90		3	B	
V. Stiff Brown with specks of Grey, Moist CLAY			1		
			3	3.1	18
	406.40		3	B	
V. Stiff Brown, Moist SILTY CLAY		-20	1		

Description	Elev. (ft)	DEPTH (ft)	BLOWS	UCS Qu (tsf)	MOIST (%)
V. Stiff Brown, Moist SILTY CLAY *(continued)*			4	2.5	17
	403.90		5	S	
M. Stiff Brown with Grey spots, Moist SILTY CLAY LOAM			1		
			2	0.7	20
	401.40		3	B	
Soft Brown with Grey spots, Moist SILTY CLAY LOAM		-25	1		
			1	0.25	25
	398.90		3	B	
Stiff Brown, Moist CLAY			1		
			4	1.6	20
	396.40		6	B	
Stiff Grey with Black streaks, Moist CLAY		-30	1		
			4	1.2	23
			5	B	
			1		
			2	1.2	21
	391.40		3	B	
Soft Grey, V. Moist CLAY		-35	WOH		
			WOH	0.25	29
	▽ 388.90		WOH	B	
V. Stiff Grey, Moist SILTY CLAY			1		
			5	2.3	19
	386.40		7	S	
M. Stiff Grey, Moist SILTY CLAY		-40	2		

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer, E-Estimated)
Abbreviations W.O.H - Sampler Advanced By Weight of Hammer, W.O.P - Advanced by Weight of Pipe, B.S. - Before Seating
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206) BBS, from 137 (Rev. 8-99)

Illinois Department of Transportation
Division of Highways
District 6

SOIL BORING LOG

Date 4/20/20

ROUTE IL 154 **DESCRIPTION** Bridge over Rend Lake **LOGGED BY** Lee Estel

SECTION 112B-3 (from 1966) **LOCATION** 0.9 miles West of I-57, **SEC.** 18, **TWP.** 5S, **RNG.** 3E, 3 **PM**

COUNTY Franklin **DRILLING METHOD** Hollow stem auger (8" O.D., 3.25" I.D.) **HAMMER TYPE** Auto SPT 140 lb

STRUCT. NO. 028-0052
Station 362+00

BORING NO. S-2
Station 360+20
Offset 10.0ft LT
Ground Surface Elev. 425.9 ft

Surface Water Elev. 408.8 ft
Stream Bed Elev. 385.3 ft

Groundwater Elev.:
First Encounter 388.9 ft
Upon Completion ft
After Hrs. ft

Description	DEPTH (ft)	BLOWS	UCS Qu (tsf)	MOIST (%)
M. Stiff Grey, Moist SILTY CLAY *(continued)*		4	0.8	28
		3	B	
381.40				
Soft Grey, Moist CLAY	-45	WOH		
		WOH	0.4	26
		WOH	B	
376.40				
Stiff Brown and mottled Grey, Moist CLAY	-50	1		
		3	2.0	26
		5	B	
	-55	1		
		3	1.2	27
		4	B	
(Grey)	-60	WOH		

Description	DEPTH (ft)	BLOWS	UCS Qu (tsf)	MOIST (%)
(Grey) *(continued)*		1	1.2	27
		1	B	
361.40				
M. Stiff Grey, Moist CLAY	-65	WOH		
		1	0.8	20
		1	B	
356.40				
V. Loose Grey, Wet Coarse Grained SAND	-70	WOH		
		1		20
		1		
351.40				
Stiff Grey, Moist SILTY LOAM	-75	10		
		16	1.3	19
		22	S	
346.40				
V. Stiff Grey, Moist SILTY LOAM	-80	4		

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer, E-Estimated)
Abbreviations W.O.H - Sampler Advanced By Weight of Hammer, W.O.P - Advanced by Weight of Pipe, B.S. - Before Seating
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206) BBS, from 137 (Rev. 8-99)

Illinois Department of Transportation
Division of Highways
District 6

SOIL BORING LOG

Date 4/20/20

ROUTE IL 154 **DESCRIPTION** Bridge over Rend Lake **LOGGED BY** Lee Estel

SECTION 112B-3 (from 1966) **LOCATION** 0.9 miles West of I-57, **SEC.** 18, **TWP.** 5S, **RNG.** 3E, 3 **PM**

COUNTY Franklin **DRILLING METHOD** Hollow stem auger (8" O.D., 3.25" I.D.) **HAMMER TYPE** Auto SPT 140 lb

STRUCT. NO. 028-0052
Station 362+00

BORING NO. S-2
Station 360+20
Offset 10.0ft LT
Ground Surface Elev. 425.9 ft

Surface Water Elev. 408.8 ft
Stream Bed Elev. 385.3 ft

Groundwater Elev.:
First Encounter 388.9 ft
Upon Completion ft
After Hrs. ft

Description	DEPTH (ft)	BLOWS	UCS Qu (tsf)	MOIST (%)
V. Stiff Grey, Moist SILTY LOAM *(continued)*		10 23	3.3 B	15
341.40				
Hard Grey, Dry CLAY SHALE (Borehole continued with rock coring.)	-85	100/2"		
	-90			
Bottom of Hole @ 93.6 feet Benchmark referenced to BM 134, Cut Square in S.E. Parapet wall SN 028-0052; Elev: 427.32 To convert "N" values to "N60", multiply by 1.5				
	-95			
	-100			

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer, E-Estimated)
Abbreviations W.O.H - Sampler Advanced By Weight of Hammer, W.O.P - Advanced by Weight of Pipe, B.S. - Before Seating
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206) BBS, from 137 (Rev. 8-99)

Illinois Department of Transportation
Division of Highways
District 6

ROCK CORE LOG

Date 4/20/20

ROUTE IL 154 **DESCRIPTION** Bridge over Rend Lake **LOGGED BY** Lee Estel

SECTION 112B-3 (from 1966) **LOCATION** 0.9 miles West of I-57, **SEC.** 18, **TWP.** 5S, **RNG.** 3E, 3 **PM**

COUNTY Franklin **CORING METHOD** Conventional rotary with water

STRUCT. NO. 028-0052
Station 362+00

CORING BARREL TYPE & SIZE NV3 5FT NWJ

Core Diameter 1.78 **in**
Top of Rock Elev. 341.40 **ft**
Begin Core Elev. 341.30 **ft**

BORING NO. S-2
Station 360+20
Offset 10.0ft LT
Ground Surface Elev. 425.9 **ft**

Description	DEPTH (ft)	CORE (#)	RECOVERY (%)	R.Q.D. (%)	CORE TIME (min/ft)	STRENGTH (tsf)
Grey, Dry CLAY SHALE, V. Fined Grained, Field Harness: Moderately Hard	-85	1	97	0	6	*66.7
	-90	2	88	0	6	*117.7 *130.3
332.30						
	-95					
	-100					

* Specimen length less than 2:1 (L/D). Results may differ from results obtained from a test specimen that meets the requirements.

Color pictures of the cores Yes, attached
Cores will be stored for examination until 5 Years after Construction
The "Strength" column represents the uniaxial compressive strength of the core sample (ASTM D-2938)
RQD is the ratio of the total length of sound core specimens >4" to total length of core run

BBS, form 138 (Rev. 8-99)

ROCK CORE 028-0052 IL 154 OVER REND LAKE 2020.GPJ D6TEMPLT.GDT 5/15/20

Illinois Department of Transportation
District Nine Materials
Unconfined Compressive Strength

IL 154
Franklin Co. 028 – 0052
Boring S-2
4-20-2020

Bottom

Middle

Top

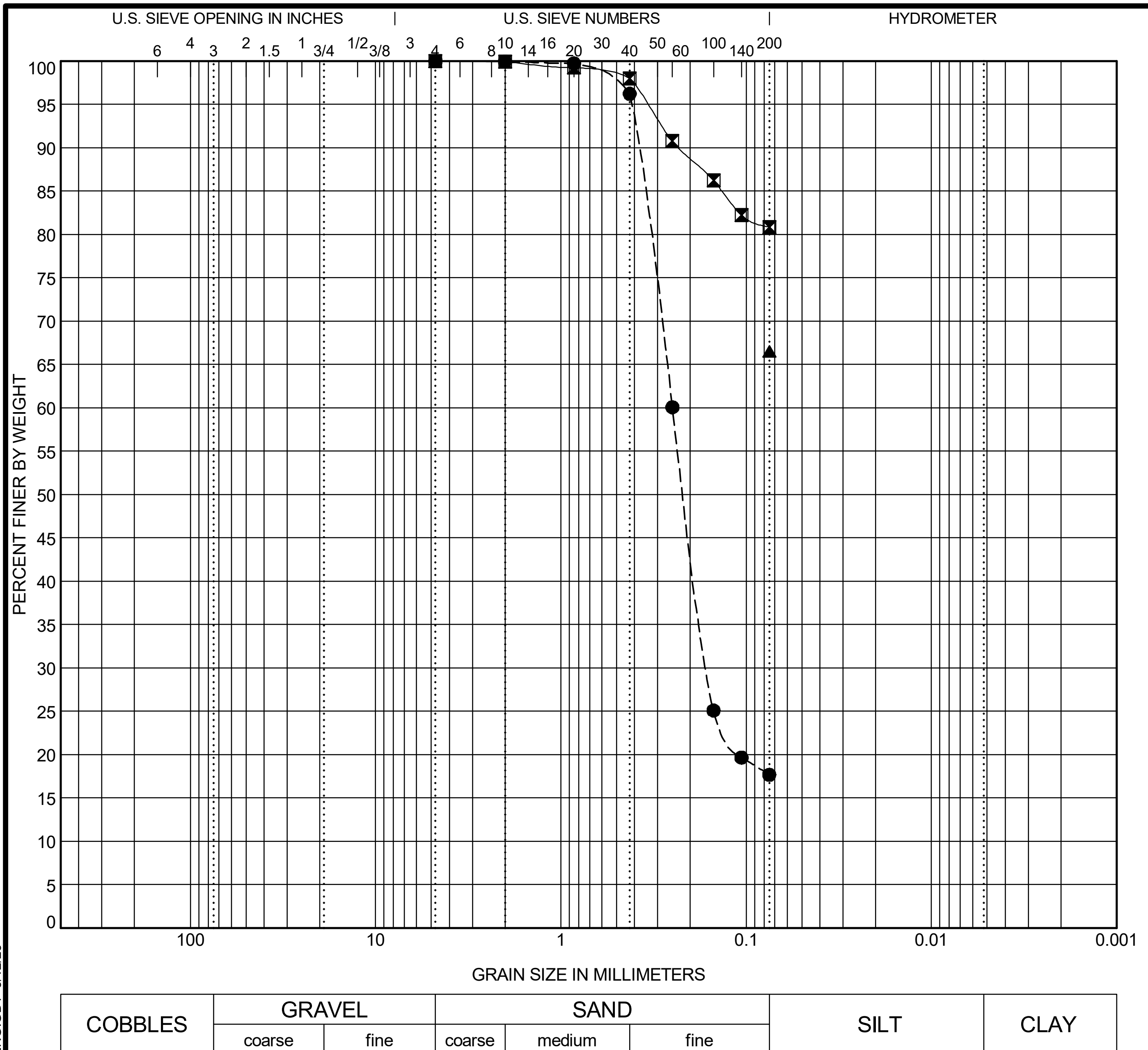
Boring #	Specimen#	Length	L/D ratio	Depth	Unconfined Reading	Unconfined Compression
S-2	3	2.8"	*1.6:1	85'	2,400 lbs	965 psi
S-2	2	3.4"	*1.9:1	92'	4,150 lbs	1,669 psi
S-2	1	3.0"	*1.7:1	92.7'	4,690 lbs	1,886 psi

*Desirable specimen length to diameter ratios are between 2.0:1 and 2.5:1. The results may differ from results obtained from a test specimen that meets the requirements.

Foundation Core Instructions
Use 1.78" for the diameter
(Pounds divided by 2.487)=psi

$$\frac{\pi d^2}{4} = 2.487$$

Appendix B



	Specimen Identification		Description	LL	PL	PI	Cc	Cu
●	B-12	43.5 ft	Sand (A-2)					
⊠	B-12	73.5 ft	Clay (A-7)					
▲	B-13	35.2 ft	Gravelly Silt (A-4)					

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	B-12	43.5 ft	4.75	0.25	0.161		0.0	82.3	17.7	
⊠	B-12	73.5 ft	4.75				0.0	19.1	80.9	
▲	B-13	35.2 ft	0.075				0.0	0.0	66.5	

SCI Engineering, Inc.
130 Point West Blvd.
St.Charles, Missouri 63301
Telephone: 636-949-8200

GRAIN SIZE DISTRIBUTION - ASTM

Project Name: PTB 195 Item 62 IL-154 at Rend Lake (SN028-0052)
Location: Franklin County, Illinois
SCI Project No.: 2020-0532.10

Appendix C

Illinois Department of Transportation

LIQUEFACTION ANALYSIS

REFERENCE BORING NUMBER ===================================== NW Abut (S-2)
ELEVATION OF BORING GROUND SURFACE ========================== 425.90 FT.
DEPTH TO GROUNDWATER - DURING DRILLING ======================= 37.00 FT. (Below Boring Ground Surface)
DEPTH TO GROUNDWATER - DURING EARTHQUAKE =================== 17.90 FT. (Below Finished Grade Cut or Fill Surface)
PEAK HORIZ. GROUND SURFACE ACCELERATION COEFFICIENT (As) ===== 0.300
EARTHQUAKE MOMENT MAGNITUDE ================================= 4.9
FINISHED GRADE FILL OR CUT FROM BORING SURFACE ================ 4.00 FT. (Fill Height)
HAMMER EFFICIENCY== 73 %
BOREHOLE DIAMETER== 6 IN.
SAMPLING METHOD== Sampler w/out Liners

EQ MAGNITUDE SCALING FACTOR
(MSF) = **2.581**

AVG. SHEAR WAVE VELOCITY (top 40')
$V_{s,40'}$ = **306** FT./SEC.

PGA CALCULATOR
Earthquake Moment Magnitude = 4.9
Source-To-Site Distance, R (km) = 10
Ground Motion Prediction Equations = CEUS
PGA = **0.244**

	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
422.4	3.5	10	2.5					0.133	0.466	17.150	17.150	0.182	0.133	0.946	0.946	1.250	**0.588**	0.770	**0.150**	**N.L. (1)**
419.9	6	7	2.3					0.132	0.796	10.304	10.304	0.116	0.132	1.276	1.276	1.126	**0.336**	0.692	**0.135**	**N.L. (1)**
417.4	8.5	8	2.5					0.133	1.128	11.168	11.168	0.124	0.133	1.608	1.608	1.068	**0.341**	0.617	**0.120**	**N.L. (1)**
414.9	11	8	1.2					0.124	1.438	10.989	10.989	0.122	0.124	1.918	1.918	1.024	**0.322**	0.547	**0.107**	**N.L. (1)**
412.4	13.5	5	0.6					0.116	1.728	6.708	6.708	0.085	0.116	2.208	2.208	0.991	**0.218**	0.485	**0.095**	**N.L. (1)**
409.9	16	4	0.7	50	11	29	19	0.117	2.021	5.190	11.228	0.124	0.055	2.346	2.477	0.976	**0.313**	0.430	**0.089**	**N.L. (2)**
407.4	18.5	6	2.5	50	11	29	18	0.133	2.353	7.427	13.912	0.149	0.071	2.523	2.810	0.956	**0.369**	0.383	**0.083**	**N.L. (2)**
404.9	21	9	2.5	50	11	29	17	0.133	2.686	10.604	17.724	0.189	0.071	2.701	3.144	0.935	**0.455**	0.344	**0.078**	**N.L. (2)**
402.4	23.5	5	0.7	50	11	29	20	0.117	2.978	5.643	11.772	0.129	0.055	2.838	3.437	0.932	**0.310**	0.312	**0.074**	**N.L. (2)**
399.9	26	4	0.25	50	11	29	25	0.107	3.246	4.342	10.210	0.115	0.045	2.951	3.706	0.926	**0.275**	0.285	**0.070**	**3.929 (C)**
397.4	28.5	10	1.6	50	11	29	20	0.127	3.563	10.353	17.423	0.185	0.065	3.113	4.024	0.899	**0.430**	0.264	**0.067**	**N.L. (2)**
394.9	31	9	1.2	50	11	29	23	0.124	3.873	8.909	15.691	0.167	0.062	3.268	4.335	0.891	**0.384**	0.247	**0.064**	**N.L. (2)**
392.4	33.5	5	1.2	50	11	29	21	0.124	4.183	4.740	10.688	0.119	0.062	3.423	4.646	0.893	**0.275**	0.234	**0.062**	**N.L. (2)**
389.9	36	0.1	0.25	50	11	29	29	0.107	4.451	0.091	5.110	0.073	0.045	3.536	4.915	0.902	**0.170**	0.223	**0.060**	**2.833 (C)**
387.4	38.5	12	2.3	50	11	29	19	0.069	4.623	10.748	17.897	0.191	0.069	3.708	5.243	0.855	**0.421**	0.215	**0.059**	**N.L. (2)**
384.9	41	7	0.8	50	11	29	28	0.057	4.766	6.166	12.399	0.135	0.057	3.851	5.542	0.863	**0.300**	0.208	**0.058**	**5.172 (C)**
379.9	46	0	0.4	50	11	29	26	0.049	5.011	0.000	5.000	0.072	0.049	4.096	6.099	0.876	**0.163**	0.199	**0.058**	**2.810 (C)**
374.9	51	8	2	50	11	29	26	0.067	5.346	6.594	12.913	0.140	0.067	4.431	6.746	0.832	**0.300**	0.194	**0.058**	**5.172 (C)**
369.9	56	7	1.2	50	11	29	27	0.061	5.651	5.572	11.687	0.128	0.061	4.736	7.363	0.823	**0.273**	0.191	**0.058**	**4.707 (C)**
364.9	61	2	1.2	50	11	29	27	0.061	5.956	1.538	6.845	0.086	0.061	5.041	7.980	0.832	**0.186**	0.186	**0.057**	**3.263 (C)**
359.9	66	2	0.8	50	11	29	20	0.057	6.241	1.488	6.786	0.086	0.057	5.326	8.577	0.823	**0.183**	0.179	**0.056**	**N.L. (2)**
354.9	71	2						0.048	6.481	1.449	1.449	0.051	0.048	5.566	9.129	0.824	**0.108**	0.172	**0.055**	**1.964 (C)**
349.9	76	38	1.3	50	11	29	15	0.062	6.791	28.812	39.575	0.109	0.062	5.876	9.751	0.665	**0.187**	0.165	**0.053**	**N.L. (2)**
344.9	81	33	2.5	50	11	29	15	0.070	7.141	23.529	33.235	1.549	0.070	6.226	10.413	0.666	**2.665**	0.158	**0.052**	**N.L. (2)**
341.4	84.5	33	2.5	50	11	29	15	0.070	7.386	22.871	32.445	0.879	0.070	6.471	10.876	0.660	**1.498**	0.153	**0.050**	**N.L. (2)**

* 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

Illinois Department of Transportation

LIQUEFACTION ANALYSIS

REFERENCE BORING NUMBER ===================================== Pier-1 (B-12)
ELEVATION OF BORING GROUND SURFACE ========================== 386.00 FT.
DEPTH TO GROUNDWATER - DURING DRILLING ======================= 0.00 FT. (Below Boring Ground Surface)
DEPTH TO GROUNDWATER - DURING EARTHQUAKE =================== 0.00 FT. (Below Finished Grade Cut or Fill Surface)
PEAK HORIZ. GROUND SURFACE ACCELERATION COEFFICIENT (As) ===== 0.300
EARTHQUAKE MOMENT MAGNITUDE ================================ 4.9
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) = **2.581**

AVG. SHEAR WAVE VELOCITY (top 40')
$V^{*}_{s,40'}$ = **503** FT./SEC.

PGA CALCULATOR
Earthquake Moment Magnitude = 4.9
Source-To-Site Distance, R (km) = 10
Ground Motion Prediction Equations = CEUS
PGA = **0.244**

ELEV. OF SAMPLE (FT.)	BORING DATA: 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 (%)	CONDITIONS DURING DRILLING: 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 $CRR_{7.5}$	CONDITIONS DURING EARTHQUAKE: 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
381	5	11		18				0.062	0.310	20.320	24.902	0.290	0.062	0.310	0.622	1.500	**1.122**	0.962	**0.376**	**2.984 (D)**
378.5	7.5	14	1					0.059	0.458	25.543	25.543	0.303	0.059	0.458	0.926	1.500	**1.173**	0.937	**0.369**	**N.L. (3)**
376	10	14	2.1					0.068	0.628	25.848	25.848	0.310	0.068	0.628	1.252	1.495	**1.195**	0.907	**0.353**	**N.L. (3)**
371	15	9	0.7		11	29	32	0.055	0.903	15.588	15.588	0.166	0.055	0.903	1.839	1.255	**0.538**	0.834	**0.331**	**1.625 (D)**
368.5	17.5	8	0.9		11	29	25	0.058	1.048	13.438	13.438	0.145	0.058	1.048	2.140	1.195	**0.446**	0.791	**0.315**	**1.416 (D)**
366	20	8	0.2		11	29	26	0.042	1.153	13.268	13.268	0.143	0.042	1.153	2.401	1.166	**0.431**	0.746	**0.303**	**1.422 (D)**
361	25	8	0.2		11	29	23	0.042	1.363	12.831	12.831	0.139	0.042	1.363	2.923	1.116	**0.400**	0.653	**0.273**	**N.L. (2)**
358.5	27.5	8	0.8		11	29	27	0.057	1.505	12.464	12.464	0.135	0.057	1.505	3.221	1.088	**0.381**	0.609	**0.254**	**1.500 (D)**
356	30	15	0.8		11	29	22	0.057	1.648	24.073	24.073	0.275	0.057	1.648	3.520	1.084	**0.768**	0.567	**0.236**	**N.L. (2)**
351	35	5	0.3		11	29	29	0.046	1.878	7.227	7.227	0.090	0.046	1.878	4.062	1.026	**0.237**	0.496	**0.209**	**1.134 (C)**
347.5	38.5	5	0.3		11	29	29	0.046	2.039	7.004	7.004	0.088	0.046	2.039	4.441	1.008	**0.228**	0.458	**0.195**	**1.169 (C)**

* 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

Illinois Department of Transportation

LIQUEFACTION ANALYSIS

REFERENCE BORING NUMBER ==================================== Pier-2 (B-13)
ELEVATION OF BORING GROUND SURFACE ========================== 394.30 FT.
DEPTH TO GROUNDWATER - DURING DRILLING ====================== 0.00 FT. (Below Boring Ground Surface)
DEPTH TO GROUNDWATER - DURING EARTHQUAKE ==================== 0.00 FT. (Below Finished Grade Cut or Fill Surface)
PEAK HORIZ. GROUND SURFACE ACCELERATION COEFFICIENT (As) ===== 0.300
EARTHQUAKE MOMENT MAGNITUDE ================================ 4.9
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) = **2.581**

AVG. SHEAR WAVE VELOCITY (top 40')
$V_{s,40'}$ = **307** FT./SEC.

PGA CALCULATOR
Earthquake Moment Magnitude = 4.9
Source-To-Site Distance, R (km) = 10
Ground Motion Prediction Equations = CEUS
PGA = **0.244**

ELEV. OF SAMPLE (FT.)	BORING DATA: 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 (%)	CONDITIONS DURING DRILLING: 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 $CRR_{7.5}$	CONDITIONS DURING EARTHQUAKE: 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
389.3	5	2	0.2	50	11	29	19	0.042	0.210	3.570	9.284	0.107	0.042	0.210	0.522	1.500	**0.414**	0.850	**0.412**	**N.L. (2)**
389.3	5	9	1.1	50	11	29	23	0.060	0.210	16.829	25.195	0.296	0.060	0.210	0.522	1.500	**1.145**	0.850	**0.412**	**N.L. (2)**
387.3	7	29						0.071	0.352	58.173	58.173	0.385	0.071	0.352	0.789	1.500	**1.489**	0.787	**0.344**	**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

Illinois Department of Transportation

LIQUEFACTION ANALYSIS

REFERENCE BORING NUMBER ==================================== SE Abut (S-1)
ELEVATION OF BORING GROUND SURFACE ========================= 425.40 FT.
DEPTH TO GROUNDWATER - DURING DRILLING ====================== 26.00 FT. (Below Boring Ground Surface)
DEPTH TO GROUNDWATER - DURING EARTHQUAKE ================== 17.40 FT. (Below Finished Grade Cut or Fill Surface)
PEAK HORIZ. GROUND SURFACE ACCELERATION COEFFICIENT (As) ===== 0.300
EARTHQUAKE MOMENT MAGNITUDE ================================ 4.9
FINISHED GRADE FILL OR CUT FROM BORING SURFACE =============== 4.00 FT. (Fill Height)
HAMMER EFFICIENCY== 73 %
BOREHOLE DIAMETER== 6 IN.
SAMPLING METHOD== Sampler w/out Liners

EQ MAGNITUDE SCALING FACTOR
(MSF) = **2.581**

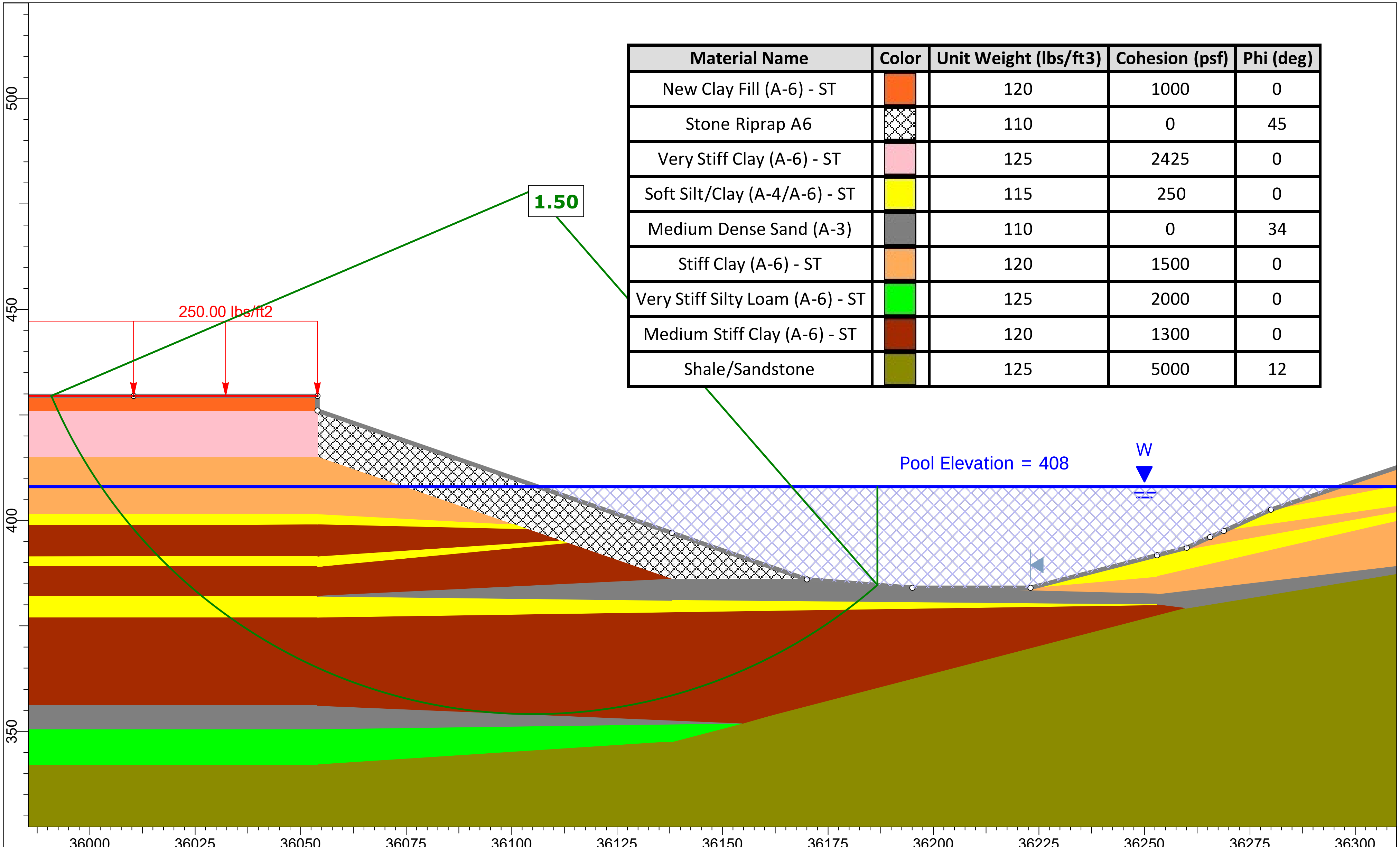
AVG. SHEAR WAVE VELOCITY (top 40')
$V_{s,40'}$ = **528** FT./SEC.

PGA CALCULATOR
Earthquake Moment Magnitude = 4.9
Source-To-Site Distance, R (km) = 10
Ground Motion Prediction Equations = CEUS
PGA = **0.244**

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
421.9	3.5	8	2.1					0.130	0.455	13.404	13.404	0.144	0.130	0.935	0.935	1.230	**0.458**	0.948	**0.185**	**N.L. (1)**
419.4	6	7	1.7					0.128	0.775	10.367	10.367	0.116	0.128	1.255	1.255	1.130	**0.339**	0.923	**0.180**	**N.L. (1)**
416.9	8.5	9	1.1					0.123	1.083	12.885	12.885	0.139	0.123	1.563	1.563	1.079	**0.388**	0.894	**0.174**	**N.L. (1)**
414.4	11	7	0.2					0.104	1.343	9.852	9.852	0.112	0.104	1.823	1.823	1.035	**0.299**	0.861	**0.168**	**N.L. (1)**
411.9	13.5	10	0.5	50	11	29	19	0.114	1.628	13.886	21.664	0.237	0.052	1.953	1.959	1.025	**0.628**	0.823	**0.161**	**N.L. (2)**
409.4	16	7	0.5	50	11	29	17	0.114	1.913	9.303	16.164	0.172	0.052	2.083	2.245	1.005	**0.446**	0.782	**0.164**	**N.L. (2)**
406.9	18.5	11	1.1	50	11	29	15	0.123	2.220	14.094	21.913	0.241	0.061	2.235	2.553	0.984	**0.611**	0.738	**0.165**	**N.L. (2)**
404.4	21	10	2.7	50	11	29	17	0.134	2.555	12.083	19.500	0.209	0.072	2.415	2.889	0.963	**0.520**	0.694	**0.162**	**N.L. (2)**
401.9	23.5	6	1.4	50	11	29	27	0.125	2.868	6.910	13.293	0.143	0.063	2.573	3.203	0.952	**0.352**	0.650	**0.158**	**2.228 (C)**
399.4	26	8	1.7	50	11	29	22	0.128	3.188	8.771	15.526	0.165	0.190	3.048	3.834	0.908	**0.388**	0.609	**0.149**	**N.L. (2)**
396.9	28.5	6	1.8	50	11	29	19	0.066	3.353	6.433	12.720	0.138	0.066	3.213	4.155	0.902	**0.321**	0.570	**0.144**	**N.L. (2)**
393.4	32	9	1.9	50	11	29	19	0.067	3.587	9.340	16.208	0.172	0.067	3.447	4.608	0.877	**0.390**	0.522	**0.136**	**N.L. (2)**
390.9	34.5	100	2.9					0.072	3.767	119.588	119.588	0.869	0.072	3.627	4.944	0.807	**1.810**	0.494	**0.131**	**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

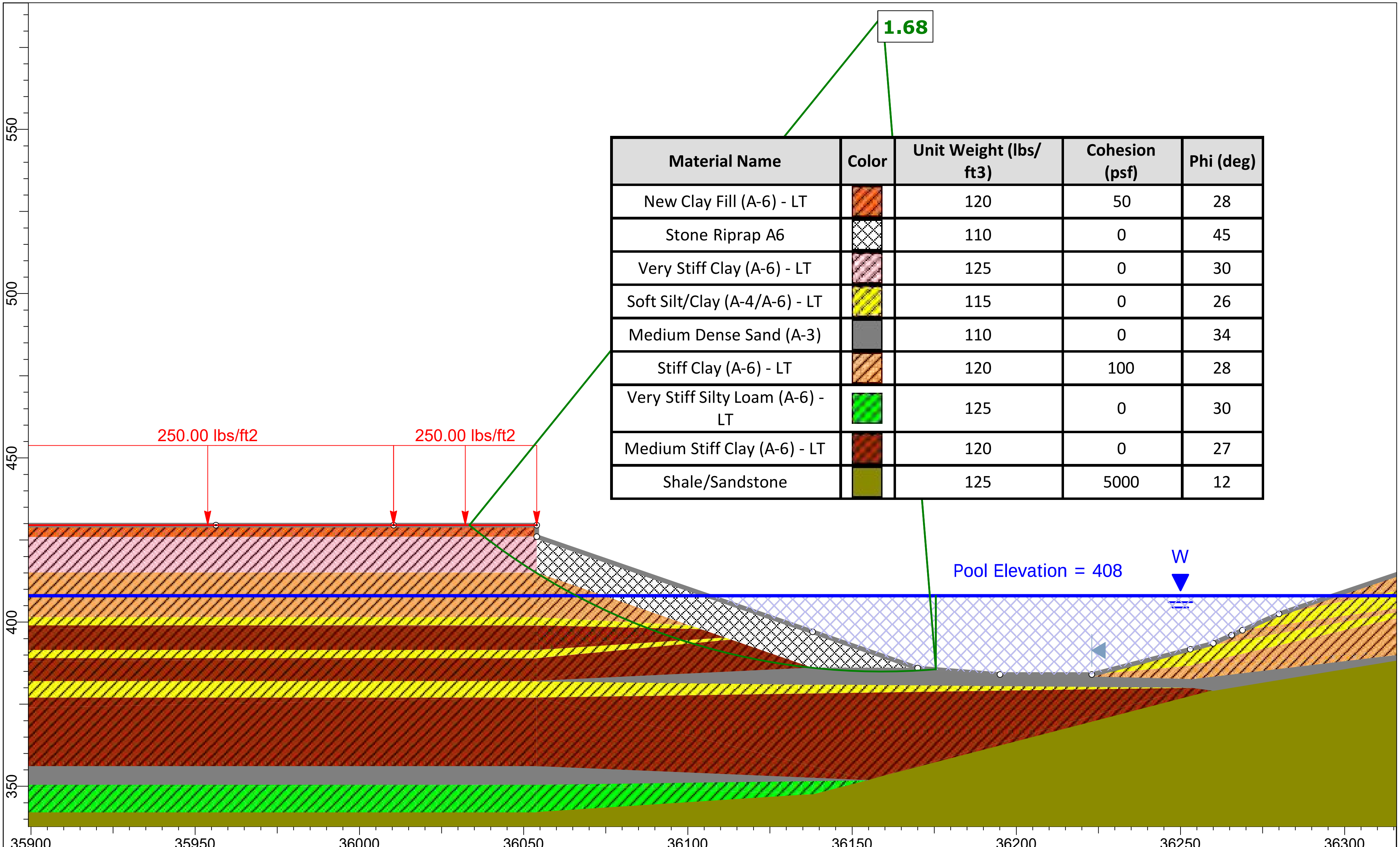
Appendix D



Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (deg)
New Clay Fill (A-6) - ST		120	1000	0
Stone Riprap A6		110	0	45
Very Stiff Clay (A-6) - ST		125	2425	0
Soft Silt/Clay (A-4/A-6) - ST		115	250	0
Medium Dense Sand (A-3)		110	0	34
Stiff Clay (A-6) - ST		120	1500	0
Very Stiff Silty Loam (A-6) - ST		125	2000	0
Medium Stiff Clay (A-6) - ST		120	1300	0
Shale/Sandstone		125	5000	12

Project	PTB 195 Item 62 IL-154 over Rend Lake (SN 028-0052)		
Analysis Description	End Slope NW Abutment (Short Term)	Location	Franklin County, Illinois
Drawn By PP	*Reviewed By:* TJC	*Scale* 1:378	*Company* SCI Engineering, Inc.
Date 5/15/2023	Project # 2020-0532.10		*File Name* Slope Stability Analysis.slmd

SLIDEINTERPRET 9.020



Material Name	Color	Unit Weight (lbs/ ft3)	Cohesion (psf)	Phi (deg)
New Clay Fill (A-6) - LT		120	50	28
Stone Riprap A6		110	0	45
Very Stiff Clay (A-6) - LT		125	0	30
Soft Silt/Clay (A-4/A-6) - LT		115	0	26
Medium Dense Sand (A-3)		110	0	34
Stiff Clay (A-6) - LT		120	100	28
Very Stiff Silty Loam (A-6) - LT		125	0	30
Medium Stiff Clay (A-6) - LT		120	0	27
Shale/Sandstone		125	5000	12

SLIDEINTERPRET 9.020

Project PTB 195 Item 62 IL-154 over Rend Lake (SN 028-0052)

Analysis Description End Slope NW Abutment (Long Term)

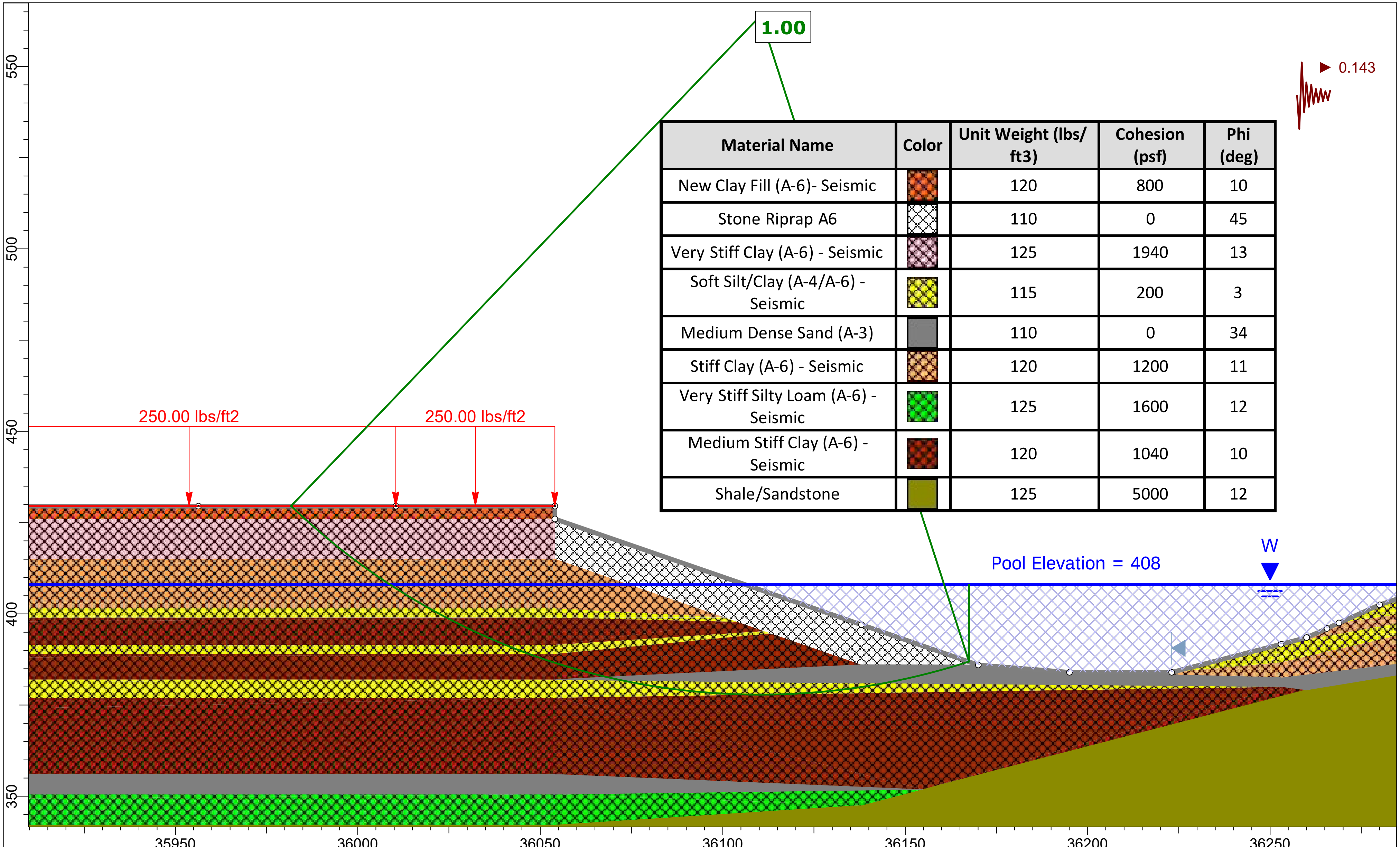
Location Franklin County, Illinois

Drawn By PP *Reviewed By:* TJC *Scale* 1:485

Company SCI Engineering, Inc.

Date 5/15/2023 *Project #* 2020-0532.10

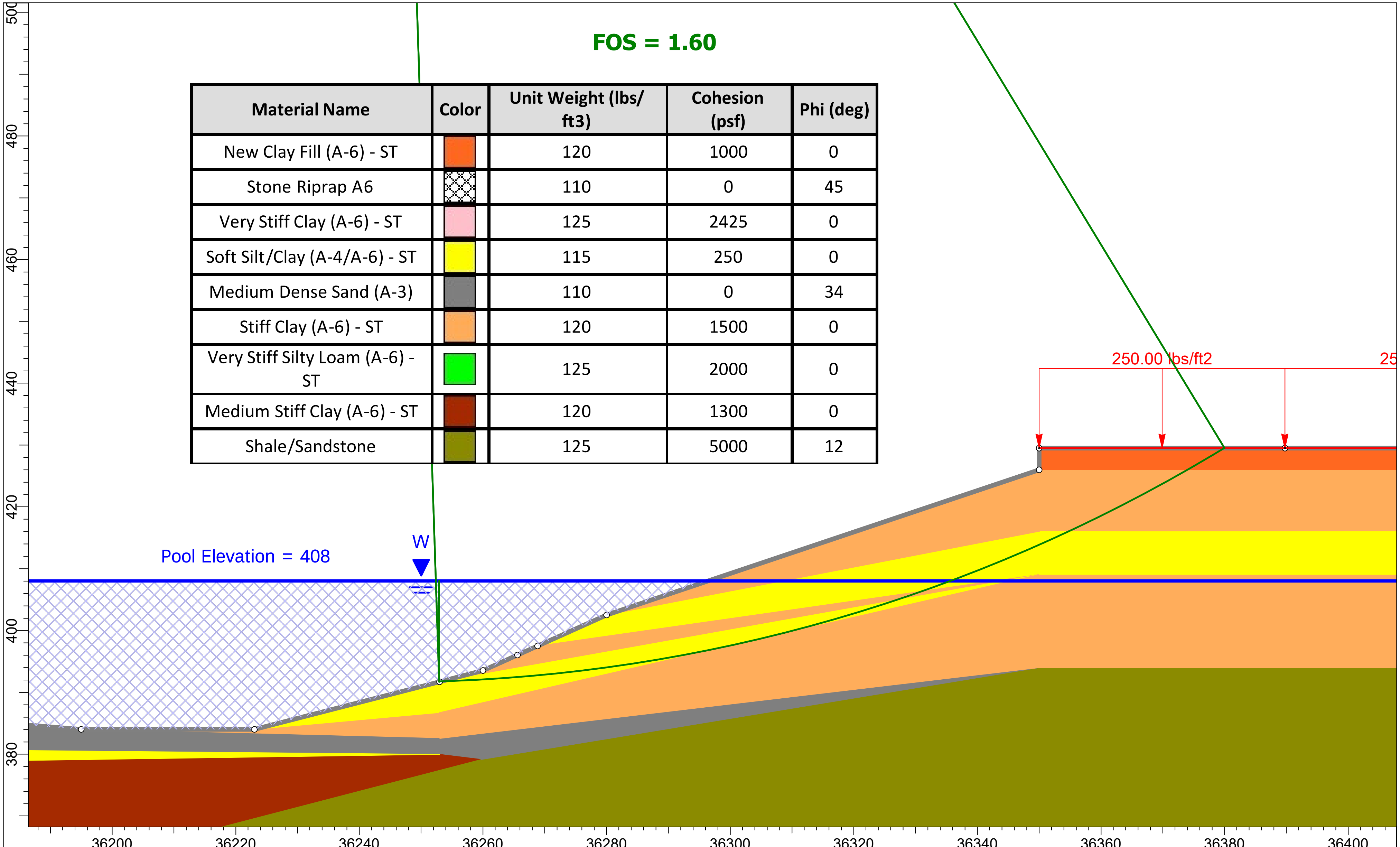
File Name Slope Stability Analysis.slmd



Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (deg)
New Clay Fill (A-6)- Seismic		120	800	10
Stone Riprap A6		110	0	45
Very Stiff Clay (A-6) - Seismic		125	1940	13
Soft Silt/Clay (A-4/A-6) - Seismic		115	200	3
Medium Dense Sand (A-3)		110	0	34
Stiff Clay (A-6) - Seismic		120	1200	11
Very Stiff Silty Loam (A-6) - Seismic		125	1600	12
Medium Stiff Clay (A-6) - Seismic		120	1040	10
Shale/Sandstone		125	5000	12

Project	PTB 195 Item 62 IL-154 over Rend Lake (SN 028-0052)		
Analysis Description	End Slope NW Abutment (Seismic)	*Location*	Franklin County, Illinois
Drawn By PP	*Reviewed By:* TJC / *Scale* 1:436	*Company*	SCI Engineering, Inc.
Date 5/15/2023	*Project #* 2020-0532.10	*File Name*	Slope Stability Analysis.slmd

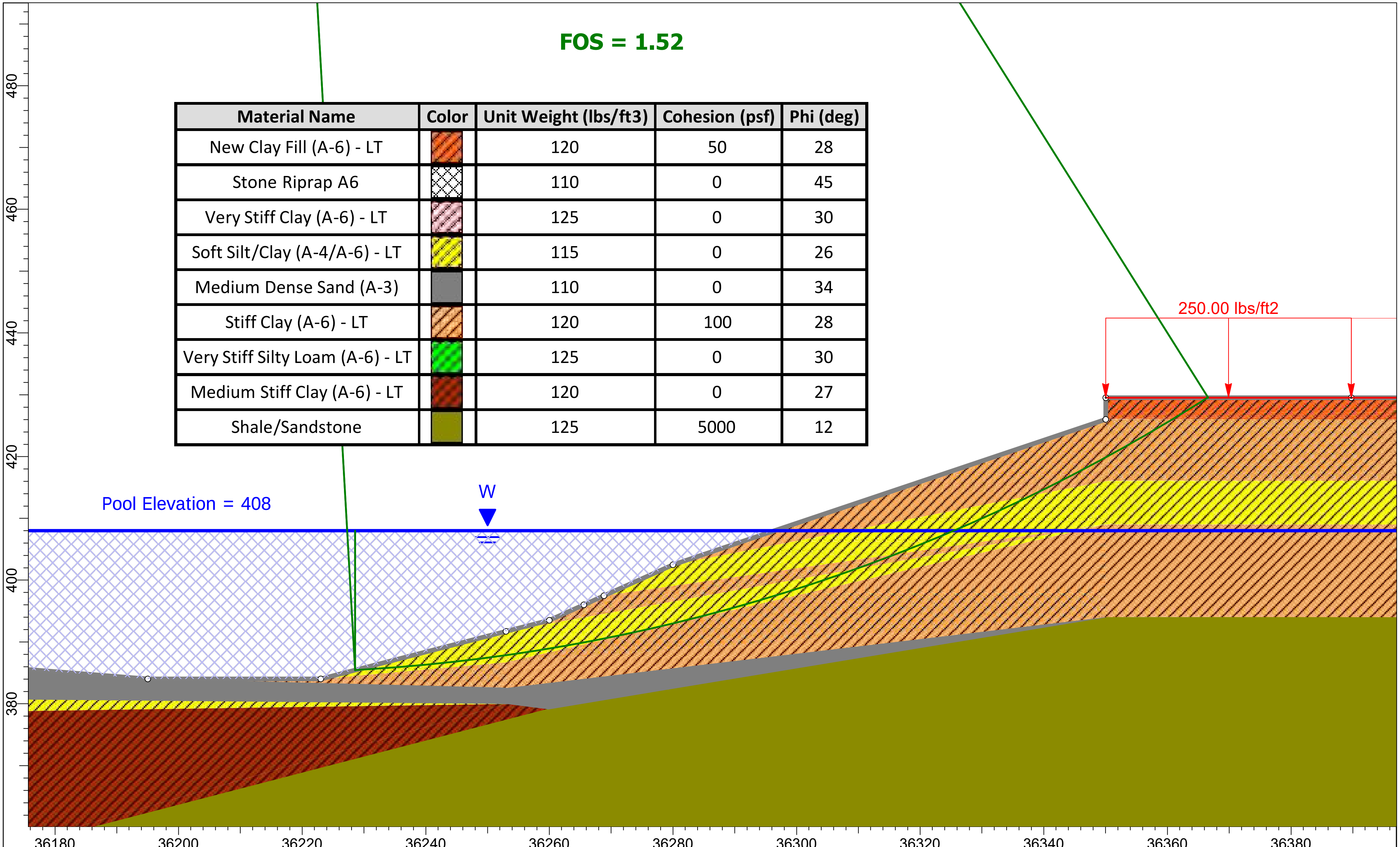
SLIDEINTERPRET 9.020



Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (deg)
New Clay Fill (A-6) - ST		120	1000	0
Stone Riprap A6		110	0	45
Very Stiff Clay (A-6) - ST		125	2425	0
Soft Silt/Clay (A-4/A-6) - ST		115	250	0
Medium Dense Sand (A-3)		110	0	34
Stiff Clay (A-6) - ST		120	1500	0
Very Stiff Silty Loam (A-6) - ST		125	2000	0
Medium Stiff Clay (A-6) - ST		120	1300	0
Shale/Sandstone		125	5000	12

SLIDEINTERPRET 9.020

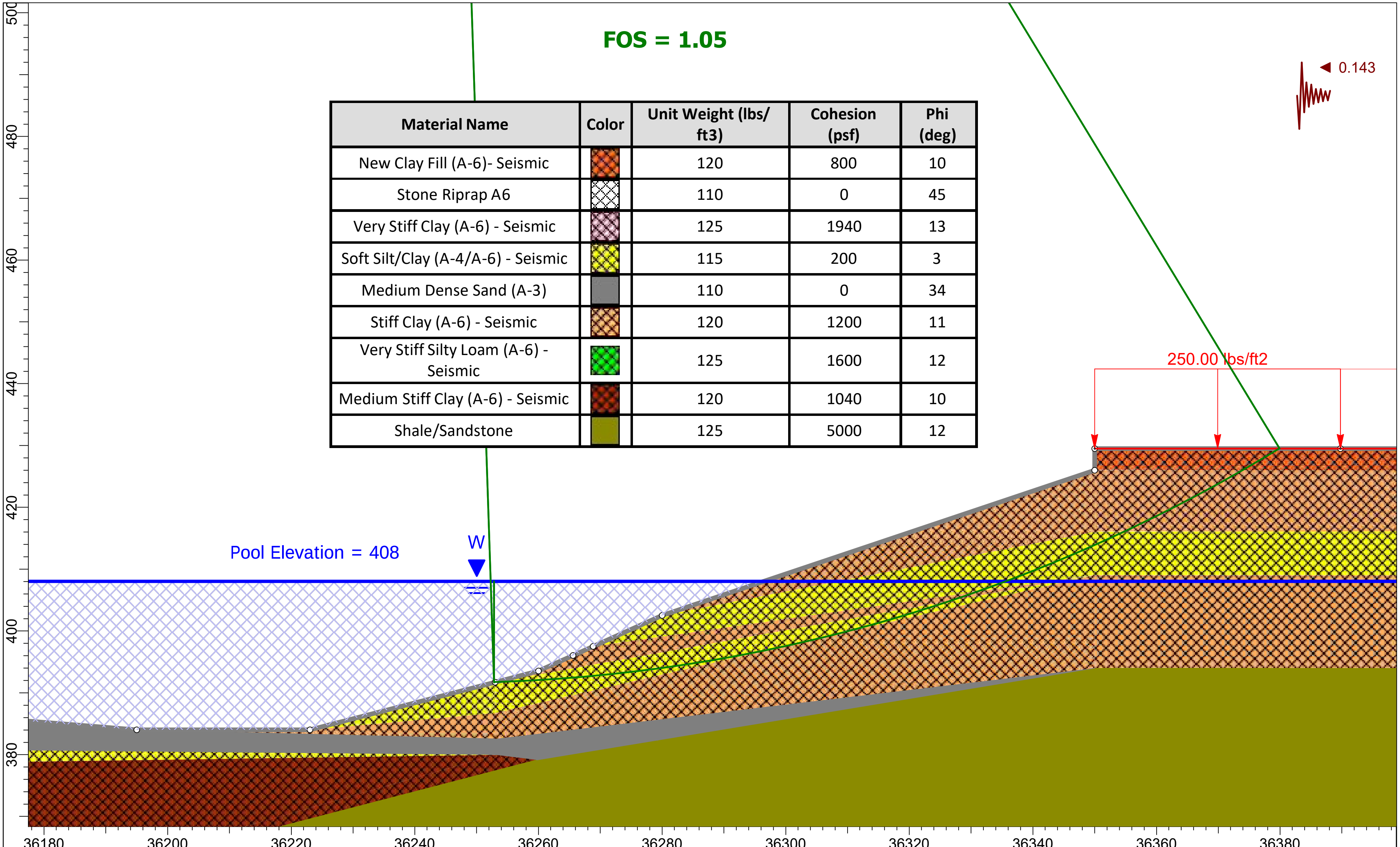
Project	PTB 195 Item 62 IL-154 over Rend Lake (SN 028-0052)		
Analysis Description	End Slope SE Abutment (Short Term)	Location	Franklin County, Illinois
Drawn By PP	*Reviewed By:* TJC	*Scale* 1:258	*Company* SCI Engineering, Inc.
Date 5/15/2023	Project # 2020-0532.10		*File Name* Slope Stability Analysis.slmd



Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (deg)
New Clay Fill (A-6) - LT		120	50	28
Stone Riprap A6		110	0	45
Very Stiff Clay (A-6) - LT		125	0	30
Soft Silt/Clay (A-4/A-6) - LT		115	0	26
Medium Dense Sand (A-3)		110	0	34
Stiff Clay (A-6) - LT		120	100	28
Very Stiff Silty Loam (A-6) - LT		125	0	30
Medium Stiff Clay (A-6) - LT		120	0	27
Shale/Sandstone		125	5000	12

Project	PTB 195 Item 62 IL-154 over Rend Lake (SN 028-0052)
Analysis Description	End Slope SE Abutment (Long Term)
Location	Franklin County, Illinois
Drawn By	PP
Reviewed By:	TJC
Scale	1:258
Company	SCI Engineering, Inc.
Date	5/15/2023
Project #	2020-0532.10
File Name	Slope Stability Analysis.slmd

SLIDEINTERPRET 9.020



Material Name	Color	Unit Weight (lbs/ft3)	Cohesion (psf)	Phi (deg)
New Clay Fill (A-6)- Seismic		120	800	10
Stone Riprap A6		110	0	45
Very Stiff Clay (A-6) - Seismic		125	1940	13
Soft Silt/Clay (A-4/A-6) - Seismic		115	200	3
Medium Dense Sand (A-3)		110	0	34
Stiff Clay (A-6) - Seismic		120	1200	11
Very Stiff Silty Loam (A-6) - Seismic		125	1600	12
Medium Stiff Clay (A-6) - Seismic		120	1040	10
Shale/Sandstone		125	5000	12

SLIDEINTERPRET 9.020

Project PTB 195 Item 62 IL-154 over Rend Lake (SN 028-0052)

Analysis Description End Slope SE Abutment (Seismic)		*Location* Franklin County, Illinois	
Drawn By PP	*Reviewed By:* TJC	*Scale* 1:258	*Company* SCI Engineering, Inc.
Date 5/15/2023	*Project #* 2020-0532.10		*File Name* Slope Stability Analysis.slmd

Appendix E-1

Illinois Department of Transportation

IDOT STATIC METHOD OF ESTIMATING PILE LENGTH

SUBSTRUCTURE==================================== NW Abutment
REFERENCE BORING ================================ S-2
LRFD or ASD or SEISMIC ============================= LRFD
PILE CUTOFF ELEV. ================================= 419.80 ft
GROUND SURFACE ELEV. AGAINST PILE DURING DRIVING = 418.80 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)========= 55.00 ft
NUMBER OF ROWS OF PILES PER SUBSTRUCTURE ====== 1
Approx. Factored Loading Applied per pile at 8 ft. Cts ============ 247.27 KIPS
Approx. Factored Loading Applied per pile at 3 ft. Cts ============ 92.73 KIPS

PILE TYPE AND SIZE ============= Steel HP 14 X 117
Pile Perimeter============================== 4.850 FT. Unplugged Pile Perimeter============== 7.117 FT.
Pile End Bearing Area========================== 1.469 SQFT. Unplugged Pile End Bearing Area======= 0.239 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
929 KIPS	**929** KIPS	**511** KIPS	**86** 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 UNPLUG'D SIDE RESIST. (KIPS)	NOMINAL UNPLUG'D END BRG. RESIST. (KIPS)	NOMINAL UNPLUG'D TOTAL RESIST. (KIPS)	NOMINAL REQ'D BEARING (KIPS)	FACTORED GEOTECH. LOSS FROM SCOUR or DD (KIPS)	FACTORED GEOTECH. LOSS LOAD FROM DD (KIPS)	FACTORED RESISTANCE AVAILABLE (KIPS)	ESTIMATED PILE LENGTH (FT.)
416.40	2.40	3.10	8		18.2		42.9	26.8		***30.8***	31	0	0	17	3
413.90	2.50	1.20			9.9	24.7	***40.5***	14.6	4.0	43.3	41	0	0	22	6
411.40	2.50	0.60			5.6	12.4	***48.2***	8.2	2.0	51.9	48	0	0	26	8
408.90	2.50	0.70			6.4	14.4	104.0	9.4	2.3	***69.3***	69	0	0	38	11
406.40	2.50	3.10	6		19.0	63.8	110.6	27.9	10.4	***95.1***	95	0	0	52	13
403.90	2.50	2.50			16.3	51.5	***89.9***	24.0	8.4	113.1	90	0	0	49	16
401.40	2.50	0.70			6.4	14.4	***87.0***	9.4	2.3	120.9	87	0	0	48	18
398.90	2.50	0.25			2.5	5.1	***117.2***	3.6	0.8	129.1	117	0	0	64	21
396.40	2.50	1.60			12.2	32.9	***121.2***	17.9	5.4	145.6	121	0	0	67	23
393.90	2.50	1.20			9.9	24.7	***131.1***	14.6	4.0	160.2	131	0	0	72	26
391.40	2.50	1.20			9.9	24.7	***121.5***	14.6	4.0	171.6	122	0	0	67	28
388.90	2.50	0.25			2.5	5.1	***166.2***	3.6	0.8	182.1	166	0	0	91	31
386.40	2.50	2.30			15.4	47.4	***150.7***	22.7	7.7	199.7	151	0	0	83	33
381.40	5.00	0.80			14.3	16.5	***156.8***	21.0	2.7	219.4	157	0	0	86	38
376.40	5.00	0.40			7.7	8.2	***197.5***	11.3	1.3	236.0	197	0	0	109	43
371.40	5.00	2.00			28.2	41.2	***209.2***	41.4	6.7	274.8	209	0	0	115	48
366.40	5.00	1.20			19.9	24.7	***229.1***	29.2	4.0	303.9	229	0	0	126	53
361.40	5.00	1.20			19.9	24.7	***240.7***	29.2	4.0	331.7	241	0	0	132	58
356.40	5.00	0.80			14.3	16.5	***245.9***	21.0	2.7	351.3	246	0	0	135	63
351.40	5.00		2	Clean Coarse Sand	1.0	7.3	***266.3***	1.4	1.2	355.8	266	0	0	146	68
346.40	5.00	1.30			21.1	26.8	***351.2***	30.9	4.4	397.2	351	0	0	193	73
341.40	5.00		33	Hard Till	8.8	90.6	452.4	12.8	14.7	***425.0***	425	0	0	234	78
340.40	1.00			Shale	60.4	183.0	***512.8***	88.7	29.8	513.7	513	0	0	282	79.4
339.40	1.00			Shale	60.4	183.0	***573.3***	88.7	29.8	602.4	573	0	0	315	80.4
338.40	1.00			Shale	60.4	183.0	***633.7***	88.7	29.8	691.0	634	0	0	349	81.4
337.40	1.00			Shale	60.4	183.0	***694.1***	88.7	29.8	779.7	694	0	0	382	82.4
336.40	1.00			Shale	60.4	183.0	***754.5***	88.7	29.8	868.3	755	0	0	415	83.4
335.40	1.00			Shale	60.4	183.0	***814.9***	88.7	29.8	957.0	815	0	0	448	84.4
334.40	1.00			Shale	60.4	183.0	***875.3***	88.7	29.8	1045.6	875	0	0	481	85.4
333.40	1.00			Shale	60.4	183.0	***935.8***	88.7	29.8	1134.3	~~936~~	~~0~~	~~0~~	~~515~~	~~86.4~~
332.40	1.00			Shale	60.4	183.0	***996.2***	88.7	29.8	1222.9	~~996~~	~~0~~	~~0~~	~~548~~	~~87.4~~
331.40	1.00			Shale	60.4	183.0	***1056.6***	88.7	29.8	1311.6	~~1057~~	~~0~~	~~0~~	~~581~~	~~88.4~~
330.40	1.00			Shale	60.4	183.0	***1117.0***	88.7	29.8	1400.2	~~1117~~	~~0~~	~~0~~	~~614~~	~~89.4~~
329.40	1.00			Shale	60.4	183.0	***1177.4***	88.7	29.8	1488.9	~~1177~~	~~0~~	~~0~~	~~648~~	~~90.4~~
328.40	1.00			Shale	60.4	183.0	***1237.8***	88.7	29.8	1577.5	~~1238~~	~~0~~	~~0~~	~~681~~	~~91.4~~
327.40	1.00			Shale	60.4	183.0	***1298.3***	88.7	29.8	1666.2	~~1298~~	~~0~~	~~0~~	~~714~~	~~92.4~~
326.40	1.00			Shale	60.4	183.0	***1358.7***	88.7	29.8	1754.8	~~1359~~	~~0~~	~~0~~	~~747~~	~~93.4~~
325.40	1.00			Shale		183.0			29.8						

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

	Nominal Required Bearing (Kips)	Factored Resistance Available (Kips)	Estimated Pile Length (Ft.)
Metal Shell 12"Φ w/.25" walls			
	154	85	38
	176	97	43
	197	109	48
	218	120	53
	234	129	58
	252	138	63
	256	141	68
	389	214	73
Metal Shell 14"Φ w/.25" walls			
	168	93	33
	180	99	38
	208	115	43
	232	128	48
	256	141	53
	275	151	58
	296	163	63
	301	166	68
Metal Shell 14"Φ w/.312" walls			
	168	93	33
	180	99	38
	208	115	43
	232	128	48
	256	141	53
	275	151	58
	296	163	63
	301	166	68
	477	263	73
Metal Shell 16"Φ w/.312" walls			
	161	89	28
	194	107	33
	207	114	38
	242	133	43
	268	147	48
	295	162	53
	315	173	58
	340	187	63
	347	191	68
	573	315	73
Metal Shell 16"Φ w/.375" walls			
	161	89	28
	194	107	33
	207	114	38
	242	133	43
	268	147	48
	295	162	53
	315	173	58
	340	187	63
	347	191	68
	573	315	73
Steel HP 8 X 36			
	141	78	68
	173	95	73
	286	157	81

	Nominal Required Bearing (Kips)	Factored Resistance Available (Kips)	Estimated Pile Length (Ft.)
Steel HP 10 X 42			
	166	91	63
	175	96	68
	219	121	73
	335	184	80
Steel HP 10 X 57			
	164	90	58
	169	93	63
	179	98	68
	224	123	73
	454	250	83
Steel HP 12 X 53			
	167	92	48
	184	101	53
	194	107	58
	200	110	63
	214	118	68
	274	151	73
	418	230	80
Steel HP 12 X 63			
	157	86	43
	169	93	48
	185	102	53
	196	108	58
	202	111	63
	216	119	68
	277	152	73
	497	273	82
Steel HP 12 X 74			
	159	88	43
	171	94	48
	188	103	53
	199	109	58
	204	112	63
	219	120	68
	281	154	73
	589	324	83

	Nominal Required Bearing (Kips)	Factored Resistance Available (Kips)	Estimated Pile Length (Ft.)
Steel HP 12 X 84			
	162	89	43
	174	96	48
	190	105	53
	201	111	58
	207	114	63
	222	122	68
	285	157	73
	664	365	84
Steel HP 14 X 73			
	152	83	38
	190	105	43
	202	111	48
	221	122	53
	233	128	58
	238	131	63
	257	141	68
	338	186	73
	578	318	81
Steel HP 14 X 89			
	153	84	38
	193	106	43
	204	112	48
	224	123	53
	235	129	58
	241	132	63
	260	143	68
	342	188	73
	705	388	83
Steel HP 14 X 102			
	155	85	38
	195	107	43
	207	114	48
	226	125	53
	238	131	58
	243	134	63
	263	145	68
	347	191	73
	810	445	85
Steel HP 14 X 117			
	157	86	38
	197	109	43
	209	115	48
	229	126	53
	241	132	58
	246	135	63
	266	146	68
	351	193	73
	929	511	86

Illinois Department of Transportation

IDOT STATIC METHOD OF ESTIMATING PILE LENGTH

SUBSTRUCTURE==================================== SE Abutment
REFERENCE BORING ================================ S-1
LRFD or ASD or SEISMIC ============================== LRFD
PILE CUTOFF ELEV. ================================= 419.80 ft
GROUND SURFACE ELEV. AGAINST PILE DURING DRIVING = 418.80 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)========= 55.00 ft
NUMBER OF ROWS OF PILES PER SUBSTRUCTURE ====== 1
Approx. Factored Loading Applied per pile at 8 ft. Cts ============ 247.27 KIPS
Approx. Factored Loading Applied per pile at 3 ft. Cts ============ 92.73 KIPS

PILE TYPE AND SIZE ============= Steel HP 14 X 117
Pile Perimeter============================== 4.850 FT. Unplugged Pile Perimeter============== 7.117 FT.
Pile End Bearing Area========================== 1.469 SQFT. Unplugged Pile End Bearing Area======== 0.239 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
929 KIPS	**929** KIPS	**511** KIPS	**33** 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 UNPLUG'D SIDE RESIST. (KIPS)	NOMINAL UNPLUG'D END BRG. RESIST. (KIPS)	NOMINAL UNPLUG'D TOTAL RESIST. (KIPS)	NOMINAL REQ'D BEARING (KIPS)	FACTORED GEOTECH. LOSS FROM SCOUR or DD (KIPS)	FACTORED GEOTECH. LOSS LOAD FROM DD (KIPS)	FACTORED RESISTANCE AVAILABLE (KIPS)	ESTIMATED PILE LENGTH (FT.)
415.90	2.90	1.10			10.8		***14.9***	15.8		16.5	15	0	0	8	4
413.40	2.50	0.20			2.0	4.1	23.1	2.9	0.7	***20.4***	20	0	0	11	6
410.90	2.50	0.50			4.7	10.3	27.8	6.9	1.7	***27.3***	27	0	0	15	9
408.40	2.50	0.50			4.7	10.3	44.9	6.9	1.7	***36.3***	36	0	0	20	11
405.90	2.50	1.10			9.3	22.7	83.0	13.6	3.7	***54.6***	55	0	0	30	14
403.40	2.50	2.50			16.3	51.5	76.7	24.0	8.4	***74.9***	75	0	0	41	16
400.90	2.50	1.40			11.1	28.8	94.0	16.3	4.7	***92.2***	92	0	0	51	19
398.40	2.50	1.70			12.7	35.0	***108.7***	18.6	5.7	111.2	109	0	0	60	21
395.90	2.50	1.80			13.2	37.1	***124.0***	19.3	6.0	130.9	124	0	0	68	24
392.90	3.00	1.90			16.4	39.1	398.7	24.1	6.4	***196.9***	197	0	0	108	27
391.90	1.00			Sandstone	100.7	297.4	499.4	147.8	48.4	***344.7***	345	0	0	190	27.9
390.90	1.00			Sandstone	100.7	297.4	600.1	147.8	48.4	***492.4***	492	0	0	271	28.9
389.90	1.00			Sandstone	100.7	297.4	700.8	147.8	48.4	***640.2***	640	0	0	352	29.9
388.90	1.00			Sandstone	100.7	297.4	801.5	147.8	48.4	***787.9***	788	0	0	433	30.9
387.90	1.00			Sandstone	100.7	297.4	***902.2***	147.8	48.4	935.7	902	0	0	496	31.9
386.90	1.00			Sandstone	100.7	297.4	***1002.8***	147.8	48.4	1083.5	~~1003~~	~~0~~	~~0~~	~~552~~	~~32.9~~
385.90	1.00			Sandstone	100.7	297.4	***1103.5***	147.8	48.4	1231.2	~~1104~~	~~0~~	~~0~~	~~607~~	~~33.9~~
384.90	1.00			Sandstone	100.7	297.4	***1204.2***	147.8	48.4	1379.0	~~1204~~	~~0~~	~~0~~	~~662~~	~~34.9~~
383.90	1.00			Sandstone	100.7	297.4	***1304.9***	147.8	48.4	1526.7	~~1305~~	~~0~~	~~0~~	~~718~~	~~35.9~~
382.90	1.00			Sandstone	100.7	297.4	***1405.6***	147.8	48.4	1674.5	~~1406~~	~~0~~	~~0~~	~~773~~	~~36.9~~
381.90	1.00			Sandstone	100.7	297.4	***1506.3***	147.8	48.4	1822.2	~~1506~~	~~0~~	~~0~~	~~828~~	~~37.9~~
380.90	1.00			Sandstone	100.7	297.4	***1607.0***	147.8	48.4	1970.0	~~1607~~	~~0~~	~~0~~	~~884~~	~~38.9~~
379.90	1.00			Sandstone	100.7	297.4	***1707.7***	147.8	48.4	2117.8	~~1708~~	~~0~~	~~0~~	~~939~~	~~39.9~~
378.90	1.00			Sandstone	100.7	297.4	***1808.4***	147.8	48.4	2265.5	~~1808~~	~~0~~	~~0~~	~~995~~	~~40.9~~
377.90	1.00			Sandstone		297.4			48.4						

Pile Design Table for SE Abutment utilizing Boring #S-1

	Nominal Required Bearing (Kips)	Factored Resistance Available (Kips)	Estimated Pile Length (Ft.)
Metal Shell 12"Φ w/.25" walls			
	102	56	24
Metal Shell 14"Φ w/.25" walls			
	123	67	24
Metal Shell 14"Φ w/.312" walls			
	123	67	24
Metal Shell 16"Φ w/.312" walls			
	144	79	24
Metal Shell 16"Φ w/.375" walls			
	144	79	24
Steel HP 8 X 36			
	258	142	29

	Nominal Required Bearing (Kips)	Factored Resistance Available (Kips)	Estimated Pile Length (Ft.)
Steel HP 10 X 42			
	321	176	29
Steel HP 10 X 57			
	423	233	30
Steel HP 12 X 53			
	384	211	29
Steel HP 12 X 63			
	393	216	29
Steel HP 12 X 74			
	522	287	30

	Nominal Required Bearing (Kips)	Factored Resistance Available (Kips)	Estimated Pile Length (Ft.)
Steel HP 12 X 84			
	639	351	31
Steel HP 14 X 73			
	119	65	24
	176	97	27
	578	318	30
Steel HP 14 X 89			
	121	66	24
	184	101	27
	705	388	31
Steel HP 14 X 102			
	122	67	24
	190	104	27
	810	445	32
Steel HP 14 X 117			
	124	68	24
	197	108	27
	929	511	33

Appendix E-2

Illinois Department of Transportation

DRILLED SHAFT AXIAL CAPACITY IN SHALE < 100 KSF

STRUCTURE ========================== SN 028-0052
SUBSTRUCTURE & REFERENCE BORING ==== Pier-1 (B-12)

ESTIMATED TOP OF SHALE ELEVATION ===== 347.00 FT
DRILLED SHAFT DIAMETER IN SHALE ======= 36 IN.
FACTORED AXIAL LOAD ================== 3000 KIPS

SOCKET DEPTH (FT)	TIP ELEV. (FT)	LAYER THICK. (FT)	UNCONFINED COMPRESSIVE STRENGTH (q_u) (KSF)	AVG. q_u W/IN 2 - SHAFT DIA. (KSF)	NOMINAL SIDE RESIST. (KIPS)	CUMULATIVE SIDE RESIST. (KIPS)	DEPTH CORR. FACTORS k	DEPTH CORR. FACTORS d_c	NOMINAL TIP RESIST. (KIPS)	NOMINAL SHAFT RESIST. (KIPS)	FACTORED SHAFT RESIST. (KIPS)	RANGE OF SERVICE LOADING AND CORRESPONDING SETTLEMENT: LOAD (KIPS)	SETTLEMENT (IN.)	LOAD (KIPS)	SETTLEMENT (IN.)
5.00	342.00	5.00	40.0	100.0	584	584	1.030	1.21	2558	3142	1571	750	0.11	1300	0.20
10.00	337.00	5.00	100.0	100.0	1414	1998	1.279	1.26	2663	4661	2331	1100	0.10	1900	0.18
15.00	332.00	5.00	100.0	100.0	1414	3412	1.373	1.27	2703	6115	3057	1500	0.12	2500	0.20
20.00	327.00	5.00	100.0	100.0	1414	4825	1.422	1.28	2724	7549	3775	1800	0.13	3100	0.23
25.00	322.00	5.00	100.0		1414	6239									
30.00	317.00	5.00	100.0		1414	7653									

Illinois Department of Transportation

DRILLED SHAFT AXIAL CAPACITY IN SHALE < 100 KSF

Drilled Shaft Design Table for Pier-1 (B-12)

Estimated Top of Shale Elevation: 347.00

SOCKET DEPTH (FT)	TIP ELEV. (FT)	NOMINAL TOTAL SIDE RESIST. (KIPS)	NOMINAL TIP RESIST. (KIPS)	NOMINAL SHAFT RESIST. (KIPS)	FACTORED SHAFT RESIST. (KIPS)	RANGE OF SERVICE LOADING AND CORRESPONDING SETTLEMENT: LOAD (KIPS)	SETTLEMENT (IN.)	LOAD (KIPS)	SETTLEMENT (IN.)
36 in. Diameter Drilled Shaft									
5	342	584	2558	3142	1571	750	0.11	1300	0.20
10	337	1998	2663	4661	2331	1100	0.10	1900	0.18
15	332	3412	2703	6115	3057	1500	0.12	2500	0.20
20	327	4825	2724	7549	3775	1800	0.13	3100	0.23
42 in. Diameter Drilled Shaft									
5	342	682	3441	4122	2061	1000	0.13	1700	0.24
10	337	2331	3599	5930	2965	1400	0.12	2400	0.21
15	332	3980	3661	7641	3821	1900	0.13	3100	0.22
20	327	5630	3693	9323	4661	2300	0.15	3800	0.25
48 in. Diameter Drilled Shaft									
5	342	779	4446	5225	2612	1300	0.15	2100	0.26
10	337	2664	4667	7331	3666	1800	0.14	3000	0.24
15	332	4549	4758	9307	4653	2300	0.14	3800	0.24
20	327	6434	4805	11239	5620	2800	0.16	4500	0.26
54 in. Diameter Drilled Shaft									
5	342	877	5571	6447	3224	1600	0.17	2600	0.30
10	337	2997	5867	8864	4432	2200	0.16	3600	0.26
15	332	5118	5992	11110	5555	2700	0.16	4500	0.27
20	327	7238	6059	13297	6649	3300	0.17	5400	0.28

Illinois Department of Transportation

DRILLED SHAFT AXIAL CAPACITY IN SHALE < 100 KSF

Drilled Shaft Design Table: Unit Resistances for Pier-1 (B-12)

Estimated Top of Shale Elevation: 347.00

LAYER ELEVATIONS (FT)	UNIT SIDE RESISTANCE		UNIT TIP RESISTANCE AT BASE OF LAYER — DRILLED SHAFT ϕ							
			36"		42"		48"		54"	
	NOM. (KSF)	FACT. (KSF)	NOM. (KSF)	FACT. (KSF)	NOM. (KSF)	FACT. (KSF)	NOM. (KSF)	FACT. (KSF)	NOM. (KSF)	FACT. (KSF)
347.00 - 342.00	12.4	6.2	361.8	180.9	357.6	178.8	353.8	176.9	350.3	175.1
342.00 - 337.00	31.0	15.5	376.8	188.4	374.0	187.0	371.4	185.7	368.9	184.4
337.00 - 332.00	31.0	15.5	382.4	191.2	380.5	190.2	378.6	189.3	376.8	188.4
332.00 - 327.00	31.0	15.5	385.3	192.7	383.9	191.9	382.4	191.2	381.0	190.5
327.00 - 322.00	31.0	15.5								
322.00 - 317.00	31.0	15.5								

Illinois Department of Transportation

DRILLED SHAFT AXIAL CAPACITY IN SHALE < 100 KSF

STRUCTURE ========================== SN 028-0052
SUBSTRUCTURE & REFERENCE BORING ==== Pier-2 (B-13)

ESTIMATED TOP OF SHALE ELEVATION ===== 374.30 FT
DRILLED SHAFT DIAMETER IN SHALE ======= 36 IN.
FACTORED AXIAL LOAD ================== 3000 KIPS

SOCKET DEPTH (FT)	TIP ELEV. (FT)	LAYER THICK. (FT)	UNCONFINED COMPRESSIVE STRENGTH (q_u) (KSF)	AVG. q_u W/IN 2 - SHAFT DIA. (KSF)	NOMINAL SIDE RESIST. (KIPS)	CUMULATIVE SIDE RESIST. (KIPS)	DEPTH CORR. FACTORS		NOMINAL TIP RESIST. (KIPS)	NOMINAL SHAFT RESIST. (KIPS)	FACTORED SHAFT RESIST. (KIPS)	RANGE OF SERVICE LOADING AND CORRESPONDING SETTLEMENT			
							k	d_c				LOAD (KIPS)	SETTLEMENT (IN.)	LOAD (KIPS)	SETTLEMENT (IN.)
5.00	369.30	5.00	40.0	100.0	584	584	1.030	1.21	2558	3142	1571	750	0.11	1300	0.20
10.00	364.30	5.00	100.0	100.0	1414	1998	1.279	1.26	2663	4661	2331	1100	0.10	1900	0.18
15.00	359.30	5.00	100.0	100.0	1414	3412	1.373	1.27	2703	6115	3057	1500	0.12	2500	0.20
20.00	354.30	5.00	100.0	100.0	1414	4825	1.422	1.28	2724	7549	3775	1800	0.13	3100	0.23
25.00	349.30	5.00	100.0		1414	6239									
30.00	344.30	5.00	100.0		1414	7653									

DRILLED SHAFT AXIAL CAPACITY IN SHALE < 100 KSF

Drilled Shaft Design Table for Pier-2 (B-13)

Estimated Top of Shale Elevation: 374.30

(Page 1 of 1)

SOCKET DEPTH (FT)	TIP ELEV. (FT)	NOMINAL TOTAL SIDE RESIST. (KIPS)	NOMINAL TIP RESIST. (KIPS)	NOMINAL SHAFT RESIST. (KIPS)	FACTORED SHAFT RESIST. (KIPS)	RANGE OF SERVICE LOADING AND CORRESPONDING SETTLEMENT LOAD (KIPS)	SETTLEMENT (IN.)	LOAD (KIPS)	SETTLEMENT (IN.)
36 in. Diameter Drilled Shaft									
5	369.3	584	2558	3142	1571	750	0.11	1300	0.20
10	364.3	1998	2663	4661	2331	1100	0.10	1900	0.18
15	359.3	3412	2703	6115	3057	1500	0.12	2500	0.20
20	354.3	4825	2724	7549	3775	1800	0.13	3100	0.23
42 in. Diameter Drilled Shaft									
5	369.3	682	3441	4122	2061	1000	0.13	1700	0.24
10	364.3	2331	3599	5930	2965	1400	0.12	2400	0.21
15	359.3	3980	3661	7641	3821	1900	0.13	3100	0.22
20	354.3	5630	3693	9323	4661	2300	0.15	3800	0.25
48 in. Diameter Drilled Shaft									
5	369.3	779	4446	5225	2612	1300	0.15	2100	0.26
10	364.3	2664	4667	7331	3666	1800	0.14	3000	0.24
15	359.3	4549	4758	9307	4653	2300	0.14	3800	0.24
20	354.3	6434	4805	11239	5620	2800	0.16	4500	0.26
54 in. Diameter Drilled Shaft									
5	369.3	877	5571	6447	3224	1600	0.17	2600	0.30
10	364.3	2997	5867	8864	4432	2200	0.16	3600	0.26
15	359.3	5118	5992	11110	5555	2700	0.16	4500	0.27
20	354.3	7238	6059	13297	6649	3300	0.17	5400	0.28

Drilled Shaft Design Table: Unit Resistances for Pier-2 (B-13)

Estimated Top of Shale Elevation: 374.30

LAYER ELEVATIONS (FT)	UNIT SIDE RESISTANCE		UNIT TIP RESISTANCE AT BASE OF LAYER — DRILLED SHAFT ϕ							
			36"		42"		48"		54"	
	NOM. (KSF)	FACT. (KSF)	NOM. (KSF)	FACT. (KSF)	NOM. (KSF)	FACT. (KSF)	NOM. (KSF)	FACT. (KSF)	NOM. (KSF)	FACT. (KSF)
374.30 - 369.30	12.4	6.2	361.8	180.9	357.6	178.8	353.8	176.9	350.3	175.1
369.30 - 364.30	31.0	15.5	376.8	188.4	374.0	187.0	371.4	185.7	368.9	184.4
364.30 - 359.30	31.0	15.5	382.4	191.2	380.5	190.2	378.6	189.3	376.8	188.4
359.30 - 354.30	31.0	15.5	385.3	192.7	383.9	191.9	382.4	191.2	381.0	190.5
354.30 - 349.30	31.0	15.5								
349.30 - 344.30	31.0	15.5								

Appendix F

L-Pile Table Inputs (SN028-0052)

	Depth (ft)	Elevation (ft)	Abbreviated Soil Description	Effective Unit Weight (pcf)	Cohesion (psf)	Phi (degrees)	Soil Modulus Parameter (pci)	E_{50}
NW Abutment (S-2)	0 to 12.1	425.9 to 413.8	Stiff Clay (without free water)	120	1800	--	500	0.007
	12.1 to 34	413.8 to 391.9	Soft to Medium Stiff Clay (with free water)	55	1000	--	100	0.01
	34 to 50	391.9 to 375.9	Soft Clay (with free water)	55	500	--	40	0.015
	50 to 67	375.9 to 358.9	Medium Stiff Clay (with free water)	55	1200	--	200	0.01
	67 to 72	358.9 to 353.9	Very Loose Submerged Sand	45	--	28	20	--
	72 to 84.5	353.9 to 341.4	Very Stiff Silty Loam (with free water)	60	2000	--	600	0.007
	84.5+	< 341.4	Shale (cemented c-ϕ material)	130	5000	12	2000	0.004

	Depth (ft)	Elevation (ft)	Abbreviated Soil Description	Effective Unit Weight (pcf)	Cohesion (psf)	Phi (degrees)	Soil Modulus Parameter (pci)	E_{50}
Pier-1 (B-12)	0 to 5	386 to 381	Submerged Medium Dense Sand	45	--	30	60	--
	5 to 18	381 to 368	Medium Stiff Clay (with free water)	55	1000	--	100	0.01
	18 to 25	368 to 361	Soft Clay (with free water)	55	250	--	30	0.02
	25 to 30	361 to 356	Medium Stiff Clay (with free water)	55	750	--	100	0.01
	30 to 38.5	356 to 347.5	Soft Clay (with free water)	55	250	--	30	0.02
	38.5+	< 347.5	Shale (cemented c-ϕ material)	130	5000	12	2000	0.004

	Depth (ft)	Elevation (ft)	Abbreviated Soil Description	Effective Unit Weight (pcf)	Cohesion (psf)	Phi (degrees)	Soil Modulus Parameter (pci)	E_{50}
Pier-2 (B-13)	0 to 8	394.3 to 386.3	Soft Clay (with free water)	55	250	--	30	0.02
	8 to 12	386.3 to 382.3	Medium Stiff Clay (with free water)	55	1000	--	100	0.01
	12 to 17	382.3 to 377.3	Submerged Dense Sand	45	--	32	120	--
	17+	< 377.3	Shale (cemented c-ϕ material)	130	5000	12	2000	0.004

	Depth (ft)	Elevation (ft)	Abbreviated Soil Description	Effective Unit Weight (pcf)	Cohesion (psf)	Phi (degrees)	Soil Modulus Parameter (pci)	E_{50}
SE Abutment (S-1)	0 to 9.5	425.4 to 415.9	Stiff Clay (without free water)	120	1500	--	500	0.008
	9.5 to 17	415.9 to 408.4	Soft Clay (with free water)	55	400	--	30	0.02
	17 to 32.5	408.4 to 392.9	Stiff Clay (with free water)	55	1600	--	500	0.007
	32.5+	< 392.9	Sandstone (Weak Rock)	135	10000	45	--	--

Bedrock	Effective Unit Weight (pcf)	Initial Rock Mass Modulus (psi)	Unaxial Compressive Strength (psi)	Rock Quality Designation (RQD) (%)	Strain Factor (krm)
Sandstone (Weak Rock)	135	30,000	135	0	0.00005

Appendix G

Illinois Department of Transportation

TEMPORARY SHEET PILE DESIGN CHARTS

STRUCTURE ============================ SN 028-0052
SUBSTRUCTURE & REFERENCE BORING ===== Staged Construction (S-1)

RETAINED HEIGHT (FT)	LAYER THICKNESS (FT)	SPT N-VALUE (BPF)	UNCONFINED COMPR. STRENGTH Qu (TSF)
5	3.5	2.1	2.1
	2.5	7	1.7
	2.5	9	1.1
	2.5	7	0.2
	2.5	10	0.5
	2.5	7	0.5
	2.5	11	1.1

(SOIL PROPERTIES BELOW EXCAVATION LINE)

COHESIVE CHARTS CONTROL USING AN EMBEDMENT DEPTH OF: 3.75 FT

AND REQUIRES A SECTION MODULUS OF: 0.94 IN.^{3}/FT

DEPTH BELOW EXCAV. (FT)	SPLIT LAYER THICK-NESS (FT)	SPLIT N AT DEPTH (BPF)	SPLIT Qu AT DEPTH (TSF)	AVG. N ABOVE DEPTH (BPF)	AVG. N IN UPPER 50% (BPF)	REQ'D CHART EMBED. DEPTH (FT)	AVG. N IN UPPER 33% (BPF)	REQ'D CHART SECT. MOD. W/ AMP. (IN.^{3}/FT)	RATIO LOWER/ UPPER 1/3 N	AVG. Qu ABOVE DEPTH (TSF)	AVG. Qu IN UPPER 50% (TSF)	REQ'D CHART EMBED. DEPTH (FT)	AVG. Qu IN UPPER 33% (TSF)	REQ'D CHART SECT.MOD. W/ AMP. (IN.^{3}/FT)	RATIO OF LOWER/ UPPER 1/3 Qu
0.88	0.875	21	2.1	21.00						2.10					
1.75	0.875	21	2.1	21.00						2.10					
2.63	0.875	21	2.1	21.00	21.00	~~7.14~~	21.00		1.00	2.10	2.10	~~3.75~~	2.10		1.00
3.50	0.875	21	2.1	21.00	21.00	~~7.14~~	21.00		1.00	2.10	2.10	~~3.75~~	2.10		1.00
3.81	0.3125	17	1.7	20.67	21.00	~~7.14~~	21.00		1.00	2.07	2.10	3.75	2.10	0.94	1.00
4.13	0.3125	17	1.7	20.39	21.00	~~7.18~~	21.00		1.00	2.04	2.10		2.10		1.00
4.44	0.3125	17	1.7	20.15	21.00	~~7.21~~	21.00		1.00	2.02	2.10		2.10		1.00
4.75	0.3125	17	1.7	19.95	21.00	~~7.24~~	21.00		1.00	1.99	2.10		2.10		1.00
5.06	0.3125	17	1.7	19.77	21.00	~~7.26~~	21.00		1.00	1.98	2.10		2.10		1.00
5.38	0.3125	17	1.7	19.60	21.00	~~7.29~~	21.00		1.00	1.96	2.10		2.10		1.00
5.69	0.3125	17	1.7	19.46	21.00	~~7.30~~	21.00		1.00	1.95	2.10		2.10		1.00
6.00	0.3125	17	1.7	19.33	21.00	~~7.32~~	21.00		1.00	1.93	2.10		2.10		1.00
6.31	0.3125	11	1.1	18.92	21.00	~~7.34~~	21.00		1.00	1.89	2.10		2.10		1.00
6.63	0.3125	11	1.1	18.55	21.00	~~7.39~~	21.00		1.00	1.85	2.10		2.10		1.00
6.94	0.3125	11	1.1	18.21	21.00	~~7.44~~	21.00		1.00	1.82	2.10		2.10		1.00
7.25	0.3125	11	1.1	17.90	20.86	~~7.49~~	21.00		1.00	1.79	2.09		2.10		1.00
7.56	0.3125	11	1.1	17.61	20.70	7.53	21.00	2.23	1.00	1.76	2.07		2.10		1.00

Appendix H

Benchmark: BM 134 - Chiseled square on south parapet wall on east end of SN 028-0052 - Elevation 427.322

Existing Structure: SN 028-0052 Built In 1966, Station 362+00.00 under Section 112 B-3 to carry S.B.I Rte 183. 5-span reinforced concrete deck on continous non-composite steel beams with welded cover plates supported by abutments and multi-column piers on rock. The structure length is 292'-2" bk. to bk. abutments. and 36'-0" out to out deck. Bridge alignment follows roadway horizontal curve. Superstructure is chorded beam sections at splices with variable overhangs.

Traffic Control: Traffic to be maintained utilizing staged construction by utilizing temporary signals to allow for two-way traffic on one lane.

No Salvage

SEISMIC DATA

Seismic Performance Zone (SPZ) = 3
Design Spectral Acceleration at 1.0 Sec. (SD1) = 0.142
Design Spectral Acceleration at 0.2 Sec. (SDS) = 0.547
Soil Site Class = D

DESIGN STRESSES

FIELD UNITS

f'c = 3,500 psi (Substructure)
f'c = 4,000 psi (Superstructure & Drilled shafts)
fy = 60,000 psi (Reinforcement)
fy = 50,000 psi (M270 Grade 50)
Steel girders to be metallized

DESIGN SPECIFICATIONS

2020 AASHTO LRFD Bridge Design Specifications, 9th Edition

LIVE LOAD DEFLECTION

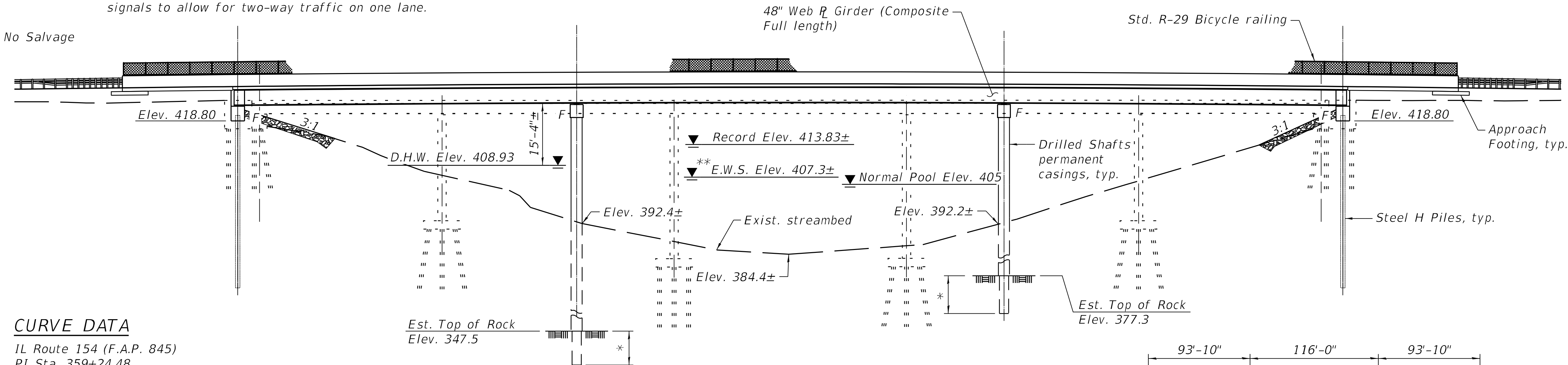
Live Load Deflection ≤ Span Length/1000

LOADING HL-93

Allow 50#/Sq. Ft. for future wearing surface

HIGHWAY CLASSIFICATION

Functional Class: Minor Arterial
IL. Rte. 154 (F.A.P. 845)
ADT: 3,150 (2019); 4,040 (2044)
ADTT: 570 (2019); 730 (2044)
DHV: 365 (2044)
Design Speed: 60 m.p.h.
Posted Speed: 55 m.p.h.
Two-way Traffic distribution: 50:50

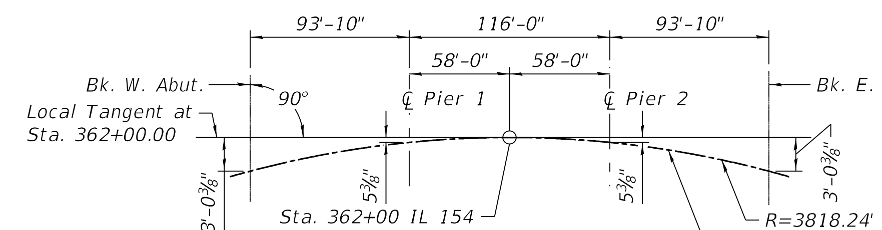


ELEVATION

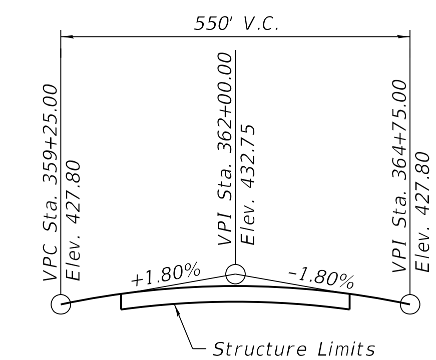
*Rock Socket Depth to be determined in final design
** Rend Lake is a controlled pool by U.S. Army Corps of Engineers
Normal Pool elev. 405.0
Record Elev. 413.83

CURVE DATA

IL Route 154 (F.A.P. 845)
PI Sta. 359+24.48
Δ=48°02'07" Rt.
D=1°30'02"
R=3818.24'
T=1701.40'
L=3201.11'
E=361.92'
PC Sta. 342+23.08
PT Sta. 374+24.19

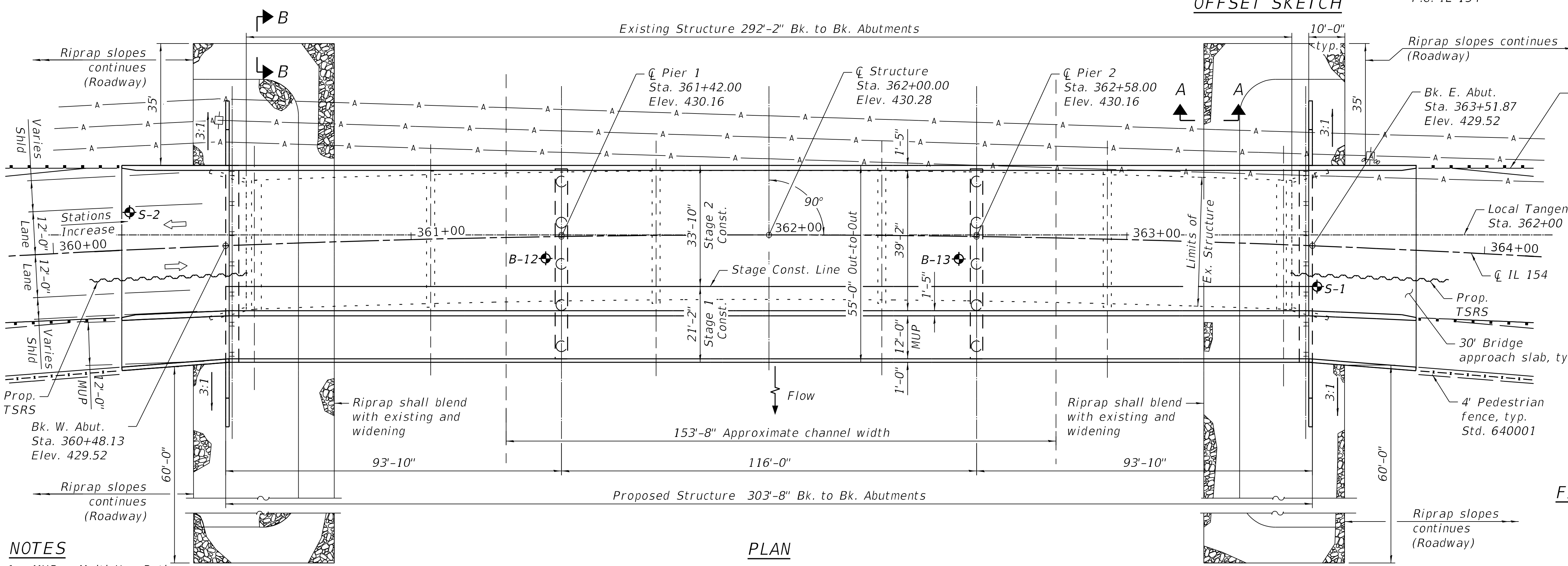


OFFSET SKETCH

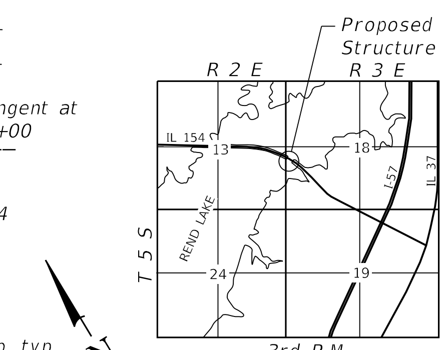


PROFILE GRADE

(Along ℄ IL Rte. 154)



PLAN



LOCATION SKETCH

NOTES

1- MUP = Multi-Use Path

GENERAL PLAN & ELEVATION
IL 154 OVER REND LAKE
FAP ROUTE 845 - SECTION 112B-4
FRANKLIN COUNTY
STATION 362+00.00
STRUCTURE NO. 028-0095

ABNA DESIGN FIRM REG. 184.002117
4140 Lindell Blvd.
St. Louis, MO 63108
Ph. (314) 454-0222
Fax: (314) 454-1253

USER NAME =	DESIGNED - FH	REVISED -	
	CHECKED - SEA	REVISED -	
PLOT SCALE =	DRAWN - MBJ	REVISED -	
PLOT DATE = 6/28/2024	CHECKED - SEA / FH	REVISED -	

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

SHEET 1 OF 4 SHEETS

F.A.P. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
845	112B-4	FRANKLIN	4	1

CONTRACT NO. 78786

ILLINOIS FED. AID PROJECT

MODEL: Default
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WATERWAY INFORMATION

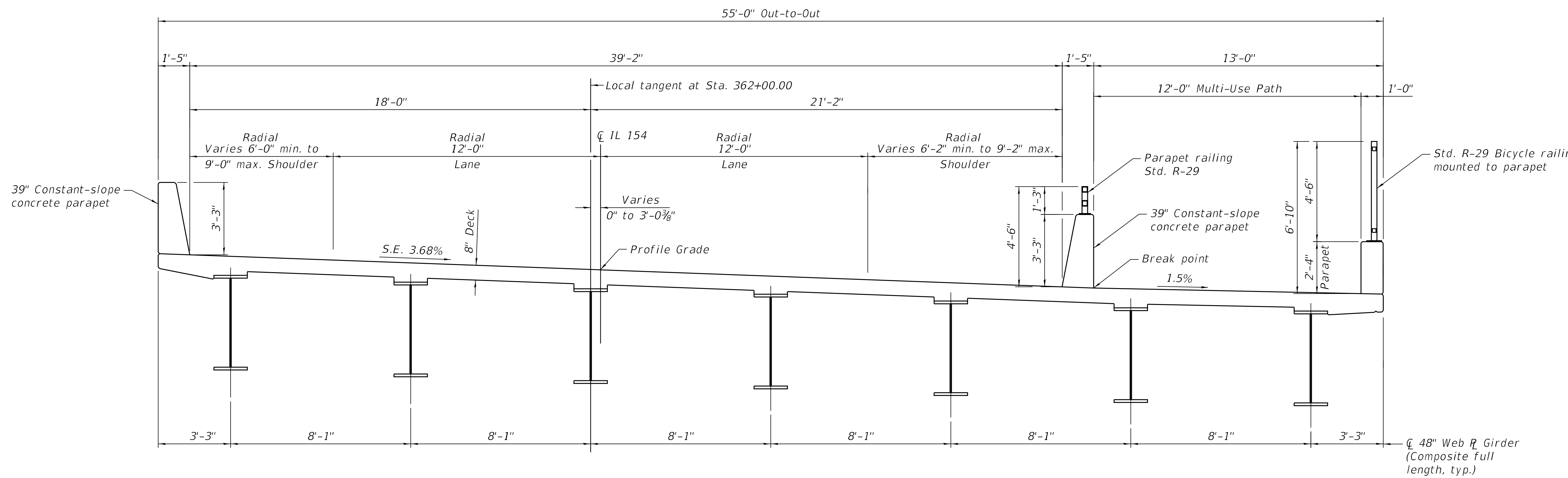
Drainage Area = 46 Sq. mi.
Exist. Overtopping Elev. - 417.95 @ Sta. 325+62.12-348+44.65
Prop. Overtopping Elev. - 417.95 @ Sta. 325+62.12-348+44.65

Flood Event	Freq. Yr.	Discharge Q C.F.S.	Waterway Opening Ft² Exist.	Waterway Opening Ft² Prop.	Nat. H.W.E.	Head - Ft. Exist.	Head - Ft. Prop.	Headwater Elev. Exist.	Headwater Elev. Prop.
10 Year	10	3,310	2824	2842	408.01	0.0	0.0	408.01	408.01
Design	50	5,035	3046	3068	408.93	0.0	0.0	408.93	408.93
Base	100	5,773	3157	3180	409.27	0.0	0.0	409.27	409.27
Scour Check	200	6,480	3279	3305	409.57	0.0	0.0	409.57	409.57
Max. Calc.	500	7,661	3451	3479	410.05	0.0	0.0	410.05	410.05

10 Year velocity through existing bridge = 1.2 ft/s
10 Year velocity through proposed bridge = 1.2 ft/s

DESIGN SCOUR ELEVATION TABLE

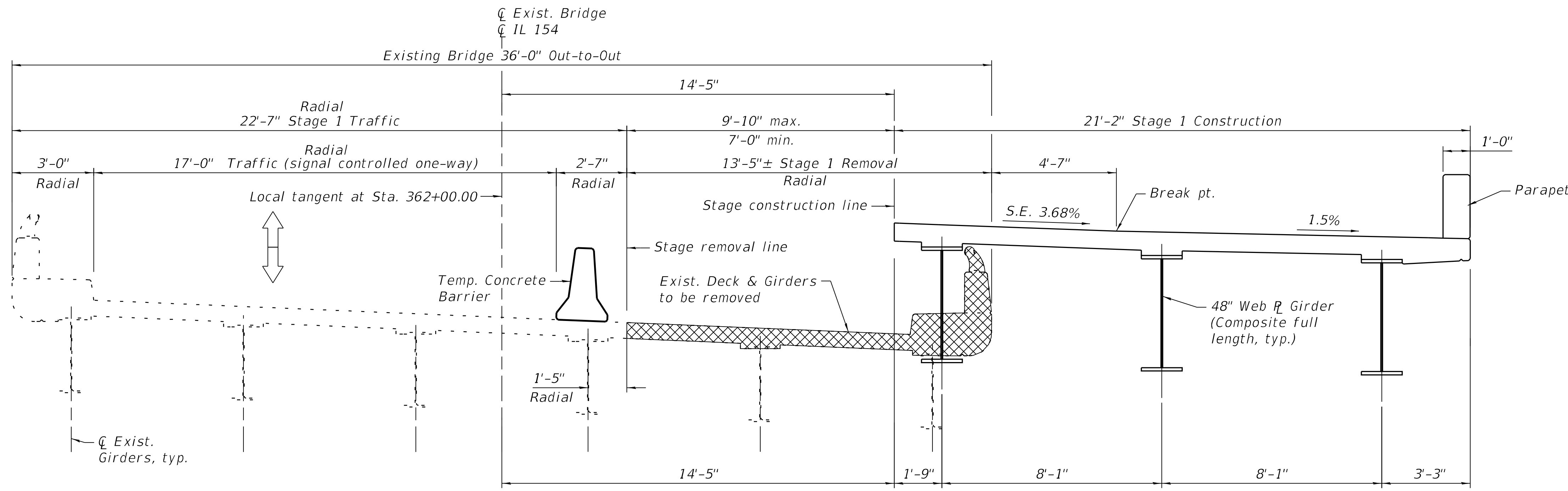
Event / Limit State	Design Scour Elevations (ft.) E. Abut.	Pier 1	Pier 2	W. Abut.	Item 113
Q100	418.8	380.8	380.8	418.8	5
Q200	418.8	380.6	380.6	418.8	
Design	418.8	380.8	380.8	418.8	
Check	418.8	380.6	380.6	418.8	



FINAL CROSS SECTION

(Looking East - Upstation)

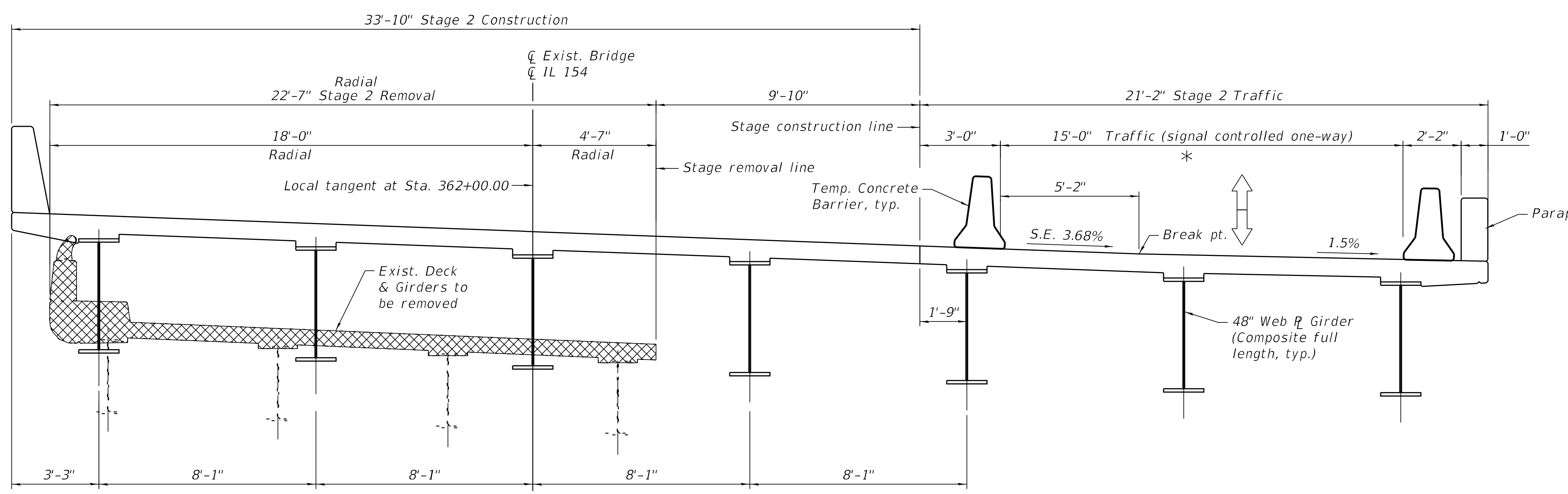
CROSS SECTION
IL 154 OVER REND LAKE
FAP ROUTE 845 - SECTION 112B-4
FRANKLIN COUNTY
STATION 362+00.00
STRUCTURE NO. 028-0095



STAGE 1 REMOVAL & CONSTRUCTION

(Looking East - Upstation)

* After stage 2 is complete, traffic shall be placed into the final configuration with TCB in place while parapet and rail is installed at the edge of shoulder / multi-use path.



STAGE 2 REMOVAL & CONSTRUCTION

(Looking East - Upstation)

CONSTRUCTION STAGING
IL 154 OVER REND LAKE
FAP ROUTE 845 - SECTION 112B-4
FRANKLIN COUNTY
STATION 362+00.00
STRUCTURE NO. 028-0095

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STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

SHEET 3 OF 4 SHEETS

F.A.P. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
845	112B-4	FRANKLIN	4	3

CONTRACT NO. 78786

ILLINOIS | FED. AID PROJECT

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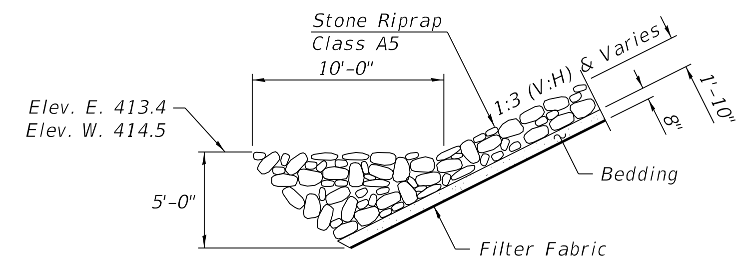
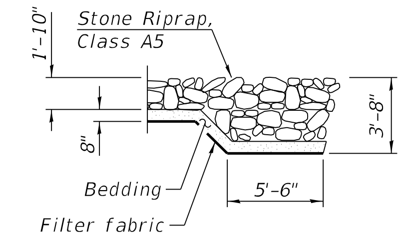
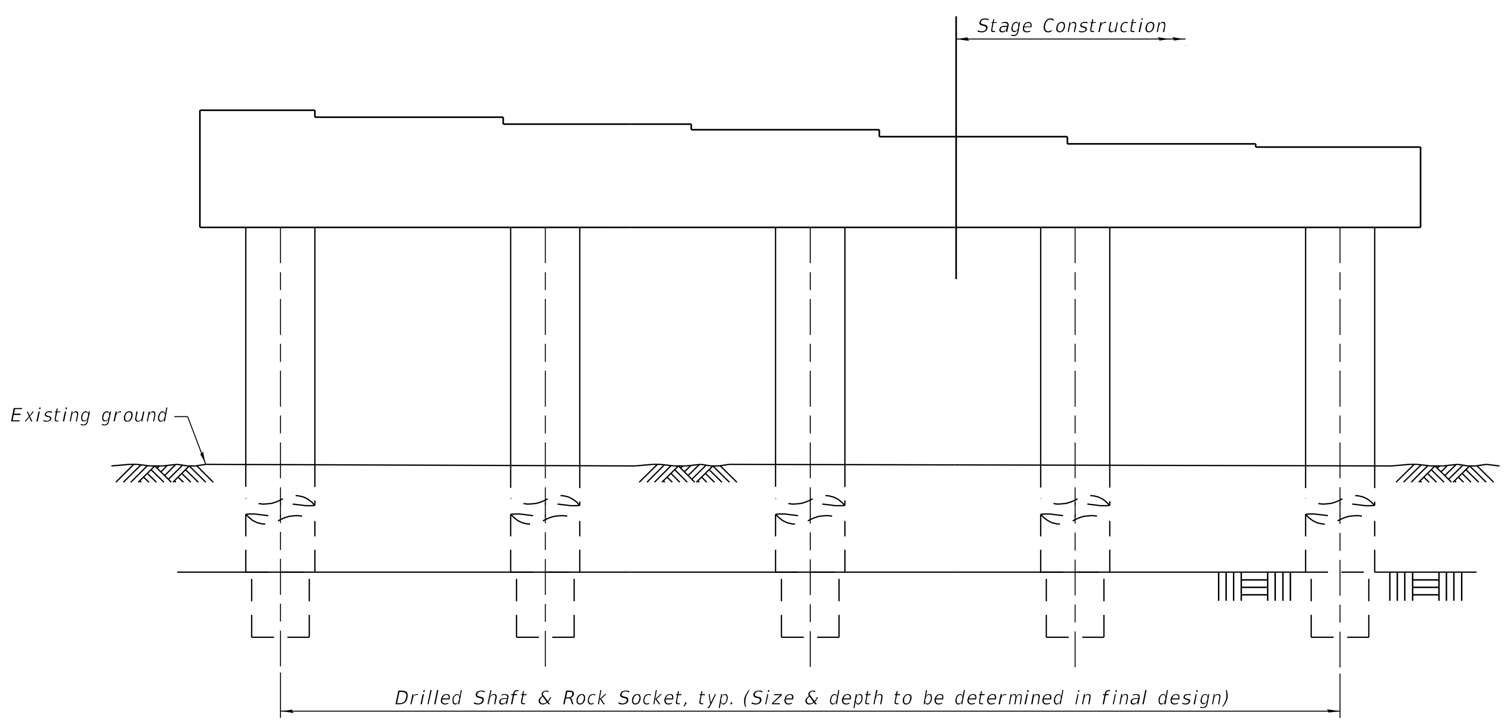


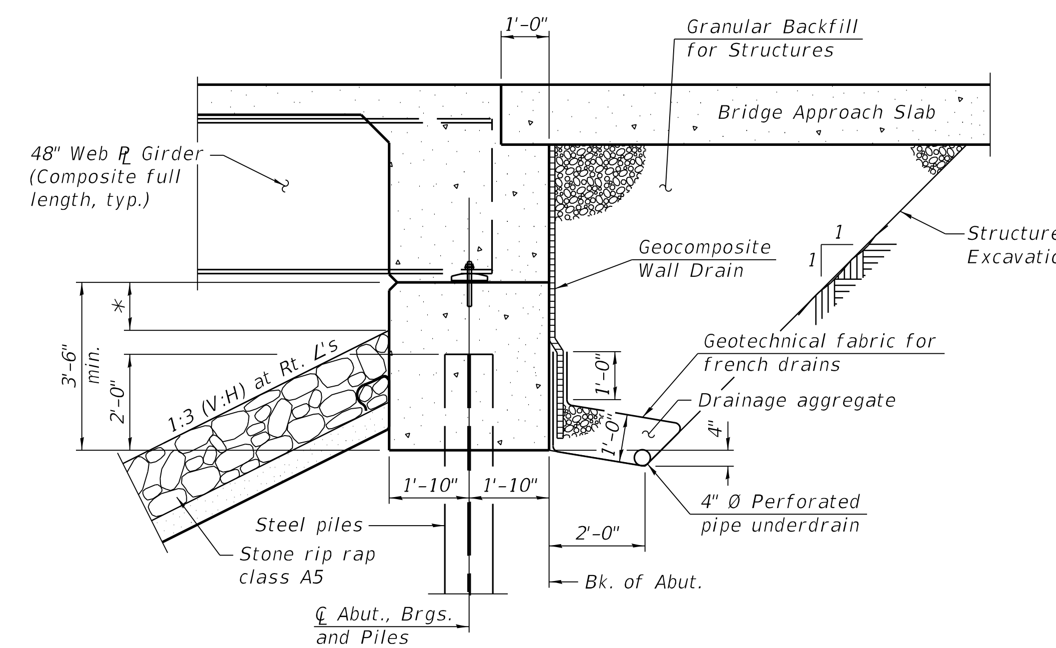
SECTION A-A



SECTION B-B



PIER SKETCH



SECTION THRU INTEGRAL ABUTMENT

(Horiz. dim. at Rt. ∠'s)

* 1'-0" min. to 2'-0" max. at low bearing seat

DETAILS
IL 154 OVER REND LAKE
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STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

SHEET 4 OF 4 SHEETS

F.A.P. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
845	112B-4	FRANKLIN	4	4
		CONTRACT NO. 78786		
		ILLINOIS	FED. AID PROJECT	

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Important Information about This 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.

The Geoprofessional Business Association (GBA) has prepared this advisory to help you – assumedly a client representative – interpret and apply this geotechnical-engineering report as effectively as possible. In that way, you can benefit from a lowered exposure to problems associated with subsurface conditions at project sites and development of them that, for decades, have been a principal cause of construction delays, cost overruns, claims, and disputes. If you have questions or want more information about any of the issues discussed herein, contact your GBA-member geotechnical engineer. Active engagement in GBA exposes geotechnical engineers to a wide array of risk-confrontation techniques that can be of genuine benefit for everyone involved with a construction project.

Understand the Geotechnical-Engineering Services Provided for this Report

Geotechnical-engineering services typically include the planning, collection, interpretation, and analysis of exploratory data from widely spaced borings and/or test pits. Field data are combined with results from laboratory tests of soil and rock samples obtained from field exploration (if applicable), observations made during site reconnaissance, and historical information to form one or more models of the expected subsurface conditions beneath the site. Local geology and alterations of the site surface and subsurface by previous and proposed construction are also important considerations. Geotechnical engineers apply their engineering training, experience, and judgment to adapt the requirements of the prospective project to the subsurface model(s). Estimates are made of the subsurface conditions that will likely be exposed during construction as well as the expected performance of foundations and other structures being planned and/or affected by construction activities.

The culmination of these geotechnical-engineering services is typically a geotechnical-engineering report providing the data obtained, a discussion of the subsurface model(s), the engineering and geologic engineering assessments and analyses made, and the recommendations developed to satisfy the given requirements of the project. These reports may be titled investigations, explorations, studies, assessments, or evaluations. Regardless of the title used, the geotechnical-engineering report is an engineering interpretation of the subsurface conditions within the context of the project and does not represent a close examination, systematic inquiry, or thorough investigation of all site and subsurface conditions.

Geotechnical-Engineering Services are Performed for Specific Purposes, Persons, and Projects, and At Specific Times

Geotechnical engineers structure their services to meet the specific needs, goals, and risk management preferences of their clients. A geotechnical-engineering study conducted for a given civil engineer will not likely meet the needs of a civil-works constructor or even a different civil engineer. Because each geotechnical-engineering study is unique, each geotechnical-engineering report is unique, prepared *solely* for the client.

Likewise, geotechnical-engineering services are performed for a specific project and purpose. For example, it is unlikely that a geotechnical-engineering study for a refrigerated warehouse will be the same as one prepared for a parking garage; and a few borings drilled during a preliminary study to evaluate site feasibility will not be adequate to develop geotechnical design recommendations for the project.

Do not rely on this report if your geotechnical engineer prepared it:
- for a different client;
- for a different project or purpose;
- for a different site (that may or may not include all or a portion of the original site); or
- before important events occurred at the site or adjacent to it; e.g., man-made events like construction or environmental remediation, or natural events like floods, droughts, earthquakes, or groundwater fluctuations.

Note, too, the reliability of a geotechnical-engineering report can be affected by the passage of time, because of factors like changed subsurface conditions; new or modified codes, standards, or regulations; or new techniques or tools. *If you are the least bit uncertain* about the continued reliability of this report, contact your geotechnical engineer before applying the recommendations in it. A minor amount of additional testing or analysis after the passage of time – if any is required at all – could prevent major problems.

Read this Report in Full

Costly problems have occurred because those relying on a geotechnical-engineering report did not read the report in its entirety. Do not rely on an executive summary. Do not read selective elements only. *Read and refer to the report in full.*

You Need to Inform Your Geotechnical Engineer About Change

Your geotechnical engineer considered unique, project-specific factors when developing the scope of study behind this report and developing the confirmation-dependent recommendations the report conveys. Typical changes that could erode the reliability of this report include those that affect:
- the site's size or shape;
- the elevation, configuration, location, orientation, function or weight of the proposed structure and the desired performance criteria;
- the composition of the design team; or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project or site changes – even minor ones – and request an assessment of their impact. *The geotechnical engineer who prepared this report cannot accept* *responsibility or liability for problems that arise because the geotechnical engineer was not informed about developments the engineer otherwise would have considered.*

Most of the "Findings" Related in This Report Are Professional Opinions

Before construction begins, geotechnical engineers explore a site's subsurface using various sampling and testing procedures. *Geotechnical engineers can observe actual subsurface conditions only at those specific locations where sampling and testing is performed.* The data derived from that sampling and testing were reviewed by your geotechnical engineer, who then applied professional judgement to form opinions about subsurface conditions throughout the site. Actual sitewide-subsurface conditions may differ – maybe significantly – from those indicated in this report. Confront that risk by retaining your geotechnical engineer to serve on the design team through project completion to obtain informed guidance quickly, whenever needed.

This Report's Recommendations Are Confirmation-Dependent

The recommendations included in this report – including any options or alternatives – are confirmation-dependent. In other words, they are <u>not</u> final, because the geotechnical engineer who developed them relied heavily on judgement and opinion to do so. Your geotechnical engineer can finalize the recommendations *only after observing actual subsurface conditions* exposed during construction. If through observation your geotechnical engineer confirms that the conditions assumed to exist actually do exist, the recommendations can be relied upon, assuming no other changes have occurred. *The geotechnical engineer who prepared this report cannot assume responsibility or liability for confirmation-dependent recommendations if you fail to retain that engineer to perform construction observation.*

This Report Could Be Misinterpreted

Other design professionals' misinterpretation of geotechnical-engineering reports has resulted in costly problems. Confront that risk by having your geotechnical engineer serve as a continuing member of the design team, to:

- confer with other design-team members;
- help develop specifications;
- review pertinent elements of other design professionals' plans and specifications; and
- be available whenever geotechnical-engineering guidance is needed.

You should also confront the risk of constructors misinterpreting this report. Do so by retaining your geotechnical engineer to participate in prebid and preconstruction conferences and to perform construction-phase observations.

Give Constructors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can shift unanticipated-subsurface-conditions liability to constructors by limiting the information they provide for bid preparation. To help prevent the costly, contentious problems this practice has caused, include the complete geotechnical-engineering report, along with any attachments or appendices, with your contract documents, *but be certain to note conspicuously that you've included the material for information purposes only.* To avoid misunderstanding, you may also want to note that "informational purposes" means constructors have no right to rely on the interpretations, opinions, conclusions, or recommendations in the report. Be certain that constructors know they may learn about specific project requirements, including options selected from the report, *only* from the design drawings and specifications. Remind constructors that they may perform their own studies if they want to, and *be sure to allow enough time* to permit them to do so. Only then might you be in a position to give constructors the information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions. Conducting prebid and preconstruction conferences can also be valuable in this respect.

Read Responsibility Provisions Closely

Some client representatives, design professionals, and constructors do not realize that geotechnical engineering is far less exact than other engineering disciplines. This happens in part because soil and rock on project sites are typically heterogeneous and not manufactured materials with well-defined engineering properties like steel and concrete. That lack of understanding has nurtured unrealistic expectations that have resulted in disappointments, delays, cost overruns, claims, and disputes. To confront that risk, geotechnical engineers commonly include 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 <u>Not</u> Covered

The personnel, equipment, and techniques used to perform an environmental study – e.g., a "phase-one" or "phase-two" environmental site assessment – differ significantly from those used to perform a geotechnical-engineering study. For that reason, a geotechnical-engineering report does not usually provide environmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated subsurface environmental problems have led to project failures.* If you have not obtained your own environmental information about the project site, ask your geotechnical consultant for a recommendation on how to find environmental risk-management guidance.

Obtain Professional Assistance to Deal with Moisture Infiltration and Mold

While your geotechnical engineer may have addressed groundwater, water infiltration, or similar issues in this report, the engineer's services were not designed, conducted, or intended to prevent migration of moisture – including water vapor – from the soil through building slabs and walls and into the building interior, where it can cause mold growth and material-performance deficiencies. Accordingly, ***proper implementation of the geotechnical engineer's recommendations will <u>not</u> of itself be sufficient to prevent moisture infiltration. Confront the risk of moisture infiltration*** by including building-envelope or mold specialists on the design team. ***Geotechnical engineers are <u>not</u> building-envelope or mold specialists.***

GEOPROFESSIONAL BUSINESS ASSOCIATION

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