Structural Geotechnical Report

Bridge Rehabilitation Project
IL Route 120 Bridge over US Route 41
Lake County, Illinois

Existing Structure Number: SN 049-0050
Route Carried: IL Route 120 (FAP 342)
Section: 12(HB & VB)BR
County: Lake

Project Structural Engineer:
Primera Engineers, Ltd.
100 South Wacker Drive, Suite 700
Chicago, Illinois 60606
Phone: 312-606-0910

Geotechnical Consultant:
GSG Consultants, Inc.
Robert Claussen, P.E.
312-733-6262

April 14, 2014
Revised June 26, 2014
Revised August 12, 2014

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

855 West Adams Street, Suite 200
Chicago, IL 60607
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GSG CONSULTANTS, INC.

Engineers, Scientists & Construction Managers

August 12, 2014

Mr. Ted Georgas
Chief Structural Engineer/Vice President Transportation
Primera Engineers, Ltd.
100 South Wacker Drive, Suite 700
Chicago, Illinois 60606

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Bridge Rehabilitation Project
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Dear Mr. Georgas:

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 geotechnical parameters for the use in the design of the proposed improvements to the existing structure. The site investigation included advancing four (4) soil borings to depths of up to 85 feet.

- Revisions dated June 26, 2014 include revisions to pile tables and seismic data to LFD design methodology.
- Revisions dated August 12, 2014 include revisions based on comments received from URS on July 22, 2014.

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

Sincerely,

Robert J. Claussen, P.E.
Senior Engineer

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

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Bridge Rehabilitation Project
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Section: 12(HB & VB)BR
Lake County, Illinois

Prepared by: ______________________________
Robert J. Claussen, P.E.
Senior Engineer

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

Approved by: ______________________________
Ala E. Sassila Ph.D., P.E.
Principal

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1.0 PROJECT DESCRIPTION AND PROPOSED IMPROVEMENTS

GSG Consultants, Inc. (GSG) completed a geotechnical investigation as part of the rehabilitation project for the IL Route 120 bridge over US Route 41 in Lake County, Illinois. The purpose of the investigation was to explore the subsurface conditions, determine engineering properties of the subsurface soil, and develop design and construction recommendations. GSG understands that the proposed improvements to the existing bridge will include the removal and replacement of the existing bridge deck and approach slabs, modification of the existing abutments, the repair and reuse of the existing superstructure and substructure, reuse of the existing foundations, and the removal of the existing wing walls and construction of new wing walls parallel to the bridge parapet. The project will also include verifying that the existing foundations are suitable for supporting the bridge after the proposed rehabilitation and improvements.

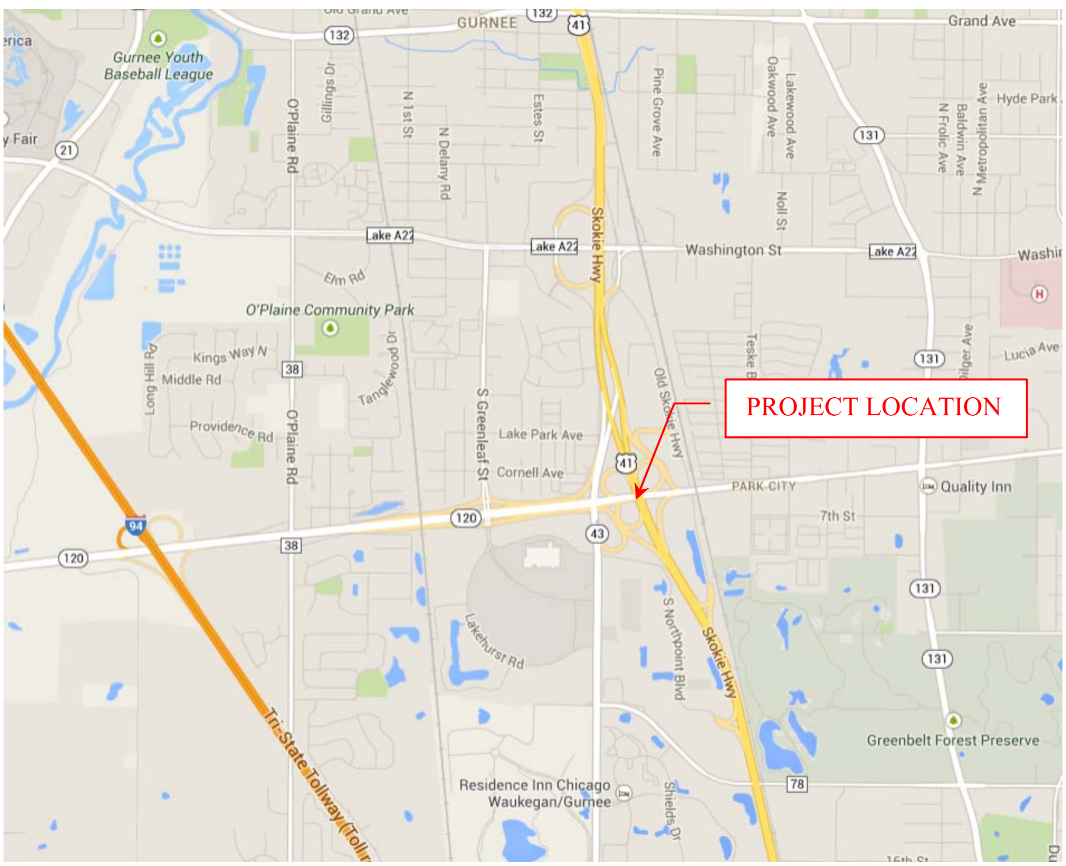


Figure 1 - Project Location Map

1.1 Existing and Proposed Structure Information

The existing bridge (SN 049-0050) runs in an east-west direction, and carries IL Route 120 over US Route 41. The Type Size and Location Plan (TS&L) was provided by Primera Engineers, Ltd. (Primera – Project Structural Engineers). According to the TS&L, the existing structure was built in 1959 of a continuous steel beam superstructure supported by stub abutments and multi column piers with pile supported footings. The back to back abutment length is 236 feet and the out to out width is approximately 90 feet. The bridge carries two through lanes and a diminishing taper entrance ramp in each direction. The east and west bound traffic are separated by a concrete barricade.

The proposed improvements will include the removal and replacement of the existing bridge deck and approach slabs, modification of the existing abutments, the repair and reuse of the existing superstructure and substructure, reuse of the existing foundations, and the removal of the existing wing walls and construction of new wing walls parallel to the bridge parapet. The project may also include the use of temporary earth retaining structures to maintain traffic during the construction of the improvements. According to the TS&L, the proposed structure is a continuous steel beam superstructure supported by stub abutments and multi column piers with pile supported footings. The back to back abutment length is 236 feet and the out to out width is approximately 90 feet. The bridge carries two through lanes and a diminishing taper entrance ramp in each direction. The east and west bound traffic are separated by a concrete barricade.

1.2 Site Conditions

IL Route 120 runs in an east-west direction and US Route 41 runs in a north-south direction. The existing bridge carries IL Route 120 over US Route 41 and has vertical clearance of approximately 14.2 feet. The embankment slopes adjacent to the bridge are approximately 2:1 to 3:1 (H:V). The area directly north of the crossing consists of residential properties, and the area to the south is a mix of residential and commercial properties.

Photo 1: View of IL Rte 120 Bridge over US Rte 41, facing north.

Photo 2: View of IL Rte 120 Bridge over US Rte 41, facing south.

1.3 Existing Subsurface Information

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 north central portion of Lake County, Illinois. The surficial geologic deposits in this area are typically glacial drift deposited during the Wisconsin Episode. The subject area consists of deposits primarily from the Equality Formation and the Wadsworth Formation. The areas within the Equality Formation consist of silt and clay with very fine interbedded sand layers. The areas within the Wadsworth Formation consist of diamicton; silty clay loam to silty clay, pebbly with occasional cobbles and or sand and gravel lenses. This formation overlies the Silurian Racine Dolomite Bedrock Formation with an average depth of 200 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 the IDOT geotechnical manual and procedures.

2.1 Subsurface Exploration Program

The site subsurface exploration was conducted between March 13th and the 21st, 2014, and included advancing a total of four (4) standard penetration test (SPT) borings within the vicinity of the existing bridge abutments. The locations of the soil borings were coordinated with Primera and were completed based on field conditions and accessibility. The locations of the soil borings are shown on the **Boring Location Plan** (**Appendix A**). The borings were completed to depths that would provide a minimum 65 tons bearing for a 12-inch diameter concrete fill metal shell pile, per the requirements of the IDOT Geotechnical Manual.

The soil borings were drilled using a truck mounted 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.

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 within the vicinity of the 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-89/90
- Dry Unit Weight ASTM D7263

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 **Laboratory Test Summary 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 existing 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 (Appendix C) and are shown graphically in the Subsurface Profile (Appendix B). The boring logs provide specific soil 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 based on 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 existing ground surface elevations shown in the soil boring logs were estimated from internet sources.

The soil borings were performed on the shoulders and outside driving lanes of IL Route 120. The approximate surface elevation is 723 on the west side of the bridge, and 728 on the east side of the bridge. The borings performed in the grass area adjacent to the roadway encountered approximately 4 to 8 inches of topsoil underlain by fill materials. The borings performed in the pavement areas encountered approximately 3 inches of asphalt over 3 to 7 inches of concrete, underlain by fill materials.

The fill materials consisted of cohesive soils, which primarily included clay and silty clay. The fill material was encountered to a depth approximately 11 to 13 feet (Approximate Elevation 711) below the ground surface on the west side of the bridge, and to a depth of approximately 21 to 22 feet (Approximate Elevation 706) on the east side of the bridge. The fill materials had moisture contents ranging from 17 to 27 percent. The fill material was underlain by very stiff to very hard cohesive soils consisting of silty clay and silty clay loam. The very stiff to very hard cohesive soils were encountered to a depth approximately 20 feet (Approximate Elevation 703) below the ground surface on the west side of the bridge, and to a depth of approximately 28 to 33 feet (Approximate Elevation 697) on the east side of the bridge. The moisture content for the very stiff to very hard cohesive soils ranged from 13 to 18 percent. These soils were underlain by very stiff to hard cohesive soils consisting of clay and silty clay. The very stiff to hard cohesive soils were encountered to boring termination at depths of 70 to 85 feet (Approximate Elevation 645) below the ground surface. The moisture content for this soil ranged from 13 to 24 percent.

Granular soil layers with a thickness of 1 to 2 feet were encountered in Boring BSB50-04 at depths of 26.5 feet and 84 feet. Water was observed in the sand samples collected at these depths.

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 only encountered in one boring (BSB50-04) at a depth of 26.5 feet (Elevation 701.5) while drilling and at 84 feet (Elevation 643) after the boring was completed. It should be noted that granular soil layers were encountered at each of these depths in Boring BSB50-04.

It should be noted that the soils encountered in the borings generally consisted of cohesive soils. Generally, it takes a long time for water levels to reach equilibrium in these types of materials. Water that is encountered in granular soils in a predominantly cohesive soil profile often have water trapped in them that does not represent the actual ground water level. Based on the color transition from brown to gray, it is anticipated that the long term water table may be as high as elevation 707. The color change of the soil from brown to gray can be based on the oxidation of the material that exists above the water table.

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, seasonal changes, other climatic conditions, or other factors not evident at the time measurements were made and reported herein.

3.0 GEOTECHNICAL ANALYSES

3.1 Derivation of Soil Parameters for Design

Unit weights, friction angles and shear strength parameters were estimated using corrected standard penetration test (SPT) using published correlations for N values results for the fill and cohesionless soils and in-situ and laboratory test results for cohesive soils. The SPT values were corrected for hammer efficiency. The hammer efficiency correction factor considers the use of a safety hammer/rope/cat-head system, generally estimated to be 60% efficient. Thus, correlations should be based upon what is currently termed as N_{60} data. The efficiency of the automatic hammer used for this exploration was estimated to be approximately 80% based on previous efficiency testing of the drill rigs equipped with such equipment. The correction for hammer efficiency is a direct ratio of relative efficiencies as follows:

$$N_{60} = N * (80/60)$$

*Where the N value is the field recorded blow counts.

Table 1 presents the general soil parameters that were derived from the field and laboratory test data.

Table 1 – Summary of Soil Parameters

Approximate Depth/Elevation (feet)	Soil Description	Insitu Unit Weight γ (pcf)	Undrained		Drained	
			Cohesion c (psf)	Friction Angle ϕ (Degrees)	Cohesion c (psf)	Friction Angle ϕ (Degrees)
NA	New Granular Fill	120	0	30	0	30
Surface to 711 (West) 706 (East)	Existing Cohesive Fill	120	3,000	0	50	28
711 to 703 (West) 706 to 697 (East)	Very Stiff to Very Hard Cohesive Soils	135	4,500	0	100 4,500*	30 0*

Approximate Depth/Elevation (feet)	Soil Description	Insitu Unit Weight γ (pcf)	Undrained		Drained	
			Cohesion c (psf)	Friction Angle ϕ (Degrees)	Cohesion c (psf)	Friction Angle ϕ (Degrees)
703 to 645 (West) 697 to 645 (East)	Very Stiff to Hard Cohesive Soils	140	2,000	0	2,000*	0*

*Materials are below the estimated long term groundwater level (elevation 707), and will not reach a drained condition long term.

3.2 Settlement

The existing IL Rte 120 abutment slopes and roadway side slopes to the north and south sides of the highway are approximately 2:1 to 3:1 (H:V). It is our understanding that the proposed slope grading will approximately match the existing grading and that proposed project will not include any grading that will exceed 10 feet in height. Based on the limited fill placement, the anticipated settlement is considered to be negligible.

3.3 Slope Stability

IDOT requires that at a minimum, slope stability analysis should be performed for any area having a cut depth or fill height greater than or equal to 15 feet. The proposed end slopes and wing walls for the abutments will require a minimal site grading, undercutting and filling. Therefore, no slope stability analysis is required for this project.

3.4 Seismic Parameters

The seismic hazard for the site was analyzed per the AASHTO Standard Specifications for Highway Bridges. The Seismic Performance Category (SPC), Acceleration Coefficient (A) and the Site Coefficient (S) were calculated per the specifications, and are based on the soils encountered in the borings performed at the site. Table 2 presents a summary of the seismic parameters.

Table 2 – Seismic Parameters

Seismic Performance Category (SPC)	Acceleration Coefficient (A)	Site Coefficient (S)
A	0.04	1.0

GSG used the IDOT Liquefaction spreadsheet to evaluate liquefaction potential at the site. Based on the data calculated, the factor of safety against liquefaction for the soils encountered at the site is greater than one, thus liquefaction should not be a concern for this project.

3.5 Scour

The bridge structure over US Route 41 serves as a grade separation between the IL Route 120 and US Route 41. There is no waterway below the structure; therefore scour is not an issue for this project.

3.6 Mining Activity

GSG has checked the Illinois State Geologic Survey (ISGS) web site for mining activity within the project area. The site does not have any record of mining activity in Lake County. No known mining activity that has occurred in the vicinity of the proposed project location.

4.0 GEOTECHNICAL DESIGN RECOMMENDATIONS

The foundations of the bridge must provide sufficient support to resist the dead and live loads, as well as seismic loading. It is our understanding that the proposed improvements to the existing bridge will include the removal and replacement of the existing bridge deck and approach slabs, modification of the existing abutments, the repair and reuse of the existing superstructure and substructure, and reuse of the existing foundations. The proposed improvements will also include the removal of the existing wing walls and construction of new wing walls parallel to the bridge parapet. The geotechnical recommendations in this report are provided for use in the design of the proposed improvements, and also for use in confirming that the existing foundations are suitable for supporting the structure after these improvements to the existing bridge have been made. The foundation design recommendations were completed per the AASHTO Standard Specifications for Highway Bridges 17th Edition (2002).

4.1 Bridge Foundation Recommendations

There was no information available regarding the existing driven pile at the time this report was written. It is assumed that the pile foundation is similar to the adjacent bridge over Old Skokie Highway, which has existing bridge abutments are supported on driven piles, and the piers are supported on timber piles. The improvements to the bridge will include the reuse of the pile foundation system. The geotechnical design information provided in this report is limited to only pile foundations. Shallow foundations and drilled shafts have not been included as they are not part of the scope of this project.

4.1.1 Driven Pile Foundations

The pile analysis was performed based on the soil conditions encountered adjacent to the existing abutments supporting the bridge. The soil conditions at each abutment location were evaluated and suitable values were determined from the borings for use in performing the pile analysis for each abutment. The Load Factored Design (LFD) methods were used to calculate the nominal and factored resistance available at each abutment. The existing plans provided a provision for using three different pile types to support the abutments: tables 3-1 and 3-2 provide information pertaining to the 14” x 14” precast concrete piles, 3-3 and 3-4 provide information for the spirally welded steel shell CIP concrete piles, and 3-5 and 3-6 for the metal shell CIP concrete piles. It should be noted that the resistances listed are based on the pile to soil contact beginning approximately 8 feet below the existing ground surface, which was the approximate abutment thickness in the original plans.

Table 3-1: West Abutment Pile Design for Precast-Concrete Piles

Depth	Elevation	Nominal Axial Resistance	Performance Factor	Factored Axial Resistance
15	701	114.66	0.70	80.26
20	696	131.72	0.70	92.20
25	691	160.16	0.70	112.11
30	686	191.51	0.70	134.05
35	681	223.60	0.70	156.52
40	676	256.27	0.70	179.39
45	671	292.00	0.70	204.40
50	666	361.80	0.70	253.26

Table 3-2: East Abutment Pile Design for Precast-Concrete Piles

Depth	Elevation	Nominal Axial Resistance	Performance Factor	Factored Axial Resistance
15	706	105.41	0.70	73.79
20	701	140.99	0.70	98.70
25	696	161.12	0.70	112.79
30	691	171.62	0.70	120.14
35	686	195.60	0.70	136.92
40	681	237.72	0.70	166.40
45	676	251.17	0.70	175.82
50	671	272.93	0.70	191.05

Table 3-3: West Abutment Pile Design for Spirally Welded Steel Shell CIP Concrete Piles

Depth	Elevation	Nominal Axial Resistance	Performance Factor	Factored Axial Resistance
15	701	54.52	0.70	38.16
20	696	64.92	0.70	45.44
25	691	80.58	0.70	56.41
30	686	97.07	0.70	67.95
35	681	114.30	0.70	80.01
40	676	132.35	0.70	92.65
45	671	152.78	0.70	106.95
50	666	184.98	0.70	129.48

Table 3-4: East Abutment Pile Design for Spirally Welded Steel Shell CIP Concrete Piles

Depth	Elevation	Nominal Axial Resistance	Performance Factor	Factored Axial Resistance
15	706	58.84	0.70	41.19
20	701	75.80	0.70	53.06
25	696	81.31	0.70	56.92
30	691	86.93	0.70	60.85
35	686	100.51	0.70	70.36
40	681	123.94	0.70	86.76
45	676	131.46	0.70	92.02
50	671	141.12	0.70	98.78

Table 3-5: West Abutment Pile Design for Metal Shell CIP Concrete Piles

Depth	Elevation	Nominal Axial Resistance	Performance Factor	Factored Axial Resistance
15	701	31.38	0.70	21.97
20	696	39.54	0.70	27.68
25	691	50.43	0.70	35.30
30	686	61.71	0.70	43.20
35	681	73.41	0.70	51.39
40	676	85.51	0.70	59.86
45	671	98.01	0.70	68.61
50	666	114.43	0.70	80.10

Table 3-6: East Abutment Pile Design for Metal Shell CIP Concrete Piles

Depth	Elevation	Nominal Axial Resistance	Performance Factor	Factored Axial Resistance
15	706	34.67	0.70	24.27
20	701	44.45	0.70	31.12
25	696	48.94	0.70	34.25
30	691	54.28	0.70	38.00
35	686	64.18	0.70	44.92
40	681	77.65	0.70	54.36
45	676	83.73	0.70	58.61
50	671	90.99	0.70	63.69

It should be noted that the detail for the metal shell CIP concrete piles include a taper from 12 inch diameter to 8 inch diameter. The overall length of the installed piles and the point of transition is unknown based on the info provided, therefore, only the 8 inch diameter was used for the pile data table .It is our understanding that this data will be used to evaluate the existing pile foundations at the abutment locations and determine if the piles are suitable for supporting the proposed bridge improvements, given the current IDOT and requirements, which include LFD methodology.

The factored resistance includes reduction for the geotechnical resistance of 0.55 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.

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 per pile. The analysis shall determine actual pile moment and deflection to determine the selected pile adequacy for the existing loadings. Table 3 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 3 – Lateral Resistance Parameters

Elevation Soils Encountered	Soil Description	Undrained Shear Strength (psf)	Coefficient of Subgrade Modulus (pci)	Horizontal Strain Factor e50
Surface to 711 (West) 706 (East)	Existing Cohesive Fill	3,000	1,000	0.005
711 to 703 (West) 706 to 697 (East)	Very Stiff to Very Hard Cohesive Soils	4,500	1,600	0.004
703 to 645 (West) 697 to 645 (East)	Very Stiff to Hard Cohesive Soils	2,000	750	0.005

4.3 Bridge Abutments and Retaining Walls

The abutment walls, wing walls, as well as any temporary earth retaining structures shall be designed to withstand earth and live lateral earth pressures. The lateral earth pressures on retaining wall should be determined using an active earth pressure coefficient, Ka, calculated with Rankine Theory. For the proposed abutments, the lateral earth pressures for the abutment should be designed using the at-rest condition. Table 4 provides lateral earth pressure coefficients and soil parameters for the design of the abutment.

Table 4 – Lateral Earth Pressure Parameters

Soil Type	In-situ Moist Unit Weight (pcf) (γ)	Angle of Internal Friction (ϕ)	At-Rest Earth Pressure Coefficient (Ko)	Active Earth Pressure Coefficient (Ka)	Passive Earth Pressure Coefficient (Kp)
New Granular Backfill	120	30	0.5	0.33	3.0
Existing Clay Fill	120	28	0.53	0.36	2.76
Very Stiff to Very Hard Cohesive Soils	135	30	0.5	0.33	3.0

Traffic and other surcharge loads should be included in the abutment design. A live load surcharge shall be applied where vehicular load is expected to act on the surface of the backfill within a distance equal to one-half the wall height behind the back face of the. The live load surcharge may be estimated as a uniform horizontal earth pressure due to an equivalent height (Heq) of soil. Wingwalls should be designed using a surcharge pressure equal to a minimum of 2 feet of earth pressure in accordance with Section 3 of the IDOT Culvert Manual. Tables 5 and 6 provide the equivalent heights of soils for vehicular loadings on abutments and wing walls, respectively.

Table 5 –Equivalent Height of Soil for Vehicular Loading on Abutments Perpendicular to Traffic

Abutment Height (ft)	H_{eq}
5	4.0 feet
10	3.0 feet
≥20	2.0 feet

Table 6 - Equivalent Height of Soil for Vehicular Loading on Retaining Walls Parallel to Traffic

Retaining Wall Height (ft)	H_{eq} Distance from Wall Back face to Edge of Traffic	
	0 feet	1.0 feet or Further
5	5.0 feet	2.0 feet
10	3.5 feet	2.0 feet
≥20	2.0 feet	2.0 feet

The abutment and wing walls design should include a drainage system to allow movement of any water behind the wall. Abutment and wing walls should be backfilled with a minimum of 4 feet of free draining materials (as measured horizontally from the back of the wall), in accordance with IDOT design standards. Geocomposite wall drains, perforated pipe and drainage aggregate should be installed behind the abutment and wing walls.

Heavy compaction equipment should not be allowed closer than five (5) feet to the wall to prevent inducing high lateral earth pressures and causing wall yielding and/or other damage. The passive lateral earth pressure coefficient (Kp) from the upper 3 feet of level backfill at the toe of the wall should be neglected, unless the soil is confined or protected by a concrete slab or well drained pavement. The passive lateral earth pressure coefficient from the upper 3 feet of soil for a descending slope at the wall toe should also be neglected, regardless of any surface protection.

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 Preparation

Based on the design drawings provided by Primera, the proposed improvements to the existing bridge will include the removal and replacement of the existing bridge deck and approach slabs, modification of the existing abutments, the repair and reuse of the existing superstructure and substructure, and reuse of the existing foundations. The proposed improvements will also include the removal of the existing wing walls and construction of new wing walls parallel to the bridge parapet. Any resulting excavations as part of the improvements should be backfilled with structural fill consisting of crushed aggregate meeting IDOT CA-6 gradation requirements to the final finished grade.

For the proposed approach slabs on either end of the bridge, site preparation should include the removal of existing pavements and landscaping as necessary. All vegetation, surface topsoil, pavements and debris should be cleared and removed. The exposed subgrade should then be field inspected to determine if undercuts are required. Any undercut areas may be backfilled with structural fill consisting of crushed aggregate meeting IDOT CA-6 gradation requirements to the final proposed foundation bearing elevation.

5.2 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.

5.3 Borrow Material and Compaction Requirements

If borrow material is to be used for onsite construction, it should conform to Section 204, Borrow and Furnish Excavations, of the IDOT Standard Specifications for Road and Bridge Construction (SSRBC). The fill material should be free of organic matter and debris, and should be placed and compacted in accordance with Section 205, Embankment, of the IDOT Construction Manual. Earth-moving operations should be avoided during excessively cold or wet weather to avoid freezing and/or softening subgrade soils.

Suitable structural fill materials shall be of a nature that will compact and develop stability satisfactory to the geotechnical engineer. Structural fill shall consist of crushed limestone or recycled concrete consistent with IDOT CA-6 gradation or medium plasticity silty clays. Suitable structural fill should have the following soil properties:

Table 7 – Structural Fill Soil Properties

REQUIRED TEST	AASHTO METHOD	PERMISSIBLE LIMIT
Standard Dry Density (SDD)	T 99 (Method C)	90 pcf min.*
Organic Content	T 194	10 % max.*
Percent Silt and Fine Sand	T 88	65 % max. **
Plasticity Index	T 90	12 % min. **
Liquid Limit	T 89	50 % max.
Shear Strength (c) at 95 % SDD	T 208 or T 234	1,000 psf min.***

* As per IDOT Standard Specifications.
** Frost Susceptibility Criteria

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 Soil Classification System (ASTM D2847). Soils with these classifications may be used for general purpose landscaping and in areas where uncontrolled settlement is acceptable.

5.4 Groundwater Management

Groundwater was encountered in one of the borings in the granular soil layers encountered at elevations 701.5 and 643. Due to the fact that the soils encountered in the borings were primarily cohesive, and the water was only encountered in relatively thin granular layers in one boring, it is not anticipated that water will present any issues during foundation construction.

Perched water may be encountered in fill materials, or from run-off during construction. For near surface excavations, it is anticipated that the contractor should be able to control the groundwater with traditional sump and pump methods.

If water seepage occurs while excavating 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. The CA-7 stone should be placed to 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 should be backfilled using approved structural fill.

5.5 Temporary Sheeting and Soil Retention

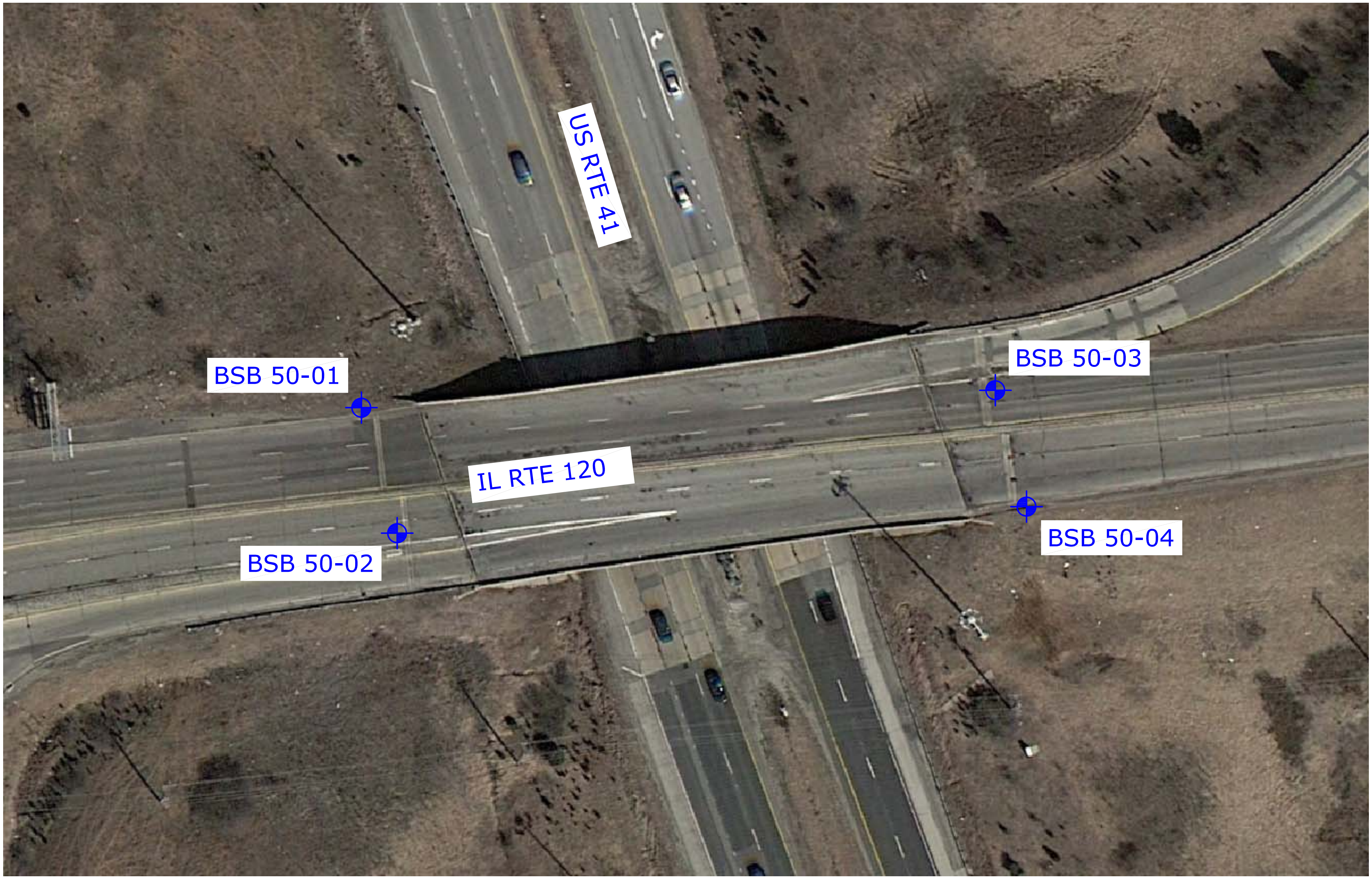
According to the preliminary design information, the project will include phased construction to maintain traffic across the bridge. Temporary sheet piling may be required at the centerline of the east and west abutments and approaches to facilitate the bridge improvements and slopewalls. Based on the soil profile, a cantilevered sheet pile system could be used. The sheet pile retaining system should be designed in accordance with the IDOT Bridge Design Manual, Section 3.13.1, *Temporary Sheet Piling Design, Temporary Soil Retention Systems and Braced Excavations* and the IDOT Design Guide, Section 3.13.1, *Temporary Sheet Piling Design.*

6.0 LIMITATIONS

This report has been prepared for the exclusive use of the Illinois Department of Transportation and its structural consultant. The recommendations provided in the report are specific to the project described herein, and are based on the information obtained at four (4) soil boring locations within the bridge area. The analyses have been performed and the recommendations have been 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

BORING LOCATION PLAN



SOIL BORING LOCATIONS

GSG CONSULTANTS, INC.
855 W. ADAMS, SUITE 200
CHICAGO, IL 60607
PHONE: (312) 733-6262
FAX : (312) 733-5612

SCALE:	DRAWN BY:
NTS	CDJ
	CHECKED BY: RC
	DATE: 4/7/14

APPENDIX A – BORING LOCATION DIAGRAM
IL RTE 120 BRIDGE OVER US RTE 41
EXISTING STRUCTURE NUMBER 049-0050
LAKE COUNTY, ILLINOIS

APPENDIX B

SUBSURFACE PROFILE

PLAN

SURVEYED
PLOTTED
ALIGNMENT CHECKED
R.T. OF WAY CHECKED
CADD FILE NAME

NOTE BOOK

NO. ______

BY | DATE

PROFILE

SURVEYED
PLOTTED
GRADES CHECKED
STA. NOTED
STRUCTURE NOTATNS CHK'D

NOTE BOOK

NO. ______

BY | DATE

FILE NAME = \\GSGFS02\Projects - Engineering\Illinois DOT\Primera PTB 165-005\Geotechnical\CAD\049-0050.BP.dgn $MODELNAME$	USER NAME = rclaussen	DESIGNED - RJC	REVISED -	STATE OF ILLINOIS DEPARTMENT OF TRANSPORTATION	BRIDGE SOIL BORING PLAN IL RTE. 120 OVER US RTE. 41 SN 049-0050
		DRAWN - CEY	REVISED -		
	PLOT SCALE = N/A	CHECKED - RJC	REVISED -		
	PLOT DATE = 4/10/2014	DATE - 4/7/2014	REVISED -		SCALE: N.T.S. | SHEET 1 OF 1 SHEETS | STA. 498+00 TO STA. 502+00

F.A.U. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
1225	12RS-4(82)	LAKE		
		CONTRACT NO.		
	ILLINOIS FED. AID PROJECT			

APPENDIX C

SOIL BORING LOGS

Illinois Department of Transportation

Division of Highways
GSG CONSULTANTS INC.

SOIL BORING LOG

Date 3/17/14

ROUTE F.A.P. Rte. 342 (IL Rte.120) **DESCRIPTION** IL Rt. 120 over US Rt. 41 **LOGGED BY** JR

SECTION 12(HB&VB)BR **LOCATION** West Abutment (WB), **SEC.** 25, **TWP.** 45N, **RNG.** 11E, 3rd **PM**, **Latitude** N42°20'52.64", **Longitude** W87°53'34.67"

COUNTY Lake **DRILLING METHOD** HSA **HAMMER TYPE** AUTO

STRUCT. NO.	049-0050
Station	499+94.46
BORING NO.	BSB50-01
Station	498+39.36
Offset	36.30ft LT
Ground Surface Elev.	723.00 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

Description	Bottom Elev.	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
4 inches of Topsoil	722.67				
Brown, Moist FILL: SANDY CLAY LOAM, trace gravel	721.50		9 8 7	6.0 P	21
Brown and Gray, Moist FILL: SILTY CLAY, trace gravel	719.00				
Gray, Moist FILL: SILTY CLAY	717.00	-5	2 3 5	2.5 P	20
Brown and Gray, Moist to Very Moist FILL: SILTY CLAY, trace gravel	710.00		3 5 6	2.5 B	19
		-10	6 5 8	3.5 P	23
			3 3 6	2.3 B	27
Hard Brown, Moist SILTY CLAY, trace gravel (CL-ML)	707.00	-15	5 8 9	5.0 B	18
Hard Gray, Moist SILTY CLAY, trace gravel (CL-ML)	702.00		5 10 12	5.4 B	17
		-20	4 7 9	4.2 B	17
Very Stiff Gray, Moist CLAY, trace gravel (CL)			5 5 7	2.5 B	19
		-25	4 4 6	2.5 B	21
			3 4 6	2.5 B	19
		-30	3 5 7	2.5 B	20
		-35	3 4 6	2.1 B	21
		-40	4 5 7	2.5 B	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)

Illinois Department of Transportation
Division of Highways
GSG CONSULTANTS INC.

SOIL BORING LOG

Date 3/17/14

ROUTE F.A.P. Rte. 342 (IL Rte.120) **DESCRIPTION** IL Rt. 120 over US Rt. 41 **LOGGED BY** JR

SECTION 12(HB&VB)BR **LOCATION** West Abutment (WB), **SEC.** 25, **TWP.** 45N, **RNG.** 11E, 3rd **PM**, **Latitude** N42°20'52.64", **Longitude** W87°53'34.67"

COUNTY Lake **DRILLING METHOD** HSA **HAMMER TYPE** AUTO

STRUCT. NO. 049-0050
Station 499+94.46

BORING NO. BSB50-01
Station 498+39.36
Offset 36.30ft LT
Ground Surface Elev. 723.00 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

Description	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
Very Stiff Gray, Moist CLAY, trace gravel (CL) *(continued)*				
	-45	3 5 6	2.5 B	20
	-50	4 6 7	2.5 B	23
670.00				
Very Stiff to Hard Gray, Moist SILTY CLAY, trace gravel (CL-ML)	-55	7 11 14	5.0 B	17
	-60	5 7 9	3.8 B	17
Very Stiff to Hard Gray, Moist SILTY CLAY, trace gravel (CL-ML) *(continued)*				
	-65	5 7 9	3.3 B	18
	-70	4 7 9	3.3 B	18
648.00	-75	6 7 8	2.9 B	21
End of Boring	-80			

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 3/14/14

ROUTE F.A.P. Rte. 342 (IL Rte.120) **DESCRIPTION** IL Rt. 120 over US Rt. 41 **LOGGED BY** JR

SECTION 12(HB&VB)BR **LOCATION** West Abutment (EB), **SEC.** 25, **TWP.** 45N, **RNG.** 11E, 3rd **PM**, **Latitude** N42°20'52.04", **Longitude** W87°53'34.11"

COUNTY Lake **DRILLING METHOD** HSA **HAMMER TYPE** AUTO

STRUCT. NO. 049-0050
Station 499+94.46

BORING NO. BSB50-02
Station 498+52.21
Offset 17.65ft RT
Ground Surface Elev. 723.00 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

Description	Elev.	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
3 inches of Asphalt 7 inches of Concrete	722.17				
Brown, Moist FILL: SAND, some gravel	721.50		9 11 10	8.0 P	19
Gray, Moist to Very Moist FILL: SILTY CLAY, trace gravel		-5	4 7 9	6.0 P	26
	717.00				
Brown, Moist FILL: SILTY CLAY, trace gravel			2 4 6	3.0 P	19
	715.00				
Dark Gray, Moist FILL: SILTY CLAY, trace gravel		-10	9 6 6	2.0 P	23
	712.00				
Hard Brown, Moist SILTY CLAY, trace gravel (CL-ML)			5 5 7	4.6 B	18
		-15	5 9 10	5.0 B	18
	706.50				
Hard Gray, Moist SILTY CLAY, trace gravel (CL-ML)			6 9 13	6.3 B	18
	704.00				
		-20	5 6 7	2.9 B	16

Description	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
Stiff to Very Stiff Gray, Moist CLAY, trace gravel (CL) *(continued)*		5 6 8	2.5 B	21
	-25	4 4 6	2.5 B	19
		4 5 7	2.1 B	19
	-30	3 5 6	2.1 B	21
	-35	3 4 6	2.1 B	22
	-40	3 4 6	1.7 B	15

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 3/14/14

ROUTE F.A.P. Rte. 342 (IL Rte.120) **DESCRIPTION** IL Rt. 120 over US Rt. 41 **LOGGED BY** JR

SECTION 12(HB&VB)BR **LOCATION** West Abutment (EB), **SEC.** 25, **TWP.** 45N, **RNG.** 11E, 3rd **PM**, **Latitude** N42°20'52.04", **Longitude** W87°53'34.11"

COUNTY Lake **DRILLING METHOD** HSA **HAMMER TYPE** AUTO

STRUCT. NO. 049-0050
Station 499+94.46

BORING NO. BSB50-02
Station 498+52.21
Offset 17.65ft RT
Ground Surface Elev. 723.00 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

Description	Elev.	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
Stiff to Very Stiff Gray, Moist CLAY, trace gravel (CL) *(continued)*					
			2		
			4	1.7	18
		-45	6	B	
			5		
			7	2.9	21
		-50	9	B	
	670.00				
Very Stiff to Hard Gray, Moist SILTY CLAY, trace gravel (CL-ML)			8		
			11	7.1	17
		-55	16	B	
			7		
			10	4.2	19
		-60	11	B	

Description	Elev.	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
Very Stiff to Hard Gray, Moist SILTY CLAY, trace gravel (CL-ML) *(continued)*					
			6		
			9	4.6	17
		-65	11	B	
			5		
			8	3.3	19
	653.00	-70	10	B	
End of Boring					
		-75			
		-80			

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 3/13/14

ROUTE F.A.P. Rte. 342 (IL Rte.120) **DESCRIPTION** IL Rt. 120 over US Rt. 41 **LOGGED BY** JR

SECTION 12(HB&VB)BR **LOCATION** East Abutment (WB), **SEC.** 25, **TWP.** 45N, **RNG.** 11E, 3rd **PM**, **Latitude** N42°20'52.77", **Longitude** W87°53'30.22"

COUNTY Lake **DRILLING METHOD** HSA **HAMMER TYPE** AUTO

STRUCT. NO. 049-0050
Station 499+94.46

BORING NO. BSB50-03
Station 501+38.47
Offset 17.07ft LT
Ground Surface Elev. 728.00 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

Description	Elev. (ft)	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
3 inches of Asphalt	727.50				
3 inches of Concrete	726.50				
Brown, Moist FILL: SAND, some gravel			11		
Gray, Moist FILL: SILTY CLAY, trace gravel			10	5.8	19
			12	B	
			4		
			6	4.2	19
		-5	7	B	
	722.00				
Brown and Gray, Moist FILL: CLAY			4		
			5	2.5	21
			7	B	
	719.00		5		
Brown and Gray, Moist FILL: SILTY CLAY, trace gravel			7	4.2	17
		-10	10	B	
			5		
			7	3.8	19
			9	B	
			5		
			5	3.8	18
		-15	7	P	
			4		
			5	4.3	22
			6	P	
	710.00				
Gray, Moist FILL: SILTY CLAY LOAM			3		
			4	3.0	20
		-20	5	P	
Gray, Moist FILL: SILTY CLAY LOAM *(continued)*	707.00		3		
Brown and Gray, Moist FILL: CLAY			5	2.9	21
			7	B	
	705.00				
Hard to Very Hard Brown, Moist SILTY CLAY, trace gravel (CL-ML)			8		
			12	8.8	16
		-25	16	B	
			8		
			12	6.7	17
			17	B	
	700.00				
Hard Brown, Moist SILTY CLAY LOAM (CL-ML)			11		
			12	4.5	14
		-30	16	P	
	695.00				
Very Stiff Gray, Moist to Very Moist CLAY, trace gravel (CL)			4		
			6	2.3	19
		-35	8	B	
			3		
			5	2.3	23
		-40	6	B	

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 3/13/14

ROUTE F.A.P. Rte. 342 (IL Rte.120) DESCRIPTION IL Rt. 120 over US Rt. 41 LOGGED BY JR

SECTION 12(HB&VB)BR LOCATION East Abutment (WB), **SEC.** 25, **TWP.** 45N, **RNG.** 11E, 3rd **PM**, **Latitude** N42°20'52.77", **Longitude** W87°53'30.22"

COUNTY Lake DRILLING METHOD HSA HAMMER TYPE AUTO

STRUCT. NO. 049-0050
Station 499+94.46

BORING NO. BSB50-03
Station 501+38.47
Offset 17.07ft LT
Ground Surface Elev. 728.00 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

Description	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
Very Stiff Gray, Moist to Very Moist CLAY, trace gravel (CL) *(continued)*				
	-45	3 7 7	2.5 B	21
	-50	5 7 10	2.9 B	20
	-55	3 4 6	2.1 B	29
670.00				
Very Stiff Gray, Moist SILTY CLAY, trace gravel (CL-ML)	-60	7 10 14	3.5 P	18

Description	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
Very Stiff Gray, Moist SILTY CLAY, trace gravel (CL-ML) *(continued)*				
	-65	5 7 9	3.3 B	20
	-70	5 7 10	3.8 B	19
	-75	7 8 10	3.3 B	20
648.00	-80	4 6 8	2.9 B	24

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 3/13/14

ROUTE F.A.P. Rte. 342 (IL Rte.120) DESCRIPTION IL Rt. 120 over US Rt. 41 LOGGED BY JR

SECTION 12(HB&VB)BR LOCATION East Abutment (WB), **SEC.** 25, **TWP.** 45N, **RNG.** 11E, 3rd **PM**, **Latitude** N42°20'52.77", **Longitude** W87°53'30.22"

COUNTY Lake DRILLING METHOD HSA HAMMER TYPE AUTO

STRUCT. NO. 049-0050
Station 499+94.46

BORING NO. BSB50-03
Station 501+38.47
Offset 17.07ft LT
Ground Surface Elev. 728.00 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

Description	Elev.	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
Very Stiff Gray, Moist CLAY, trace gravel (CL)					
			4		
			5	2.1	24
	643.00	-85	6	B	
End of Boring					
		-90			
		-95			
		-100			

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 3/21/14

ROUTE F.A.P. Rte. 342 (IL Rte.120) **DESCRIPTION** IL Rt. 120 over US Rt. 41 **LOGGED BY** SLM

SECTION 12(HB&VB)BR **LOCATION** East Abutment (EB), **SEC.** 25, **TWP.** 45N, **RNG.** 11E, 3rd **PM**,
Latitude N42°20'52.19", **Longitude** W87°53'29.71"

COUNTY Lake **DRILLING METHOD** HSA **HAMMER TYPE** AUTO

STRUCT. NO. 049-0050
Station 499+94.46

BORING NO. BSB50-04
Station 501+49.51
Offset 34.04ft RT
Ground Surface Elev. 728.00 ft

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

Groundwater Elev.:
First Encounter 701.5 ft ▼
Upon Completion 644.0 ft ▽
After NA **Hrs.** NA ft

Description	Elev. (ft)	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
8 inches of Topsoil	727.33				
Brown, Moist FILL: SILTY CLAY			4 4 3	2.5 B	19
	724.00				
Gray and Brown, Moist FILL: SILTY CLAY, trace gravel		-5	2 3 4	2.0 P	19
			2 4 5	2.1 B	20
	719.00				
Gray and Black, Moist FILL: SILTY CLAY LOAM, trace gravel		-10	2 2 5	3.0 S	18
			2 5 7	2.1 B	21
		-15	4 5 6	3.5 P	23
			3 4 4	3.0 P	18
		-20	2 4 7	3.0 S	19
	707.00				
Hard Gray and Brown, Moist SILTY CLAY, trace gravel (CL-ML)			4 8 12	5.8 B	16
	705.00				
Hard Brown, Moist SILTY CLAY LOAM, trace gravel (ML-CL)		-25	4 7 13	4.0 P	13
	701.50 ▼				
Medium Dense Brown, Wet SANDY LOAM (SM)			5 12 12		18
	699.50				
Very Stiff Brown, Moist SILTY CLAY, trace gravel (CL-ML)		-30	6 7 7	2.9 B	18
		-35	3 4 7	2.9 B	18
	689.00				
		-40	2 4 5	1.7 B	22

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 3/21/14

ROUTE F.A.P. Rte. 342 (IL Rte.120) **DESCRIPTION** IL Rt. 120 over US Rt. 41 **LOGGED BY** SLM

SECTION 12(HB&VB)BR **LOCATION** East Abutment (EB), **SEC.** 25, **TWP.** 45N, **RNG.** 11E, 3rd **PM**, **Latitude** N42°20'52.19", **Longitude** W87°53'29.71"

COUNTY Lake **DRILLING METHOD** HSA **HAMMER TYPE** AUTO

STRUCT. NO. 049-0050
Station 499+94.46

BORING NO. BSB50-04
Station 501+49.51
Offset 34.04ft RT
Ground Surface Elev. 728.00 ft

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

Groundwater Elev.:
First Encounter 701.5 ft ▼
Upon Completion 644.0 ft ▽
After NA **Hrs.** NA ft

Description	Elev. (ft)	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
Stiff Gray, Moist CLAY (CL) *(continued)*	685.00				
Hard Gray, Moist SILTY CLAY, trace gravel (CL-ML)		-45	6 9 12	4.2 B	13
	679.00				
Very Stiff Gray, Moist CLAY (CL)		-50	3 4 7	2.5 B	19
		-55	3 6 7	2.5 B	20
	670.00				
Hard Gray, Moist SILTY CLAY, trace gravel (CL-ML)		-60	4 7 10	4.2 B	17
Hard Gray, Moist SILTY CLAY, trace gravel (CL-ML) *(continued)*	665.00				
Very Stiff Gray, Moist CLAY, trace gravel (CL)		-65	4 6 8	2.5 B	19
		-70	4 7 9	2.5 B	19
		-75	4 6 9	2.5 B	20
	650.00				
Very Stiff Gray, Moist SILTY CLAY (CL-ML)		-80	3 7 8	2.9 B	20

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

Illinois Department of Transportation
Division of Highways
GSG CONSULTANTS INC.

SOIL BORING LOG

Date 3/21/14

ROUTE F.A.P. Rte. 342 (IL Rte.120) **DESCRIPTION** IL Rt. 120 over US Rt. 41 **LOGGED BY** SLM

SECTION 12(HB&VB)BR **LOCATION** East Abutment (EB), **SEC.** 25, **TWP.** 45N, **RNG.** 11E, 3rd **PM**, **Latitude** N42°20'52.19", **Longitude** W87°53'29.71"

COUNTY Lake **DRILLING METHOD** HSA **HAMMER TYPE** AUTO

STRUCT. NO. 049-0050
Station 499+94.46

BORING NO. BSB50-04
Station 501+49.51
Offset 34.04ft RT
Ground Surface Elev. 728.00 ft

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

Groundwater Elev.:
First Encounter 701.5 ft ▼
Upon Completion 644.0 ft ▽
After NA **Hrs.** NA ft

Description	Elev.	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
Very Stiff Gray, Moist SILTY CLAY (CL-ML) *(continued)*					
	644.00 ▽		10		
Extremely Dense Gray, Wet SAND (SP)			45		16
	643.00	-85	47		
End of Boring					
		-90			
		-95			
		-100			

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)

APPENDIX D

LABORATORY TEST RESULTS

Atterberg Limit Results						
Boring ID	**Sample Number**	**Sample Depth (Below Existing Grade)**		**Liquid Limit**	**Plastic Limit**	**Plasticity Index**
		Top (ft.)	Bottom (ft.)			
BSB50-01	SS-7	16.0	17.5	35.5	17.0	18.5
	SS-19	63.5	65.0	33.1	15.4	17.7
BSB50-04	SS-6	13.5	15.0	39.3	18.6	20.7
	SS-13	33.5	35.0	36.7	16.1	20.6

Dry Unit Weight Results				
Boring ID	**Sample Number**	**Sample Depth (Below Existing Grade)**		**Dry Unit Weight (pcf)**
		Top (ft.)	Bottom (ft.)	
BSB50-01	SS-7	16.0	17.5	117.6
	SS-19	63.5	65.0	116.9
BSB50-04	SS-13	33.5	35.0	119.4