Structural Geotechnical Report

Bridge Construction Project
Weber Road over I-55
Will County, Illinois
Structure Number: 099-0428 (NB)

Prepared for

Illinois Department of Transportation

IDOT PTB: 169-017

Project Design Engineer Team:
Knight Engineers & Architects

Geotechnical Consultant:
GSG Consultants, Inc.
Kalyan Chandhuri, PE
kchandhuri@gsg-consultants.com

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GSG CONSULTANTS, INC.

855 West Adams, Suite 200
Chicago, Illinois 60607
tel: 312.733.6262
fax: 312.733.5612

GSG CONSULTANTS, INC.
Engineers, Scientists & Construction Managers

855 West Adams Street, Suite 200
Chicago, IL 60607
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May 20, 2015

Mr. John C. Murillo, P.E.
Project Manager
Knight Engineers & Architects
221 North LaSalle Street, Suite 300
Chicago, Illinois 60601

Structural Geotechnical Report
Bridge Construction Project
Weber Road over I-55
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Dear Mr. Murillo,

Attached is a copy of the Structural Geotechnical Report for the above referenced project. The report provides a brief description of the site investigation, site conditions and foundation recommendations. The site investigation included advancing three (3) soil borings for the bridge improvements to depths ranging from 36 to 41 feet. The foundation recommendations include supporting the proposed abutments and piers on driven piles or drilled shafts.

Should you have any questions or require additional information, please call us at 312-733-6262.

Sincerely,

Kalyan S. Chandhuri, M.S., P.E.
Senior Engineer

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

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Prepared by: ______________________________
Kalyan S. Chandhuri, M.S., P.E.
Senior Engineer

Reviewed by: Dawn Edgell. ______________________________
Dawn Edgell, P.E.
Senior Project Engineer

Approved by: ______________________________
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 construction of a new Weber Road Bridge over I-55 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 project.

Exhibit 1 Project Location Map

1.1 Existing and Proposed Structure Information

The existing bridge at Weber Road, Structure number 099-0281, was first constructed in 1990 and consists of a 2 span structure with 2 approach slabs. The main spans of the existing bridge structure consist of precast prestressed concrete I-beams with a cast-in-place concrete deck. The total length of the bridge is 242.8 feet with the largest span of 85.6 feet, and an out-to-out deck width of 73.2 feet. The substructure consists of two reinforced concrete vaulted abutments supported on metal shell piles and one center pier supported on a spread footing. The existing structure has an existing vertical clearance of 16’-4” over I-55.

Based on the recommendations in the Bridge Condition Report, the existing structure will be reused to carry 4 southbound lanes and this new parallel bridge is proposed west of the existing bridge to carry 3 northbound lanes. The proposed bridge will consist of two 124 feet spans supported by a central pier and two integral abutments.

1.2 Site Conditions

Weber Road runs north-south and crosses over I-55 from a residential area to the south to a commercial area to the north. The embankment side slopes on the north and south sides of the bridge appear to be approximately 1:2 (V:H) from the abutments as shown in Exhibits 2 and 3.

Exhibit 2 Weber Road over I-55 (southbound on I-55)

Exhibit 3 Weber Road over I-55 (northbound on I-55)

1.3 Regional Geology

GSG reviewed several published documents in an effort to determine the regional geological setting in the area of the site. The subject area is located in the northwest portion of Will County, Illinois. The surficial geologic deposits in this area are typically glacial drift deposited during the Wisconsin Glacial Age. Deposits are primarily from the Yorkville Member in the Lemont Formation of the Wedron Group which consists of characteristically gray clayey till, generally with few cobbles and boulders, but with abundant small pebbles. This formation overlies the Silurian Joliet Dolomite Bedrock Formation with depths at approximately 28 feet to 75 feet below ground surface in the subject area.

2.0 SITE SUBSURFACE EXPLORATION PROGRAM

This section describes the subsurface exploration program and laboratory testing program completed as part of this project. The subsurface exploration program was performed in accordance with applicable IDOT geotechnical manuals and procedures.

2.1 Subsurface Exploration Program

The site subsurface exploration was conducted between October 17th and October 27th, 2014. The borings included advancing a total of three (3) standard penetration test (SPT) borings within the vicinity of the proposed bridge pier and abutment locations. The locations of the soil borings were provided by Knight, and were completed based on field conditions and accessibility. Table 1 presents a list of the borings completed along with their location information.

Table 1 – Summary of Subsurface Exploration

Boring ID	Location	Weber Road Station	Offset	Depth (feet)	Surface Elevation (Feet)
BR-01	South Abutment	810+16	92’ LT	36	648
BR-02	Center Pier	811+56	52’ LT	41	650
BR-03	North Abutment	812+59	93’ LT	40	649

In accordance with the IDOT Geotechnical Manual, the bridge borings were completed to depths to provide a minimum of 65 tons bearing for a 12-inch diameter concrete filled metal shell pile.

The existing ground surface elevations shown in the soil boring logs were taken from the topographic survey provided by Knight. The approximate locations of the soil borings are shown on the Boring Location Map & Subsurface Profile **(Appendix A)**.

The soil borings were drilled using a truck mounted Dietrich D-50 drill rig. All of the borings were drilled using 3¼-inch I.D. hollow stem augers. 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 a minimum depth of 30 feet below existing grade, and 5 foot intervals thereafter. 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.

Bedrock coring was performed at each abutment boring locations using rotary method drilling procedures with a five-foot, diamond bit, NX split core barrel. The rock core was collected in a 5 foot, continuous sample beginning at the bedrock surface. The collected bedrock core was also evaluated in the field for texture, physical condition, recovery percentage, Rock Quality Designation (RQD), and field hardness. The rock cores were then returned to the laboratory for further testing and evaluation.

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 samples:

- Moisture content ASTM D2216 / AASHTO T-265
- Atterberg Limits ASTM D 4318 / AASHTO T-89 / AASHTO T-90
- Unconfined Compression ASTM D2166 / AASHTO T-208
- Dry Unit Weight ASTM D7263
- Organic Matter Content AASHTO T-194
- Unconfined Compression Test on Rock Cores ASTM D-2938

The laboratory tests were performed in accordance with test procedures outlined in the IDOT Geotechnical Manual (1999), 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 **Appendix C**, Laboratory Test Results, and are also shown along with the field test results in **Appendix B,** Soil Boring Logs and Rock Core Logs.

2.3 Subsurface 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 Map & Subsurface Profile. The soil boring logs provide specific conditions encountered at each boring location. The soil boring logs 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.

Bridge Abutments

Boring BR-01 was drilled in the vicinity of the proposed south abutment in the existing grassy area adjacent to the south shoulder of northbound I-55. This boring was performed at approximate Weber Road station 810+16 and had a surface elevation of about 648 feet.

Boring BR-03 was drilled in the vicinity of the proposed north abutment in the existing grassy area adjacent to the north shoulder of southbound I-55. This boring was performed at approximate Weber Road station 812+59 and had a surface elevation of about 649 feet.

The abutment borings noted approximately 10 to 12 inches of topsoil with vegetation at the existing surface. Below the topsoil, boring BR-01 noted brown and gray silty clay fill material to a depth of 7.5 feet below existing grade. Following this layer in BR-01 and below the topsoil layer in BR-03, the borings noted brown to gray stiff to very stiff silty clay or clay to a depth between 33.5 feet and 38.5 feet below grade. Underlying the native clay soils, a layer of extremely dense sand with gravel was noted in both borings prior to auger refusal on bedrock. The auger refusal depth at these borings varied between 36 and 40 feet below existing grade (elevations 612 and 609 feet).

Generally, the fill soils had unconfined compressive strength results ranging from 5 tsf to 6.25 tsf and the native cohesive soils had unconfined compressive strength results ranging from 1.67 tsf to 4.25 tsf. Representative native clay samples had dry unit weights of 114 and 118.9 pcf.

The top of bedrock was noted at 36 feet below grade in boring BR-01 and at 40 feet below grade in BR-03. The bedrock cores consisted of gray limestone with occasional vugs. The rock cores appeared to be damp, but this could have been due to the wet coring method used to core and extract the samples. The recovery percentage of the rock cores at BR-01 and BR-03 were 97% and 100%, respectively, and the RQD values were 92% and 93%, respectively. The Rock Mass Rating of these cores indicated the rock class as Class I, and rock description as Very Good Rock. Laboratory photographs of the rock cores and a summary of the classification data is included in Appendix B.

Bridge Pier

Boring BR-02 was drilled in the vicinity of the proposed pier in the existing median along the shoulder of northbound I-55. This boring was performed at approximate Weber Road station 811+56 and had a surface elevation of about 650 feet.

The pier boring noted 6 inches of asphalt underlain by 1.5 feet of sand and gravel fill at the existing surface. Below the pavement, the boring encountered stiff to very stiff black and gray clay to a depth of 9.5 feet below grade. Below this depth, the boring encountered stiff to hard brown to gray silty clay to a depth of 38 feet below grade. Following this layer, the boring encountered medium dense sand to auger refusal depth on bedrock at 41 feet below grade.

The native cohesive soils generally had unconfined compressive strength results ranging from 1.25 tsf to 5 tsf. A representative sample had a dry unit weight of 110.6 pcf.

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 encountered in two borings (BR-01 and BR-02) while drilling at elevations of 614 and 612 feet, respectively. Groundwater was not encountered in BR-03 while drilling. No groundwater was observed in any of the borings after the completion of drilling.

Based on the color change from brown to gray, it is anticipated that the long term groundwater level will be close to elevation 638 feet. It should be noted that the water levels recorded were within granular soils close to the auger refusal depths. This water could be perched in the granular soils that were encountered prior to the bedrock. 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 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, and laboratory testing.

3.1 Derivation of Soil Parameters for Design

Unit weights, friction angles and shear strength parameters were estimated using standard penetration test (SPT) results for the fill and cohesionless soils and in-situ and laboratory test results for cohesive soils.

Table 2 presents generalized soil parameters based on the laboratory and in-situ testing data.

Table 2 – Summary of Soil Parameters

Approximate Elevation (feet)	Soil Description	In situ Unit Weight γ (pcf)	Undrained		Drained	
			Cohesion c (psf)	Friction Angle ϕ (Degrees)	Cohesion c (psf)	Friction Angle ϕ (Degrees)
	New Engineered Clay Fill	120	1,000	0	75	26
	New Engineered Granular Fill	120	0	30	0	30
650' - 640'	Existing Clay Fill (BR-01 only)	140	5,000	0	150	28
650' - 648'	Existing Granular Fill (BR-02 only)	120	0	28	0	28
648' – 640'	Stiff Black Silty Clay (BR-02)	130	1,250	0	0	26
648'- 638'	**Stiff to Very Stiff Brown and Gray Silty Clay	137	2,500	0	100	28

Approximate Elevation (feet)	Soil Description	In situ Unit Weight γ (pcf)	Undrained		Drained	
			Cohesion c (psf)	Friction Angle ϕ (Degrees)	Cohesion c (psf)	Friction Angle ϕ (Degrees)
638' – 624'	Very Stiff to Hard Gray Silty Clay	140	3,500	0	75	28
624' – 612'	Stiff Gray Silty Clay	133	1,750	0	50	27
Below 612'	Medium Dense to Extremely Dense Sand	135	0	34	0	34

** Thickness of this layer varied in the borings from 2 feet to 8 feet.

3.2 Settlement

The existing side slopes of Weber road are about 1:2 (V:H) towards the north and south side of I-55. It is not anticipated that any new fill materials will be placed at the existing bridge location.

Based on the preliminary TS&L provided to GSG, the proposed side slopes grades for the new bridge will be similar to the existing slopes with similar elevations. It is anticipated that approximately 15 feet of additional engineered fill will be necessary for the proposed bridge construction, immediately west of the existing bridge. GSG completed the settlement analysis of the proposed embankment load. It is anticipated that settlement of the native clays due to the new embankments could be approximately 0.5 inch.

3.3 Slope Stability

The proposed abutment side slopes below the new bridge will be about 1:2 (V:H) from the north and south abutments of Weber Road down to I-55, similar to the existing bridge. Based on the geometry for the proposed interchange improvement, which will include redesign of the existing bridge and construction of the new bridge to the west, the existing slopes will not change significantly. No slope stability analysis is required for the existing slopes.

Based on the proposed slopes for the new embankments, long term slope stability analysis was required to analyze the stability of the slopes. Slide 6.0 is a comprehensive slope stability analysis software that performs finite element analysis and was used to evaluate the proposed slopes for the project. The proposed side slopes below the new Weber Road Bridge were analyzed based on the grading and the soils encountered while drilling. Two analyses were evaluated using the Bishop and Janbu analyses methods for the proposed slope geometry – short term (undrained) and long term (drained) failure envelope. The analyses were performed using the soil parameters in Table 2 above.

The results of the analyses are shown in Table 3. Copies of the analyses exhibits are included in **Appendix E.**

Table 3 – Stability Analyses Results – Bridge Abutments

Analysis Exhibit	Analysis Type	Factor of Safety	Minimum Factor of Safety
Exhibit 1	Circular – short term	3.0	1.5
Exhibit 2	Circular – long term	1.9	1.5
Exhibit 3	Block – short term	3.2	1.5
Exhibit 4	Block – Long Term	2.2	1.5

Based on the analyses performed, the proposed slopes meet the minimum required factor of safety of 1.5

3.4 Seismic Parameters

The seismic hazard for the site was analyzed 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. The proposed bridge has a total length less than 750 feet, with no single span longer than 200 feet, therefore, a global Site Class

Definition was determined for this project, and was found to be Soil Site Class C. 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 short (S_{DS}) and long (S_{D1}) period design spectral acceleration coefficients. The S_{DS} was determined to be 0.124g and the S_{D1} was determined to be 0.066g.

3.5 Scour

The bridge structure carrying Weber Road crosses over I-55 and no waterways are in the vicinity of the proposed project; therefore scour will not be a concern for this project.

4.0 GEOTECHNICAL DESIGN RECOMMENDATIONS

The foundations for the proposed bridge construction must provide sufficient support to resist the dead and live loads, as well as seismic loading provided in the preliminary information by Knight. The foundation design recommendations were completed per the AASHTO LRFD 7th Edition (2014).

4.1 Bridge Foundation Recommendations

GSG evaluated shallow and deep foundation system for the proposed bridge. Based on the subsurface conditions encountered and the preliminary design information provided by the structural engineer, it is recommended that the proposed bridge be supported on a deep foundation system consisting of driven piles or drilled shafts bearing on the bedrock. The results of GSG's foundation evaluation for shallow spread footings, drilled shafts, and driven piles are presented below.

4.1.1 Shallow Foundations

Based on the soils encountered, the new span lengths and the anticipated loads, shallow foundations are not a feasible option for the proposed substructure of the bridge. We anticipate that shallow foundations will undergo excessive settlement or the size of the footings will be very large, and therefore will be not be a feasible option, and are not discussed further in the report.

4.1.2 Drilled Shafts

Drilled shafts are considered a feasible option for the propose bridge. The borings encountered predominantly very stiff clays at the surface and terminated in bedrock. The drilled shafts could be supported upon the bedrock noted at depths of approximately 36 to 41 feet below existing grade. Also, the piers should be socketed at least a foot in to the bedrock.

If drilled shafts are considered, they should be designed in accordance with the parameters provided in Table 4.

Table 4 – Drilled Shaft Foundation Parameters

Location	Bearing Elevation (ft)	End Bearing		Side Friction	
		Nominal Bearing Capacity (ksf)	Resistance Factor	Nominal Friction (ksf)	Resistance Factor
North Abutment	610	2,200	0.50	3.4	0.45
Pier	609		0.50	3.7	0.45
South Abutment	609		0.50	4.6	0.45

The side friction values are for the existing site conditions and also account for approximately 15 feet of new embankment fill placed as part of the proposed new bridge construction and site preparation.

We recommend that the drilled shafts be installed with a minimum center-to-center spacing of at least 3 shaft diameters. Drilling the shafts at close spacing can reduce the effective stresses against both the side and base of the adjacent piers, and will thus reduce the total capacity.

Due to the wet sand layers observed immediately above the bedrock, a temporary casing consisting of a corrugated steel liner may be required for the bottom 5 feet during the drilling of the caissons to prevent caving of the excavations or from groundwater entering the excavation. If a permanent steel liner is used, side friction should not be used as part of the calculated available resistance.

4.1.3 Driven Pile Foundations

Deep foundations consisting of driven piles are considered a feasible option for the proposed bridge. Piles considered for this site include metal shell piles, concrete piles and H-piles. Based on ABD memo 12.3, 2012 Integral Abutment Bridge Policies and Details, metal shell piles and HP 8x36 are not considered suitable for integral abutments, but may be considered elsewhere for the bridge or for non-integral abutments. Driving shoes for the piles should be considered, and a wall thickness of 0.25” or greater is recommended for any metal shell piles to minimize potential damage during driving.

The Modified IDOT static method Excel spreadsheet was used to estimating the pile lengths at various axial geotechnical resistances for driven piles per AGMU Memo 10.2. Tables 5.1 to 5.3

summarize the estimated pile lengths at various axial resistances for H-piles and metal shell piles of various common sizes for each substructure. The complete IDOT Pile Design Tables for each substructure are included in **Appendix D**.

The factored resistance includes reduction of 0.55 for the geotechnical resistance for the pile installation. Based on the results of the subsurface investigation, no geotechnical losses due to down drag or liquefaction were included in the axial pile capacity calculations.

Integral abutments will likely be used for the proposed bridge, and will be designed in accordance with IDOT All Bridge Designers (ABD) memo 12.3, 2012 Integral Abutment Bridge Policies and Details. The proposed abutments will be built within the new embankments constructed for the bridge. Based on the ABD memo, if the abutment is to be constructed on a new embankment the unconfined compressive strength of the embankment materials shall be assumed to be 1.0 tsf. However, it is our opinion that the new fill materials for the embankments constructed using the standard procedures outlined in IDOT Standard Specifications for Road and Bridge Construction (SSRBC) would have unconfined compressive strengths greater than 1.0 tsf. The estimated pile lengths shown in the tables below and in **Appendix D** are based on the pile cut off elevation provided on the preliminary TS&L plans.

The actual pile length and capacity should be evaluated based on test piles installed in accordance with the specifications provided in Section 512.15 of IDOT Standard Specifications for Road and Bridge Construction. Per section 3.10.1.11 of the IDOT Bridge Manual (2012), the minimum pile spacing should be 3 pile diameters, and the maximum pile spacing should not be more than 3.5 times the effective footing thickness plus one foot, not to exceed a total of 8 feet.

Table 5.1: South Abutment Pile Design (BR-01)

Estimated Pile Length*	**Metal Shell 12" Φ w/ 0.25" Walls** (Max. R_N = 355 kips)		**Metal Shell 14" Φ w/ 0.25" Walls** (Max. R_N = 416 kips)		**Metal Shell 14" Φ w/ 0.312" Walls** (Max. R_N = 516 kips)	
	R_N (kips)	R_F (kips)	R_N (kips)	R_F (kips)	R_N (kips)	R_F (kips)
33	219	121	262	144	262	144
36	246	136	295	162	295	162
38	271	149	323	178	323	178
41	280	154	331	182	331	182
43	286	158	336	185	336	185

Estimated Pile Length	**Steel HP 10 X 42** (Max. R_N = 335 kips)		**Steel HP 10 X 57** (Max. R_N = 454 kips)		**Steel HP 12 X 53** (Max. R_N = 418 kips)	
	R_N (kips)	R_F (kips)	R_N (kips)	R_F (kips)	R_N (kips)	R_F (kips)
48	285	157	293	161	364	200
50	301	165	308	170	382	210
52	316	174	324	178	401	220
53	335	184	454	250	418	230

Estimated Pile Length	**Steel HP 12 X 63** (Max. R_N = 497 kips)		**Steel HP 14 X 73** (Max. R_N = 578 kips)		**Steel HP 14 X 89** (Max. R_N = 705 kips)	
	R_N (kips)	R_F (kips)	R_N (kips)	R_F (kips)	R_N (kips)	R_F (kips)
46	256	141	306	168	310	170
48	368	202	442	243	450	248
50	386	212	475	261	483	266
52	405	223	501	276	509	280
54	497	273	578	318	705	388

NOTES:

R_N = Nominal Required Bearing; R_F = Factored Resistance Available

Pile cut off elevation = 665.2 feet (preliminary TS&L)

Ground surface elevation against pile during driving, i.e. B/footing = 663.2 feet

Fill or unsuitable material depth neglected in pile length calculation = none

*Estimated pile length for metal shell piles are presented only to a depth 10 feet above the top of the rock to avoid the risk for pile damage.

Table 5.2: Center Pier Pile Design (BR-02)

Estimated Pile Length*	Metal Shell 12" Φ w/ 0.25" Walls (Max. R_N = 355 kips)		Metal Shell 14" Φ w/ 0.25" Walls (Max. R_N = 416 kips)		Metal Shell 14" Φ w/ 0.312" Walls (Max. R_N = 516 kips)	
	R_N (kips)	R_F (kips)	R_N (kips)	R_F (kips)	R_N (kips)	R_F (kips)
23	176	97	208	114	208	114
26	197	108	234	128	234	128
28	210	115	249	137	249	137
30	223	123	264	145	264	145

Estimated Pile Length	Steel HP 10 X 42 (Max. R_N = 335 kips)		Steel HP 10 X 57 (Max. R_N = 454 kips)		Steel HP 12 X 53 (Max. R_N = 418 kips)	
	R_N (kips)	R_F (kips)	R_N (kips)	R_F (kips)	R_N (kips)	R_F (kips)
32	168	92	172	94	208	114
35	195	107	199	110	243	134
39	335	184	454	249	418	230

Estimated Pile Length	Steel HP 12 X 63 (Max. R_N = 497 kips)		Steel HP 14 X 73 (Max. R_N = 578 kips)		Steel HP 14 X 89 (Max. R_N = 705 kips)	
	R_N (kips)	R_F (kips)	R_N (kips)	R_F (kips)	R_N (kips)	R_F (kips)
28	188	103	228	126	231	127
30	199	109	241	133	244	134
32	210	115	254	139	257	141
35	246	135	300	165	304	167
39	497	273	578	318	705	388

NOTES:

R_N = Nominal Required Bearing; R_F = Factored Resistance Available

Pile cut off elevation = 646.4 (preliminary TS&L)

Ground surface elevation against pile during driving, i.e. B/footing = 645.4 feet

Fill or unsuitable material depth neglected in pile length calculation = None

*Estimated pile length for metal shell piles are presented only to a depth 10 feet above the top of the rock to avoid the risk for pile damage.

Table 5.3: North Abutment Pile Design (BR-03)

Estimated Pile Length*	**Metal Shell 12" Φ w/ 0.25" Walls** (Max. R_N = 355 kips)		**Metal Shell 14" Φ w/ 0.25" Walls** (Max. R_N = 416 kips)		**Metal Shell 14" Φ w/ 0.312" Walls** (Max. R_N = 516 kips)	
	R_N (kips)	R_F (kips)	R_N (kips)	R_F (kips)	R_N (kips)	R_F (kips)
35	196	108	232	128	232	128
38	211	116	250	138	250	138
43	248	136	293	161	293	161
45	263	145	311	171	311	171
48	276	152	326	179	326	179

Estimated Pile Length	**Steel HP 10 X 42** (Max. R_N = 335 kips)		**Steel HP 10 X 57** (Max. R_N = 454 kips)		**Steel HP 12 X 53** (Max. R_N = 418 kips)	
	R_N (kips)	R_F (kips)	R_N (kips)	R_F (kips)	R_N (kips)	R_F (kips)
50	203	112	208	114	249	137
53	215	118	219	121	263	145
57	300	165	307	169	381	209
58	335	184	454	250	418	230

Estimated Pile Length	**Steel HP 12 X 63** (Max. R_N = 497 kips)		**Steel HP 14 X 73** (Max. R_N = 578 kips)		**Steel HP 14 X 89** (Max. R_N = 705 kips)	
	R_N (kips)	R_F (kips)	R_N (kips)	R_F (kips)	R_N (kips)	R_F (kips)
48	239	131	286	157	290	159
50	251	138	301	166	305	168
53	265	146	317	175	321	177
57	385	212	473	260	481	264
59	497	273	578	318	705	388

NOTES:

R_N = Nominal Required Bearing; R_F = Factored Resistance Available

Pile cut off elevation = 666.7 feet (preliminary TS&L)

Ground surface elevation against pile during driving, i.e. B/footing = 664.7 feet

Fill or unsuitable material depth neglected in pile length calculation = None

*Estimated pile length for metal shell piles are presented only to a depth 10 feet above the top of the rock to avoid the risk for pile damage.

4.2 Lateral Load Resistance

Lateral loadings applied to pile foundations are typically resisted by battering selected piles, 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. Table 6 provides recommended lateral soil modulus and soil strain parameters that can be used for laterally loaded pile analysis via the p-y curve method based on the encountered subsurface conditions.

Table 6 – Lateral Resistance Parameters

Approximate Elevation (feet)	Soil Description	In situ Unit Weight γ (pcf)	Cohesion c (psf)	Friction Angle ϕ (Degrees)	Subgrade Modulus (pci)	Horizontal Strain Factor e_{50}
	New Engineered Clay Fill	120	1,000	0	500	0.007
	New Engineered Granular Fill	120	0	30	200	NA
650' - 640'	Existing Clay Fill (BR-01 only)	140	5,000	0	2,000	0.004
650' - 648'	Existing Granular Fill (BR-02 only)	120	0	28	50	NA
648' – 640'	Stiff Black Silty Clay (BR-02 only)	130	1,250	0	500	0.007
648'- 638'	**Stiff to Very Stiff Brown and Gray Silty Clay	137	2,500	0	1,250	0.005
638' – 624'	Very Stiff to Hard Gray Silty Clay	140	3,500	0	1,750	0.005

Approximate Elevation (feet)	**Soil Description**	**In situ Unit Weight γ (pcf)**	**Cohesion c (psf)**	**Friction Angle ϕ (Degrees)**	**Subgrade Modulus (pci)**	**Horizontal Strain Factor e_{50}**
624' – 612'	Stiff Gray Silty Clay	133	1,750	0	875	0.007
Below 612'	Medium Dense to Extremely Dense Sand	135	0	34	125	NA

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 (2012). Any deviation from the requirements in the manuals above should be approved by the design engineer.

5.1 Site Excavation

The contractor will be responsible to provide a safe excavation during the construction activities of the project. All excavations should be conducted in accordance with applicable federal, state, and local safety regulations, including, but not limited to the Occupational Safety and Health administration (OSHA) excavation safety standards. Excavation stability and soil pressures on temporary shoring are dependent on soil conditions, depth of excavations, installation procedures, and the magnitude of any surcharge loads on the ground surface adjacent to the excavation. Excavation near existing structures and underground utilities should be performed with extreme care to avoid undermining existing structures. Excavations should not extend below the level of adjacent existing foundations or utilities unless underpinning or other support is installed. It is the responsibility of the contractor for field determinations of applicable conditions and providing adequate shoring for all excavation activities.

5.2 Groundwater Management

Based on the depth of groundwater observed in the borings, we do not anticipate significant groundwater management would be required for bridge construction. The contractor should control groundwater and surface water infiltration to the construction area. Temporary ditches, sumps, granular drainage blankets, stone ditch protection, or hand-laid riprap with geotextile underlayment could be used to divert groundwater if significant seepage is encountered during construction.

5.3 Temporary Sheeting and Soil Retention

The preliminary plans indicate that construction of the proposed new bridge will be west of the existing bridge. Based on IDOT Temporary Sheet Piling Design Guide and Charts, a cantilevered sheet pile system would not be feasible and a temporary soil retention system will be required during construction of the proposed abutments and embankments.

5.4 Drilled Shafts Construction

The drilled shaft construction should be completed in accordance according to Section 516, Drilled

Shafts, in the IDOT Standard Specification for Road and Bridge Construction. Wet construction method should be assumed where shallow ground water is present within the proposed shaft depth. Water should be removed from the base of the drilled shaft base prior to placing any concrete. The placement method of concrete for the drilled shaft foundation should be based on the amount of water present at the base of the shaft just prior to placing the concrete. Concrete may be placed using the free fall method, provided less than 2 inches of water is present at the base of the shaft at the time the concrete is being placed. If more than 2 inches of water is present, a tremie should be used in an effort to displace the water to the surface for removal.

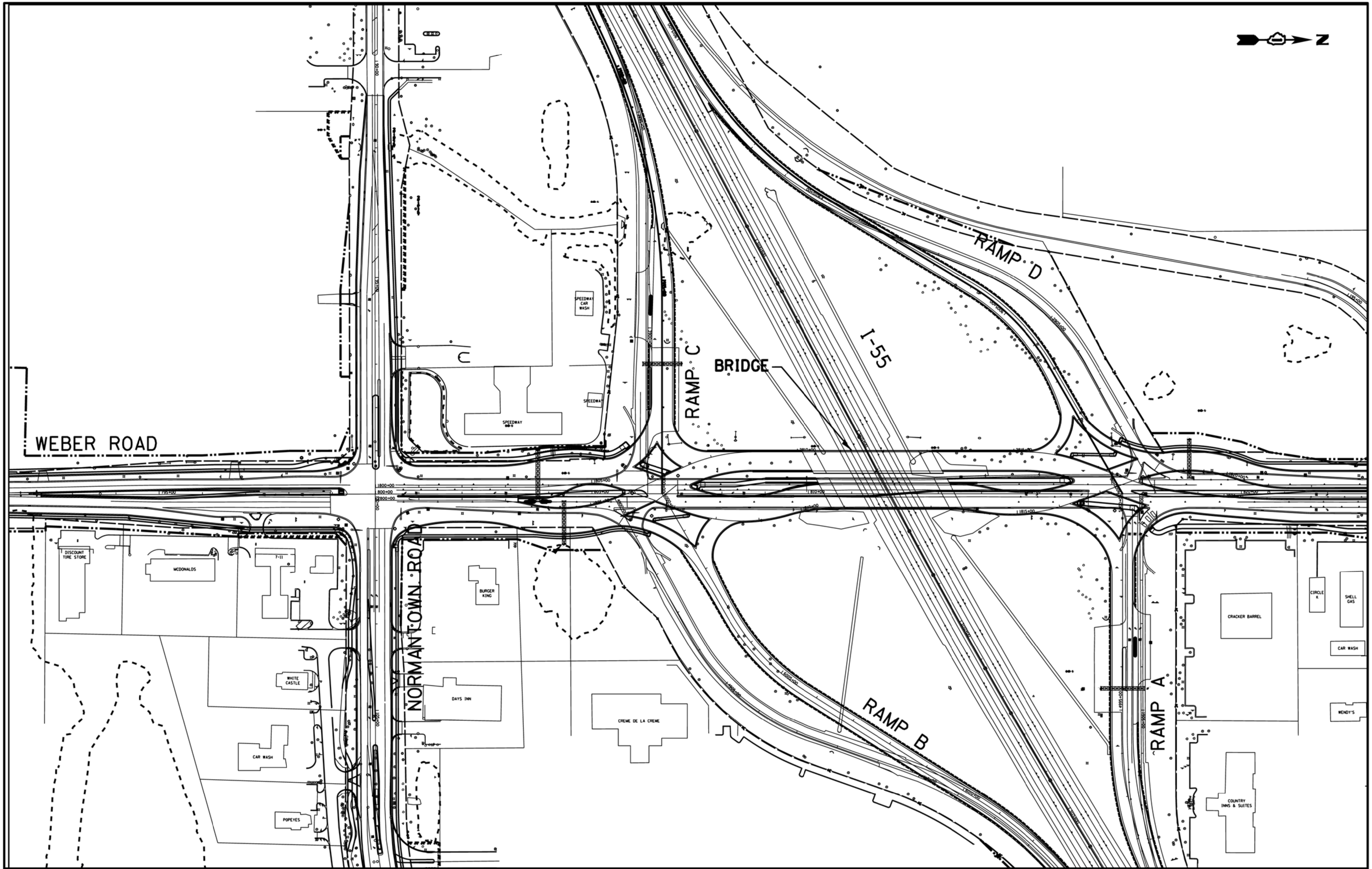
GSG recommends that the caisson concrete be ready on site as the drilled shaft excavation is completed, so that the concrete can be placed immediately after completing the excavation. This will reduce the potential of water accumulation in the bottom of the shaft. Bottom cleanliness of the drilled shaft excavation should be observed from the ground surface with the use of flood light or down-hole camera. Workers should not enter the shaft to manually clean the base of the shaft due to safety reasons.

6.0 LIMITATIONS

This report has been prepared for the exclusive use of IDOT and its structural consultant. The recommendations provided in the report are specific to the project described herein, and are based on the information obtained from the soil borings located within the project limits. The analyses performed and the recommendations provided in this report are based on subsurface conditions determined at the location of the borings. This report does 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

BORING LOCATION DIAGRAMS



GSG CONSULTANTS, INC.
855 West Adams, Suite 200
Chicago, Illinois 60607
tel: 312.733.6262 • fax: 312.733.5612

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

DESIGNED - NE	REVISED -
DRAWN - KNIGHT E/A	REVISED -
CHECKED - DE	REVISED -
DATE - 11/11/14	REVISED -

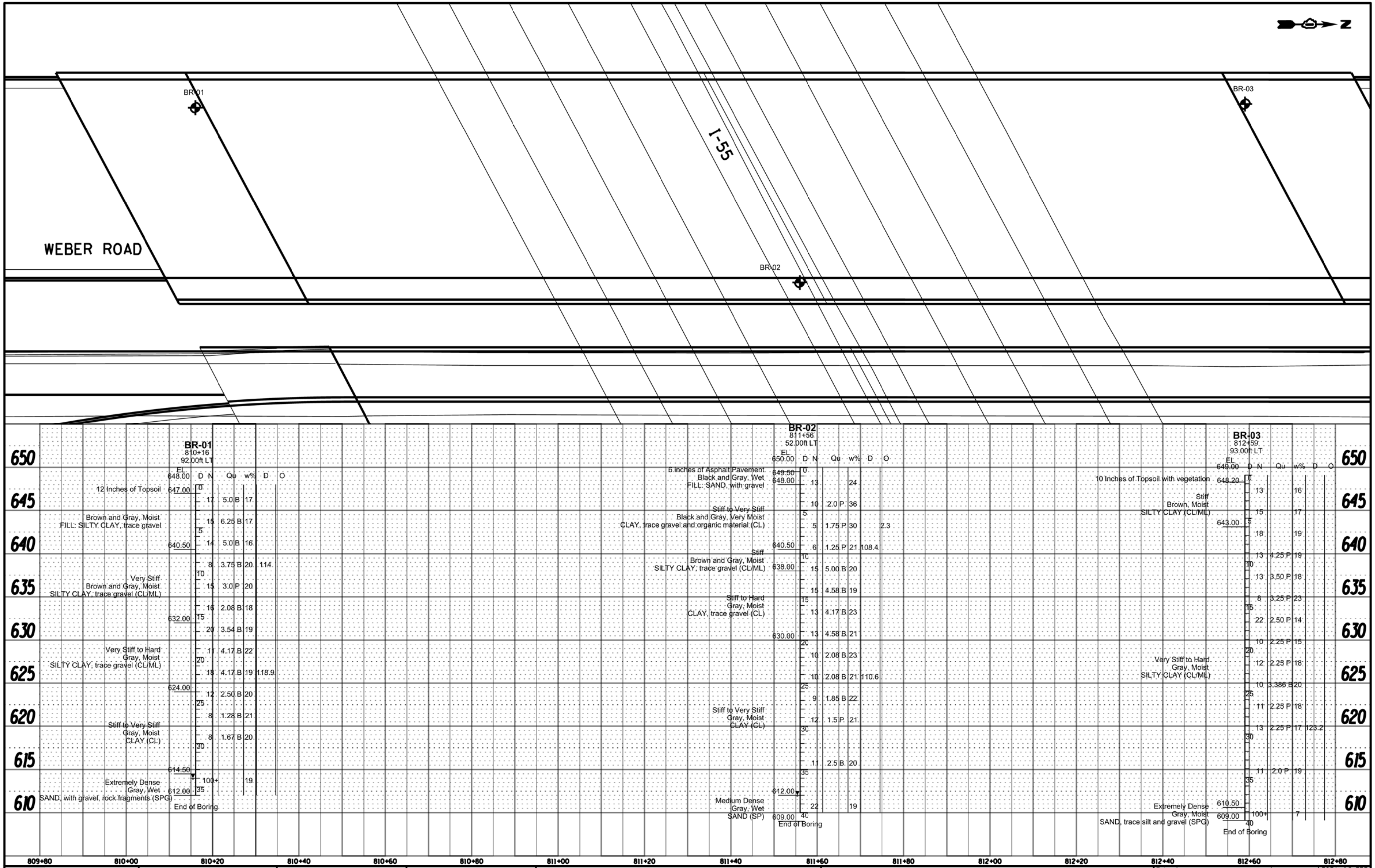
STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

WEBER RD /I-55 REDESIGN
SHEET LAYOUT PLAN

SCALE: 100 SHEET 1 OF 1 SHEETS STA. TO STA.

F.A. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
FAI 55	WEBER RD FROM NORMANTOWN RD TO 135TH ST	WILL		
		IDOT PTB 169-017		

ILLINOIS FED. AID PROJECT



BR-01
810+16
92.00ft LT

	EL	D	N	Qu	w%	D	O
	648.00						
12 Inches of Topsoil	647.00	0					
			17	5.0 B	17		
Brown and Gray, Moist FILL: SILTY CLAY, trace gravel			15	6.25 B	17		
		5					
	640.50		14	5.0 B	16		
			8	3.75 B	20	114	
		10					
Very Stiff Brown and Gray, Moist SILTY CLAY, trace gravel (CL/ML)			15	3.0 P	20		
			16	2.08 B	18		
	632.00	15					
			20	3.54 B	19		
Very Stiff to Hard Gray, Moist SILTY CLAY, trace gravel (CL/ML)			11	4.17 B	22		
		20					
			18	4.17 B	19	118.9	
	624.00		12	2.50 B	20		
		25					
			8	1.28 B	21		
Stiff to Very Stiff Gray, Moist CLAY (CL)			8	1.67 B	20		
		30					
	614.50		100+		19		
Extremely Dense Gray, Wet SAND, with gravel, rock fragments (SPG)	612.00	35					
End of Boring							

BR-02
811+56
52.00ft LT

	EL	D	N	Qu	w%	D	O
	650.00						
6 inches of Asphalt Pavement	649.50	0					
Black and Gray, Wet FILL: SAND, with gravel	648.00		13		24		
			10	2.0 P	36		
Stiff to Very Stiff Black and Gray, Very Moist CLAY, trace gravel and organic material (CL)		5	5	1.75 P	30		2.3
	640.50		6	1.25 P	21	108.4	
Stiff Brown and Gray, Moist SILTY CLAY, trace gravel (CL/ML)	638.00	10	15	5.00 B	20		
			15	4.58 B	19		
Stiff to Hard Gray, Moist CLAY, trace gravel (CL)		15	13	4.17 B	23		
	630.00		13	4.58 B	21		
		20					
			10	2.08 B	23		
			10	2.08 B	21	110.6	
		25					
			9	1.85 B	22		
Stiff to Very Stiff Gray, Moist CLAY (CL)			12	1.5 P	21		
		30					
			11	2.5 B	20		
		35					
	612.00						
Medium Dense Gray, Wet SAND (SP)			22		19		
	609.00	40					
End of Boring							

BR-03
812+59
93.00ft LT

	EL	D	N	Qu	w%	D	O
	649.00						
10 Inches of Topsoil with vegetation	648.20	0					
			13		16		
Stiff Brown, Moist SILTY CLAY (CL/ML)			15		17		
	643.00	5					
			18		19		
			13	4.25 P	19		
		10					
			13	3.50 P	18		
			8	3.25 P	23		
		15					
			22	2.50 P	14		
			10	2.25 P	15		
		20					
Very Stiff to Hard Gray, Moist SILTY CLAY (CL/ML)			12	2.25 P	18		
			10	3.386 B	20		
		25					
			11	2.25 P	18		
			13	2.25 P	17	123.2	
		30					
			11	2.0 P	19		
		35					
	610.50						
Extremely Dense Gray, Moist SAND, trace silt and gravel (SPG)	609.00		100+		7		
		40					
End of Boring							

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Chicago, Illinois 60607
tel: 312.733.6262 • fax: 312.733.5612

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

DESIGNED	- NE	REVISED	-
DRAWN	-	REVISED	-
CHECKED	- DE	REVISED	-
DATE	- 11/20/14	REVISED	-

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

SOIL BORING
PLAN & PROFILE

SCALE: 10 | SHEET 1 OF 1 SHEETS | STA. 809+80 TO STA. 812+80

F.A. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
FAI 55	WEBER RD FROM	WILL		
	NORMANTOWN RD TO 135TH ST	IDOT PTB 169-017		
		ILLINOIS FED. AID PROJECT		

PLAN
NOTE BOOK NO.
SURVEYED
PLOTTED
ALIGNMENT CHECKED
R.O. WAY CHECKED
CADD FILE NAME
BY
DATE

PROFILE
NOTE BOOK NO.
SURVEYED
PLOTTED
GRADES CHECKED
B.M. NOTED
STRUCTURE NOTATIONS CHK'D
BY
DATE

APPENDIX B

SOIL BORING AND ROCK CORE LOGS

Illinois Department of Transportation
Division of Highways
GSG CONSULTANTS INC.

SOIL BORING LOG

Page 1 **of** 2

Date 10/17/14

ROUTE Weber Road **DESCRIPTION** Proposed Weber Road & I-55 Improvements **LOGGED BY** JJR

SECTION Normantown Road to 135th Street/Romeo Road **LOCATION** Weber Road Bridge, **SEC.** , **TWP.** , **RNG.** , **Latitude** , **Longitude**

COUNTY Will County **DRILLING METHOD** HSA **HAMMER TYPE** AUTO

STRUCT. NO. NA
Station NA

BORING NO. BR-01
Station 810+16
Offset 92.00ft LT
Ground Surface Elev. 648.00 **ft**

Surface Water Elev. NA **ft**
Stream Bed Elev. NA **ft**

Groundwater Elev.:
First Encounter 614.0 **ft** ▼
Upon Completion None **ft**
After NA **Hrs.** NA **ft**

		DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
12 Inches of Topsoil	647.00				
Brown and Gray, Moist FILL: SILTY CLAY, trace gravel			4 8 9	5.0 B	17
		-5	4 6 9	6.3 B	17
	640.50		3 6 8	5.0 B	16
Very Stiff Brown and Gray, Moist SILTY CLAY, trace gravel (CL/ML)		-10	2 3 5	3.8 B	20
			5 6 9	3.0 P	20
	632.00	-15	2 8 8	2.1 B	18
Very Stiff to Hard Gray, Moist SILTY CLAY, trace gravel (CL/ML)			5 8 12	3.5 B	19
		-20	3 5 6	4.2 B	22

		DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
Very Stiff to Hard Gray, Moist SILTY CLAY, trace gravel (CL/ML) *(continued)*			4 8 10	4.2 B	19
	624.00				
Stiff to Very Stiff Gray, Moist CLAY (CL)		-25	3 5 7	2.5 B	20
			2 4 4	1.3 B	21
		-30	2 3 5	1.7 B	20
	614.50				
Extremely Dense Gray, Wet SAND, with gravel, rock fragments (SPG)	▼	-35	50/5"		19
	612.00				
Borehole continued with rock coring.		-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)

BBS, form 137 (Rev. 8-99)

Illinois Department of Transportation
Division of Highways
GSG CONSULTANTS INC.

ROCK CORE LOG

Page 2 **of** 2

Date 10/17/14

ROUTE Weber Road **DESCRIPTION** Proposed Weber Road & I-55 Improvements **LOGGED BY** JJR

SECTION Normantown Road to 135th Street/Romeo Road **LOCATION** Weber Road Bridge, **SEC.** , **TWP.** , **RNG.** , **Latitude** , **Longitude**

COUNTY Will County **CORING METHOD** Rotary, Diamond Bit Core Barrel

STRUCT. NO. NA
Station NA

BORING NO. BR-01
Station 810+16
Offset 92.00ft LT
Ground Surface Elev. 648.00 **ft**

CORING BARREL TYPE & SIZE NX 5 split barrel

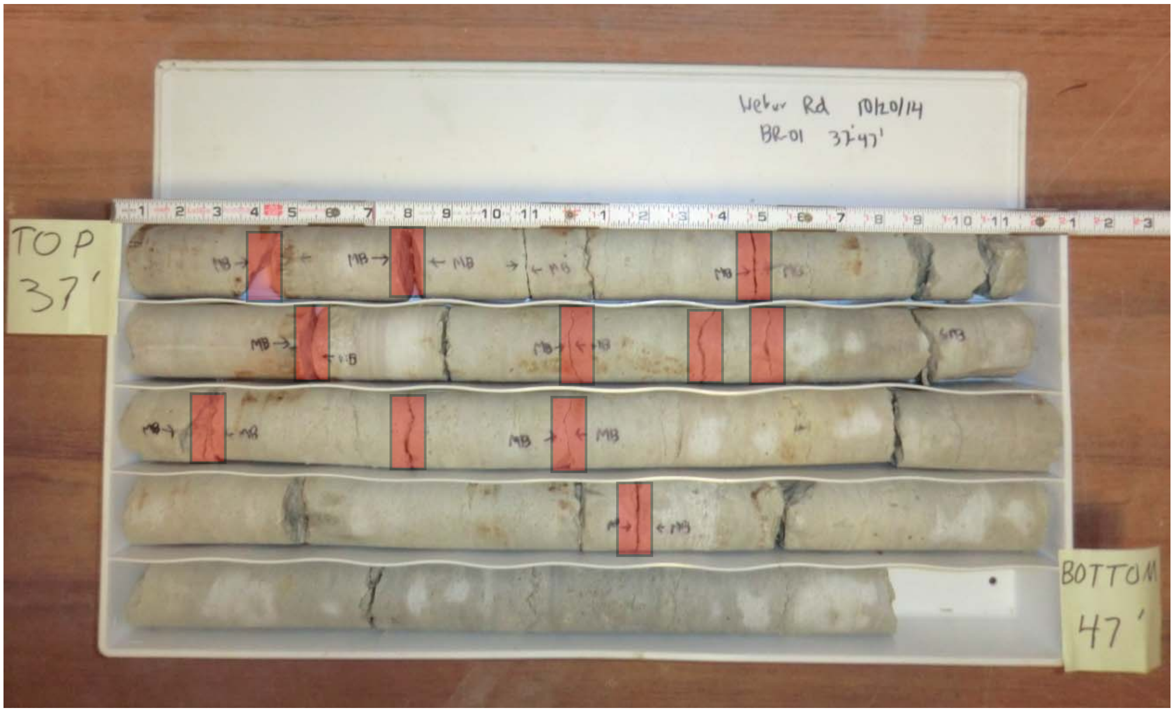
Core Diameter 2 **in**
Top of Rock Elev. 611.00 **ft**
Begin Core Elev. 611.00 **ft**

	DEPTH (ft)	CORE (#)	RECOVERY (%)	R.Q.D. (%)	CORE TIME (min/ft)	STRENGTH (tsf)
Very Hard, Slightly Weathered Gray, Fine Grained, Damp LIMESTONE, with cavities		1	97	92	2.5	1070.6
	-40					
	-45					
601.00						
End of Boring						
	-50					
	-55					

Color pictures of the cores Yes
Cores will be stored for examination until 1/2016
The "Strength" column represents the uniaxial compressive strength of the core sample (ASTM D-2938)

BBS, form 138 (Rev. 8-99)

Rock Core Photos: Boring BR-01



🟥 Mechanical Breaks

Run	Sample No.	Depth (ft)	Recovery (%)	RQD (%)	RQD Classification	Description
1	NX-01	37’-47’	96.7	91.7	Excellent	Gray Limestone

Illinois Department of Transportation
Division of Highways
GSG CONSULTANTS INC.

SOIL BORING LOG

Page 1 **of** 2

Date 10/27/14

ROUTE Weber Road **DESCRIPTION** Proposed Weber Road & I-55 Improvements **LOGGED BY** JJR

SECTION Normantown Road to 135th Street/Romeo Road **LOCATION** Weber Road Bridge, **SEC.** , **TWP.** , **RNG.** , **Latitude** , **Longitude**

COUNTY Will County **DRILLING METHOD** HSA **HAMMER TYPE** AUTO

STRUCT. NO. NA
Station NA

BORING NO. BR-02
Station 811+56
Offset 52.00ft LT
Ground Surface Elev. 650.00 ft

Surface Water Elev. NA ft
Stream Bed Elev. NA ft

Groundwater Elev.:
First Encounter 612.0 ft ▼
Upon Completion None ft
After NA **Hrs.** NA ft

	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
6 inches of Asphalt Pavement 649.50				
Black and Gray, Wet FILL: SAND, with gravel 648.00		10 7 6		24
Stiff to Very Stiff Black and Gray, Very Moist CLAY, trace gravel and organic material (CL)	-5	7 5 5	2.0 P	36
		3 2 3	1.8 P	30
640.50	-10	1 2 4	1.3 P	21
Stiff Brown and Gray, Moist SILTY CLAY, trace gravel (CL/ML) 638.00		3 6 9	5.0 B	20
Stiff to Hard Gray, Moist CLAY, trace gravel (CL)	-15	3 7 8	4.6 B	19
		2 5 8	4.2 B	23
630.00	-20	3 5 8	4.6 B	21

	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
Stiff to Very Stiff Gray, Moist CLAY (CL)		3 4 6	2.1 B	23
	-25	2 4 6	2.1 B	21
		2 3 6	1.9 B	22
	-30	2 5 7	1.5 P	21
	-35	6 5 6	2.5 B	20
612.00 ▼				
Medium Dense Gray, Wet SAND (SP)	-40	6 10 12		19

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)

SOIL BORING LOG

Date 10/27/14

ROUTE Weber Road **DESCRIPTION** Proposed Weber Road & I-55 Improvements **LOGGED BY** JJR

SECTION Normantown Road to 135th Street/Romeo Road **LOCATION** Weber Road Bridge, **SEC.** , **TWP.** , **RNG.** , **Latitude** , **Longitude**

COUNTY Will County **DRILLING METHOD** HSA **HAMMER TYPE** AUTO

STRUCT. NO. NA
Station NA

BORING NO. BR-02
Station 811+56
Offset 52.00ft LT
Ground Surface Elev. 650.00 **ft**

Surface Water Elev. NA **ft**
Stream Bed Elev. NA **ft**

Groundwater Elev.:
First Encounter 612.0 **ft** ▼
Upon Completion None **ft**
After NA **Hrs.** NA **ft**

	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
609.00				
End of Boring				
	-45			
	-50			
	-55			
	-60			

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

Page 1 **of** 2

Date 10/20/14

ROUTE Weber Road **DESCRIPTION** Proposed Weber Road & I-55 Improvements **LOGGED BY** JH

SECTION Normantown Road to 135th Street/Romeo Road **LOCATION** Weber Road Bridge, **SEC.** , **TWP.** , **RNG.** , **Latitude** , **Longitude**

COUNTY Will County **DRILLING METHOD** HSA **HAMMER TYPE** AUTO

STRUCT. NO. NA
Station NA

BORING NO. BR-03
Station 812+59
Offset 93.00ft LT
Ground Surface Elev. 649.00 **ft**

Surface Water Elev. NA **ft**
Stream Bed Elev. NA **ft**

Groundwater Elev.:
First Encounter None **ft**
Upon Completion None **ft**
After NA **Hrs.** NA **ft**

	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
10 Inches of Topsoil with vegetation				
648.20				
Stiff Brown, Moist SILTY CLAY (CL/ML)		3 5 8		16
	-5	3 6 9		17
643.00				
Very Stiff to Hard Gray, Moist SILTY CLAY (CL/ML)		5 7 11		19
	-10	5 6 7	4.3 P	19
		4 6 7	3.5 P	18
	-15	2 3 5	3.3 P	23
		3 6 16	2.5 P	14
	-20	4 4 6	2.3 P	15

	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
Very Stiff to Hard Gray, Moist SILTY CLAY (CL/ML) *(continued)*		3 5 7	2.3 P	18
	-25	2 4 6	3.4 B	20
		3 4 7	2.3 P	18
	-30	4 5 8	2.3 P	17
	-35	3 4 7	2.0 P	19
610.50				
Extremely Dense Gray, Moist SAND, trace silt and gravel (SPG)		12 50/6"		7
609.00	-40			

Borehole continued with rock coring.

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

BBS, form 137 (Rev. 8-99)

Illinois Department of Transportation
Division of Highways
GSG CONSULTANTS INC.

ROCK CORE LOG

Date 10/20/14

ROUTE Weber Road **DESCRIPTION** Proposed Weber Road & I-55 Improvements **LOGGED BY** JH

SECTION Normantown Road to 135th Street/Romeo Road **LOCATION** Weber Road Bridge, **SEC.** , **TWP.** , **RNG.** , **Latitude** , **Longitude**

COUNTY Will County **CORING METHOD** Rotary, Diamond Bit Core Barrel

STRUCT. NO. NA
Station NA

CORING BARREL TYPE & SIZE NX 5 split barrel

Core Diameter 2 **in**
Top of Rock Elev. 609.00 **ft**
Begin Core Elev. 609.00 **ft**

BORING NO. BR-03
Station 812+59
Offset 93.00ft LT
Ground Surface Elev. 649.00 **ft**

		DEPTH (ft)	**CORE (#)**	**RECOVERY (%)**	**R.Q.D. (%)**	**CORE TIME (min/ft)**	**STRENGTH (tsf)**
Very Hard, Slightly Weathered Gray, Fine Grained, Damp LIMESTONE, with cavities	609.00		1	100	93	2.4	933.6
		-45					
	599.00	-50					
End of Boring							
		-55					
		-60					

Color pictures of the cores Yes
Cores will be stored for examination until 1/2016
The "Strength" column represents the uniaxial compressive strength of the core sample (ASTM D-2938)

Rock Core Photos: Boring BR-03

🟥 Mechanical Breaks

Run	Sample No.	Depth (ft)	Recovery (%)	RQD (%)	RQD Classification	Description
1	NX-01	40' - 50'	100%	93%	Excellent	Gray Limestone

APPENDIX C

LABORATORY TEST DATA

Moisture Content Results

Boring ID	Sample Number	Sample		Moisture Content (%)
		Top (ft.)	Bottom (ft.)	
BR-01	SS-1	1	2.5	17.2
	SS-2	3.5	5	17
	SS-3	6	7.5	15.7
	SS-4	8.5	10	20.4
	SS-5	11	12.5	19.8
	SS-6	13.5	15	18.2
	SS-7	16	17.5	19.4
	SS-8	18.5	20	21.7
	SS-9	21	22.5	18.6
	SS-10	23.5	25	20
	SS-11	26	27.5	21.3
	SS-12	28.5	30	20.3
	SS-13	33.5	35	18.7
BR-02	SS-1	1	2.5	23.7
	SS-2	3.5	5	36.2
	SS-3	6	7.5	29.7
	SS-4	8.5	10	20.7
	SS-5	11	12.5	19.9
	SS-6	13.5	15	19.3
	SS-7	16	17.5	23.1
	SS-8	18.5	20	21.1
	SS-9	21	22.5	22.6
	SS-10	23.5	25	20.6
	SS-11	26	27.5	21.8
	SS-12	28.5	30	20.8
	SS-13	33.5	35	20
	SS-14	38.5	40	19
BR-03	SS-1	1	2.5	16
	SS-2	3.5	5	17.1
	SS-3	6	7.5	18.8
	SS-4	8.5	10	18.5
	SS-5	11	12.5	18.3
	SS-6	13.5	15	22.6
	SS-7	16	17.5	13.7
	SS-8	18.5	20	15.2
	SS-9	21	22.5	17.5
	SS-10	23.5	25	20.1
	SS-11	26	27.5	17.8
	SS-12	28.5	30	17.3
	SS-13	33.5	35	19.3
	SS-14	38.5	40	7.2

Dry Unit Weight Results

Boring ID	Sample Number	Sample		Dry Unit Weight (pcf)
		Top (ft.)	Bottom (ft.)	
BR-01	SS-4	8.5	10	114
BR-01	SS-9	21	22.5	118.9
BR-02	SS-4	8.5	10	108.4
BR-02	SS-10	23.5	25	110.6
BR-03	SS-12	28.5	30	123.2

Organic Content Results

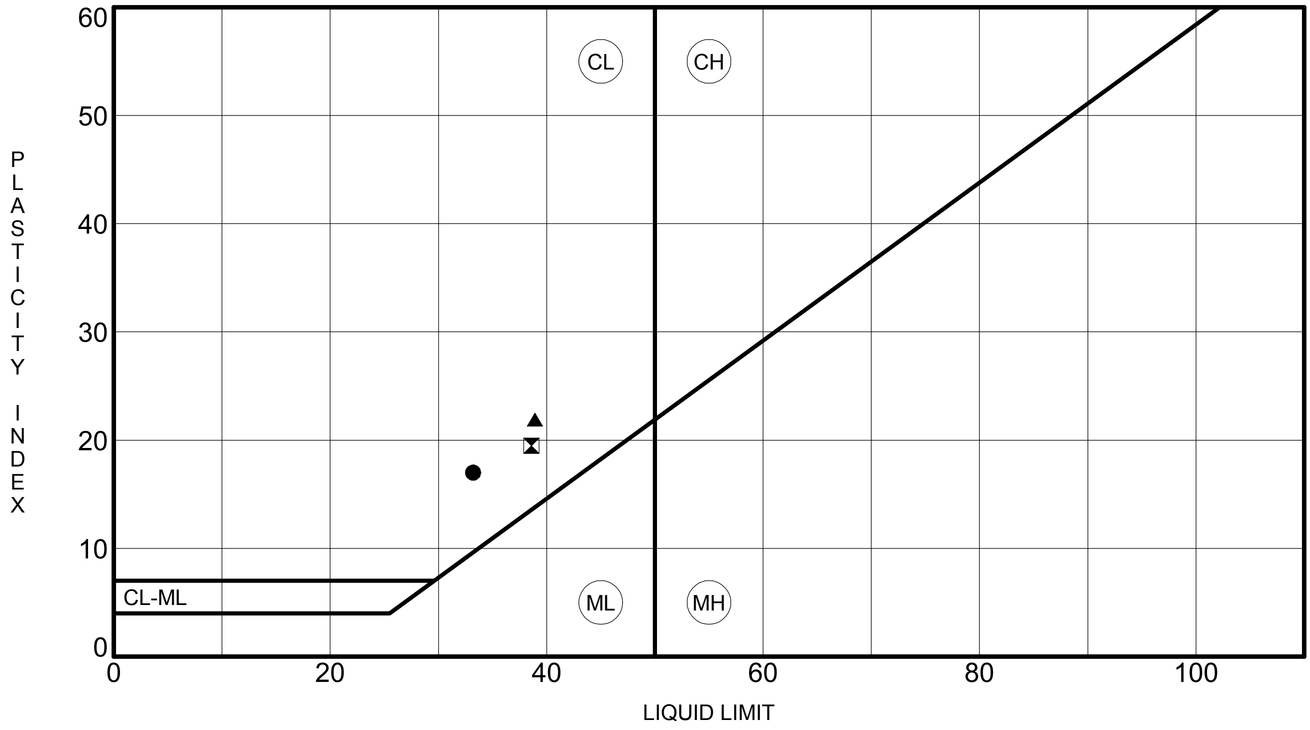
Boring ID	Sample Number	Sample		Organic Content (%)
		Top (ft.)	Bottom (ft.)	
BR-02	SS-3	6	7.5	2.3

Unconfine Compression Test Results

Boring ID	Sample Number	Sample		Unconfine Compression Test
		Top (ft.)	Bottom (ft.)	
BR-01	SS-11	26	27.5	1.284
BR-02	SS-11	26	27.5	1.848
BR-03	SS-10	23.5	25	3.386

Atterberg Limit Results

Boring ID	Sample Number	Sample		Liquid Limit	Plastic Limit	Plasticity Index
		Top (ft.)	Bottom (ft.)			
BR-01	SS-10	23.5	25	33.2	16.2	17
BR-02	SS-8	18.5	20	38.6	19.1	19.5
BR-03	SS-6	13.5	15	38.9	17	21.9



	Specimen Identification		LL	PL	PI	Fines	Classification
●	**BR-01**	**23.50**	**33.2**	**16.2**	**17.0**		
⧗	**BR-02**	**18.50**	**38.6**	**19.1**	**19.5**		
▲	**BR-03**	**13.50**	**38.9**	**17.0**	**21.9**		

Illinois Department of Transportation

Division of Highways
GSG CONSULTANTS INC.

ATTERBERG LIMITS' RESULTS

Route: Weber Road

Section: Normantown Road to 135th Street/Romeo Road

County: Will County

Weber Road

Specimen A Information

Unconfined Test

File Location
BR-01, S-11@26-27.5.HSD

Project Information

Project No. BR-01
Project Name: Weber Road
Client:
Sample Location: S-11@26-27.5
Specimen Description: Gray Silty Clay
Specimen Remarks:

Molding Date:
Date Tested: 10-21-14
Boring Number: BR-01
Sample Number: S-11@26-27.5
Sample Depth: S-11@26-27.5

Specimen A Sample Data

Sample Type: Undisturbed
Specific Gravity: 2.650 Assumed LL: PL:

Sample Parameters	Before Test	After Test
Diameter (in)	1.362	N/A
Height (in)	1.999	N/A
Weight (g)	100.260	N/A
Moisture (%)	21.34	N/A
Dry Density (pcf)	108.016	N/A
Saturation (%)	106.39	N/A
Void Ratio	0.53	N/A
Height-to-Diameter Ratio	1.47	N/A

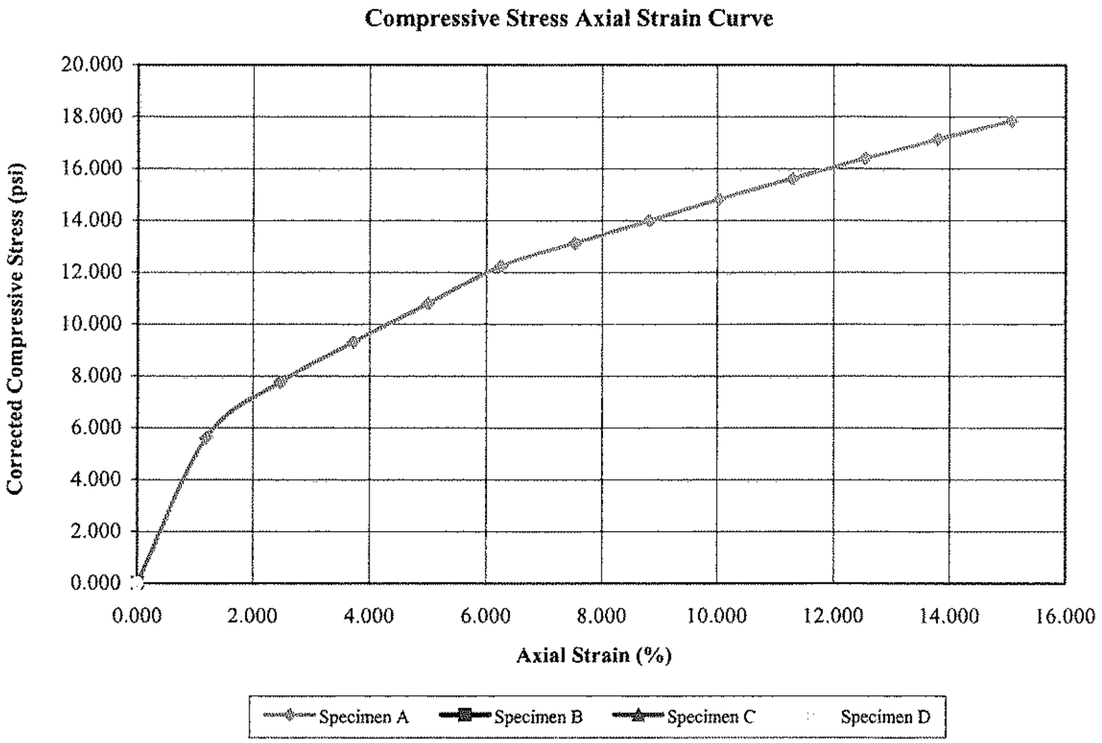
Project Weber Road Specimen A Test Data

Rate of Strain (in/min): 0.025000
Peak Corrected Compressive Stress (psi): 17.837 at reading number: 13

Read Number	Disp (in)	Load (lbs)	Strain (%)	Corr. Comp. Stress (psi)
0	0.005	0	0.000	0.000
1	0.029	8.3	1.195	5.609
2	0.055	11.6	2.475	7.751
3	0.080	14.1	3.727	9.291
4	0.105	16.5	5.007	10.785
5	0.130	19	6.259	12.240
6	0.156	20.7	7.540	13.122
7	0.181	22.3	8.820	13.976
8	0.206	24	10.043	14.810
9	0.231	25.7	11.295	15.611
10	0.256	27.3	12.547	16.383
11	0.281	29	13.799	17.128
12	0.307	30.6	15.079	17.837
13	0.307	30.6	15.079	17.837

Test Performed By: **Tony** Checked By:

Unconfined Compression Test Report (ASTM D2166)



Before Test	Specimen			
	A	B	C	D
Water Content (%)	21.34			
Dry Density (pcf)	108.016			
Saturation (%)	106.39			
Void Ratio	0.53			
Diameter (in)	1.362			
Height (in)	1.999			
Test Data	**A**	**B**	**C**	**D**
Unconfined Strength (psi)	17.837			
Undrained Shear Strength (tsf)	0.642			
Undrained Shear Strength (psi)	8.919			
Rate of Strain (in/min)	0.025000			
Strain at Failure (%)	15.08			
Description				

Project Information		Specimen Description	
Project Num	BR-01	Specimen A	Gray Silty Clay
Project	Weber Road	Specimen B	
Sampling Date	10-21-14	Specimen C	
Sample #	S-11@26-27.5	Specimen D	
Client		**Test Variables**	
		Specific Gravity	2.65
		Liquid Limit:	
		Plastic Limit:	

Remarks

Tested By Tony

Date: ###### #

Computed By

Date

Checked By

Date

Weber Road

Specimen A Information

Unconfined Test

File Location
BR-02, S-11@26-27.5.HSD

Project Information

Project No.		Molding Date:	
Project Name:	Weber Road	Date Tested:	10-28-14
Client:		Boring Number:	BR-02
Sample Location:	BR-02 S-11@26-27.5	Sample Number:	S-11@26-27.5
Specimen Description:	Gray Silty Clay	Sample Depth:	26-27.5
Specimen Remarks:			

Specimen A Sample Data

Sample Type: Undisturbed
Specific Gravity: 2.650 Assumed LL: PL:

Sample Parameters	Before Test	After Test
Diameter (in)	1.348	N/A
Height (in)	2.606	N/A
Weight (g)	131.340	N/A
Moisture (%)	21.81	N/A
Dry Density (pcf)	110.446	N/A
Saturation (%)	116.09	N/A
Void Ratio	0.50	N/A
Height-to-Diameter Ratio	1.93	N/A

Project Weber Road Specimen A Test Data

Rate of Strain (in/min): 0.035000
Peak Corrected Compressive Stress (psi): 25.668 at reading number: 11

Read Number	Disp (in)	Load (lbs)	Strain (%)	Corr. Comp. Stress (psi)
0	0.003	1.7	0.000	0.000
1	0.039	12.4	1.353	7.435
2	0.073	17.4	2.685	10.721
3	0.110	21.5	4.082	13.347
4	0.146	24.8	5.457	15.349
5	0.181	29	6.810	17.831
6	0.215	29	8.120	17.580
7	0.250	33.9	9.451	20.475
8	0.285	37.2	10.805	22.238
9	0.320	39.7	12.158	23.428
10	0.356	42.2	13.511	24.572
11	0.391	44.7	14.865	25.668
12	0.395	44.7	15.017	25.622

Test Performed By: **Tony** Checked By:

Unconfined Compression Test Report (ASTM D2166)

Date

Checked By

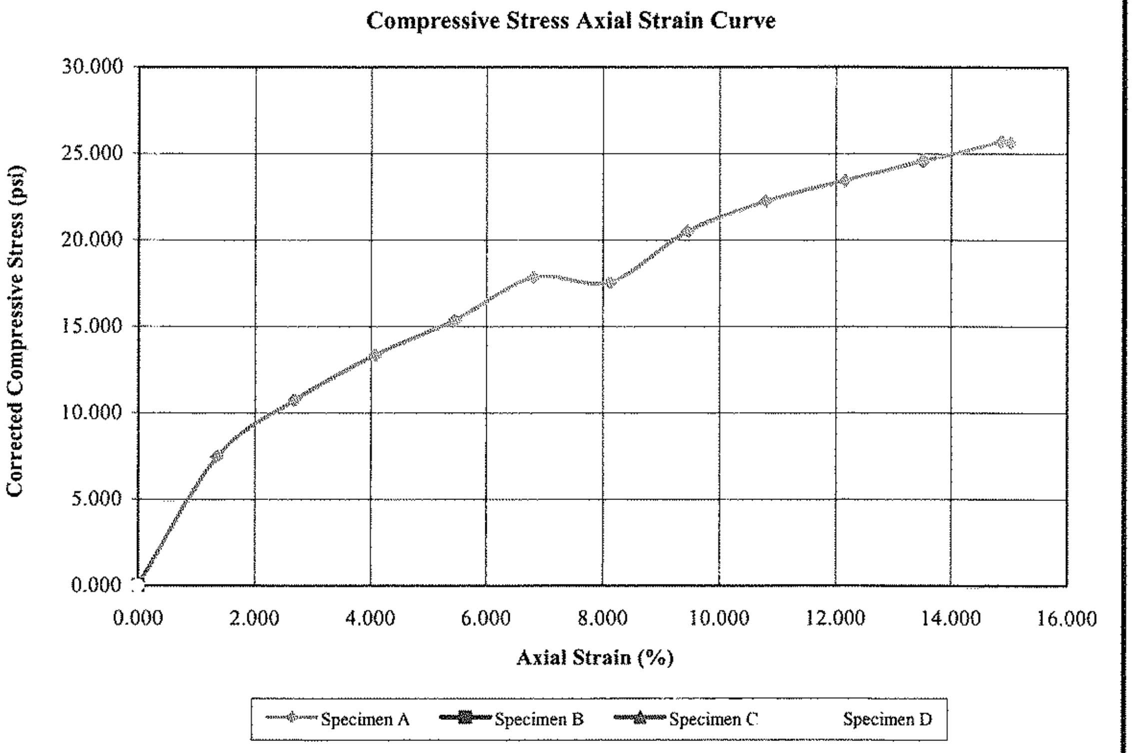
Date

Computed By

######
#

Date

Tested By Tony



	Specimen			
Before Test	**A**	**B**	**C**	**D**
Water Content (%)	21.81			
Dry Density (pcf)	110.446			
Saturation (%)	116.09			
Void Ratio	0.50			
Diameter (in)	1.348			
Height (in)	2.606			
Test Data	**A**	**B**	**C**	**D**
Unconfined Strength (psi)	25.668			
Undrained Shear Strength (tsf)	0.924			
Undrained Shear Strength (psi)	12.834			
Rate of Strain (in/min)	0.035000			
Strain at Failure (%)	14.86			
Description				

Project Information	
Project Num	
Project	Weber Road
Sampling Date	10-28-14
Sample #	S-11@26-27.5
Client	

Specimen Description	
Specimen A	Gray Silty Clay
Specimen B	
Specimen C	
Specimen D	

Test Variables	
Specific Gravity	2.65
Liquid Limit:	
Plastic Limit:	

Remarks

Weber Road

Specimen A Information

Unconfined Test

File Location
BR-03, S-10@23.5-25.HSD

Project Information

Project No.	BR-03	Molding Date:	
Project Name:	Weber Road	Date Tested:	10-23-14
Client:		Boring Number:	BR-03
Sample Location:	S-10@23.5-25	Sample Number:	S-10@23.5-25
Specimen Description:	Gray Silty Clay	Sample Depth:	S-10@23.5-25
Specimen Remarks:			

Specimen A Sample Data

Sample Type: Undisturbed
Specific Gravity: 2.650 Assumed LL: PL:

Sample Parameters	Before Test	After Test
Diameter (in)	1.345	N/A
Height (in)	2.573	N/A
Weight (g)	130.420	N/A
Moisture (%)	20.05	N/A
Dry Density (pcf)	113.173	N/A
Saturation (%)	115.06	N/A
Void Ratio	0.46	N/A
Height-to-Diameter Ratio	1.91	N/A

Project Weber Road Specimen A Test Data

Rate of Strain (in/min): 0.035000
Peak Corrected Compressive Stress (psi): 47.025 at reading number: 11

Read Number	Disp (in)	Load (lbs)	Strain (%)	Corr. Comp. Stress (psi)
0	-0.009	2.5	0.000	0.000
1	0.026	19	1.349	11.486
2	0.061	26.5	2.720	16.423
3	0.097	33.9	4.090	21.216
4	0.132	41.4	5.461	25.866
5	0.167	48	6.832	29.830
6	0.202	55.4	8.181	34.209
7	0.237	61.2	9.529	37.393
8	0.271	67	10.878	40.467
9	0.307	71.2	12.271	42.388
10	0.342	77	13.620	45.257
11	0.377	81.1	14.969	47.025
12	0.378	81.1	15.035	46.988

Test Performed By: **Tony** Checked By:

Unconfined Compression Test Report (ASTM D2166)

Date

Checked By

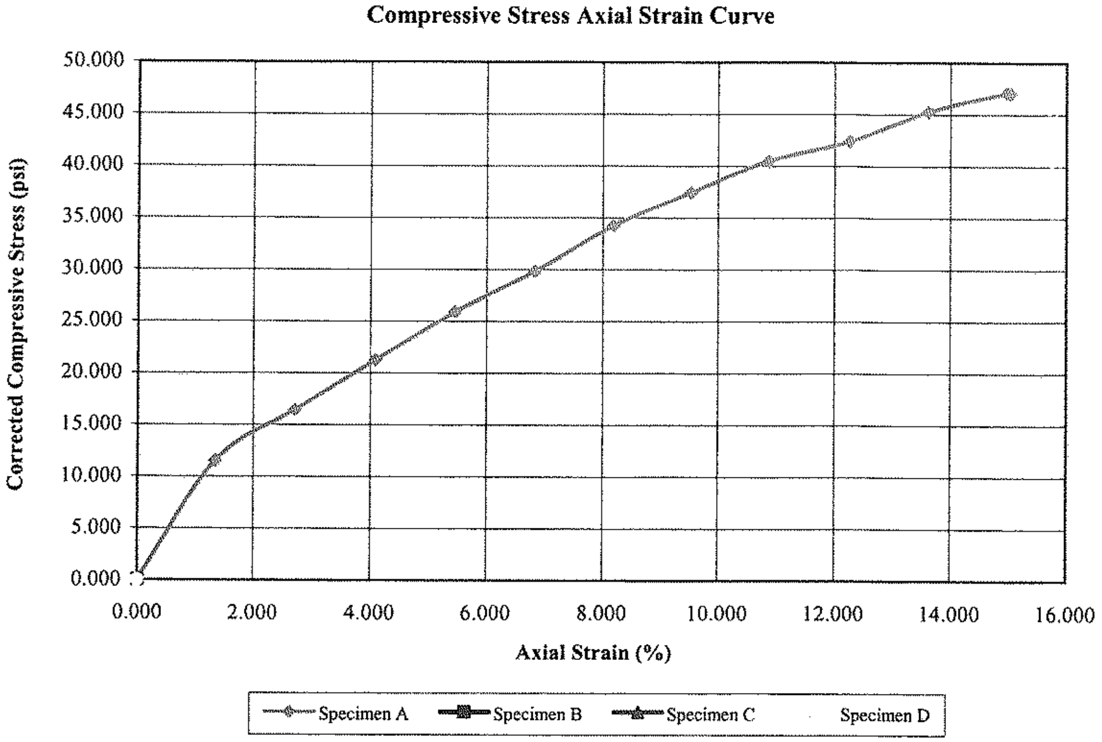
Date

Computed By

#

Date

Tested By Tony



Before Test	Specimen A	B	C	D
Water Content (%)	20.05			
Dry Density (pcf)	113.173			
Saturation (%)	115.06			
Void Ratio	0.46			
Diameter (in)	1.345			
Height (in)	2.573			
Test Data	**A**	**B**	**C**	**D**
Unconfined Strength (psi)	47.025			
Undrained Shear Strength (tsf)	1.693			
Undrained Shear Strength (psi)	23.512			
Rate of Strain (in/min)	0.035000			
Strain at Failure (%)	14.97			
Description				

Project Information	
Project Num	BR-03
Project	Weber Road
Sampling Date	10-23-14
Sample #	S-10@23.5-25
Client	

Specimen Description	
Specimen A	Gray Silty Clay
Specimen B	
Specimen C	
Specimen D	

Test Variables	
Specific Gravity	2.65
Liquid Limit:	
Plastic Limit:	

Remarks

GSG Material Testing, Inc.
2945 West Harrison Street, Chicago, Illinois 60612
Tel: (312) 666-2989, Fax: (312) 666-2952

ROCK CORE COMPRESSION TEST RESULTS

Report No.:
Page:
Project: Weber Road
Address:
Client: GSG Consultants Inc.
Contractor:
Sampled by: Kalyan Chandhuri
Project No.:

Specimen ID. No.	Sampled Location	Date Sampled	Date Broken	Age Days	% Air	Temperature		Unit Wt. lbs/ft3	Core Type	Height Inch	Dia Inch	Cross-Sectional Area (in^2)	Load LBS	CYL. Strength PSI	Break Type	Results	
																Passed	Failed
BR-03	Weber Road		12/16/2014						rock	4.106	2.053	3.3086	42,900	12,966	3		
BR-01	Weber Road		12/17/2014						rock	3.956	2.053	3.3086	49,200	14,870	3		

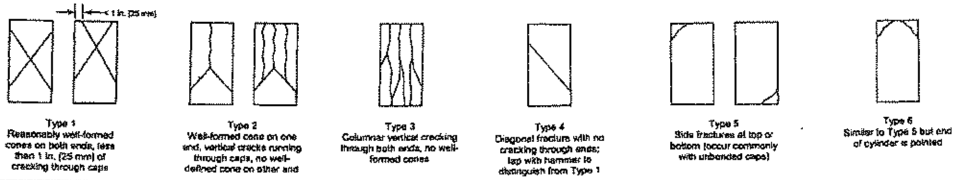
Test Methods Used:

ASTM C 31	Standard Practice for Making and Curing Concrete Test Specimens in the Field
ASTM C 39	Standard Test Method for Compressive Strength of Cylindrical Concrete Test Specimens
ASTM C 109	Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2" Cube Specimens)
ASTM C 173	Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method
ASTM C 231	Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method
ASTM C 270	Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method
ASTM C 496	Standard Specification for Mortar for Unit Masonry
ASTM C 780	Standard Test Method for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry
ASTM C 1064	Standard Test Method for Temperature of Freshly Mixed Portland Cement Concrete

☐ Test specimens were cast by GSG Material Testing, Inc.

☐ Test specimens were not cast by GSG Material Testing - No other information is available

Typical Fracture Patterns (ASTM C 39)



"The test results obtained under this test method are not required to meet the minimum compressive values in accordance with the property specification in ASTM C 270. "
ASTM C 780.1.3

Deviation from Standard:

Project Manager:

APPENDIX D

IDOT PILE DESIGN TABLES

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

	Nominal Required Bearing (Kips)	Factored Resistance Available (Kips)	Estimated Pile Length (Ft.)
Metal Shell 12"Φ w/.179" walls			
	151	83	23
	166	91	26
	182	100	28
	193	106	31
	219	121	33
	246	136	36
Metal Shell 12"Φ w/.25" walls			
	151	83	23
	166	91	26
	182	100	28
	193	106	31
	219	121	33
	246	136	36
	271	149	38
	280	154	41
	286	158	43
	301	165	46
Metal Shell 14"Φ w/.25" walls			
	125	69	18
	170	93	21
	184	101	23
	200	110	26
	217	119	28
	228	126	31
	262	144	33
	295	162	36
	323	178	38
	331	182	41
	336	185	43
	354	194	46
Metal Shell 14"Φ w/.312" walls			
	125	69	18
	170	93	21
	184	101	23
	200	110	26
	217	119	28
	228	126	31
	262	144	33
	295	162	36
	323	178	38
	331	182	41
	336	185	43
	354	194	46
Steel HP 8 X 36			
	142	78	36
	155	85	38
	158	87	41
	159	88	43
	168	92	46
	220	121	48
	233	128	50
	246	135	52
	286	157	53
Steel HP 10 X 42			
	137	75	31
	160	88	33
	181	100	36
	197	108	43
	208	114	46
	285	157	48
	301	165	50
	316	174	52
	335	184	53
Steel HP 10 X 57			
	140	77	31
	164	90	33
	186	102	36
	201	111	43
	213	117	46
	293	161	48
	308	170	50
	324	178	52
	454	250	54
Steel HP 12 X 53			
	135	74	23
	160	88	26
	167	92	28
	170	93	31
	201	110	33
	228	125	36
	240	132	43
	254	140	46
	364	200	48
	382	210	50
	401	220	52
	418	230	53
Steel HP 12 X 63			
	138	76	23
	162	89	26
	169	93	28
	171	94	31
	203	112	33
	230	126	36
	242	133	43
	256	141	46
	368	202	48
	386	212	50
	405	223	52
	497	273	54
Steel HP 12 X 74			
	140	77	23
	164	90	26
	171	94	28
	174	96	31
	206	113	33
	234	128	36
	245	135	43
	260	143	46
	374	206	48
	393	216	50
	412	226	52
	589	324	54
Steel HP 12 X 84			
	142	78	23
	167	92	26
	174	96	28
	176	97	31
	209	115	33
	237	130	36
	249	137	43
	263	145	46
	380	209	48
	399	220	50
	418	230	52
	664	365	54
Steel HP 14 X 73			
	130	71	21
	163	90	23
	197	108	26
	207	114	28
	207	114	31
	249	137	33
	282	155	36
	288	159	43
	306	168	46
	442	243	48
	475	261	50
	501	276	52
	578	318	54
Steel HP 14 X 89			
	134	73	21
	167	92	23
	200	110	26
	210	115	28
	210	116	31
	252	139	33
	286	157	36
	292	160	43
	310	170	46
	450	248	48
	483	266	50
	509	280	52
	705	388	54
Steel HP 14 X 102			
	136	75	21
	169	93	23
	202	111	26
	212	117	28
	213	117	31
	255	140	33
	290	159	36
	295	162	43
	313	172	46
	455	250	48
	488	268	50
	516	284	52
	810	445	54
Steel HP 14 X 117			
	140	77	21
	173	95	23
	206	113	26
	215	118	28
	215	118	31
	259	142	33
	294	162	36
	298	164	43
	317	174	46
	462	254	48
	495	273	50
	523	288	52
	929	511	54
Precast 14"x 14"			
	77	42	14
	159	87	18
	216	119	21
	235	129	23
	255	140	26
Timber Pile			
	144	79	26

Pile Design Table for Pier utilizing Boring #B-2

	Nominal Required Bearing (Kips)	Factored Resistance Available (Kips)	Estimated Pile Length (Ft.)
Metal Shell 12"Φ w/.179" walls			
	223	123	30
	236	130	32
Metal Shell 12"Φ w/.25" walls			
	223	123	30
	236	130	32
	343	189	35
Metal Shell 14"Φ w/.25" walls			
	208	114	23
	234	128	26
	249	137	28
	264	145	30
	280	154	32
Metal Shell 14"Φ w/.312" walls			
	208	114	23
	234	128	26
	249	137	28
	264	145	30
	280	154	32
	422	232	35
Steel HP 8 X 36			
	153	84	35
Steel HP 10 X 42			
	195	107	35
Steel HP 10 X 57			
	389	214	38
Steel HP 12 X 53			
	208	114	32
	243	134	35
	418	230	38
Steel HP 12 X 63			
	210	115	32
	246	135	35
	497	273	39
Steel HP 12 X 74			
	213	117	32
	249	137	35
	589	324	39
Steel HP 12 X 84			
	216	119	32
	253	139	35
	664	365	39
Steel HP 14 X 73			
	216	119	26
	228	126	28
	241	133	30
	254	139	32
	300	165	35
	578	318	39
Steel HP 14 X 89			
	218	120	26
	231	127	28
	244	134	30
	257	141	32
	304	167	35
	705	388	39
Steel HP 14 X 102			
	221	122	26
	234	129	28
	247	136	30
	260	143	32
	308	169	35
	810	445	39
Steel HP 14 X 117			
	192	106	23
	224	123	26
	237	130	28
	250	138	30
	263	145	32
	312	172	35
	929	511	39
Precast 14"x 14"			
	209	115	16
	231	127	18
	250	138	21
Timber Pile			
	141	77	18

Pile Design Table for North Abutment utilizing Boring #B-3

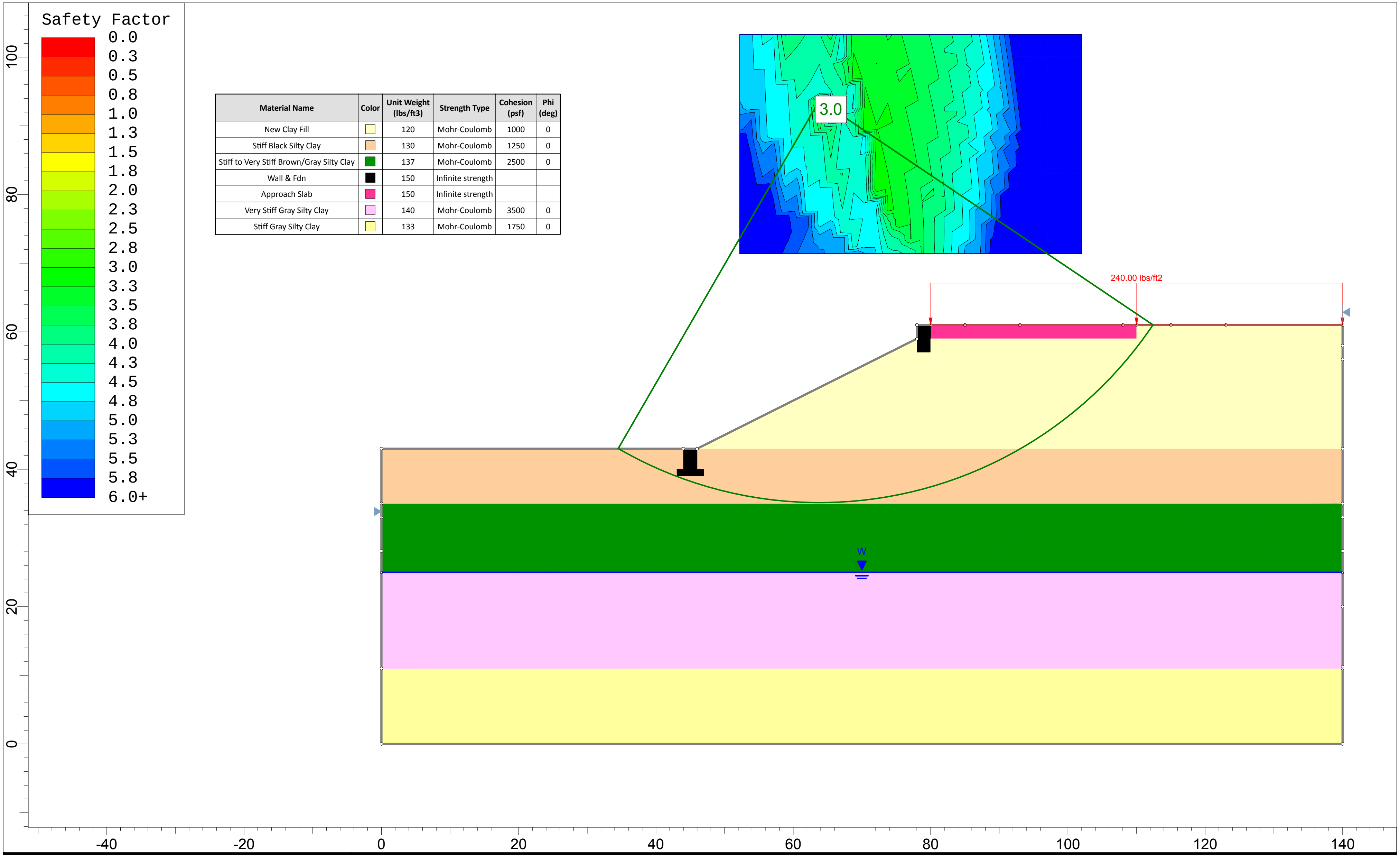
	Nominal Required Bearing (Kips)	Factored Resistance Available (Kips)	Estimated Pile Length (Ft.)
Metal Shell 12"Φ w/.179" walls			
	148	81	28
	168	92	30
	181	99	33
	196	108	35
	211	116	38
	248	136	43
Metal Shell 12"Φ w/.25" walls			
	148	81	28
	168	92	30
	181	99	33
	196	108	35
	211	116	38
	248	136	43
	263	145	45
	276	152	48
	292	160	50
	309	170	53
Metal Shell 14"Φ w/.25" walls			
	159	88	25
	179	98	28
	201	111	30
	215	118	33
	232	128	35
	250	138	38
	293	161	43
	311	171	45
	326	179	48
	344	189	50
	364	200	53
Metal Shell 14"Φ w/.312" walls			
	159	88	25
	179	98	28
	201	111	30
	215	118	33
	232	128	35
	250	138	38
	293	161	43
	311	171	45
	326	179	48
	344	189	50
	364	200	53
Steel HP 8 X 36			
	148	81	45
	155	85	48
	163	90	50
	173	95	53
	232	128	57
	286	157	58
Steel HP 10 X 42			
	171	94	40
	175	96	43
	185	102	45
	193	106	48
	203	112	50
	215	118	53
	300	165	57
	335	184	58

	Nominal Required Bearing (Kips)	Factored Resistance Available (Kips)	Estimated Pile Length (Ft.)
Steel HP 10 X 57			
	143	79	35
	154	85	38
	179	98	43
	189	104	45
	197	108	48
	208	114	50
	219	121	53
	307	169	57
	454	250	59
Steel HP 12 X 53			
	143	79	28
	158	87	30
	163	90	33
	173	95	35
	186	102	38
	215	118	43
	228	125	45
	237	130	48
	249	137	50
	263	145	53
	381	209	57
	418	230	58
Steel HP 12 X 63			
	145	80	28
	159	88	30
	165	91	33
	175	96	35
	188	103	38
	217	120	43
	230	127	45
	239	131	48
	251	138	50
	265	146	53
	385	212	57
	497	273	59
Steel HP 12 X 74			
	147	81	28
	162	89	30
	167	92	33
	178	98	35
	191	105	38
	221	121	43
	233	128	45
	242	133	48
	255	140	50
	269	148	53
	392	215	57
	589	324	59
Steel HP 12 X 84			
	150	82	28
	165	91	30
	170	93	33
	180	99	35
	193	106	38
	224	123	43
	237	130	45
	245	135	48
	258	142	50
	273	150	53
	398	219	57
	664	365	59

	Nominal Required Bearing (Kips)	Factored Resistance Available (Kips)	Estimated Pile Length (Ft.)
Steel HP 14 X 73			
	141	78	25
	175	96	28
	197	108	30
	201	110	33
	212	117	35
	227	125	38
	262	144	43
	277	152	45
	286	157	48
	301	166	50
	317	175	53
	473	260	57
	578	318	58
Steel HP 14 X 89			
	144	79	25
	178	98	28
	199	110	30
	203	112	33
	215	118	35
	230	127	38
	265	146	43
	280	154	45
	290	159	48
	305	168	50
	321	177	53
	481	264	57
	705	388	59
Steel HP 14 X 102			
	147	81	25
	180	99	28
	202	111	30
	206	113	33
	218	120	35
	233	128	38
	269	148	43
	284	156	45
	293	161	48
	308	170	50
	325	179	53
	486	267	57
	810	445	59
Steel HP 14 X 117			
	150	82	25
	183	100	28
	205	113	30
	209	115	33
	221	121	35
	236	130	38
	272	150	43
	287	158	45
	297	163	48
	312	172	50
	329	181	53
	493	271	57
	929	511	59
Precast 14"x 14"			
	203	112	25
	228	125	28
	256	141	30
Timber Pile			
	149	82	30

APPENDIX E

SLOPE STABILITY ANALYSES EXHIBITS



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)
New Clay Fill	🟨	120	Mohr-Coulomb	1000	0
Stiff Black Silty Clay	🟧	130	Mohr-Coulomb	1250	0
Stiff to Very Stiff Brown/Gray Silty Clay	🟩	137	Mohr-Coulomb	2500	0
Wall & Fdn	⬛	150	Infinite strength		
Approach Slab	🟥	150	Infinite strength		
Very Stiff Gray Silty Clay	🟪	140	Mohr-Coulomb	3500	0
Stiff Gray Silty Clay	🟨	133	Mohr-Coulomb	1750	0

SLIDEINTERPRET 6.034

Project Weber Road over I-55 - Structure # 099-0428

Analysis Description Circular Failure Short Term - Exhibit 1

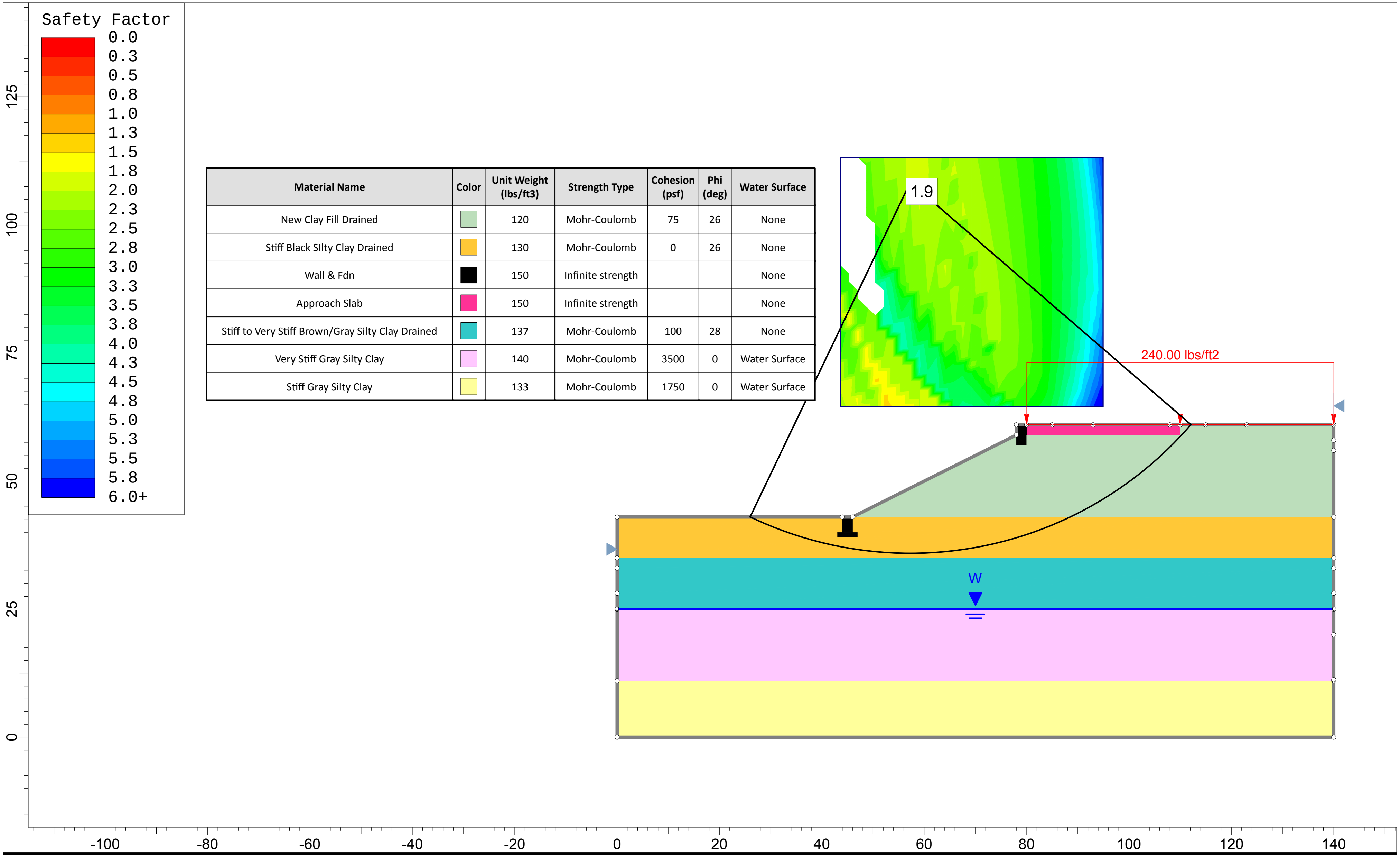
Drawn By KC

Scale 1:232

Company GSG Consultants, Inc.

Date

File Name Weber Road Bridge over I-55 abutment circular.slim



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface
New Clay Fill Drained	🟩	120	Mohr-Coulomb	75	26	None
Stiff Black SIlty Clay Drained	🟧	130	Mohr-Coulomb	0	26	None
Wall & Fdn	⬛	150	Infinite strength			None
Approach Slab	🟥	150	Infinite strength			None
Stiff to Very Stiff Brown/Gray Silty Clay Drained	🟦	137	Mohr-Coulomb	100	28	None
Very Stiff Gray Silty Clay	🟪	140	Mohr-Coulomb	3500	0	Water Surface
Stiff Gray Silty Clay	🟨	133	Mohr-Coulomb	1750	0	Water Surface

SLIDEINTERPRET 6.032

Project Weber Road over I-55 - Structure # 099-0428

Analysis Description Circular Failure Long Term - Exhibit 2

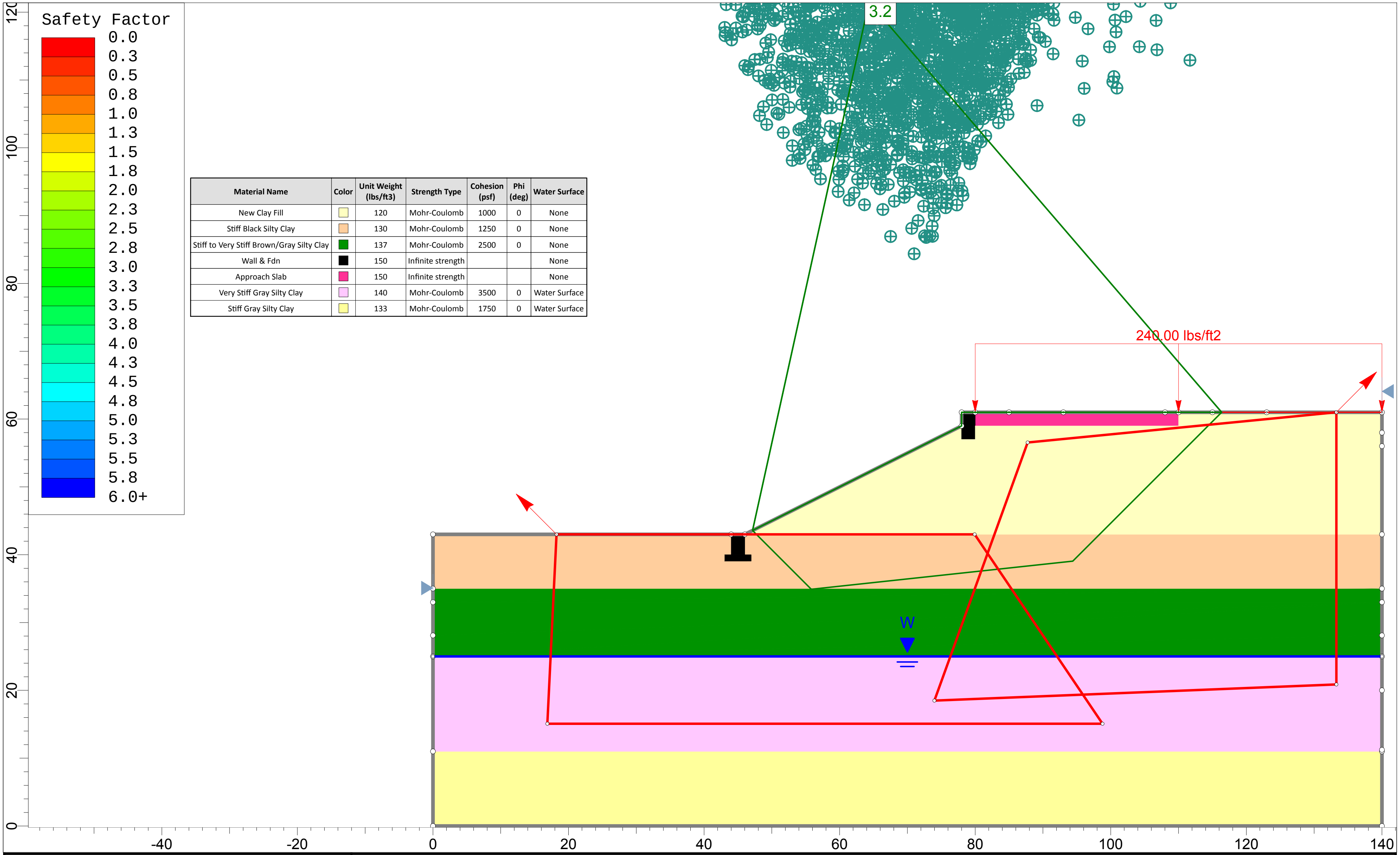
Drawn By KC

Scale 1:311

Company GSG Consultants, Inc.

Date

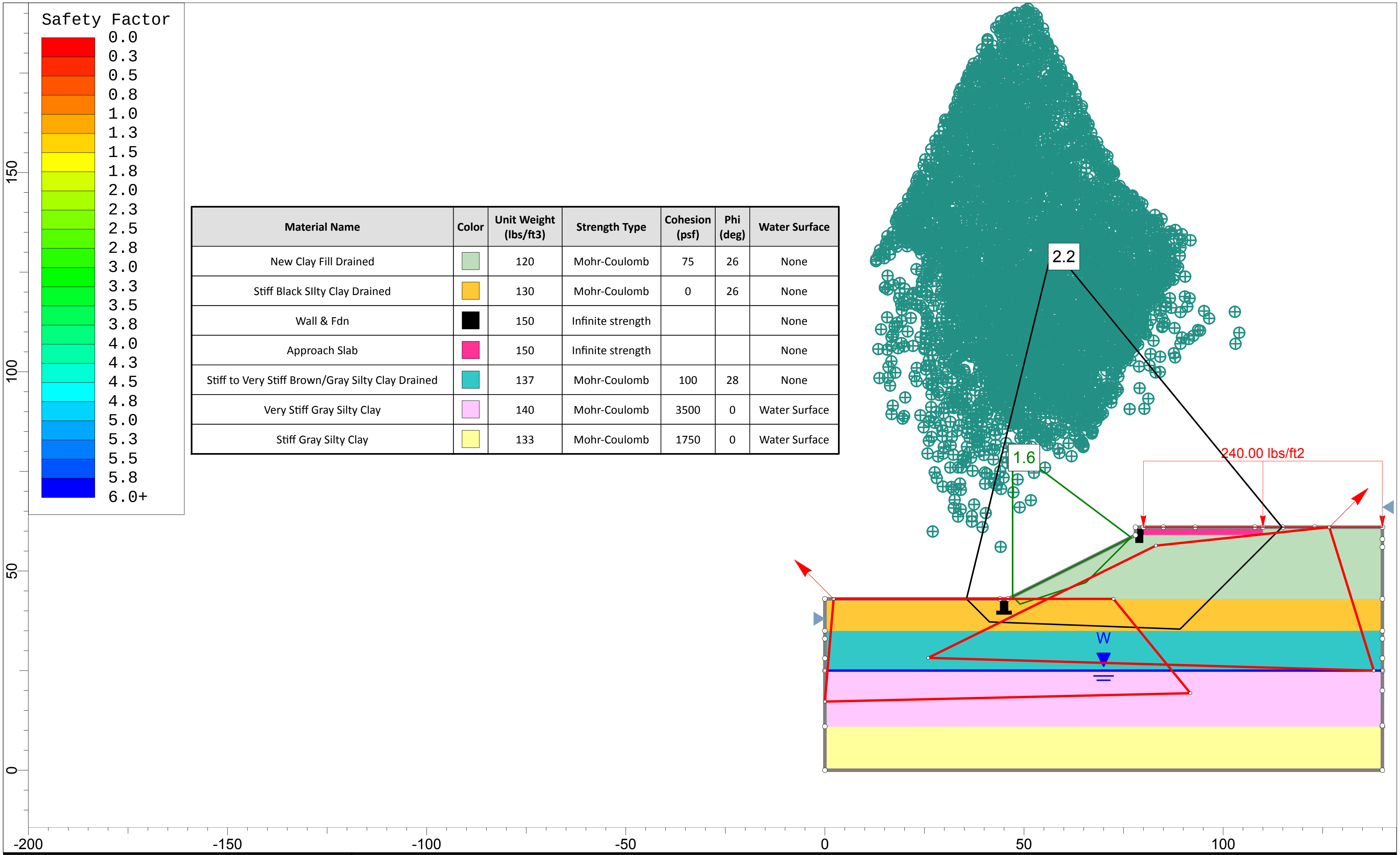
File Name Weber Road Bridge over I-55 abutment circular long term.slim



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface
New Clay Fill	🟨	120	Mohr-Coulomb	1000	0	None
Stiff Black Silty Clay	🟧	130	Mohr-Coulomb	1250	0	None
Stiff to Very Stiff Brown/Gray Silty Clay	🟩	137	Mohr-Coulomb	2500	0	None
Wall & Fdn	⬛	150	Infinite strength			None
Approach Slab	🟥	150	Infinite strength			None
Very Stiff Gray Silty Clay	🟪	140	Mohr-Coulomb	3500	0	Water Surface
Stiff Gray Silty Clay	🟨	133	Mohr-Coulomb	1750	0	Water Surface

Project	Weber Road over I-55 - Structure # 099-0428
Analysis Description	Block Failure Short Term - Exhibit 3
Drawn By	KC
Scale	1:235
Company	GSG Consultants, Inc.
Date	
File Name	Weber Road Bridge over I-55 abutment block short term.slim

SLIDEINTERPRET 6.034



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface
New Clay Fill Drained	🟩	120	Mohr-Coulomb	75	26	None
Stiff Black SIlty Clay Drained	🟧	130	Mohr-Coulomb	0	26	None
Wall & Fdn	⬛	150	Infinite strength			None
Approach Slab	🟥	150	Infinite strength			None
Stiff to Very Stiff Brown/Gray Silty Clay Drained	🟦	137	Mohr-Coulomb	100	28	None
Very Stiff Gray Silty Clay	🟪	140	Mohr-Coulomb	3500	0	Water Surface
Stiff Gray Silty Clay	🟨	133	Mohr-Coulomb	1750	0	Water Surface

SLIDEINTERPRET 6.032

Project Weber Road over I-55 - Structure # 099-0428

Analysis Description Block Failure Long Term - Exhibit 4

Drawn By KC

Scale 1:400

Company GSG Consultants, Inc.

Date

File Name Weber Road Bridge over I-55 abutment block long term.slim