Structural Geotechnical Report

IDOT PTB 198-003
FAI-80 (I-80) over Des Plaines River Bridge
Proposed Bridge Carrying IL 53/US 52 (Chicago Street) over Hickory Creek
SN: 099-8306
Will County, Illinois

Prepared for

Illinois Department of Transportation
Contract Number: D-91-204-19

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May 21, 2024

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Dear Mr. Skaleski:

Attached is a copy of the Structural Geotechnical Report for the above referenced project. The report provides a description of the site investigation, site conditions and foundation and construction recommendations. The site investigation for the proposed bridge construction included advancing eight (8) soil borings to depths ranging from 18.5 to 38.6 feet.

Should you have any questions or require additional information, please call us at 630-994-2600.

Sincerely,

Rachel Miller, P.E.
Sr. Project Engineer

Ala E Sassila, Ph.D., P.E.
Principal

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1.0 INTRODUCTION

GSG Consultants, Inc. (GSG) completed a geotechnical investigation for the proposed bridge carrying IL 53/US 52 (Chicago Street) over Hickory Creek in the City of Joliet in Will County, Illinois. The purpose of the investigation was to explore the subsurface conditions, to determine engineering properties of the subsurface soil, and develop design and construction recommendations for the proposed bridge. **Exhibit 1** shows the general project location.

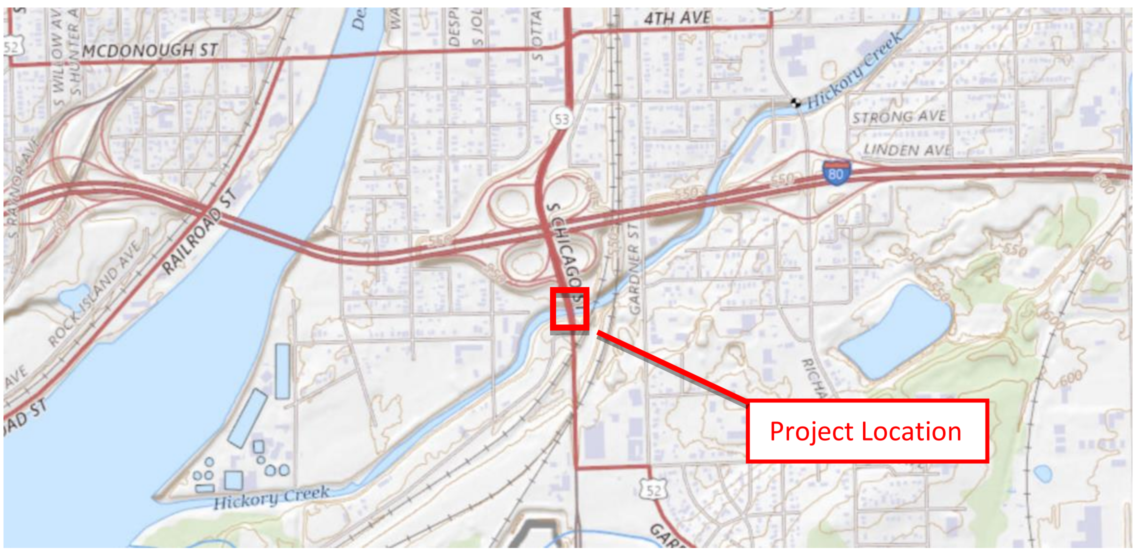


Exhibit 1 – Project Location Map
(Source: USGS Topographic Maps, usgs.gov)

1.1 Existing Bridge Information

The existing structure is a 3-span bridge carrying IL 53/US 52 (Chicago Street) over Hickory Creek. The bridge has 4 lanes of traffic with minimal shoulders. Below each abutment, the side slopes from Hickory Creek to the abutments are assumed to be at an approximate 2.5H:1V slope.

Exhibits 2a and 2b show the existing conditions of the bridge to be replaced. It is understood that the new bridge will be constructed in approximately the same location.

Exhibit 2a – Existing Bridge, Looking North

Exhibit 2b – Aerial View of Existing Bridge, Looking Northeast

1.2 Proposed Bridge Information

Based on information (**Appendix A**) provided by WSP, a new bridge will be constructed for US 52/IL 53 (Chicago Street) over Hickory Creek. The General Plan & Elevation (GPE) dated March 1, 2024, shows that the new structure will be a 3-span bridge with two piers in Hickory Creek. The bridge location appears to remain similar to the existing structure, however, the new bridge will be wider to incorporate additional lanes, including 2 southbound lanes, 2 northbound lanes, a left turn northbound lane, northbound auxiliary lane, northbound and southbound shoulders, and a shared use path.

The total length of the new bridge structure is anticipated to be approximately 193.5 feet abutment to abutment, and the out-to-out width will range from 89.5 to 114 feet, narrowing from north to south. Based on the GPE drawing, the abutments will likely be supported on steel H-piles, and new side slopes of 2H:1V (north abutment) and 2.5H:1V (south abutment), covered by concrete slopewalls, will be constructed below the abutments. The anticipated factored load per abutment pile is 223 kips.

Based on the latest information from WSP, the north and south bridge piers will be wall piers supported on piles. The Pier 1 and Pier 2 foundations will support factored loads of 50.6 k/ft and 48.6 k/ft, respectively. Cofferdams are anticipated to be used to construct the piers in Hickory Creek, which has a determinant high water (D.H.W.) elevation of 521.91 feet.

2.0 SITE SUBSURFACE CONDITIONS

This section describes the subsurface exploration program and laboratory testing program completed as part of this project. The proposed locations and depths of the soil borings were selected in accordance with IDOT requirements and reviewed with WSP. The borings were completed in the field based on field conditions and accessibility.

2.1 Subsurface Exploration and Laboratory Testing

The site subsurface exploration for the proposed bridge was conducted between April 14 and June 7, 2022. The investigation included advancing eight (8) borings to depths between 18.5 and 38.6 feet. The locations of the soil borings were reviewed by WSP and adjusted in the field as necessary based on utilities and access. Elevations and as-drilled locations for the borings were gathered by GSG's field crew using GPS surveying equipment. The approximate as-drilled locations of the soil borings are shown on the Soil Boring Location Plan & Subsurface Profiles **(Appendix B)**. **Table 1** presents a summary of the borings used for the proposed bridge analyses.

Table 1 – Summary of Subsurface Exploration Borings

Abutment/Pier Location	Boring ID	Station *	Offset (ft)/ Direction	Depth (ft)	Surface Elevation (ft)
North Abutment	BSB-69	206+36.29	68.4 LT	37.0[1]	535.4
Pier 2 (North Pier)	BSB-70	205+8.37	47.2 LT	36.2[1]	533.8
Pier 1 (South Pier)	BSB-71	204+28.24	33.7 LT	36.1[1]	534.9
South Abutment	BSB-72	203+57.66	24.8 LT	18.5	531.3
North Abutment	BSB-73	206+50.64	14.6 LT	25.0	539.4
Pier 2 (North Pier)	BSB-74	205+9.31	11.2 RT	38.6[1]	535.5**
Pier 1 (South Pier)	BSB-75	204+29.21	18.3 RT	37.3[1]	536.2
South Abutment	BSB-76	203+67.94	21.4 RT	33.5[1]	533.8

* Based on proposed Chicago Street stationing

**Elevation approximated based on the available online resources

1 – includes 15-foot rock core depth

The soil borings were drilled using truck mounted Diedrich D-50 (hammer efficiency 97%) and CME-75 (hammer efficiency 91%) drill rigs, each equipped with 3¼-inch I.D. hollow stem augers and an automatic hammer. Soil sampling was performed according to AASHTO T 206, "Penetration Test and Split Barrel Sampling of Soils." Soil samples were obtained at 2.5-foot intervals to the boring termination depths or upon encountering auger refusal on apparent bedrock. Borings BSB-70, BSB-71, BSB-74, and BSB-75 were extended through the concrete bridge deck and encountered about 19 to 23 feet of air void before drilling into the rock below. Water level measurements were made in each boring when evidence of free groundwater was detected on the drill rods or in the samples. The boreholes were also checked for free water immediately after auger removal, and before filling the open boreholes with soil cuttings and surface patching with concrete and asphalt where necessary to match the existing pavement or bridge deck. Copies of the Soil Boring Logs are provided in **Appendix C**.

GSG's field representative inspected, visually classified and logged the soil samples during the subsurface exploration activities and performed unconfined compressive strength tests on cohesive soil samples using a calibrated Rimac compression tester and a calibrated hand penetrometer in accordance with IDOT procedures and requirements. Representative soil samples were collected from each sample interval and were placed in jars and returned to the laboratory for further testing and evaluation.

GSG also collected rock core runs from six of the soil boring locations with the use of a ten-foot and/or a five-foot, diamond bit, NX-5 split core barrel during the investigation. The bedrock cores were evaluated in the field for texture, physical condition, recovery percentage, and Rock Quality Designation (RQD). The extracted samples were visually inspected and classified, and the Rock Quality Designation (RQD) was determined according to ASTM D 6032, "Standard Test Method for Determining Rock Quality Designation (RQD) of Rock Core" by totaling all sections with a length in excess of four (4) inches and dividing it by the total length of the core run. The RQD is given a classification based upon the numeric value as indicated in **Table 2**.

Table 2 – Rock Quality Designation Summary

Rock Quality Designation	Descriptions
< 25%	Very Poor
25 – 50%	Poor
51 – 75%	Fair
76 – 90%	Good
91 – 100%	Excellent

2.2 Laboratory Testing Program

All samples were inspected in the laboratory to verify the field classifications. A laboratory testing program was undertaken to characterize and determine engineering properties of the subsurface soils encountered in the area of the proposed bridge.

The following laboratory tests were performed on representative soil and rock samples:

- Moisture content ASTM D2216 / AASHTO T-265
- Atterberg Limits – AASHTO T-89 / AASHTO T-90
- Organic Content – AASHTO T-267
- Unconfined Compression Strength on Rock – ASTM D2938

The laboratory tests were performed in accordance with test procedures outlined in the most current IDOT Geotechnical Manual, and per ASTM and AASHTO requirements. Based on the laboratory test results, the soils encountered were classified according to the AASHTO and the Illinois Division of Highways (IDH) classification systems. The results of the laboratory testing program are included in the Laboratory Test Results **(Appendix D)** and are also shown along with the field test results in the Soil Boring Logs **(Appendix C)**.

2.3 Subsurface Soil Conditions

This section provides a brief description of the soils encountered in the borings performed in the vicinity of the proposed bridge. Variations in the general subsurface soil profile were noted during the drilling activities. Detailed descriptions of the subsurface soils are provided in the soil boring logs and are shown graphically in the Boring Location Plan & Subsurface Profiles. The soil boring logs provide specific conditions encountered at each boring location and include soil descriptions, stratifications, penetration resistance, elevations, location of the samples, and laboratory test data. Unless otherwise noted, soil descriptions indicated on boring logs are visual identifications. The stratifications shown on the boring logs represent the conditions only at the actual boring locations and represent the approximate boundary between subsurface materials; however, the actual transition may be gradual.

The surface elevations of the borings completed along the existing Hickory Street Bridge and the adjoining Chicago Street pavements ranged between 531.3 and 539.4 feet. The borings along Chicago Street noted 3 to 4 inches asphalt over 9 to 11 inches of concrete.

Soil borings BSB-70, BSB-71, BSB-74, and BSB-75 were drilled through the existing Hickory Creek bridge deck, through an air void, to the creek bed below. The bridge deck borings encountered 9.5 to 10 inches of concrete. Below the bridge deck, the boring casing extended between 19 feet 11 inches to 22 feet 6 inches before encountering up to 3 inches of gravel, then the top of limestone bedrock at El. 513.9 to 512.2 feet.

Below the pavement materials, the abutment borings, BSB-69, BSB-72, BSB-73, and BSB-76, encountered various fill soils ranging to depths of 3 and 3.5 feet (El. 535.9 to 527.8 feet). The fill materials were predominantly silty clay, with unconfined compressive strengths ranging from 1.0 to 3.0 tons per square foot (tsf). Sand and gravel fill was encountered at boring BSB-73 and exhibited an SPT N-value of 19 blows per foot (bpf).

Underlying the fill layers, the north and south abutment borings encountered brown and gray, very loose to medium dense sand and gravel to depths of 8.5 to 23.0 feet (El. 522.8 to 516.4 feet). This layer generally had SPT N-values between 3 bpf and 50 blows for 3 inches. Cobbles were noted within the upper granular soils at depths of 6 and 11 feet at boring locations BSB-69 and BSB-72. A thin, very loose sandy loam layer was encountered below the sand and gravel at BSB-69, to a depth of 18.5 feet (El. 516.9 feet). Below the granular soils, the borings typically encountered very soft to stiff silty clay loam and silty clay to depths of 16 to 21 feet (El. 517.8 to 512.8 feet). Typically, the clay soils were underlain by very dense sand/sandy loam extending to the limestone bedrock at depths of 18.5 to 25 feet (El. 515.3 to 512.2 feet). Limestone fragments and gravel were noted at various depths within the sand/sandy loam layer. The very dense sand/sandy loam had SPT blow counts ‘N’ values ranging between 50 blows for 3 inches and 50 blows for 2 inches. Borings BSB-72 and BSB-73 were terminated upon encountering practical auger refusal on the limestone bedrock. Rock cores were drilled at borings BSB-69, BSB-70, BSB-71, BSB-74, BSB-75, and BSB-76 to termination at depths of 33.5 to 38.6 feet (El. 500.3 to 496.9 feet).

The bedrock cores generally consisted of light gray limestone, with slight to moderate weathering and slight to heavy levels of fracturing. Clay seams were noted within the rock cores at about 23.8 and 26.3 feet in boring BSB-74. Vertical fracturing was observed within the BSB-70, BSB-74, and BSB-76 rock cores. Trace amounts of sand and silt, some chert and vugs were observed. Unconfined compressive strength tests were completed on representative samples of the rock cores. **Table 3** provides the RQD values and unconfined compression strength values of the rock cores extracted during the site investigation. Photographs of the cores are included with each boring log in **Appendix B**.

Table 3 – Rock Core Summary and Classification

Boring Number	Core Run / Length (ft)	Core Depth (feet)	Type of Rock	RQD (%)	RQD Classification	Depth (ft)/ Compressive Strength (psi)
BSB-69	1 / 10	22.0-32.0	Limestone	57.5	Fair	26.0-26.5 / 11,091
	2 / 5	32.0-37.0	Limestone	91.6	Excellent	N/A
BSB-70	1 / 5.2	21.0-26.2	Limestone	23.8	Poor	N/A
	2/10	26.2-36.2	Limestone	30.8	Poor	N/A
BSB-71	1 / 10	21.1-31.1	Limestone	70.4	Fair	N/A
	2 / 5	31.1-36.1	Limestone	75.0	Good	33.5-34.0 / 16,809
BSB-74	1 / 5.3	23.3-28.6	Limestone	13.8	Very Poor	N/A
	2 / 10	28.6-38.6	Limestone	11.3	Very Poor	32.5-33.0 / 9,780
BSB-75	1 / 10	22.3-32.3	Limestone	37.1	Poor	28.5-29.0 / 5,643
	2 / 5	32.3-37.3	Limestone	63.3	Fair	N/A
BSB-76	1 / 10	18.5-28.5	Limestone	69.0	Fair	25.0-25.5 / 14,761
	2 / 5	28.5-33.5	Limestone	60.0	Fair	N/A

2.4 Groundwater Conditions

Water levels were checked in each boring to determine the general groundwater conditions present at the site and were measured while drilling and after each boring was completed. Groundwater was observed during drilling at boring location BSB-72 at a depth of 16 feet (El. 515.3 feet). Groundwater was not encountered during or immediately after drilling at the remaining seven soil boring locations. None of the borings were left open after leaving the site due to safety concerns.

Based on the observed water levels and water level of the adjacent Hickory Creek (about El. 517 feet), it is anticipated that the long-term groundwater level is near 14 to 24 feet below existing grade (approx. El. 517 to 515 feet), near the bedrock interface. The level of nearby Des Plaines River (about El. 539 feet), may also affect the onsite water levels during construction and should be taken into consideration. Perched water may also be present within the fill materials observed in the borings. Water level readings were made in the boreholes at times and under conditions shown on the boring logs and stated in the text of this report. However, it should be noted that fluctuations in groundwater level may occur due to variations in the rainfall, other climatic conditions, or other factors not evident at the time measurements were made and reported herein.

3.0 GEOTECHNICAL ANALYSES

This section provides GSG's geotechnical analysis and recommendations for the design of the proposed bridge based on the results of the field exploration, laboratory testing, and geotechnical analysis. Subsurface conditions between borings may vary from those encountered at the boring locations. If structure locations, loadings, or elevations are changed, we request that GSG be contacted so that we may re-evaluate our recommendations.

3.1 Scour

The proposed bridge structure will carry Chicago Street over Hickory Creek. Scour is anticipated to be a concern for the proposed piers in the creek; however, the abutments will be constructed within the existing embankments and could be protected from scour. Per the IDOT Bridge Manual (2023), scour would not be applicable to the abutment locations if the abutment end slopes are designed with armored embankments (slope walls). It is understood that 6" slope walls will be used. Slope walls will be 2.5:1 (H:V) to satisfy hydraulic requirements.

Table 4 shows the bottom of the elevations for scour events provided in the GPE (**Appendix A**). Based on the observed subgrade conditions, predominately consisting of limestone bedrock along the river bottom, scour reductions were applied by the bridge designer per IDOT Bridge Manual Article 2.3.6.3 "Scour Estimation at Bridges." Item 113 rating of 8 was determined by the bridge designer based on the criteria from the same article per "Design Scour Table for Bridges."

Table 4 – Design Scour Elevation Table for Hickory Creek

Event/Limit State	Design Scour Elevations (ft.)				
	S. Abut.	Pier 1	Pier 2	N. Abut.	Item 113
Q100	526.41	512.30	511.00	530.35	8
Q200	526.41	512.30	511.00	530.35	
Design	526.41	512.30	511.00	530.35	
Check	526.41	512.30	511.00	530.35	

3.2 Integral Abutment Feasibility

According to the preliminary design drawings provided by WSP, the proposed bridge will be supported using integral abutments. Integral abutment feasibility was checked for the bridge in accordance with the 2023 IDOT Bridge Manual and the IDOT Integral Abutment Feasibility Analysis spreadsheet. A total proposed bridge structure length of 193.5' with a 90°00' skew was used in the bridge analysis. Based on the design drawings, existing soils will underly the abutments, with the exception of the northeast section of abutment, which will consist of new embankment fill.

The available pile types and sizes include type H-piles, HP 12X53, HP 10X57, HP 12X63, HP 12X74, HP 14X73, HP 12X84, HP 14X89, HP 14X102, and HP 14X117. Based on the integral abutment feasibility study, HP 8X36, HP 10X42, MS 14, MS 12 pile types should not be used for the SN: 099-8306 bridge based on the above assumptions.

3.3 Settlement

Based on the existing site conditions, it is assumed that minimal cut and fill will be required for the majority of the new bridge construction. Additional new fill will be required for the northeastern portion of the abutment where the bridge will be widened beyond the existing bridge alignment. Based on the observed site grades and proposed north abutment elevation it is assumed that approximately 20 feet of new engineered fill will be necessary for construction of the northeast abutment embankment.

A preliminary analysis was performed to evaluate the anticipated total settlement of the underlaying fill and native soils due to the new embankment construction for the alignment. Immediate settlement for cohesionless soils can typically occur during the filling operations, while the consolidation settlement for cohesive soils generally occurs over a longer period of time. The maximum estimated total settlements within the existing fill soils and native soils below the new embankments were calculated as shown in **Table 5,** where 90% of the total settlement is estimated to be completed within 12 months. The settlement values provided in **Table 5** do not include any potential settlement of the newly constructed embankment materials as it is assumed the new embankment will be compacted and constructed per the IDOT Construction Manual (2021). Settlement estimates of the existing soils were calculated for the soil boring location that includes soil information nearest to the east portion of the north abutment – BSB-73.

Table 5 – Anticipated Abutment Fill Settlement – Preliminary Calculations

Location	Nearest Borings	Fill Area		Assumed New Fill Height (feet)	Anticipated Total Settlement (inches)
		Assumed Width (feet)	Assumed Length (feet)		
North Abutment, NB	BSB-73	60	40	20	0.2

About 0.2 inches of settlement is anticipated in the area of boring BSB-73, where the new embankment soils are anticipated to bear on native, medium dense to very dense, sand underlain by bedrock. Accordingly, downdrag is not anticipated to be an issue.

3.4 Seismic Parameters

The seismic hazard for the site was evaluated per the IDOT Geotechnical Manual, IDOT Bridge Design Manual, and AASHTO LRFD Bridge Design Specifications. The Seismic Soil Site Class was determined per the requirements of All Geotechnical Manual Users (AGMU) Memo 9.1, Design Guide for Seismic Site Class Determination, and the "Seismic Site Class Determination" Excel spreadsheet provided by IDOT. A global Site Class Definition was determined for this project, and was found to be Soil Site Class D. The site class calculation sheet is presented in **Appendix E**. The Seismic Performance Zone (SPZ) was determined using Figure 2.3.10-2 in the IDOT Bridge Manual and was found to be Seismic Performance Zone 1.

The AASHTO Seismic Design Parameters program was used to determine the peak ground acceleration coefficient (PGA), and the short (S_{DS}) and long (S_{D1}) period design spectral acceleration coefficients for the proposed structure. For this section of the project, the S_{DS} and the S_{D1} were determined using 2020 AASHTO Guide Specifications as shown in **Table 6**. Given the site location and materials encountered, the potential for liquefaction is minimal.

Table 6 – Seismic Parameters

Building Code Reference	PGA	S_{DS}	S_{D1}
2020 AASHTO Guide for LRFD Seismic Bridge Design	0.049g	0.167g	0.095g

4.0 GEOTECHNICAL BRIDGE DESIGN RECOMMENDATIONS

The foundations for the proposed bridge must provide sufficient support to resist the dead and live loads, as well as seismic loading. The foundation design recommendations presented within this section were completed per the AASHTO LRFD 9th Edition (2020). The preliminary bridge loads provided by WSP are shown in **Table 7**.

Table 7 – Preliminary Foundation Loads

Substructure	Service Load (kips)	Factored Load (kips)	Service Load – per linear foot	Factored Load – per linear foot
Abutments	150 kips per pile	223 kips per pile	n/a	n/a
Pier 1	3,755 kips	5,160 kips	36.8 k/ft	50.6 k/ft
Pier 2	4,010 kips	5,490 kips	35.5 k/ft	48.6 k/ft

4.1 Bridge Foundation Recommendations

GSG evaluated potential foundation systems for the proposed bridge. GSG's evaluation included shallow foundations, drilled shafts, and driven piles. The results of the evaluation are presented below.

4.1.1 Shallow Foundations

Based on the fill soils and very loose to loose native soils encountered in the existing embankments, the new span length and the anticipated loads, excessive settlement is anticipated for shallow foundations. Additionally, integral abutments place large lateral loads and deflection demands on the abutment foundations; according to the IDOT Geotechnical Manual metal piles are the only suitable foundation option for integral abutments. Therefore, shallow foundations are not anticipated to be a feasible option for the proposed bridge abutments. The two bridge piers within Hickory Creek could be supported on spread footings bearing on the shallow bedrock. However, the current design utilizes piles at the bridge pier locations. Shallow foundations are not discussed further in this report.

4.1.2 Drilled Shaft Foundations

Metal piles are considered the only suitable foundation option for integral abutments. The current design utilizes piles at the bridge pier locations. Drilled shafts are therefore not discussed further in this report.

4.1.3 Driven Pile Foundations

It is understood that driven H-piles are being considered to support the bridge abutments. Concrete piles are not recommended for this site because the pile lengths cannot be readily adjusted to accommodate variability in soil conditions. metal shell piles are not recommended for structures supported upon the bedrock, and they will not be further evaluated. H-piles are a feasible option for the construction of the abutments for the proposed bridge structure.

Driving shoes for the piles, in accordance with Section 1006.05 (e) of the IDOT Standard Specifications for Road and Bridge Construction (SSRBC), should be considered to guard against the very dense granular soils and relatively shallow bedrock. Design recommendations for driven piles are provided in *Section 4.4* of this report.

4.3 Driven Pile Foundation Design Recommendation

It is assumed that approximately 20 feet of new engineered fill will be necessary for construction of the northeast abutment embankment, resulting in about 0.2 inches of settlement. Filling is not anticipated for the south abutment. It is assumed there will be no downward movement of the soil relative to piles (downdrag influence is assumed to be minimal). Based on the revised GPE Plan, it is anticipated that the bedrock will be cored and the piles will be grouted into the rock sockets.

4.3.1 Pile Design with No Downdrag

Rock socketed, grouted piles are considered a feasible foundation option for the proposed bridge abutments and piers. Piles set into rock should be designed in accordance with Sections 6.13.2.3.5 and 6.13.2.4.2.2 of the IDOT Geotechnical Manual. Rock core data indicates limestone with variable joint conditions. Specific joint conditions are considered at each abutment and pier for the foundation evaluation.

Based on the limestone strength and jointing conditions, base resistance was assumed to be the primary mode of axial resistance in rock. The IDOT design guide, Axial Capacity of Drilled Shafts in Rock (2016) was used to evaluate the grouted pile tip resistance which is based on AASHTO 10.8.3.5.4 and the Geological Strength Index (GSI), RQD, and rock unconfined compressive strength.

Rock core parameters are needed for a depth of two times the socket diameter below the bottom of the grouted pile. Based on the rock joint data, the range of GSI values were estimated. The lower bound of the GSI value was used in the nominal base resistance. All materials above rock are ignored in determining the geotechnical resistance and no axial group effect was considered in rock. Side resistance within a rock socket will only be evaluated if the base resistance is insufficient to support the required loading. If the limestone strength is higher than the concrete compressive strength, the maximum nominal side resistance will then be controlled by the concrete strength. The nominal side resistance for 4,000 psi and 5,000 psi compressive strength in concrete is 34.9 and 39.0 ksf, respectively (AASHTO 10.8.3.5.4b).

As per AASHTO Table 10.5.5.2.4.1, a geotechnical resistance factor of 0.55 for side resistance was used in our analyses. A resistance factor of 0.7 may be used for piles set into rock, for 'undamaged piles,' in accordance with AASHTO LRFD section 6.5.4.2. The rock-socketed piles should be supported within the competent bedrock. The final socket length should be determined based on the actual loading condition and the lateral resistance required. **Table 8** provides a summary of the grouted pile side and tip resistances of the bedrock at each abutment and pier location. An assumed grout concrete strength of 3.5 ksi was used in the analysis.

Table 8 – Grouted Pile Side and End Bearing Parameters

Substructure	Top of Bedrock Elevation (feet)	Nominal Side Resistance (ksf)	Factored Side Resistance (ksf)	Nominal Unit Tip Resistance (ksf)	Factored Unit Tip Resistance (ksf)
North Abutment	513.4	29	16	725	507
Pier 2	512.2	16	9	190	133
Pier 1	513.8	27	15	302	212
South Abutment	515.3	29	16	910	637

No skin friction should be considered within the scour depth. If no protective casing is used, and new fill will be placed in the area of the rock socketed piles, downdrag (negative skin friction) should be included in the resistance calculation. If new fill is not anticipated in the area of the drilled shafts, downdrag will not occur.

Based on the FHWA 'Drilled Shafts: Construction Procedures and LRFD Design Methods' document, Chapter 14, if constructed poorly, closely spaced drilled shafts may cause soil loosening around previously installed shafts, reducing the shaft lateral resistance. This effect on constructability is less significant in rock-socketed caissons and rock-socketed, grouted piles. Based on Section 14.4.3, the strength of bedrock is generally greater than the strength of the grouted pile/rock interface; group effects within rock are generally not significant and do not control the foundation design.

4.4 Lateral Load Resistance

Lateral loadings applied to deep foundations are typically resisted by the soil/structure interaction, pile flexure, or a combination of these factors. Section 3.10.1.10 of the 2012 IDOT Bridge Manual requires performing detailed structure interaction analysis if the factored lateral loading per pile exceeds 3 kips. The analysis shall determine actual pile moment and deflection to determine the selected pile adequacy for the existing loadings. **Tables 9a and 9b** provide generalized soil parameters for the entire site and include recommended lateral soil modulus and soil strain parameters that can be used for deep foundation analysis via the p-y curve method based on the encountered subsurface conditions.

Table 9a – Lateral Load Resistance Soil Parameters North Abutment (BSB-69, BSB-73)

Depth / Elevation Range (feet)	Soil Description	Lateral Modulus of Subgrade Reaction (pci)	Soil Strain (ε_{50})
	New Engineered Clay Fill	500	0.007
	New Engineered Granular Fill	90	N/A
0-5 (537.5-532.5) **BSB-69 only**	Fill Brown Silty Clay	750	0.007
0-1.5 (537.5-536) **BSB-73 only**	Fill Brown and Gray Sand and Gravel	90	N/A
3.5-17 (534-520.5)	Brown and Gray Very Loose to Medium Dense Sand	90	N/A
13-18 (524.5-519.5) **BSB-69 only**	Brown Medium Dense Gravel with Sand	225	N/A
18-20.5 (519.5-517) **BSB-69 only**	Dark Brown Very Loose Sandy Loam	25	N/A
20.5-23 (517-514.5) **BSB-69 only**	Black Very Soft Silty Clay Loam	30	0.02
22-23.5 (515.5-514)	Brown Very Dense Sand with Gravel	125	N/A

*The initial p-y modulus, E_{py} , varies linearly with depth. To obtain E_{py} use the equation $E_{py} = k_{py} * \text{z}$, where k_{py} is the subgrade modulus given in the table and z is the distance from the surface to the center point of the layer in inches.

Table 9b – Lateral Load Resistance Soil Parameters South Abutment (BSB-72, BSB-76)

Depth / Elevation Range (feet)	Soil Description	Lateral Modulus of Subgrade Reaction (pci)	Soil Strain (ε_{50})
	New Engineered Clay Fill	500	0.007
	New Engineered Granular Fill	90	N/A
0-3.5 (532.5-529)	Fill Brown, Black and Gray Silty Clay	1,000	0.005
3.5-9.5 (529-523)	Brown Medium Dense Sand	90	N/A
9.5-19.5 (523-513) **BSB-72 only**	Brown Stiff Silty Clay	100	0.007
9.5-14.5 (523-518) **BSB-76 only**	Brown Medium Stiff Silty Clay	100	0.01
14.5-17 (518-515.5) **BSB-76 only**	Brown Very Dense Sandy Loam	225	N/A

GSG recommends designing the abutments using the drained condition for the long-term, permanent design.

4.5 Global Slope Stability

The abutment slopewalls should be designed for external stability of the wall systems. Based on the GPE drawings it is understood that the north abutment slope wall is planned to be 2H:1V, and the south abutment slopewall will be 2.5H:1V.

SLIDE2 is a comprehensive slope stability analysis software used to evaluate the abutments based on the limit equilibrium method. Circular failure analyses were evaluated using the simplified Bishop analyses methods for the short term (undrained) and long term (drained) conditions for the proposed abutment slopes. The results of the analyses are shown in **Table 10**.

Table 10 – Abutment Global Slope Stability Analyses Results

Location	Analysis Type	Factor of Safety	Minimum Factor of Safety
North Abutment over 2H:1V Slope	Circular – Short Term	**1.3**	1.5
	Circular – Long Term	**1.1**	1.5
North Abutment over 3.5H:1V Slope	Circular – Short Term	1.6	1.5
	Circular – Long Term	1.6	1.5
South Abutment over 2.5H:1V Slope	Circular – Short Term	2.2	1.5
	Circular – Long Term	1.6	1.5

Based on the preliminary analyses performed, the proposed south abutment slope meets the minimum factor of safety of 1.5. The proposed north abutment 2H:1V slope does not meet the minimum Factor of Safety of 1.5 for the short and long term conditions. A modified north abutment slope of 3.5H:1V would be required to meet the required factor of safety. Copies of the slope stability analyses are included in the Slope Stability Analyses Exhibits (**Appendix F**).

5.0 CONSTRUCTION CONSIDERATIONS

All work performed for the proposed project should conform to the requirements in the IDOT Standard Specifications for Road and Bridge Construction (2022). Any deviation from the requirements in the manuals above should be approved by the design engineer.

5.1 Existing Utilities and Structures

Based on the existing site conditions, utilities exist along the project corridor. Before proceeding with construction, all existing underground utility lines or structures that will interfere with construction should be completely relocated from the proposed construction areas. Where possible, existing utility lines that are to be abandoned in place should be removed and/or plugged with a minimum of 2 feet of cement grout. All excavations resulting from underground utilities or structure removal activities should be cleaned of loose and disturbed materials, including all previously placed backfill, and backfilled with suitable fill materials in accordance with the requirements of this section. During the clearing and stripping operations, positive surface drainage should be maintained to prevent the accumulation of water.

5.2 Site Excavation

If borrow material is to be used for onsite construction, it should conform to Section 204 “Borrow and Furnished Excavation” of the IDOT Construction Manual (2021). The fill material should be free of organic matter and debris. Earth-moving operations should be avoided during excessively cold or wet weather to avoid freezing of softening subgrade soils.

Structural fill shall consist of crushed limestone or recycled concrete consistent with IDOT CA-6 gradation or medium plasticity silty clays. Structural fill should be placed in lifts not to exceed 8 inches in loose thickness and compacted to a minimum of 95% of the material’s standard proctor maximum dry density obtained according to the ASTM D698/AASHTO T 99 method.

Materials unsatisfactory for use as structural fill include soils classified as silt or organic silt (ML, MH, PT, OL, and OH) in the Unified Classification System (ASTM D2487). Soils with these classifications may be used for general purpose landscaping and in areas where uncontrolled settlement is acceptable.

Should fill be placed during cool, wet seasons, the use of granular fill may be necessary since weather conditions will make compaction of cohesive soils more difficult. If water seepage while excavating and backfilling procedures, or where wet conditions are encountered such that the water cannot be removed with conventional sump and pump procedures, GSG recommends placing open grade stone similar to IDOT CA-7 to stabilize the bottom of the excavation. The CA-7 stone should be placed to 12 inches above the water level, in 12-inch lifts, and should be compacted with the use of a heavy smooth drum roller or heavy vibratory plate compactor until stable. The remaining portion of the excavation should be backfilled using approved engineered fill.

GSG recommends that foundation excavations, subgrade preparation, and structural fill placement and compaction be inspected by a GSG geotechnical engineer to verify the type and strength of soil materials present at the site and their conformance with the geotechnical recommendations in this report.

5.3 Groundwater Management

The Hickory Creek elevation is anticipated to be heavily influenced by seasonal rain falls or melting snow. GSG anticipates that groundwater/creek elevations will be an issue during construction activity due to the extent of the proposed improvements and the anticipated time frame for the excavation construction. A cofferdam, potentially with a seal coat, should be used for construction of the piers within Hickory Creek.

Based on the observed water levels and water level of the adjacent Hickory Creek (about El. 517 feet), it is anticipated that the long-term groundwater level is near 14 to 24 feet below existing grade of the abutments (approx. El. 517 to 515 feet), near the bedrock interface. Perched water is also likely within the existing fill materials. If rainwater run-off or groundwater is accumulated at the base of excavations, the contractor should remove accumulated water using conventional sump pit and pump procedures and maintain a dry and stable excavation. The location of the sump should be determined by the contractor based on field conditions. During earthmoving activities at the site, grading should be performed to ensure that drainage is maintained throughout the construction period. Water should not be allowed to accumulate in the foundation area either during or after construction. Undercut and excavated areas

should be sloped toward one corner to facilitate removal of any collected rainwater or surface run-off. Grades should be sloped away from the excavations to minimize runoff from entering.
If water seepage occurs during excavations or where wet conditions are encountered such that the water cannot be removed with conventional sumping, we recommend placing open grade stone similar to IDOT CA-7 to stabilize the bottom of the excavation below the water table. The CA-7 stone should be placed 12 inches above the water table, in 12-inch lifts, and should be compacted with the use of a heavy smooth drum roller or heavy vibratory plate compactor until stable. The remaining portion of the excavation beneath the footings should be backfilled using approved structural fill.

5.4 Pile Installation

Piles set into rock should be installed in accordance with Section 8.10.8 of the IDOT Geotechnical Manual. The installation method for piles grouted into rock is similar to that of a drilled shaft. During drilling and rock coring the contractor must maintain the integrity of the excavation sidewall. Based on the soil conditions observed onsite, temporary casing or a slurry may be needed to help prevent the granular soils from caving.

GSG recommends that the concrete be ready on site as the pile excavation is completed, so that the concrete can be placed immediately after completing the excavation and setting the pile. This will reduce the potential of water accumulation in the bottom of the excavation. Bottom cleanliness of the excavation should be observed from the ground surface with the use of flood light or down-hole camera.

Once the rock socket is drilled, at least 6 inches of concrete should be placed into the rock socket, then the H-pile should be set into the concrete, then the rock socket backfilled with concrete to at least 6 inches above the top of rock. After the pile is set and the rock socket filled with concrete, the pile must be supported against lateral movement until the concrete has adequately set. The section of the drilled pile hole within soil should be backfilled with concrete or porous granular embankment.

5.5 Temporary Earth Structure Lateral Earth Pressures

It is anticipated that a soil retention system may be necessary for the bridge removal and construction of the north and south abutments. Based on the Temporary Sheet Pile Design

Chart, a temporary sheet pile system is not feasible for the north and south abutments due to the presence of cobbles at BSB-69, BSB-72 and BSB-73 and high blow counts at BSB-72, and a temporary soil retention system (TSRS) will be required.

The Temporary Soil Retention System shall be designed by an Illinois licensed structural engineer in accordance with the IDOT Bridge Design Manual. The design of the Temporary Soil Retention System is the responsibility of the contractor. The contractor should submit the TSRS plans to the structural design team for review prior to commencing construction of the TSRS.

5.6 Cofferdam Recommendations

The GPE plan indicates the Estimated Water Surface Elevation (EWSE) of Hickory Creek is 512.17 feet. The IDOT bridge Manual indicates that a cofferdam Type 1 is typically required where there is 6 feet or less between the Estimated Water Surface Elevation (EWSE) and bottom of the excavation; Type 2 is required when the EWSE is greater than 6 feet from the bottom of excavations. The EWSE should be adjusted to the month of April, typically a high month for water surfaces. The ground surface elevations for pile driving at Pier 1 and Pier 2 are anticipated to be about El. 512.3 and 511.0 feet. For the construction of the piers, Type 1 cofferdams may be utilized based on the pier locations and assumed excavation depths. The type of cofferdam should be specified in the plans. This system may be constructed with the use of sheet piles or other systems as approved by the Bureau of Bridges and Structures and should be designed by a Structural Engineer licensed in the State of Illinois.

6.0 LIMITATIONS

This report has been prepared for the exclusive use of the Illinois Department of Transportation (IDOT) and its Design Section Engineer consultant. The recommendations provided in the report are specific to the project described herein and are based on the information obtained at the soil boring locations within the proposed bridge area. The analyses have been performed and the recommendations provided in this report are based on subsurface conditions determined at the location of the borings. This report may not reflect all variations that may occur between boring locations or at some other time, the nature and extent of which may not become evident until during the time of construction. If variations in subsurface conditions become evident after submission of this report, it will be necessary to evaluate their nature and review the recommendations presented herein.

APPENDIX A

GPE PLAN – PROPOSED STRUCTURE CHICAGO STREET OVER HICKORY CREEK WILL COUNTY

Benchmark: Chiseled 'X' on top of SE Bolt of Fire Hydrant at East ROW of Joliet Street and South Street. Elev. 526.795.

Existing Structure: The Chicago St bridge over Hickory Creek was originally constructed in 1962 and rehabilitated in 1992 and 2018. The structure is a multi-beam steel bridge and consists of three simple spans, composite with the deck. The span lengths are approximately ±54'-8" (Span 1), ±54'-10" (Span 2), and 53'-11" (Span 3). The total length of the bridge is approximately 167'-1" from back to back of abutments measured at the PGL, parallel to the tangent line at the intersection of PGL and centerline of Hickory Creek. The out-to-out deck width varies and ranges from approximately ±62'-6" at the south end of the bridge to ±71'-4" at the north end of the bridge, each measured along centerline of abutment. The bridge substructure units are skewed with respect to the centerline of Hickory Creek at 5°30'00" angle. The substructure consists of concrete stub abutments with wingwalls and two solid stem pier walls. Each abutment is supported on steel H-pile footings and the pier walls are supported on rectangular spread footing foundations.

Traffic Control: Traffic will be maintained utilizing staged construction.

No salvage.

HIGHWAY CLASSIFICATION

F.A.P. Rte. 0846 - Chicago Street (IL-53, US 52)
Functional Class: Other Principal Arterial
ADT: 31,500 (2019); 47,700 (2040)
ADTT: 8,253 (2019); 12,498 (2040)
DHV: 5,247
Design Speed: 40 m.p.h.
Posted Speed: 40 m.p.h.
Two-Way Traffic
Directional Distribution: 50:50

DESIGN SPECIFICATIONS

2020 AASHTO LRFD Bridge Design Specifcations, 9th Edition

LOADING HL-93

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

DESIGN STRESSES

FIELD UNITS

f'c = 3,500 psi
f'c = 4,000 psi (Superstructure Concrete)
fy = 60,000 psi (Reinforcement))

PRECAST PRESTRESSED UNITS

f'c = 6,000 psi
fci = 5,500 psi
fpu = 270,000 psi ($\frac{1}{2}$" Ø low lax strands)
fpbt = 201,960 psi ($\frac{1}{2}$" Ø low lax strands)

SEISMIC DATA

Seismic Performance Zone (SPZ) = 1
Design Spectral Acceleration at 1.0 sec. (SD1) = 0.095
Design Spectral Acceleration at 0.2 sec. (SDS) = 0.167
Soil Site Class = D

DESIGN SCOUR ELEVATION TABLE

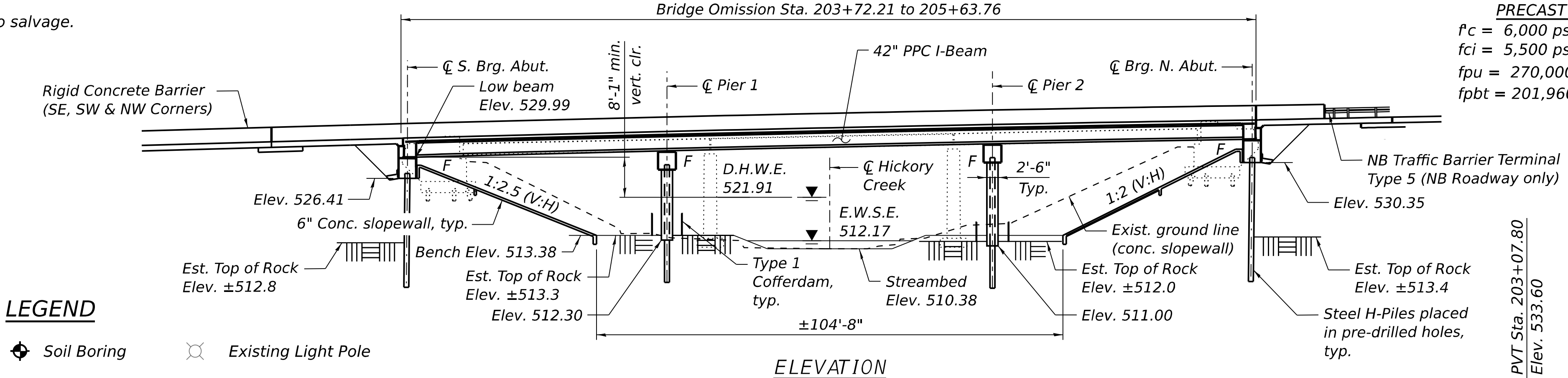
Event / Limit State	Design Scour Elevations (ft.) S. Abut.	Pier 1	Pier 2	N. Abut.	Item 113
Q100	526.41	512.30	511.00	530.35	8
Q200	526.41	512.30	511.00	530.35	
Design	526.41	512.30	511.00	530.35	
Check	526.41	512.30	511.00	530.35	

WATERWAY INFORMATION

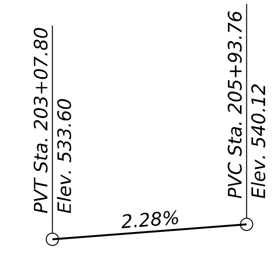
Drainage Area = 109.1 Sq. Mi. Low Grade Elev. 529.99 @ Sta. 203+75.14

Flood	Freq. Yr.	Q C.F.S.	Opening Ft² Exist.	Opening Ft² Prop.	Nat. H.W.E.	Head - Ft. Exist.	Head - Ft. Prop.	Headwater El. Exist.	Headwater El. Prop.
	10	6230	656	731	518.95	1.11	0.12	520.06	519.16
Design	50	10660	867	1120	521.91	0.98	0.14	522.89	522.23
Base	100	13750	1072	1385	523.77	1.03	0.21	524.80	524.16
Scour Check	200	17120	1290	1653	525.55	1.04	0.30	526.59	526.02
Overtopping									
Max. Calc.	500	23203	1703	2160	528.71	0.77	0.62	529.48	529.48

10-Yr. velocity through existing structure = 9.5 fps
10-Yr. velocity through proposed structure = 8.5 fps



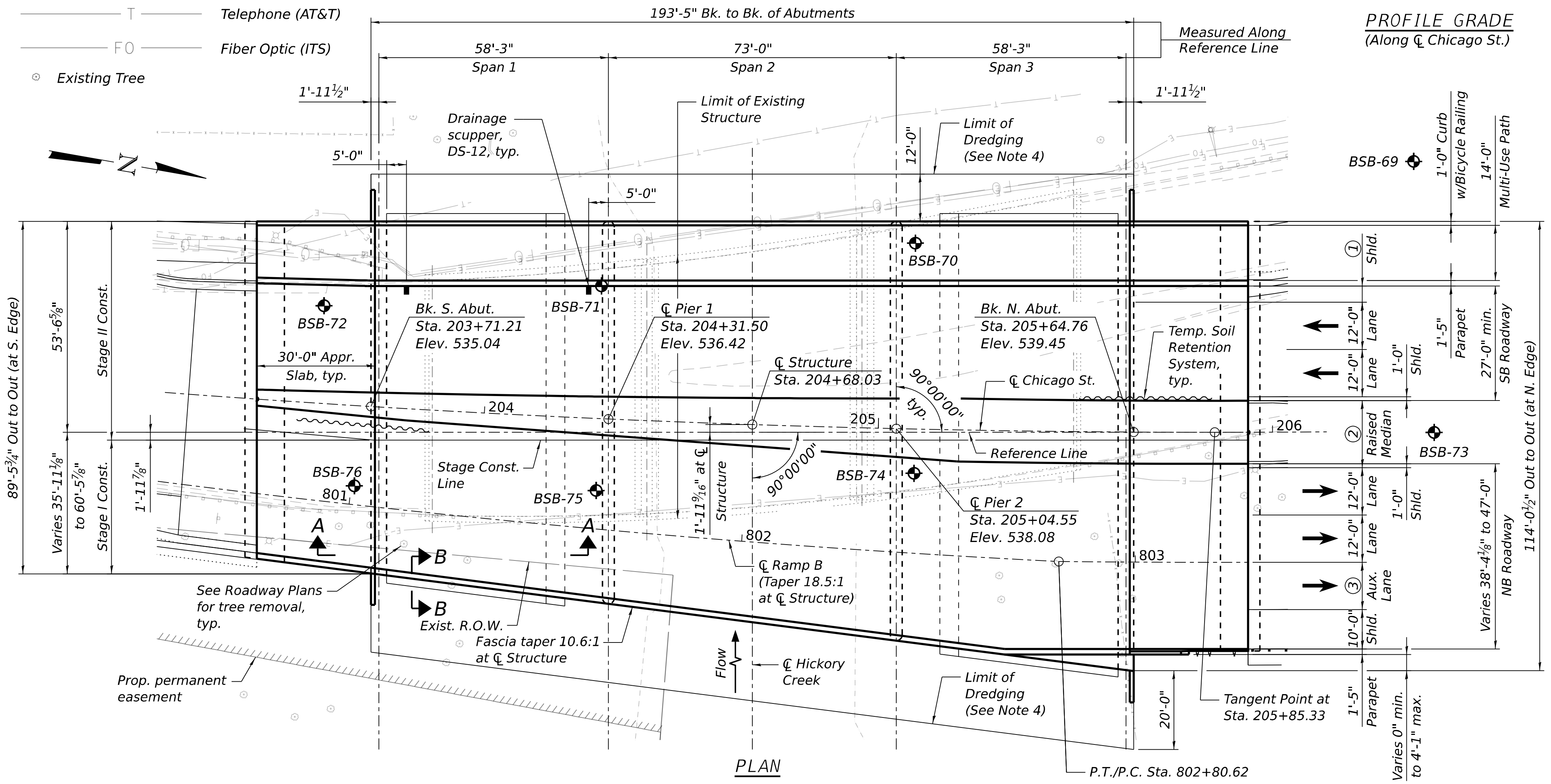
ELEVATION



PROFILE GRADE
(Along ℄ Chicago St.)

LEGEND

Soil Boring
Existing Light Pole
Electrical (Lighting)
Telephone (AT&T)
Fiber Optic (ITS)
Existing Tree



PLAN

CURVE DATA

CHICAGO STREET CURVE 1

P.I. Sta. = 204+44.22
Δ = 05°45'56" (LT)
D = 01°38'13"
R = 3,500.00'
T = 176.25'
L = 352.20'
E = 4.43'
e = N.C.
T.R. = N/A
S.E. Run = N/A
P.C. Sta. = 202+67.98
P.T. Sta. = 206+20.17

CURVE DATA

RAMP B CURVE 1

P.I. Sta. = 801+40.41
Δ = 05°21'47" (LT)
D = 01°54'40"
R = 2,988.00'
T = 140.41'
L = 280.62'
E = 3.29'
e = 2.0%
T.R. = N/A
S.E. Run = N/A
P.C. Sta. = 800+00.00
P.T. Sta. = 802+80.62

CURVE DATA

RAMP B CURVE 2

P.I. Sta. = 803+17.98
Δ = 01°12'42" (LT)
D = 01°37'18"
R = 3,533.00'
T = 37.36'
L = 74.72'
E = 0.20'
e = 2.0%
T.R. = N/A
S.E. Run = N/A
P.C. Sta. = 802+80.62
P.T. Sta. = 803+55.34

For information only, all roadway elements are defined by the Chicago St. alignment on the bridge

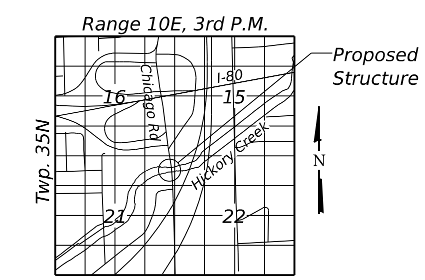
Notes:

1. See Sheet 2 for Section A-A & B-B, Offset Sketch, and Deck & Median Layout.
2. See Sheet 3 for Construction Staging.
3. Reference Line is a Local Tangent at ℄ Chicago St. Sta. 205+85.33.
4. Scope of work for dredging includes the extension of the stream profile and slopewall grade lines 20-ft upstream and 12-ft downstream of the bridge.

① Varies 2'-0" to 4'-1½"

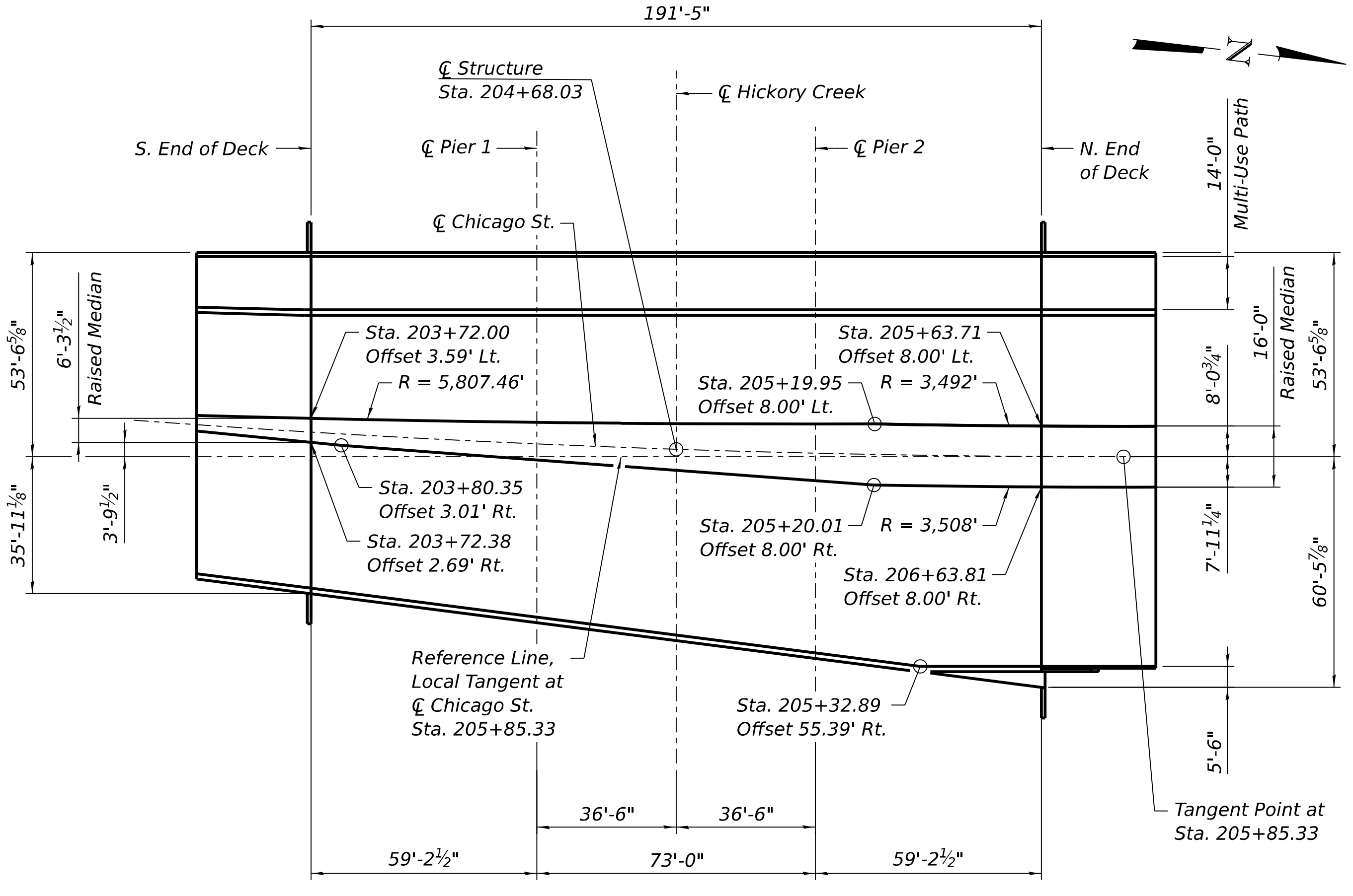
② Varies 6'-3½" to 16'-0"

③ Varies 3'-1" min. to 12'-0" max.

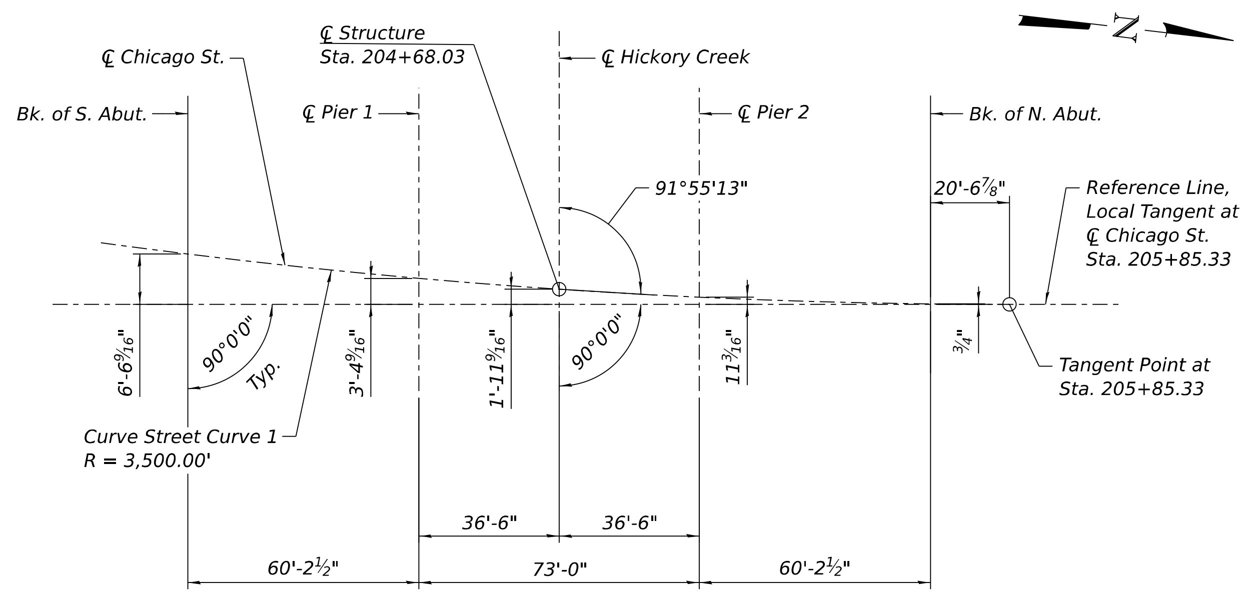


LOCATION SKETCH

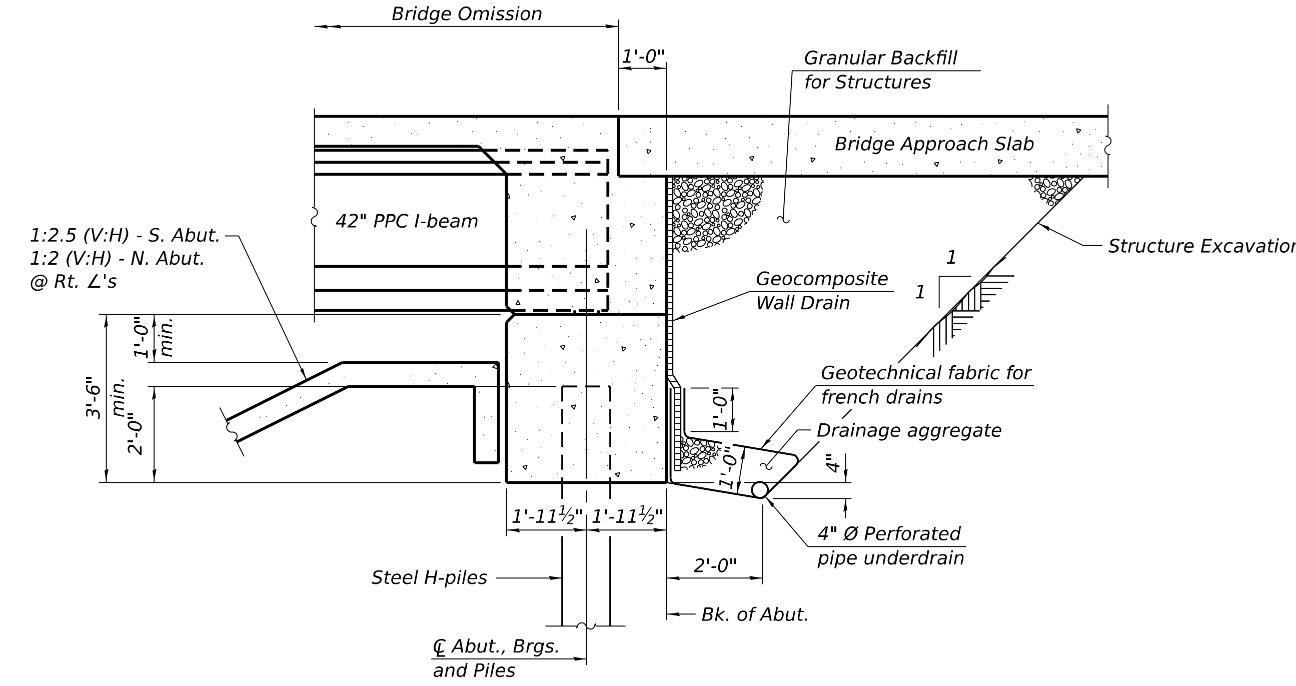
GENERAL PLAN AND ELEVATION
CHICAGO STREET (IL-53, US 52)
OVER HICKORY CREEK
F.A.P. RTE. 0846 - SEC. 2017-057F
WILL COUNTY
STA. 204+68.03
STRUCTURE NO. 099-8306



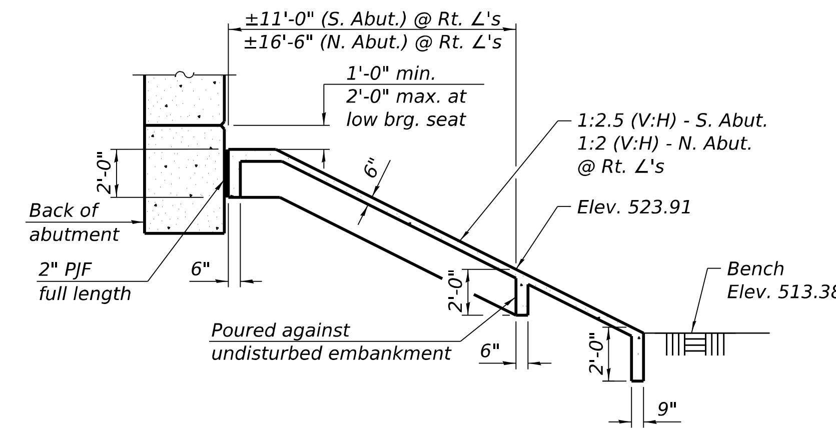
DECK & MEDIAN LAYOUT



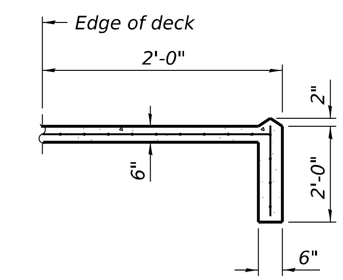
OFFSET SKETCH



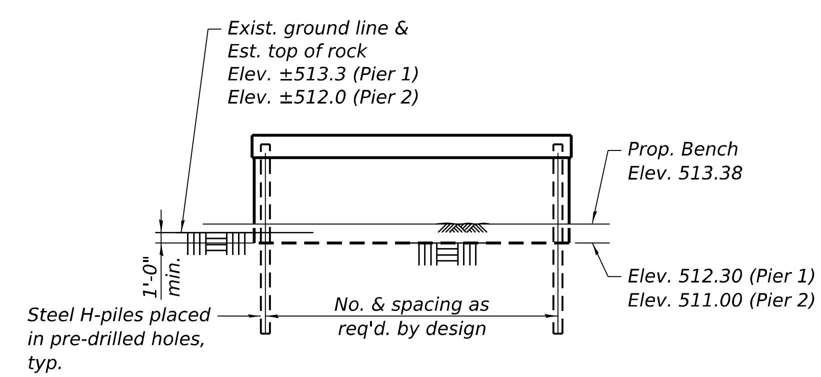
SECTION THRU INTEGRAL ABUTMENT
(Horiz. dim. at Rt. ∠'s)



SECTION A-A



SECTION B-B



PIER SKETCH

Note:
1. For location of Section A-A & B-B see Sheet 1 of 3.

DETAILS
CHICAGO STREET (IL-53, US 52)
OVER HICKORY CREEK
F.A.P. RTE. 0846 - SEC. 2017-057F
WILL COUNTY
STA. 204+68.03
STRUCTURE NO. 099-8306

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WSP
WSP USA Inc.
30 N. LASALLE STREET
SUITE 4200
CHICAGO, IL 60602
TEL: (312) 782-8150
FAX: (312) 782-1684

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	DRAWN - FIM/PJL	REVISED -	
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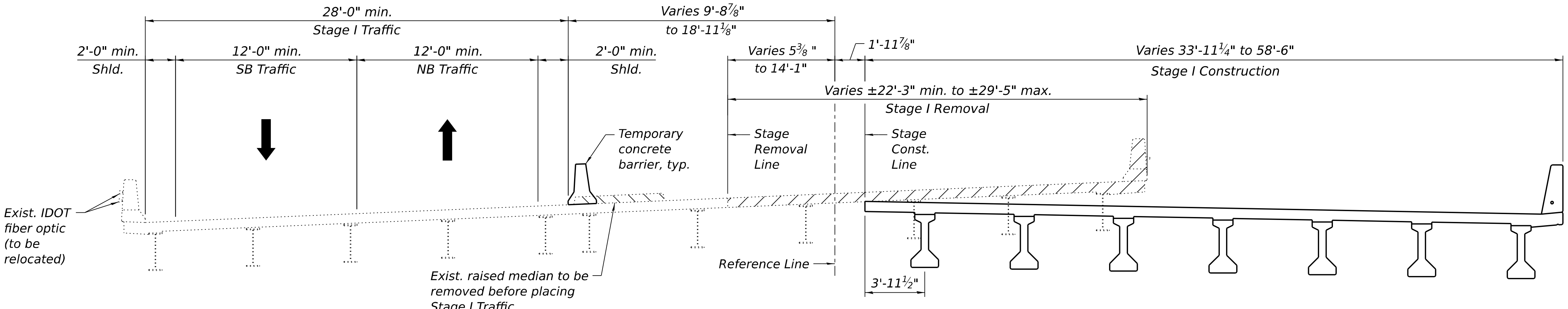
STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

SHEET 2 OF 3 SHEETS

F.A.P. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
0846	2017-057F	WILL	$TOTS	0998306_2

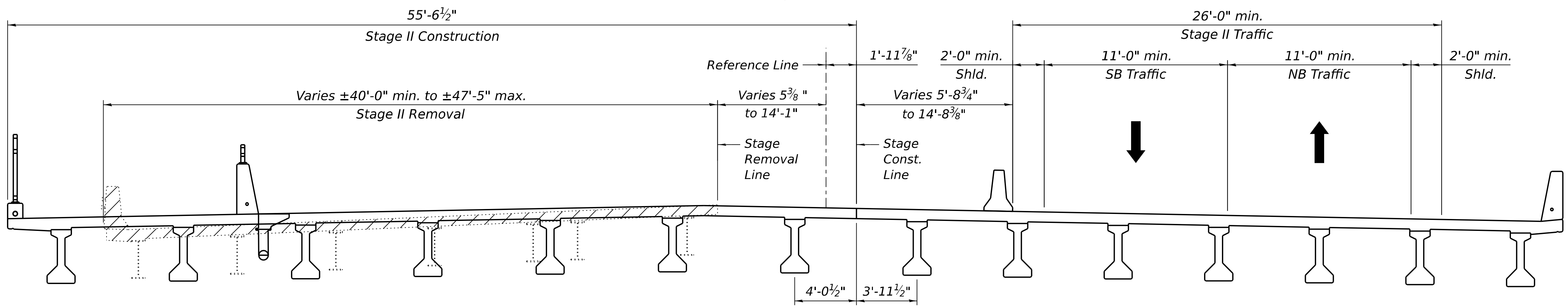
CONTRACT NO. 62F94

ILLINOIS FED. AID PROJECT



CROSS SECTION - STAGE I

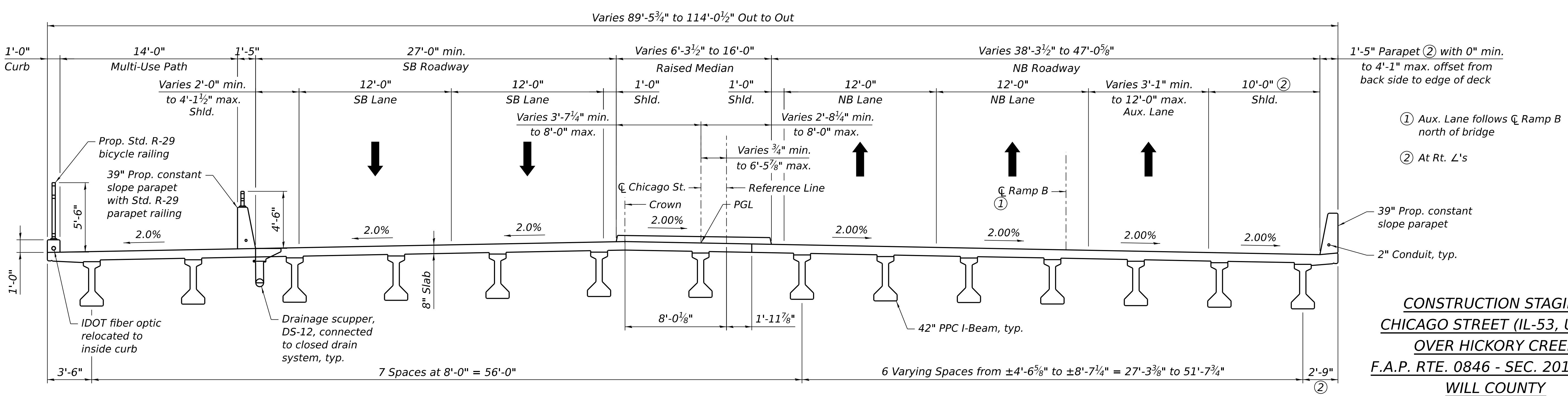
(Looking North)



CROSS SECTION - STAGE II

(Looking North)

Note:
1. All horizontal dimension are measured perpendicular to the Reference Line (Local Tangent Line at ℄ Chicago St. Sta. 205+85.33), unless noted otherwise.
2. Varying deck dimensions are measured at the at north and south ends of deck.



FINAL CROSS SECTION

(Looking North)

CONSTRUCTION STAGING
CHICAGO STREET (IL-53, US 52)
OVER HICKORY CREEK
F.A.P. RTE. 0846 - SEC. 2017-057F
WILL COUNTY
STA. 204+68.03
STRUCTURE NO. 099-8306

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WSP USA Inc.
30 N. LASALLE STREET
SUITE 4200
CHICAGO, IL 60602
TEL: (312) 782-8150
FAX: (312) 782-1684

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STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

SHEET 3 OF 3 SHEETS

F.A.P. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
0846	2017-057F	WILL	$TOTS0998306_3	

CONTRACT NO. 62F94

ILLINOIS | FED. AID PROJECT

APPENDIX B

SOIL BORING LOCATION PLAN AND SUBSURFACE PROFILES

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PLOT SCALE = $SCALE$
USER NAME = $USER$

GSG CONSULTANTS, INC.
735 E. REMINGTON RD, SCHAUMBURG, IL 60173
TEL: +1630.994.2600 | WWW.GSG-CONSULTANTS.COM

USER NAME	= $USER$	DESIGNED	- RM
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PLOT DATE	= $DATE$	DATE	- 06/22/2022

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

HICKORY STREET BRIDGE
SOIL BORING LOCATION PLAN
JOLIET, ILLINOIS

SCALE: 1:50 | SHEET 1 OF 1 SHEETS | STA. | TO STA.

F.A. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
		WILL	5	1

CONTRACT NO. PTB-198-003

ILLINOIS | FED. AID PROJECT

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GSG CONSULTANTS, INC.
735 E. REMINGTON RD, SCHAUMBURG, IL 60173
TEL: +1630.994.2600 | WWW.GSG-CONSULTANTS.COM

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PLOT SCALE	= $SCALE$	CHECKED	- DE
PLOT DATE	= $DATE$	DATE	- 06/22/2022

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

HICKORY STREET BRIDGE
SOIL BORING PROFILE

SCALE: AS NOTED | SHEET 1 OF 4 SHEETS | STA. 203+50 | TO STA. 205+75

F.A. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
		WILL	5	2

CONTRACT NO. PTB- 198-003
ILLINOIS | FED. AID PROJECT

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GSG CONSULTANTS, INC.
735 E. REMINGTON RD, SCHAUMBURG, IL 60173
TEL: +1630.994.2600 | WWW.GSG-CONSULTANTS.COM

USER NAME = $USER$		DESIGNED -	RM
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PLOT DATE = $DATE$		DATE -	06/22/2022

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

HICKORY STREET BRIDGE
SOIL BORING PROFILE

SCALE: AS NOTED | SHEET 2 OF 4 SHEETS | STA. 205+75 TO STA. 207+75

F.A. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
		WILL	5	3
		CONTRACT NO. PTB- 198-003		
	ILLINOIS	FED. AID PROJECT		

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SHEET SIZE= $SHEETSIZE$
PLOT SCALE= $SCALE$
USER NAME = $USER$

GSG CONSULTANTS, INC.
735 E. REMINGTON RD, SCHAUMBURG, IL 60173
TEL: +1630.994.2600 | WWW.GSG-CONSULTANTS.COM

USER NAME	= $USER$	DESIGNED	- RM
SHEET SIZE	= $SHEETSIZE$	DRAWN	- NN
PLOT SCALE	= $SCALE$	CHECKED	- DE
PLOT DATE	= $DATE$	DATE	- 06/22/2022

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

HICKORY STREET BRIDGE

SOIL BORING PROFILE

SCALE: AS NOTED | SHEET 3 OF 4 SHEETS | STA. 203+50 TO STA. 205+75

F.A. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
		WILL	5	4

CONTRACT NO. PTB- 198-003

ILLINOIS | FED. AID PROJECT

FILE NAME = $FILEL$
PEN TABLE = $PENTBLL$
PLOT DATE = $DATE$
TIME = $TIME$
SHEET SIZE= $SHEETSIZE$
PLOT SCALE= $SCALE$
USER NAME = $USER$

GSG CONSULTANTS, INC.
735 E. REMINGTON RD, SCHAUMBURG, IL 60173
TEL: +1630.994.2600 | WWW.GSG-CONSULTANTS.COM

USER NAME	= $USER$	DESIGNED	- RM
SHEET SIZE	= $SHEETSIZE$	DRAWN	- NN
PLOT SCALE	= $SCALE$	CHECKED	- DE
PLOT DATE	= $DATE$	DATE	- 06/22/2022

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

HICKORY STREET BRIDGE
SOIL BORING PROFILE

SCALE: AS NOTED | SHEET 4 OF 4 SHEETS | STA. 205+75 TO STA. 207+75

F.A. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
		WILL	5	5

CONTRACT NO. PTB- 198-003
ILLINOIS | FED. AID PROJECT

APPENDIX C

SOIL BORING LOGS

Illinois Department of Transportation
Division of Highways
GSG Consultants, Inc.

SOIL BORING LOG

Date 4/15/22

ROUTE I-80 **DESCRIPTION** IL 53/US 52 (Chicago Street) over Hickory Creek **LOGGED BY** DD

SECTION C-91-109-22 **LOCATION** , **SEC.** 16, **TWP.** 35 N, **RNG.** 10 E, **Latitude** 41.5101026, **Longitude** -88.08144792

COUNTY Will **DRILLING RIG** CME-75 **HAMMER TYPE** Auto
DRILLING METHOD HSA **HAMMER EFF (%)** 91

STRUCT. NO. 099-8306
Station

BORING NO. BSB-69
Station 206+36.2914
Offset 68.43ft LT
Ground Surface Elev. 535.39 ft

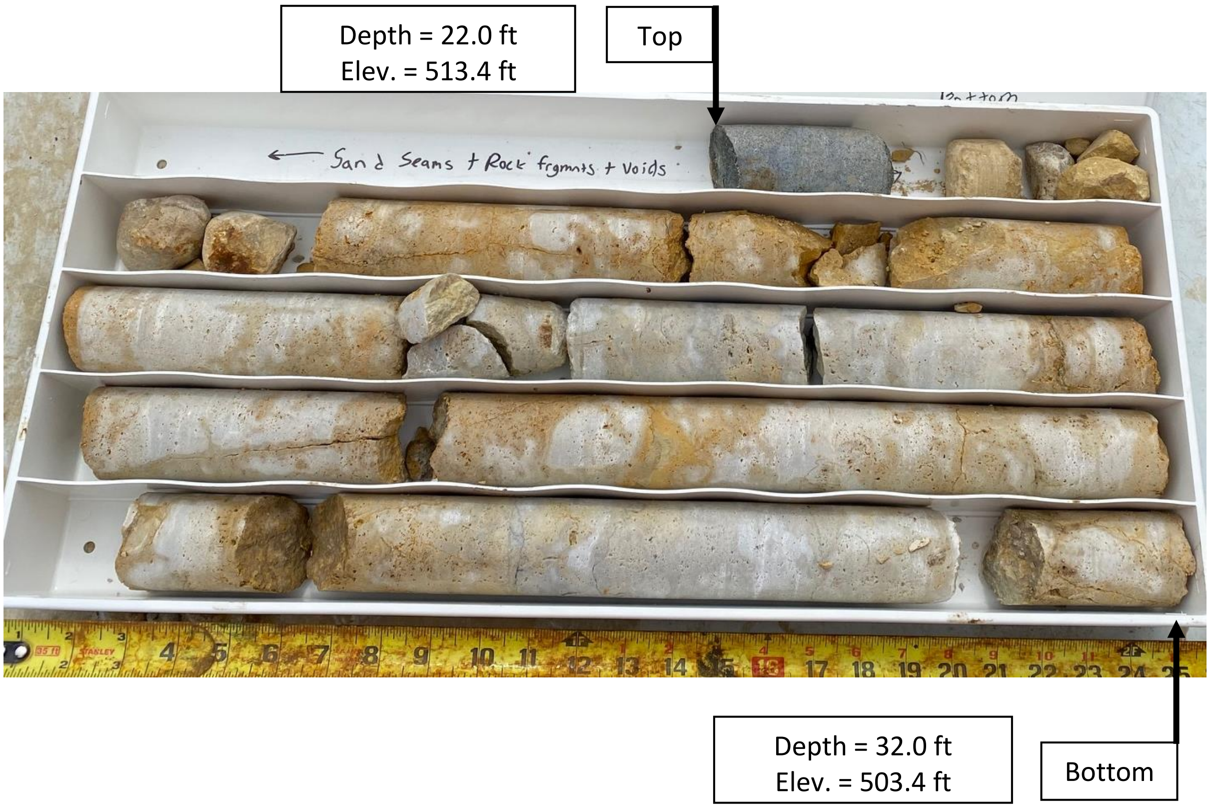
Surface Water Elev. N/A ft
Stream Bed Elev. N/A ft

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

Description	Elev.	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
4 inches of Asphalt	535.06				
10 inches of Concrete	534.56				
Brown, Moist FILL: SILTY CLAY, trace sand and gravel	532.39		7 6 8	1.5 P	8
Loose Gray, Moist SAND, trace gravel (SP)	524.39	-5	5 6 4		8
			9 4 5		6
		-10	6 3 6		8
Medium Dense Brown, Dry to Moist GRAVEL, with sand (GPS) Cobbles at 11 feet	519.39		25 11 11		2
		-15	3 19 2		6
Very Loose Dark Brown, Very Moist SANDY LOAM (SM)	516.89		2 1 2		26
		-20	1 2 4	0.2 B	63
Very Soft Black, Very Moist SILTY CLAY LOAM, with wood fragments (ML/CL) *(continued)*	514.39				
Very Dense Brown, Moist SAND, with limestone fragments (SP)	513.39		11 16 50/2"		8
Auger refusal at 22 feet Light Gray LIMESTONE, moderately weathered, heavily to moderately fractured, some vugs, trace sand Run 1: 22' - 32' Recovery: 70.8% RQD: 57.5% (Fair)	503.39	-25 -30			
Light Gray LIMESTONE, slightly weathered, slightly fractured, heavily fractured at 33.5 feet, some vugs, trace chert Run 2: 32' - 37' Recovery: 100.0% RQD: 91.6% (Excellent)	498.39	-35			
End of Boring		-40			

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

Chicago Street Bridge over Hickory Creek
Boring Number: BSB-69
Will County, IL



Boring No.	Run	Depth (ft)	Recovery (%)	RQD (%)	RQD Classification	Compressive Strength (psi)	Description
BSB-69	1	22.0' – 32.0'	70.8	57.5	Fair	11,091	Light Gray Limestone Moderately Weathered, Heavily to Moderately Fractured, Some Vugs, Trace Sand

Chicago Street Bridge over Hickory Creek
Boring Number: BSB-69
Will County, IL

Depth = 32.0 ft
Elev. = 503.4 ft

Top

Depth = 37.0 ft
Elev. = 498.4 ft

Bottom

Boring No.	Run	Depth (ft)	Recovery (%)	RQD (%)	RQD Classification	Description
BSB-69	2	32.0’ – 37.0’	100.0	91.6	Excellent	Light Gray Limestone Slightly Weathered, Slightly Fractured, Heavily Fractured at 33.5 feet, Some Vugs, Trace Chert

Illinois Department of Transportation
Division of Highways
GSG Consultants, Inc.

SOIL BORING LOG

Date 5/26/22

ROUTE I-80 **DESCRIPTION** IL 53/US 52 (Chicago Street) over Hickory Creek **LOGGED BY** KA

SECTION C-91-109-22 **LOCATION** , **SEC.** 15, **TWP.** 35 N, **RNG.** 10 E,
Latitude 41.50976506, **Longitude** -88.08131999

COUNTY Will **DRILLING RIG** CME-75 **HAMMER TYPE** Auto
DRILLING METHOD HSA **HAMMER EFF (%)** 91

STRUCT. NO. 099-8306
Station

BORING NO. BSB-70
Station 205+8.3729
Offset 47.18ft LT
Ground Surface Elev. 533.80 ft

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

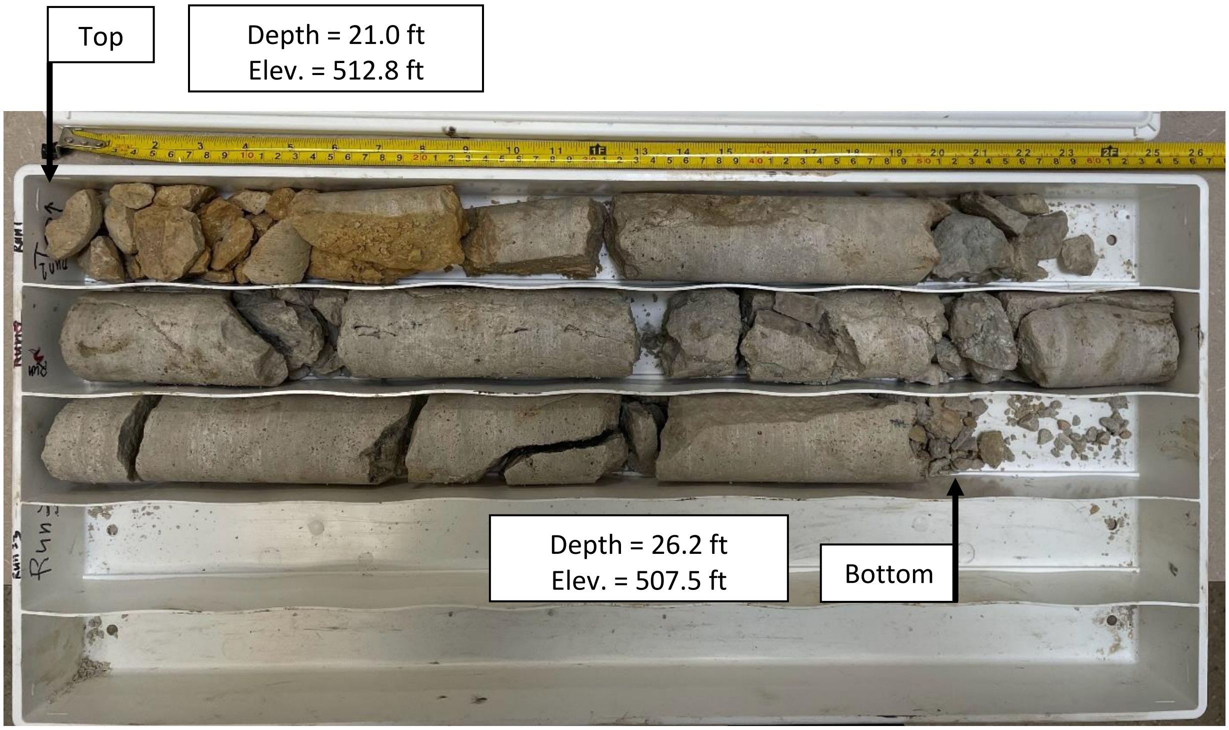
Groundwater Elev.:
First Encounter Dry ft
Upon Completion N/A ft
After ____ **Hrs.** N/A ft

Description	Elev.	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
10 inches of Concrete Bridge Deck	532.96				
19 feet 11 inches of Air Void / Casing					
		-5			
		-10			
		-15			
		-20			

Description	Elev.	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
	513.05				
3 inches of Gravel	512.80				
Light Gray LIMESTONE, slightly weathered, heavily fractured, some vugs, some sand from 21 to 22 feet Run 1: 21' - 26.2' Recovery: 100.0% RQD: 23.8% (Poor)					
		-25			
	507.55				
Light Gray LIMESTONE, slightly weathered, heavily fractured, some vugs, vertical fractures at 27, 29.5, 33 and 34.5 feet, trace silt 32 feet Run 2: 26.2' - 36.2' Recovery: 100.0% RQD: 30.8% (Poor)					
		-30			
		-35			
	497.55				
End of Boring					
		-40			

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

Chicago Street Bridge over Hickory Creek
Boring Number: BSB-70
Will County, IL



Boring No.	Run	Depth (ft)	Recovery (%)	RQD (%)	RQD Classification	Description
BSB-70	1	21.0' – 26.2'	100.0	23.8	Poor	Light Gray Limestone Slightly Weathered, Heavily Fractured, Some Vugs, Some Sand from 21 to 22 feet

Chicago Street Bridge over Hickory Creek
Boring Number: BSB-70
Will County, IL

Top

Depth = 26.2 ft
Elev. = 507.5 ft

Depth = 36.2 ft
Elev. = 497.5 ft

Bottom

Boring No.	Run	Depth (ft)	Recovery (%)	RQD (%)	RQD Classification	Description
BSB-70	2	26.2' – 36.2'	100.0	30.8	Poor	Light Gray Limestone Slightly Weathered, Heavily Fractured, Some Vugs, Vertical Fractures at 27, 29.5, 33 and 34.5 feet, Trace Silt 32 feet

Illinois Department of Transportation
Division of Highways
GSG Consultants, Inc.

SOIL BORING LOG

Date 6/6/22

ROUTE I-80 **DESCRIPTION** IL 53/US 52 (Chicago Street) over Hickory Creek **LOGGED BY** DD

SECTION C-91-109-22 **LOCATION** , **SEC.** 15, **TWP.** 35 N, **RNG.** 10 E, **Latitude** 41.5095463, **Longitude** -88.08124221

COUNTY Will **DRILLING RIG** CME-75 **HAMMER TYPE** Auto
DRILLING METHOD HSA **HAMMER EFF (%)** 91

STRUCT. NO. 099-8306
Station

BORING NO. BSB-71
Station 204+28.2390
Offset 33.66ft LT
Ground Surface Elev. 534.86 ft

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

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

Description	Elev.	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
9.5 inches of Concrete Bridge Deck	534.07				
20 feet 4 inches of Air Void / Casing		-5			
		-10			
		-15			
		-20			
20 feet 4 inches of Air Void / Casing *(continued)*	513.74				
Light Gray LIMESTONE, moderately weathered, heavily to moderately fractured, some vugs, trace sand Run 1: 21.1' - 31.1' Recovery: 100.0% RQD: 70.4% (Fair)		-25			
	503.74	-30			
Light Gray LIMESTONE, slightly weathered, moderately fractured, some vugs, trace silt Run 2: 31.1' - 36.1' Recovery: 100.0% RQD: 75% (Good)	498.74	-35			
End of Boring		-40			

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

Chicago Street Bridge over Hickory Creek
Boring Number: BSB-71
Will County, IL

Depth = 21.1 ft
Elev. = 513.8 ft

Top

Depth = 31.1 ft
Elev. = 503.8 ft

Bottom

Boring No.	Run	Depth (ft)	Recovery (%)	RQD (%)	RQD Classification	Description
BSB-71	1	21.1' – 31.1'	100.0	70.4	Fair	Light Gray Limestone Moderately Weathered, Heavily Fractured to Moderately Fractured, Some Vugs, Trace Sand

Chicago Street Bridge over Hickory Creek
Boring Number: BSB-71
Will County, IL

Top

Depth = 31.1 ft
Elev. = 503.8 ft

Depth = 36.1 ft
Elev. = 498.8 ft

Bottom

Boring No.	Run	Depth (ft)	Recovery (%)	RQD (%)	RQD Classification	Compressive Strength (psi)	Description
BSB-71	2	31.1’ – 36.1’	100.0	75.0	Good	16,809	Light Gray Limestone Slightly Weathered, Moderately Fractured, Some Vugs, Trace Silt

Illinois Department of Transportation
Division of Highways
GSG Consultants, Inc.

SOIL BORING LOG

Date 4/14/22

ROUTE I-80 **DESCRIPTION** IL 53/US 52 (Chicago Street) over Hickory Creek **LOGGED BY** EH

SECTION C-91-109-22 **LOCATION** , **SEC.** 22, **TWP.** 35 N, **RNG.** 10 E, **Latitude** 41.50936113, **Longitude** -88.08119976

COUNTY Will **DRILLING RIG** Diedrich D-50 **HAMMER TYPE** Auto

DRILLING METHOD HSA **HAMMER EFF (%)** 98

STRUCT. NO. 099-8306
Station

BORING NO. BSB-72
Station 203+57.6629
Offset 24.78ft LT
Ground Surface Elev. 531.26 ft

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

Groundwater Elev.:
First Encounter 515.3 ft ▼
Upon Completion N/A ft
After ___ **Hrs.** N/A ft

Description	Elev.	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
3 inches of Asphalt	531.01				
9 inches of Concrete	530.26				
Brown, Black and Gray, Moist FILL: SILTY CLAY, with sand and gravel, trace organics			6		
			9	3.0	13
			7	P	
	527.76				
Medium Dense Brown, Moist SAND, trace gravel (SP)			5		
			10		7
		-5	8		
Cobbles at 6 feet			50/3"		
					NR
	522.76				
Stiff Brown, Moist SILTY CLAY, trace sand and gravel (CL/ML)			6		
			5		13
		-10	8		
			5		
			3	1.0	22
			2	P	
			5		
			15	1.0	14
		-15	50/0"	P	
		▼	50/5"		
					NR
	512.76				
Auger refusal at 18.5 feet End of Boring					
		-20			

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

BBS, form 137 (Rev. 8-99)

Illinois Department of Transportation
Division of Highways
GSG Consultants, Inc.

SOIL BORING LOG

Date 4/14/22

ROUTE I-80 **DESCRIPTION** IL 53/US 52 (Chicago Street) over Hickory Creek **LOGGED BY** EH

SECTION C-91-109-22 **LOCATION** , **SEC.** 15, **TWP.** 35 N, **RNG.** 10 E,
Latitude 41.51016001, **Longitude** -88.08125951

COUNTY Will **DRILLING RIG** Diedrich D-50 **HAMMER TYPE** Auto
DRILLING METHOD HSA **HAMMER EFF (%)** 98

STRUCT. NO. 099-8306
Station

BORING NO. BSB-73
Station 206+50.6377
Offset 14.63ft LT
Ground Surface Elev. 539.37 ft

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

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

Description	Elev.	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
3 inches of Asphalt	539.12				
11 inches of Concrete	538.20				
Brown and Gray, Moist FILL: SAND AND GRAVEL			13 13 6		NR
	535.87				
Very Loose to Medium Dense Brown, Dry to Moist SAND, with gravel, trace clay (SPG)		-5	8 7 5		9
			3 3 7		10
		-10	6 4 10		4
Possible Cobbles at 11 feet			2 1 2		NR
		-15	3 4 3		7
			11 6 6		NR
		-20	4 5 5		4
Very Loose to Medium Dense Brown, Dry to Moist SAND, with gravel, trace clay (SPG) *(continued)*			8 13 9		7
	516.37				
Very Dense Brown, Moist SAND, with gravel (SPG)			8 13 50/3"		10
	514.37	-25			
Auger refusal at 25 feet End of Boring					
		-30			
		-35			
		-40			

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

Illinois Department of Transportation
Division of Highways
GSG Consultants, Inc.

SOIL BORING LOG

Date 6/7/22

ROUTE I-80 DESCRIPTION IL 53/US 52 (Chicago Street) over Hickory Creek LOGGED BY KA

SECTION C-91-109-22 LOCATION , **SEC.** 15, **TWP.** 35 N, **RNG.** 10 E, **Latitude** 41.5097893, **Longitude** -88.08111255

COUNTY Will DRILLING RIG CME-75 HAMMER TYPE Auto
DRILLING METHOD HSA HAMMER EFF (%) 91

STRUCT. NO. 099-8306
Station

BORING NO. BSB-74
Station 205+9.3110'
Offset 11.23ft RT
Ground Surface Elev. 535.50 ft

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

Groundwater Elev.:
First Encounter Dry ft
Upon Completion N/A ft
After ____ Hrs. N/A ft

Description	Elev.	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
10 inches of Concrete Bridge Deck	534.67				
22 feet 6 inches of Air Void / Casing		-5, -10, -15, -20			
22 feet 6 inches of Air Void / Casing *(continued)*	512.17				
Light Gray LIMESTONE, moderately weathered, heavily fractured, some vugs, some clay seams at 23.8 feet, 26.3 feet Run 1: 23.3' - 28.6' Recovery: 100.0% RQD: 13.8% (Very Poor)	506.92	-25			
Light Gray LIMESTONE, slightly weathered, heavily fractured, some vugs, vertical fractures at 36 feet and 37.5 feet Run 2: 28.6' - 38.6' Recovery: 100.0% RQD: 11.3% (Very Poor)	496.92	-30, -35			
End of Boring		-40			

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

Chicago Street Bridge over Hickory Creek
Boring Number: BSB-74
Will County, IL

Top

Depth = 23.3 ft
Elev. = 512.2 ft

Depth = 28.6 ft
Elev. = 506.9 ft

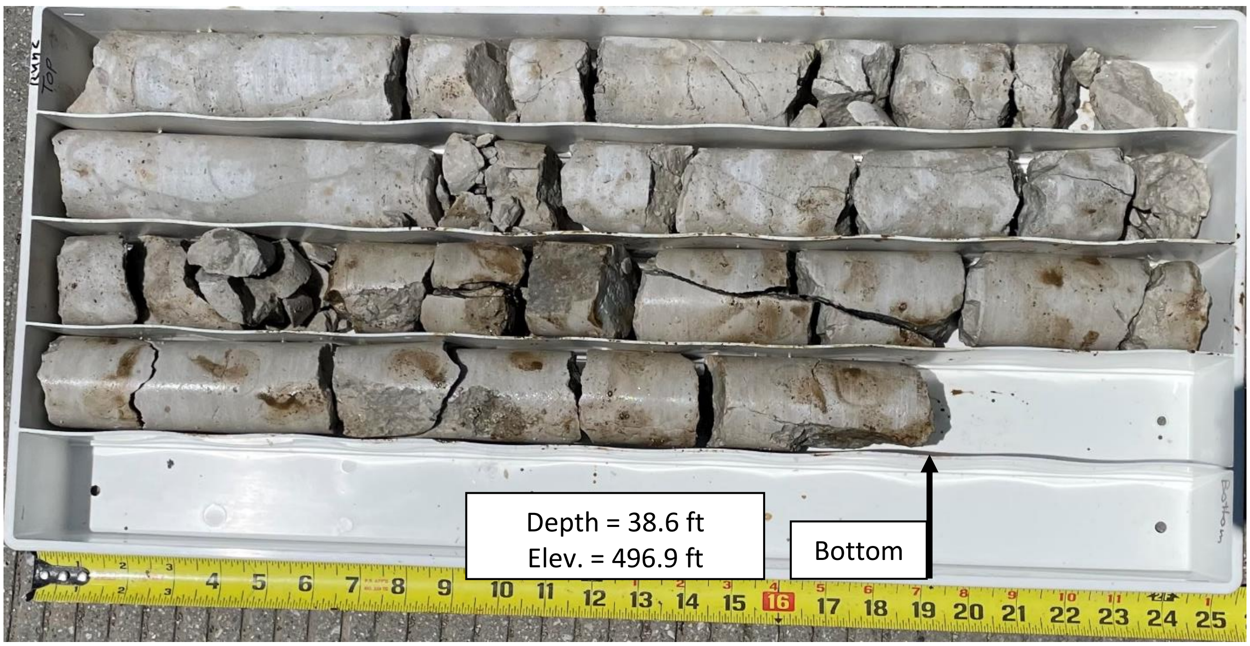
Bottom

Boring No.	Run	Depth (ft)	Recovery (%)	RQD (%)	RQD Classification	Description
BSB-74	1	23.3' – 28.6'	100.0	13.8	Very Poor	Light Gray Limestone Moderately Weathered, Heavily Fractured, Some Vugs, Some Clay Seams at 23.8 feet, 26.3 feet

Chicago Street Bridge over Hickory Creek
Boring Number: BSB-74
Will County, IL

Top

Depth = 28.6 ft
Elev. = 506.9 ft



Depth = 38.6 ft
Elev. = 496.9 ft

Bottom

Boring No.	Run	Depth (ft)	Recovery (%)	RQD (%)	RQD Classification	Compressive Strength (psi)	Description
BSB-74	2	28.6’ – 38.6’	100.0	11.3	Very Poor	9,780	Light Gray Limestone Slightly Weathered, Heavily Fractured, Some Vugs, Vertical Fractures at 36 feet and 37.5 feet

Illinois Department of Transportation
Division of Highways
GSG Consultants, Inc.

SOIL BORING LOG

Date 5/31/22

ROUTE I-80 **DESCRIPTION** IL 53/US 52 (Chicago Street) over Hickory Creek **LOGGED BY** KA

SECTION C-91-109-22 **LOCATION** , **SEC.** 15, **TWP.** 35 N, **RNG.** 10 E,
Latitude 41.5095739, **Longitude** -88.08106028

COUNTY Will **DRILLING RIG** CME-75 **HAMMER TYPE** Auto
DRILLING METHOD HSA **HAMMER EFF (%)** 91

STRUCT. NO. 099-8306
Station

BORING NO. BSB-75
Station 204+29.2083
Offset 18.26ft RT
Ground Surface Elev. 536.20 ft

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

Groundwater Elev.:
First Encounter Dry ft
Upon Completion N/A ft
After ___ Hrs. N/A ft

Description	Elev.	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
10 inches of Concrete Bridge Deck	535.36				
21 feet 6 inches of Air Void / Casing					
		-5			
		-10			
		-15			
		-20			
21 feet 6 inches of Air Void / Casing *(continued)*	513.86				
Light Gray LIMESTONE, slightly weathered, heavily to moderately fractured, some vugs, trace sand, trace chert Run 1: 22.3 - 32.3' Recovery: 100.0% RQD: 37.1% (Poor)		-25			
		-30			
	503.86				
Light Gray LIMESTONE, slightly weathered, moderately fractured, some vugs, trace sand Run 2: 32.3' - 37.3' Recovery: 100.0% RQD: 63.3% (Fair)		-35			
	498.86				
End of Boring					
		-40			

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

Chicago Street Bridge over Hickory Creek
Boring Number: BSB-75
Will County, IL

Top

Depth = 22.3 ft
Elev. = 513.9 ft

Bottom

Depth = 32.3 ft
Elev. = 503.9 ft

Boring No.	Run	Depth (ft)	Recovery (%)	RQD (%)	RQD Classification	Compressive Strength (psi)	Description
BSB-75	1	22.3' – 32.3'	100.0	37.1	Poor	5,643	Light Gray Limestone Slightly Weathered, Heavily to Moderately Fractured, Some Vugs, Trace Sand, Trace Chert

Chicago Street Bridge over Hickory Creek
Boring Number: BSB-75
Will County, IL

Top

Depth = 32.3 ft
Elev. = 503.9 ft

Depth = 37.3 ft
Elev. = 498.9 ft

Bottom

Boring No.	Run	Depth (ft)	Recovery (%)	RQD (%)	RQD Classification	Description
BSB-75	2	32.3’ – 37.3’	100.0	63.3	Fair	Light Gray Limestone Slightly Weathered, Moderately Fractured, Some Vugs, Trace Sand

Illinois Department of Transportation
Division of Highways
GSG Consultants, Inc.

SOIL BORING LOG

Date 4/15/22

ROUTE I-80 **DESCRIPTION** IL 53/US 52 (Chicago Street) over Hickory Creek **LOGGED BY** EH

SECTION C-91-109-22 **LOCATION** , **SEC.** 22, **TWP.** 35 N, **RNG.** 10 E, **Latitude** 41.50939575, **Longitude** -88.08103339

COUNTY Will **DRILLING RIG** Diedrich D-50 **HAMMER TYPE** Auto
DRILLING METHOD HSA **HAMMER EFF (%)** 98

STRUCT. NO. 099-8306
Station

BORING NO. BSB-76
Station 203+67.9444
Offset 21.37ft RT
Ground Surface Elev. 533.77 ft

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

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

Description	Elev.	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
3 inches of Asphalt	533.52				
10 inches of Concrete	532.68				
Brown and Gray, Moist FILL: SILTY CLAY, with gravel	530.27		5 4 5	1.0 P	13
Medium Dense Brown, Dry to Moist SAND, with gravel (SPG)	522.77	-5	4 7 6		6
			4 12 8		4
		-10	3 10 8		6
Medium Stiff Brown, Moist SILTY CLAY, trace sand and gravel (CL-ML)	517.77		2 3 4	0.5 P	11
		-15	3 3 2	0.5 P	17
Very Dense Brown, Moist SANDY LOAM, with gravel (SM)	515.27		4 50/3"		13
		-20			

Description	Elev.	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
Light Gray LIMESTONE, slightly weathered, moderately to heavily fractured, some vugs, vertical fractures at 23.5 feet Run 1: 18.5' - 28.5' Recovery: 90.0% RQD: 69.0% (Fair) *(continued)*	505.27	-25			
Light Gray LIMESTONE, slightly weathered, heavily to moderately fractured, some vugs, vertical fractures at 32 feet, trace sand Run 2: 28.5' - 33.5' Recovery: 100.0% RQD: 60.0% (Fair)	500.27	-30			
End of Boring		-35			
		-40			

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

Chicago Street Bridge over Hickory Creek
Boring Number: BSB-76
Will County, IL

Top

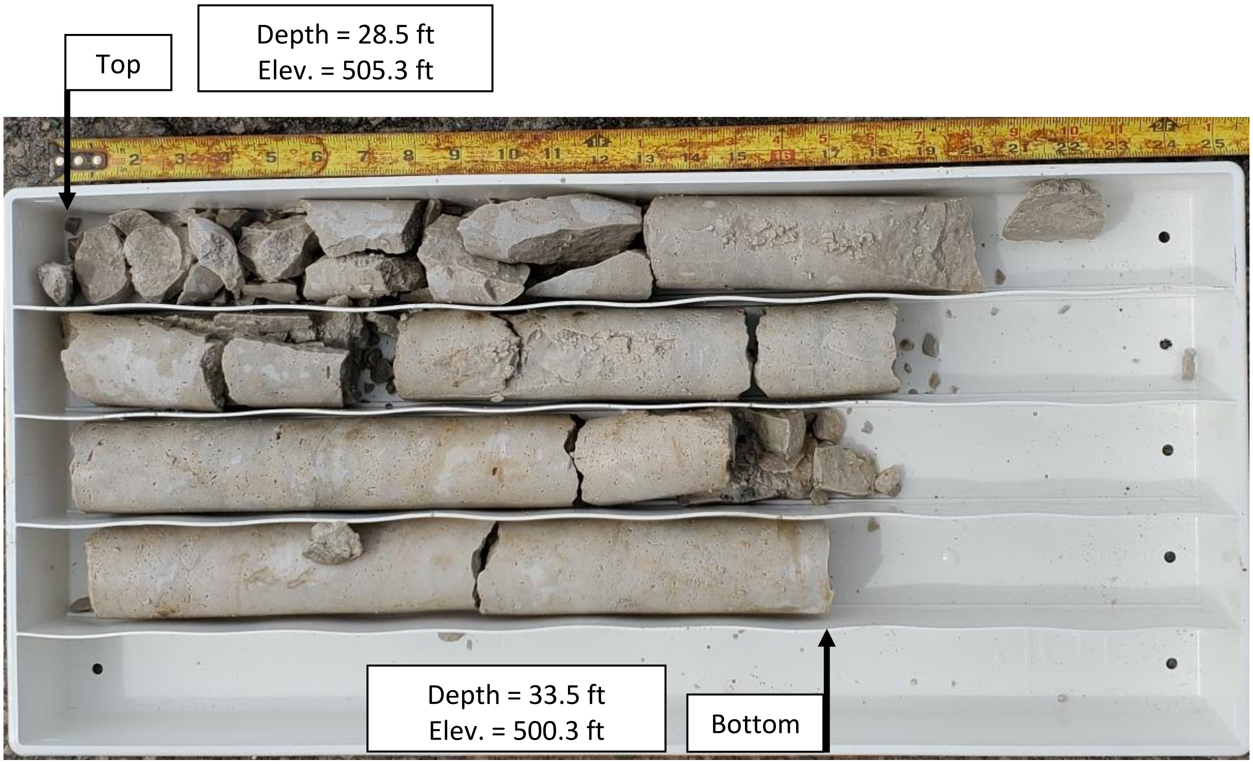
Depth = 18.5 ft
Elev. = 515.3 ft

Depth = 28.5 ft
Elev. = 505.3 ft

Bottom

Boring No.	Run	Depth (ft)	Recovery (%)	RQD (%)	RQD Classification	Compressive Strength (psi)	Description
BSB-76	1	18.5' – 28.5'	90.0	69.0	Fair	14,761	Light Gray Limestone Slightly Weathered, Moderately to Heavily Fractured, Some Vugs, Vertical Fractures at 23.5 feet

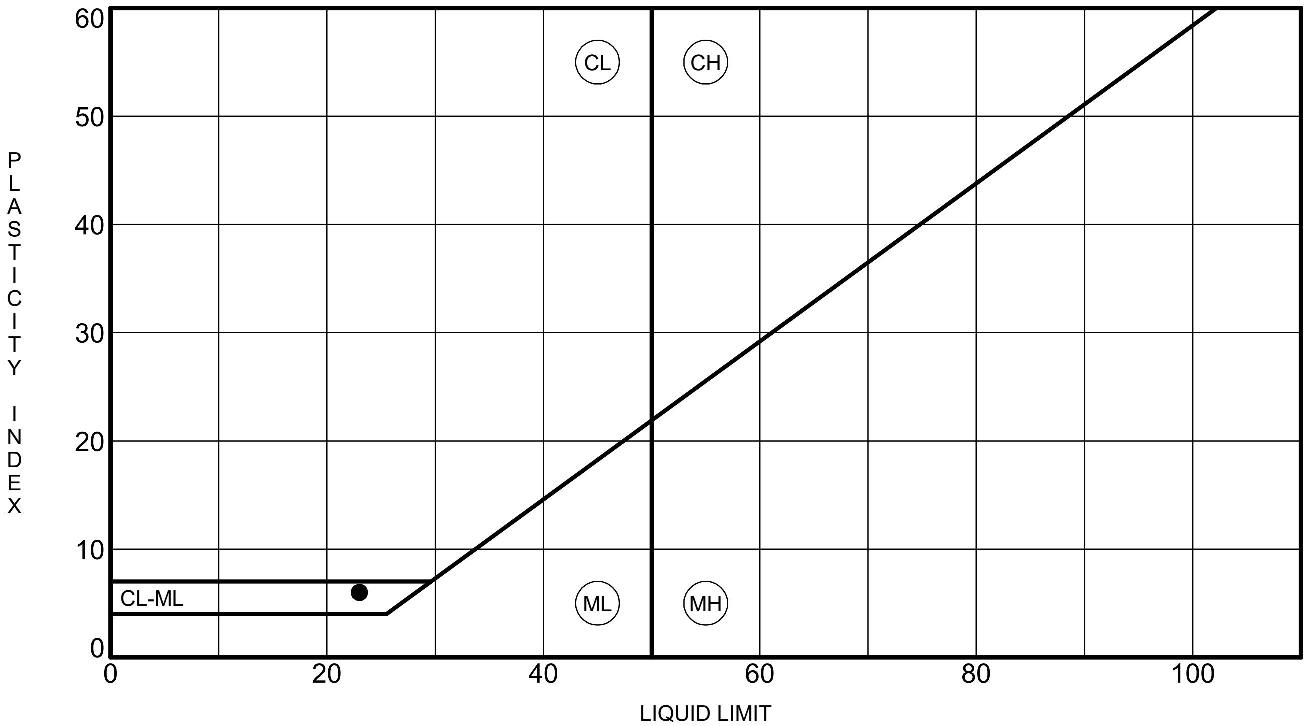
Chicago Street Bridge over Hickory Creek
Boring Number: BSB-76
Will County, IL



Boring No.	Run	Depth (ft)	Recovery (%)	RQD (%)	RQD Classification	Description
BSB-76	2	28.5' – 33.5'	100.0	60.0	Fair	Light Gray Limestone Slightly Weathered, Heavily to Moderately Fractured, Some Vugs, Vertical Fractures at 32 feet, Trace Sand

APPENDIX D

LABORATORY TEST RESULTS



	Specimen Identification		LL	PL	PI	Fines	Classification
●	**BSB-76**	**13.50**	**23.0**	**17.0**	**6.0**		

ATTERBERG LIMITS' RESULTS

Route: I-80

Section: I-80 over Des Plaines River

County: Will

Illinois Department of Transportation

Division of Highways
GSG Consultants, Inc.

Organic Content Results

Boring ID	Sample Depth (ft)	Organic Content (%)	Soil Classification
BSB-72	1.0-2.5	2.8	CL/ML Fill

Compressive Strength of Rock by ASTM D7012 - Method C

GSG CONSULTANTS, INC.
735 Remington Road, Schaumburg, IL 60173
Tel: 630.994.2600, www.gsg-consultants.com

Project Name:	WSP 198-003 I-80	Project No:	21-2007
Boring ID:	BSB-69	Bulk/Prep	MC/CS
Sample Depth (ft):	26-26.5	Tester: AJ	Tester: AJ
Lithological Description:	Limestone	Date: 5/20/22	Date: 5/24/22
Formation Name:	Silurian, Undivided	Load Direction: vertical	Angle Drilled: vertical
Appearance (e.g. cracks, shearing, spalling):	<10% vugs; stylolites		

Bulk Density Determination

	1	2	3	Average
Height, *in.*	4.1465	4.1475	4.1485	4.1475
Diameter, *in.*	1.9890	1.9900	1.9870	1.9887

Specimen Mass, *g*	559.9	Ratio (2.0-2.5)	
Bulk Density, *pcf*	165.6		2.09

Moisture Condition - D2216

Container ID	20
container, *g*	462.8
container + wet rock, *g*	979.9
container + dry soil, *g*	979.0
moisture content, *w%*	0.2

Preparation Check	Yes	No	Reason/Readings If No:
Ends Flat within 0.02 mm prior to capping?	X		
Ends perpendicular to side within 0.25 degrees?	X		
Ends parallel to each other within 0.25 degrees?	X		

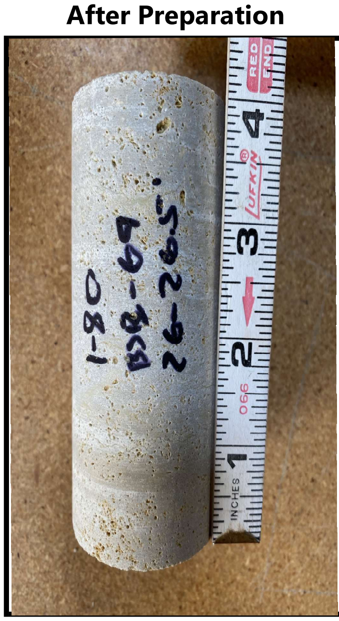
Axial Loading

Seating Load (≤1000 psi)	1000
Rate of Loading (73-145 psi/s)	75
Time to Failure (2-15 min)	2 min 0 sec
Load @ Failure, *lbf*	34,451
Uniaxial Compressive Strength, *psi*	11,091

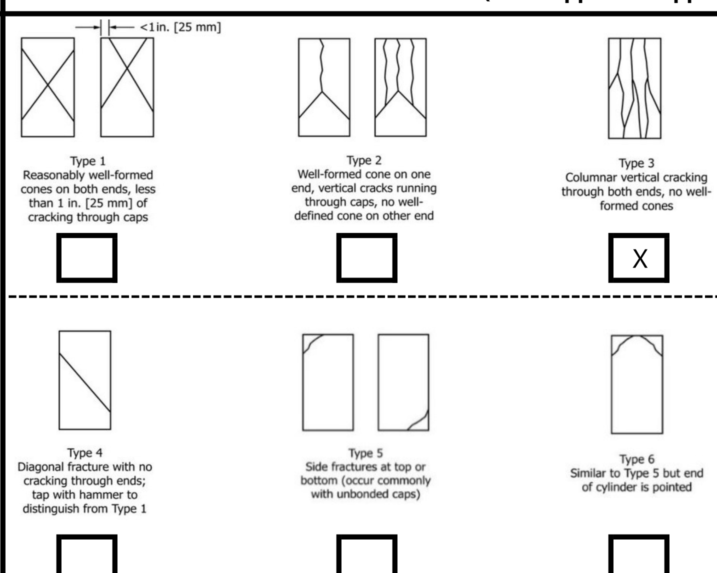
Remarks

Best efforts have been made for the specimen to meet the required tolerances of D4543. See IH3 Procedure for efforts made.

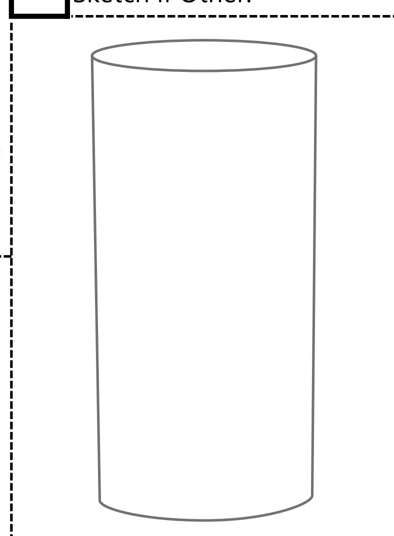
After Preparation



After Break (check applicable appearance)



Sketch if Other:



Compressive Strength of Rock by ASTM D7012 - Method C

GSG CONSULTANTS, INC.
735 Remington Road, Schaumburg, IL 60173
Tel: 630.994.2600, www.gsg-consultants.com

Project Name:	WSP_198-003 I-80	Project No:	21-007	
Boring ID:	BSB 71	Bulk/Prep		MC/CS
Sample Depth (ft):	33.5-34	Tester: MB		Tester: MB
Lithological Description:	lime stone	Date: 06/15/22		Date: 06/15/22
Formation Name:		Load Direction: vertical		Angle Drilled: vertical
Appearance (e.g. cracks, shearing, spalling):				

Bulk Density Determination

	1	2	3	Average
Height, *in.*	4.8540	4.8460	4.8565	4.8522
Diameter, *in.*	1.9920	1.9905	1.9870	1.9898

Specimen Mass, *g*	668.3	Ratio (2.0-2.5)	
Bulk Density, *pcf*	168.8		2.44

Moisture Condition - D2216

Container ID	
container, *g*	226.4
container + wet rock, *g*	697.0
container + dry soil, *g*	694.3
moisture content, *w%*	0.6

Preparation Check	Yes	No	Reason/Readings If No:
Ends Flat within 0.02 mm prior to capping?	x		
Ends perpendicular to side within 0.25 degrees?	x		
Ends parallel to each other within 0.25 degrees?	x		

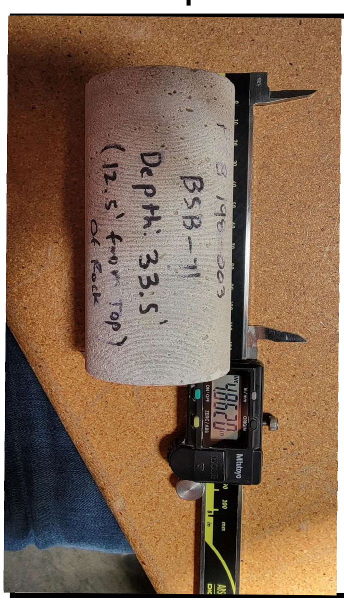
Axial Loading

Seating Load (≤1000 psi)	1000
Rate of Loading (73-145 psi/s)	75
Time to Failure (2-15 min)	3 min 40 sec
Load @ Failure, *lbf*	52,269
Uniaxial Compressive Strength, *psi*	16,809

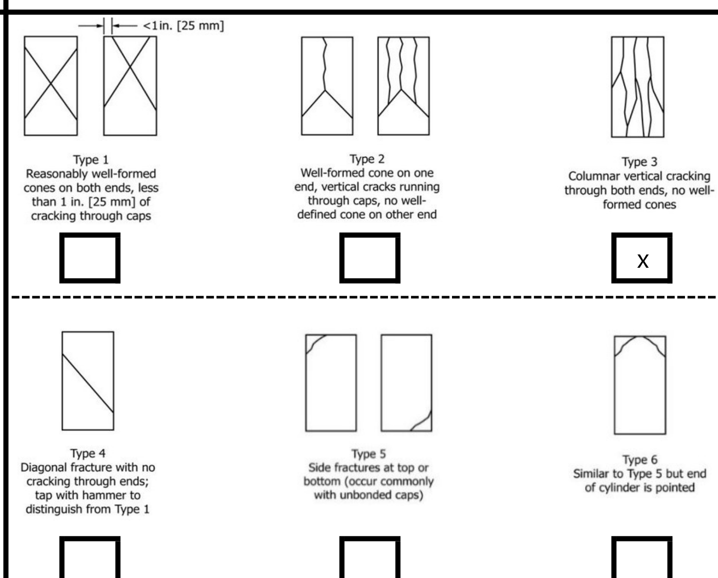
Remarks

Best efforts have been made for the specimen to meet the required tolerances of D4543. See IH3 Procedure for efforts made.

After Preparation



After Break (check applicable appearance)



Compressive Strength of Rock by ASTM D7012 - Method C

GSG CONSULTANTS, INC.
735 Remington Road, Schaumburg, IL 60173
Tel: 630.994.2600, www.gsg-consultants.com

Project Name:	WSP_198-003 I-80	Project No:	21-007		
Boring ID:	BSB 74	Bulk/Prep		MC/CS	
Sample Depth (ft):	32.5-33	Tester:	MB	Tester:	MB
Lithological Description:		Date:	06/15/22	Date:	06/15/22
Formation Name:		Load Direction:	VERTICAL	Angle Drilled:	VERTICAL
Appearance (e.g. cracks, shearing, spalling):					

Bulk Density Determination

	1	2	3	Average
Height, *in.*	4.8730	4.8685	4.8720	4.8712
Diameter, *in.*	1.9880	1.9995	1.9880	1.9918

Specimen Mass, *g*	667.3	Ratio (2.0-2.5)	
Bulk Density, *pcf*	167.5		2.45

Moisture Condition - D2216

Container ID	
container, *g*	226.4
container + wet rock, *g*	540.7
container + dry soil, *g*	536.4
moisture content, *w%*	1.4

Preparation Check	Yes	No	Reason/Readings If No:
Ends Flat within 0.02 mm prior to capping?	X		
Ends perpendicular to side within 0.25 degrees?	X		
Ends parallel to each other within 0.25 degrees?	X		

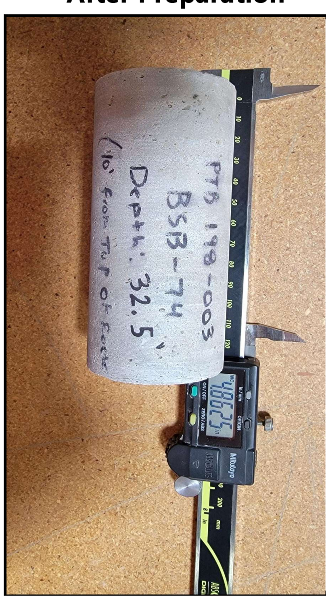
Axial Loading

Seating Load (≤1000 psi)	1000
Rate of Loading (73-145 psi/s)	75
Time to Failure (2-15 min)	2 min 6 sec
Load @ Failure, *lbf*	30,474
Uniaxial Compressive Strength, *psi*	9,780

Remarks

Best efforts have been made for the specimen to meet the required tolerances of D4543. See IH3 Procedure for efforts made.

After Preparation



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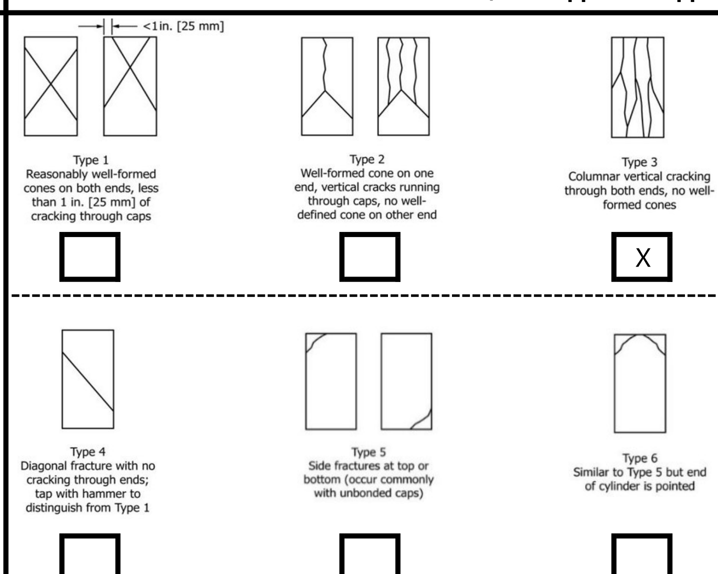


Compressive Strength of Rock by ASTM D7012 - Method C

GSG CONSULTANTS, INC.
735 Remington Road, Schaumburg, IL 60173
Tel: 630.994.2600, www.gsg-consultants.com

Project Name:	WSP_198-003 I-80	Project No:	21-007
Boring ID:	BSB 75		
Sample Depth (ft):	28.5-29		
Lithological Description:			
Formation Name:		Load Direction:	VETRTICAL

	Bulk/Prep	MC/CS
Tester:	MB	MB
Date:	06/15/22	06/15/22

Angle Drilled: VERTICAL

Appearance (e.g. cracks, shearing, spalling):

Bulk Density Determination

	1	2	3	Average
Height, *in.*	3.9670	3.9675	3.9745	3.9697
Diameter, *in.*	1.9870	1.9885	1.9845	1.9867

Specimen Mass, *g*	518.5	Ratio (2.0-2.5)	
Bulk Density, *pcf*	160.5		2.00

Moisture Condition - D2216

Container ID	
container, *g*	518.6
container + wet rock, *g*	1036.8
container + dry soil, *g*	1028.2
moisture content, *w%*	1.7

Preparation Check	Yes	No	Reason/Readings If No:
Ends Flat within 0.02 mm prior to capping?	X		
Ends perpendicular to side within 0.25 degrees?	X		
Ends parallel to each other within 0.25 degrees?	X		

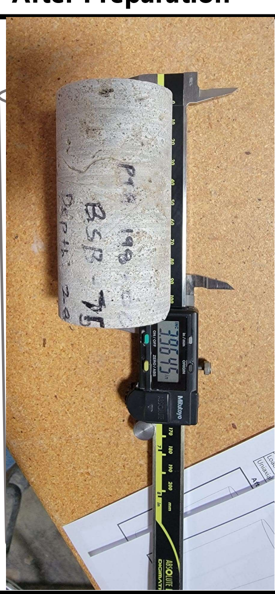
Axial Loading

Seating Load (≤1000 psi)	1000
Rate of Loading (73-145 psi/s)	75
Time to Failure (2-15 min)	1 min 11 sec
Load @ Failure, *lbf*	17,492
Uniaxial Compressive Strength, *psi*	5,643

Remarks

Best efforts have been made for the specimen to meet the required tolerances of D4543. See IH3 Procedure for efforts made.

After Preparation



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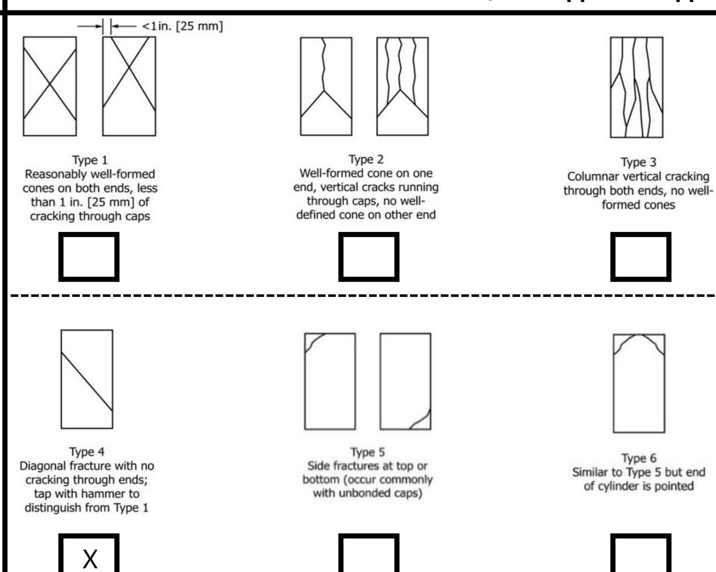
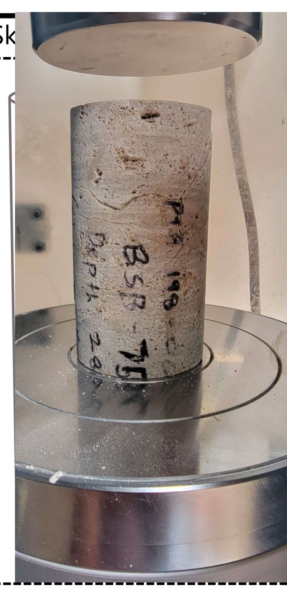




Compressive Strength of Rock by ASTM D7012 - Method C

GSG CONSULTANTS, INC.
735 Remington Road, Schaumburg, IL 60173
Tel: 630.994.2600, www.gsg-consultants.com

Project Name:	WSP 198-003 I-80	Project No:	21-2007
Boring ID:	BSB-76		
Sample Depth (ft):	25-25.5		
Lithological Description:	Limestone		

	Bulk/Prep		MC/CS
Tester:	AJ	Tester:	AJ
Date:	5/20/22	Date:	5/24/22

Formation Name: Silurian, Undivided Load Direction: vertical Angle Drilled: vertical

Appearance (e.g. cracks, shearing, spalling): ~10% <1mm vugs

Bulk Density Determination

	1	2	3	Average
Height, *in.*	4.6180	4.6165	4.6170	4.1547
Diameter, *in.*	1.9755	1.9770	1.9750	1.9758

Specimen Mass, *g*	617.1	Ratio (2.0-2.5)	
Bulk Density, *pcf*	184.6		2.10

Moisture Condition - D2216

Container ID	05
container, *g*	518.5
container + wet rock, *g*	895.2
container + dry soil, *g*	
moisture content, *w%*	

Preparation Check

Preparation Check	Yes	No	Reason/Readings If No:
Ends Flat within 0.02 mm prior to capping?	X		
Ends perpendicular to side within 0.25 degrees?	X		
Ends parallel to each other within 0.25 degrees?	X		

Axial Loading

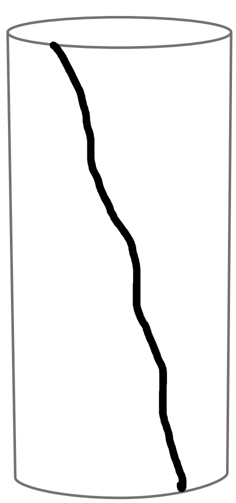
Seating Load (≤1000 psi)	1000
Rate of Loading (73-145 psi/s)	75
Time to Failure (2-15 min)	4 min 30 sec
Load @ Failure, *lbf*	45,257
Uniaxial Compressive Strength, *psi*	14,761

Remarks

Best efforts have been made for the specimen to meet the required tolerances of D4543. See IH3 Procedure for efforts made.

After Preparation

Sketch



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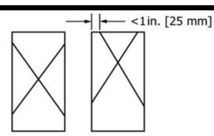
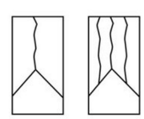


Type 1
Reasonably well-formed cones on both ends, less than 1 in. [25 mm] of cracking through caps

[ ]

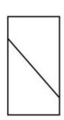


Type 2
Well-formed cone on one end, vertical cracks running through caps, no well-defined cone on other end

[ ]

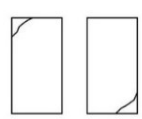
Type 3
Columnar vertical cracking through both ends, no well-formed cones

[X]



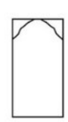
Type 4
Diagonal fracture with no cracking through ends; tap with hammer to distinguish from Type 1

[ ]



Type 5
Side fractures at top or bottom (occur commonly with unbonded caps)

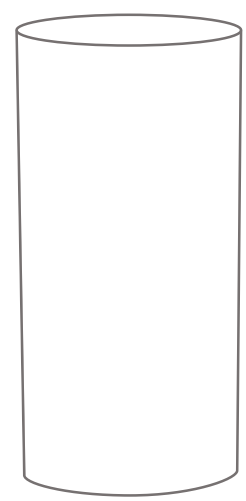
[ ]



Type 6
Similar to Type 5 but end of cylinder is pointed

[ ]

[ ] Sketch if Other:



APPENDIX E

SEISMIC SITE CLASS DETERMINATION

Illinois Department of Transportation

SEISMIC SITE CLASS DETERMINATION

PROJECT TITLE===== Hickory Creek Bridge

Substructure 1

Base of Substruct. Elev. (or ground surf for bents)	530.35	ft.
Pile or Shaft Dia.		inches
Boring Number	BSB-69	
Top of Boring Elev.	535.4	ft.
Approximate Fixity Elev.	530.35	ft.

Individual Site Class Definition:

N (bar):	27	(Blows/ft.)	Soil Site Class D
N_{ch} (bar):	29	(Blows/ft.)	Soil Site Class D <----Controls
s_u (bar):	2.94	(ksf)	Soil Site Class C

Seismic Soil Column Depth (ft)	Bot. Of Sample Elevation	Sample Thick. (ft.)	N	Qu (tsf)	Layer Description Boundary
	533.4	2.00	14	1.50	B
5.0	525.4	8.00	9		B
10.0	520.4	5.00	22		B
12.5	517.9	2.50	3		B
15.0	515.4	2.50	6	0.20	B
16.0	514.4	1.00	50		B
99.0	431.4	83.00	50	####	R

Substructure 2

Base of Substruct. Elev. (or ground surf for bents)	526.41	ft.
Pile or Shaft Dia.		inches
Boring Number	BSB-72	
Top of Boring Elev.	531.3	ft.
Approximate Fixity Elev.	526.41	ft.

Individual Site Class Definition:

N (bar):	39	(Blows/ft.)	Soil Site Class D
N_{ch} (bar):	48	(Blows/ft.)	Soil Site Class D <----Controls
s_u (bar):	3.44	(ksf)	Soil Site Class C

Seismic Soil Column Depth (ft)	Bot. Of Sample Elevation	Sample Thick. (ft.)	N	Qu (tsf)	Layer Description Boundary
	528.8	2.50	16	3.00	B
2.6	523.8	5.00	18		B
7.6	518.8	5.00	9	1.00	B
13.6	512.8	6.00	50	1.00	B
100.0	426.4	86.40	50	####	R

Substructure 3

Base of Substruct. Elev. (or ground surf for bents)	530.35	ft.
Pile or Shaft Dia.		inches
Boring Number	BSB-73	
Top of Boring Elev.	539.4	ft.
Approximate Fixity Elev.	530.35	ft.

Individual Site Class Definition:

N (bar):	33	(Blows/ft.)	Soil Site Class D <----Controls
N_{ch} (bar):	33	(Blows/ft.)	Soil Site Class D
s_u (bar):		(ksf)	NA, H < 0.1*H (Soil)

Seismic Soil Column Depth (ft)	Bot. Of Sample Elevation	Sample Thick. (ft.)	N	Qu (tsf)	Layer Description Boundary
	536.9	2.50	19		B
14.0	516.4	20.50	11		B
16.0	514.4	2.00	50		B
100.0	430.4	84.00	50	####	R

Substructure 4

Base of Substruct. Elev. (or ground surf for bents)	526.41	ft.
Pile or Shaft Dia.		inches
Boring Number	BSB-76	
Top of Boring Elev.	533.8	ft.
Approximate Fixity Elev.	526.41	ft.

Individual Site Class Definition:

N (bar):	35	(Blows/ft.)	Soil Site Class D
N_{ch} (bar):	47	(Blows/ft.)	Soil Site Class D <----Controls
s_u (bar):	3.38	(ksf)	Soil Site Class C

Seismic Soil Column Depth (ft)	Bot. Of Sample Elevation	Sample Thick. (ft.)	N	Qu (tsf)	Layer Description Boundary
	530.3	3.50	9	1.00	B
3.6	522.8	7.50	17		B
8.6	517.8	5.00	6	0.50	B
11.1	515.3	2.50	50		B
100.0	426.4	88.90	50	####	R

Global Site Class Definition: Substructures 1 through 8

N (bar):	41	(Blows/ft.)	Soil Site Class D
N_{ch} (bar):	44	(Blows/ft.)	Soil Site Class D <----Controls
s_u (bar):	4.36	(ksf)	Soil Site Class C

SEISMIC SITE CLASS DETERMINATION

Illinois Department of Transportation

PROJECT TITLE=====Hickory Creek Bridge

Substructure 5

Base of Substruct. Elev. (or ground surf for bents)	511	ft.
Pile or Shaft Dia.		inches
Boring Number	BSB-70	
Top of Boring Elev.	513.1	ft.

Approximate Fixity Elev. 511 ft.

Individual Site Class Definition:

N (bar): 49 (Blows/ft.) Soil Site Class D <----Controls
N_{ch} (bar): 49 (Blows/ft.) Soil Site Class D
s_u (bar): (ksf) NA, H < 0.1*H (Soil)

Seismic Soil Column Depth (ft)	Bot. Of Sample Elevation	Sample Thick. (ft.)	N	Qu (tsf)	Layer Description Boundary
2.9	508.1	5.00	35		B
100.0	411.0	97.10	50	####	R

Substructure 6

Base of Substruct. Elev. (or ground surf for bents)	512.3	ft.
Pile or Shaft Dia.		inches
Boring Number	BSB-71	
Top of Boring Elev.	513.7	ft.

Approximate Fixity Elev. 512.3 ft.

Individual Site Class Definition:

N (bar): 49 (Blows/ft.) Soil Site Class D <----Controls
N_{ch} (bar): 49 (Blows/ft.) Soil Site Class D
s_u (bar): (ksf) NA, H < 0.1*H (Soil)

Seismic Soil Column Depth (ft)	Bot. Of Sample Elevation	Sample Thick. (ft.)	N	Qu (tsf)	Layer Description Boundary
3.6	508.7	5.00	35		B
100.0	412.3	96.40	50	####	R

Substructure 7

Base of Substruct. Elev. (or ground surf for bents)	511	ft.
Pile or Shaft Dia.		inches
Boring Number	BSB-74	
Top of Boring Elev.	511	ft.

Approximate Fixity Elev. 511 ft.

Individual Site Class Definition:

N (bar): 49 (Blows/ft.) Soil Site Class D <----Controls
N_{ch} (bar): 49 (Blows/ft.) Soil Site Class D
s_u (bar): (ksf) NA, H < 0.1*H (Soil)

Seismic Soil Column Depth (ft)	Bot. Of Sample Elevation	Sample Thick. (ft.)	N	Qu (tsf)	Layer Description Boundary
5.0	506.0	5.00	35		B
100.0	411.0	95.00	50	####	R

Substructure 8

Base of Substruct. Elev. (or ground surf for bents)	512.3	ft.
Pile or Shaft Dia.		inches
Boring Number	BSB-75	
Top of Boring Elev.	513.9	ft.

Approximate Fixity Elev. 512.3 ft.

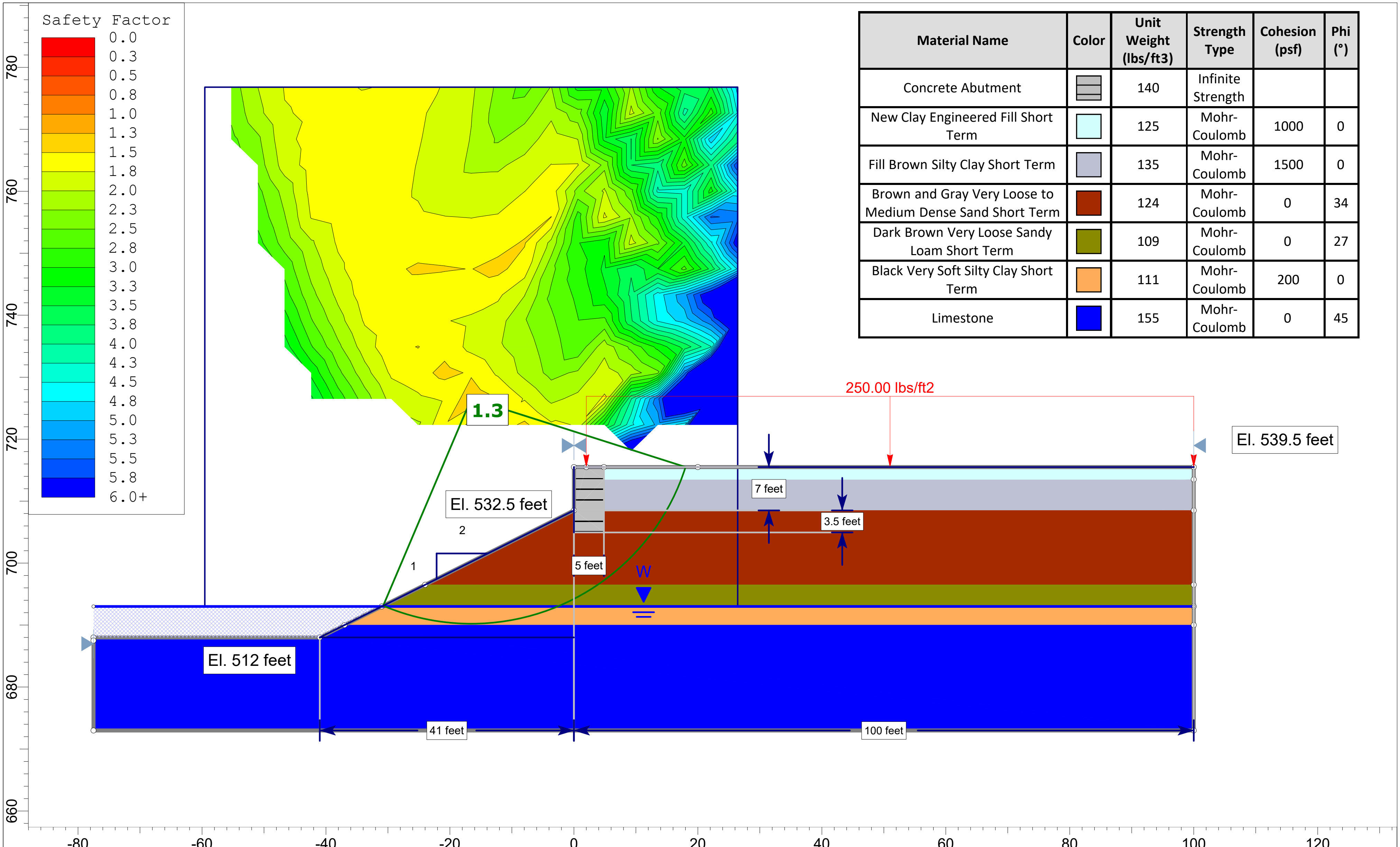
Individual Site Class Definition:

N (bar): 49 (Blows/ft.) Soil Site Class D <----Controls
N_{ch} (bar): 49 (Blows/ft.) Soil Site Class D
s_u (bar): (ksf) NA, H < 0.1*H (Soil)

Seismic Soil Column Depth (ft)	Bot. Of Sample Elevation	Sample Thick. (ft.)	N	Qu (tsf)	Layer Description Boundary
3.4	508.9	5.00	35		B
100.0	412.3	96.60	50	####	R

APPENDIX F

SLOPE STABILITY ANALYSES EXHIBITS

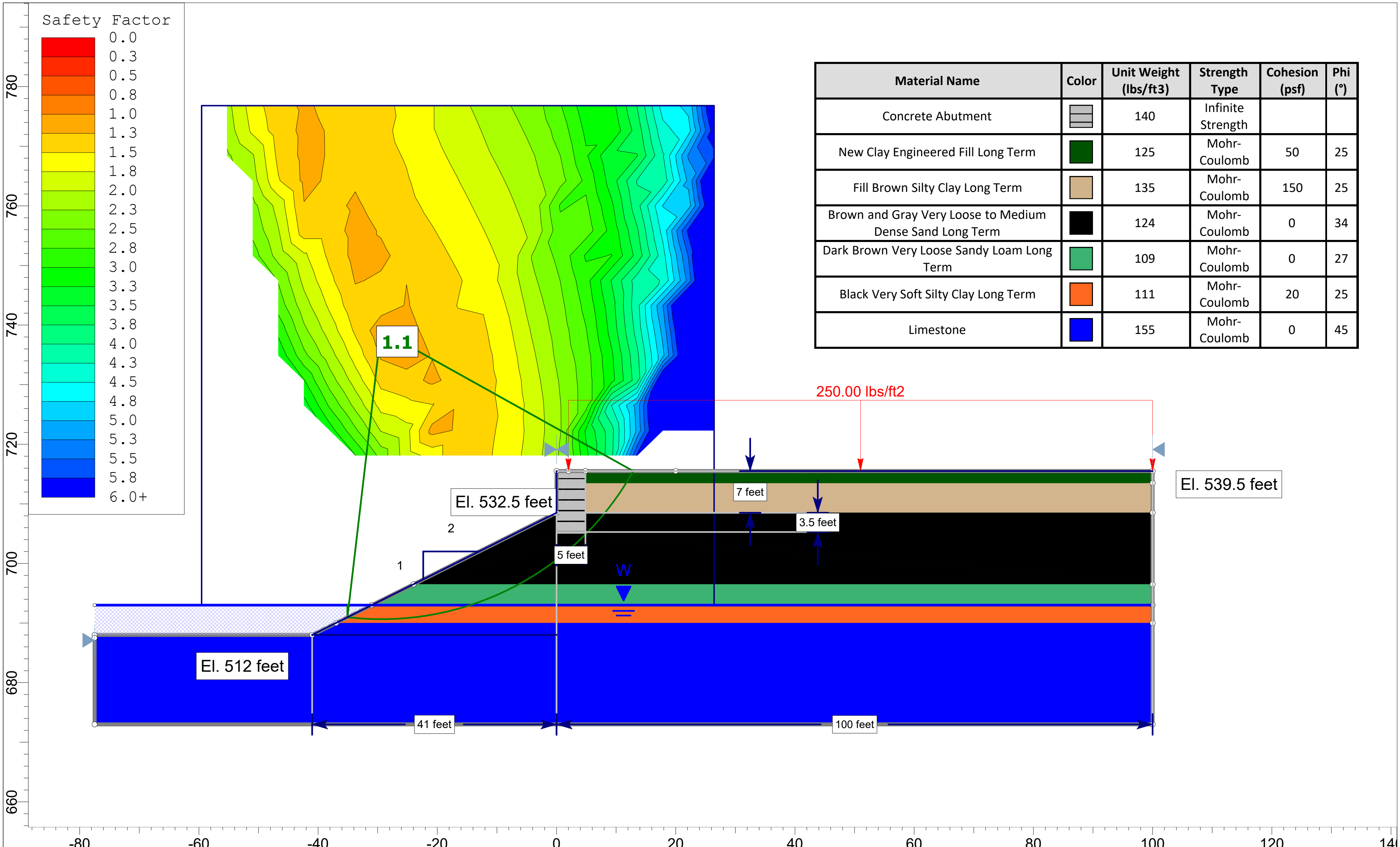


Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (°)
Concrete Abutment		140	Infinite Strength		
New Clay Engineered Fill Short Term		125	Mohr-Coulomb	1000	0
Fill Brown Silty Clay Short Term		135	Mohr-Coulomb	1500	0
Brown and Gray Very Loose to Medium Dense Sand Short Term		124	Mohr-Coulomb	0	34
Dark Brown Very Loose Sandy Loam Short Term		109	Mohr-Coulomb	0	27
Black Very Soft Silty Clay Short Term		111	Mohr-Coulomb	200	0
Limestone		155	Mohr-Coulomb	0	45

GSG CONSULTANTS, INC.
735 Remington Road, Schaumburg, IL 60173
Tel: 630.994.2600, www.gsg-consultants.com

SLIDEINTERPRET 9.031

Project	Hickory Creek Bridge - North Abutment, 2H:1V Slope
Group	Group 1
Scenario	Short Term Stability - Water El. 517
Drawn By	RM
Company	GSG Consultants, Inc.
Date	11/15/2021, 3:10:38 PM
File Name	North Abutment 2,1.slmd



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (°)
Concrete Abutment		140	Infinite Strength		
New Clay Engineered Fill Long Term		125	Mohr-Coulomb	50	25
Fill Brown Silty Clay Long Term		135	Mohr-Coulomb	150	25
Brown and Gray Very Loose to Medium Dense Sand Long Term		124	Mohr-Coulomb	0	34
Dark Brown Very Loose Sandy Loam Long Term		109	Mohr-Coulomb	0	27
Black Very Soft Silty Clay Long Term		111	Mohr-Coulomb	20	25
Limestone		155	Mohr-Coulomb	0	45

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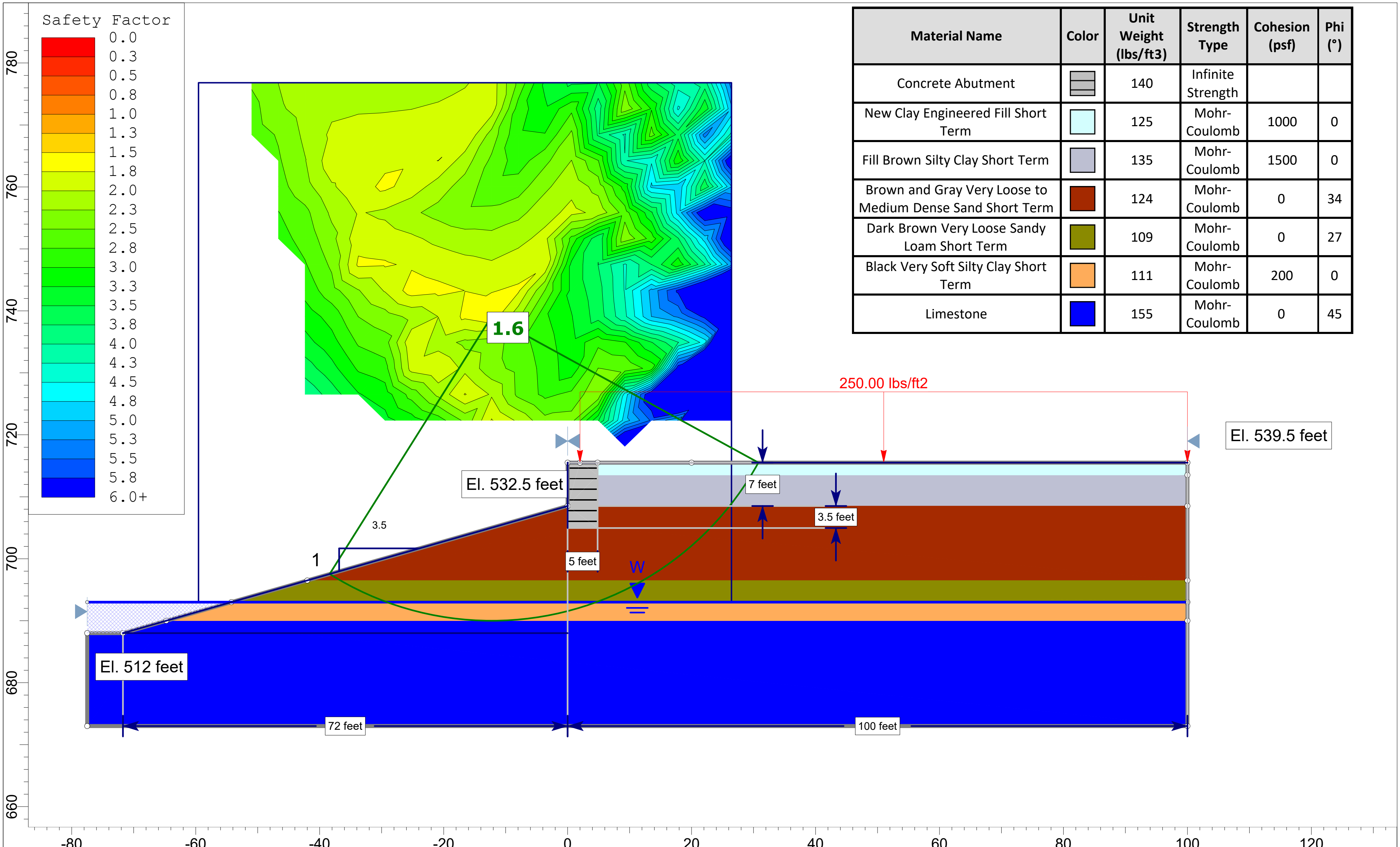
SLIDEINTERPRET 9.031

Project	Hickory Creek Bridge - North Abutment, 2H:1V Slope
Group	Group 1
Scenario	Long Term Stability - Water El. 517
Drawn By	RM
Company	GSG Consultants, Inc.
Date	11/15/2021, 3:10:38 PM
File Name	North Abutment 2,1.slmd



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (°)
Concrete Abutment		140	Infinite Strength		
New Clay Engineered Fill Short Term		125	Mohr-Coulomb	1000	0
Fill Brown Silty Clay Short Term		135	Mohr-Coulomb	1500	0
Brown and Gray Very Loose to Medium Dense Sand Short Term		124	Mohr-Coulomb	0	34
Dark Brown Very Loose Sandy Loam Short Term		109	Mohr-Coulomb	0	27
Black Very Soft Silty Clay Short Term		111	Mohr-Coulomb	200	0
Limestone		155	Mohr-Coulomb	0	45

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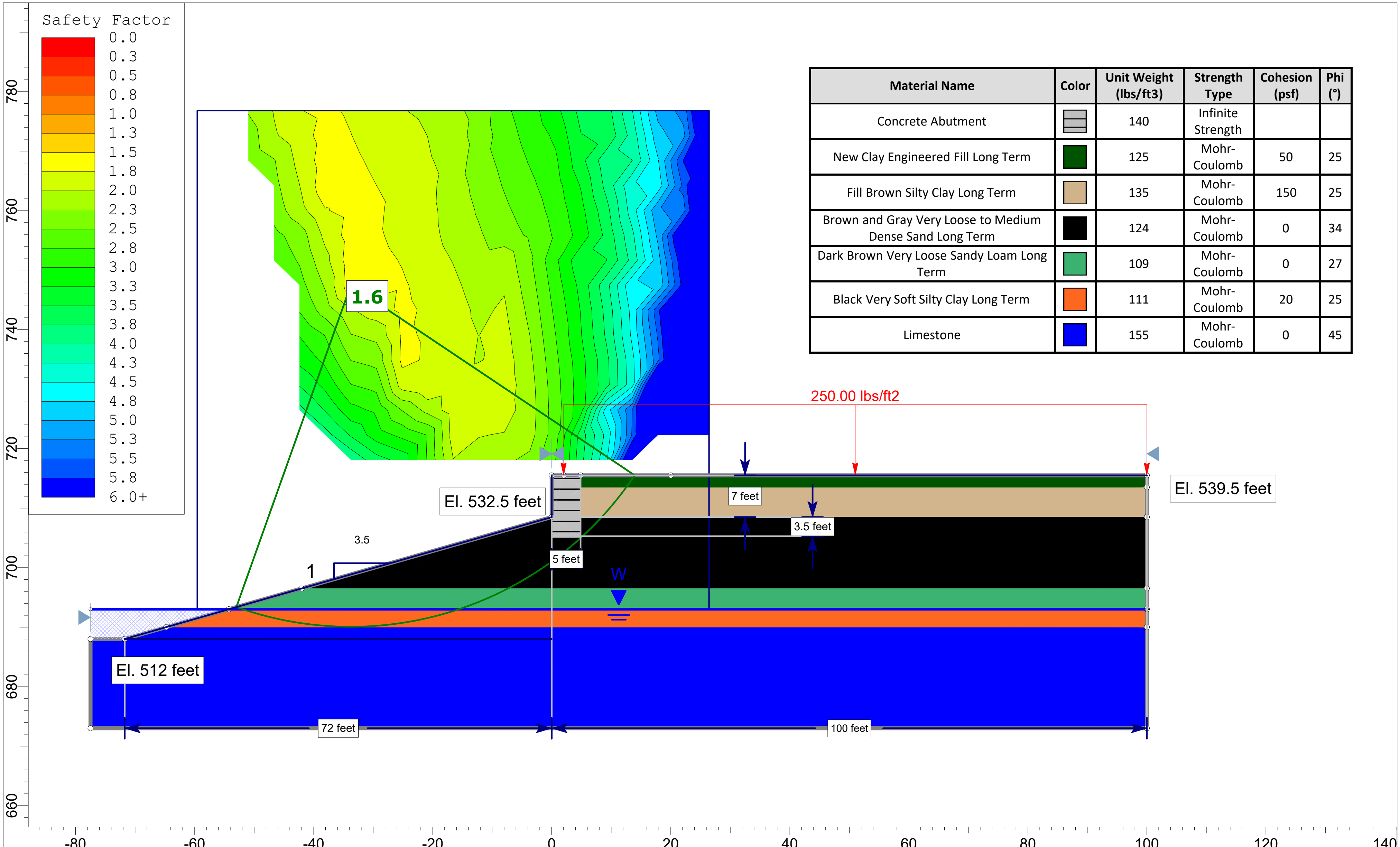
SLIDEINTERPRET 9.031

Project	Hickory Creek Bridge - North Abutment, 3.5H:1V Slope		
Group	Group 1	*Scenario*	Short Term Stability - Water El. 517
Drawn By	RM	*Company*	GSG Consultants, Inc.
Date	11/15/2021, 3:10:38 PM	*File Name*	North Abutment 3.5,1.slmd



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (°)
Concrete Abutment		140	Infinite Strength		
New Clay Engineered Fill Long Term		125	Mohr-Coulomb	50	25
Fill Brown Silty Clay Long Term		135	Mohr-Coulomb	150	25
Brown and Gray Very Loose to Medium Dense Sand Long Term		124	Mohr-Coulomb	0	34
Dark Brown Very Loose Sandy Loam Long Term		109	Mohr-Coulomb	0	27
Black Very Soft Silty Clay Long Term		111	Mohr-Coulomb	20	25
Limestone		155	Mohr-Coulomb	0	45

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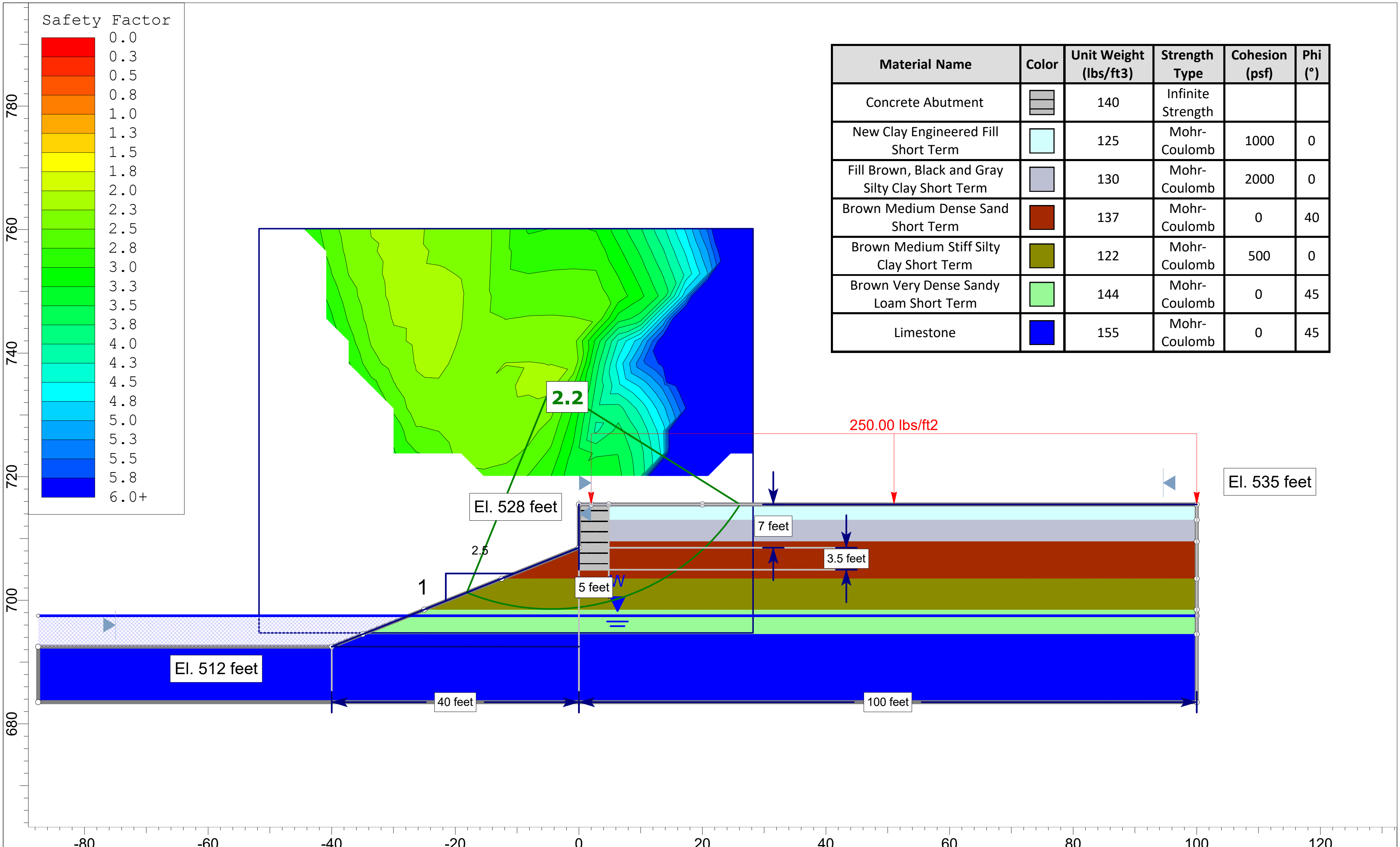
SLIDEINTERPRET 9.031

Project	Hickory Creek Bridge - North Abutment, 3.5H:1V Slope		
Group	Group 1	*Scenario*	Long Term Stability - Water El. 517
Drawn By	RM	*Company*	GSG Consultants, Inc.
Date	11/15/2021, 3:10:38 PM	*File Name*	North Abutment 3.5,1.slmd



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (°)
Concrete Abutment		140	Infinite Strength		
New Clay Engineered Fill Short Term		125	Mohr-Coulomb	1000	0
Fill Brown, Black and Gray Silty Clay Short Term		130	Mohr-Coulomb	2000	0
Brown Medium Dense Sand Short Term		137	Mohr-Coulomb	0	40
Brown Medium Stiff Silty Clay Short Term		122	Mohr-Coulomb	500	0
Brown Very Dense Sandy Loam Short Term		144	Mohr-Coulomb	0	45
Limestone		155	Mohr-Coulomb	0	45

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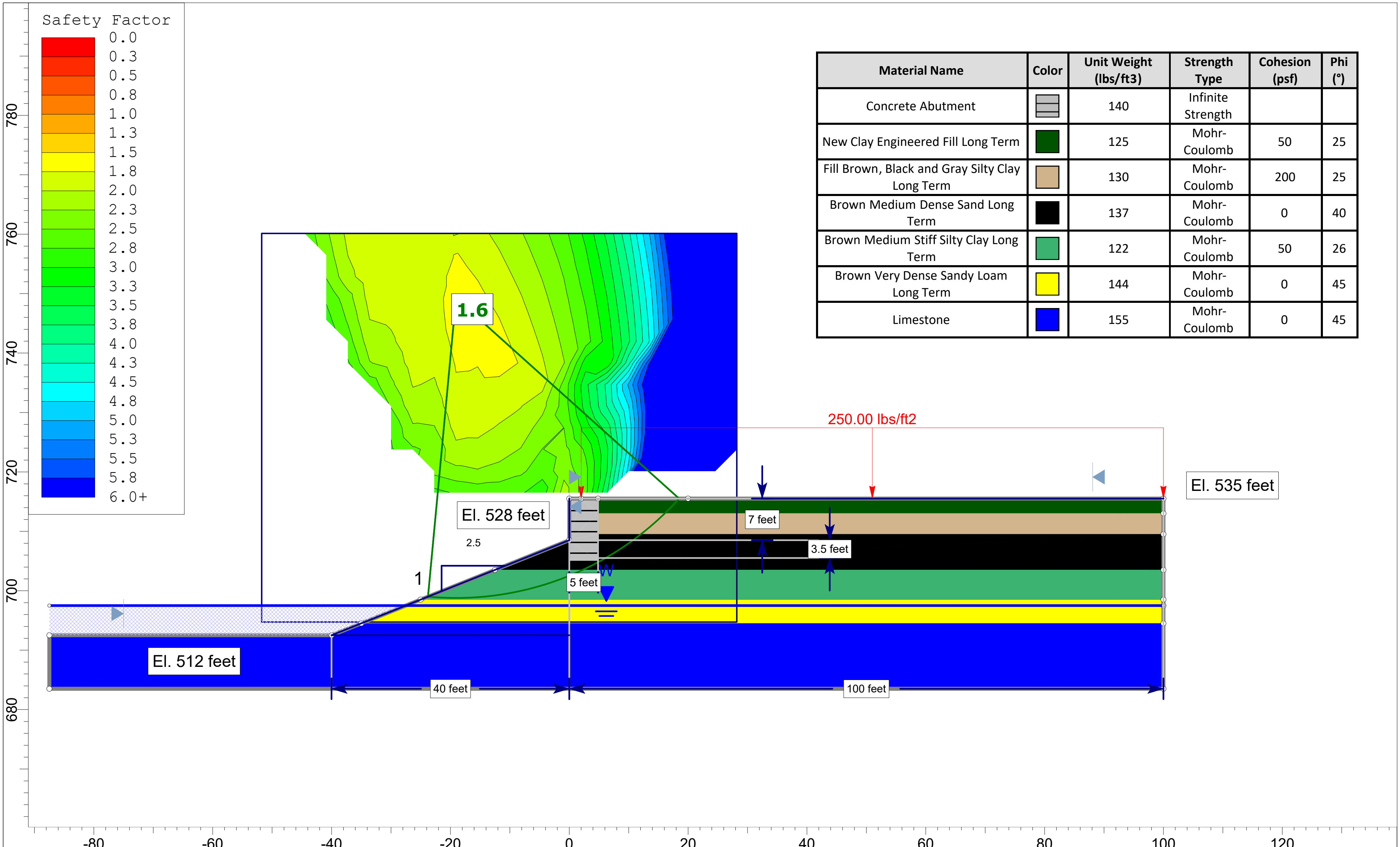
SLIDEINTERPRET 9.031

Project	Hickory Creek Bridge - South Abutment, 2.5H:1V Slope		
Group	Group 1	*Scenario*	Short Term Stability - Water El. 517
Drawn By	RM	*Company*	GSG Consultants, Inc.
Date	11/15/2021, 3:10:38 PM	*File Name*	South Abutment.slmd



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (°)
Concrete Abutment		140	Infinite Strength		
New Clay Engineered Fill Long Term		125	Mohr-Coulomb	50	25
Fill Brown, Black and Gray Silty Clay Long Term		130	Mohr-Coulomb	200	25
Brown Medium Dense Sand Long Term		137	Mohr-Coulomb	0	40
Brown Medium Stiff Silty Clay Long Term		122	Mohr-Coulomb	50	26
Brown Very Dense Sandy Loam Long Term		144	Mohr-Coulomb	0	45
Limestone		155	Mohr-Coulomb	0	45

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SLIDEINTERPRET 9.031

Project	Hickory Creek Bridge - South Abutment, 2.5H:1V Slope		
Group	Group 1	*Scenario*	Long Term Stability - Water El. 517
Drawn By	RM	*Company*	GSG Consultants, Inc.
Date	11/15/2021, 3:10:38 PM	*File Name*	South Abutment.slmd