Structural Geotechnical Report

IL 78 over Plum River
IDOT PTB 195-024
Jo Daviess County, Illinois
Structure Number: 043-0081

Prepared for

Illinois Department of Transportation

Project Design Engineer Team
Globetrotters Engineering Corp.

Geotechnical Consultant:
GSG Consultants, Inc.

April 1, 2021

GSG CONSULTANTS, INC.
ENGINEERS • SCIENTISTS • CONSTRUCTION MANAGERS
623 Cooper Court • Schaumburg, IL 60173
Tel: 630.994.2600 • Fax: 312.733.5612

623 Cooper Court . Schaumburg, IL 60173
Tel: 630.994.2600 . Fax: 312.733.5612

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April 1, 2021

Mr. Chris Wine, P.E.
Globetrotters Engineering Corp.
300 South Wacker Drive, Suite 400
Chicago, Illinois 60606

Structural Geotechnical Report
IL 78 over Plum River
Structure Number: 043-0081
IDOT PTB 195-024

Dear Mr. Wine:

Attached is a copy of the Structural Geotechnical Report for the above referenced project. The report provides a description of the site investigation, site conditions and foundation and construction recommendations. The site investigation for the bridge construction included advancing two (2) soil borings to depths ranging from 36.5 to 37 feet. The foundation recommendations for the bridge include supporting the proposed abutments on driven piles and the center pier on drilled shafts.

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

Sincerely,

Rachel Miller, P.E.
Project Engineer

LICENSED PROFESSIONAL ENGINEER
ALA E. SASSILA
062-048569
STATE OF ILLINOIS

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

EXPIRES 11/30/2021

Structural Geotechnical Report
Bridge Construction Project
Structure Number: 043-0081

IL 78 over Plum River
Jo Daviess County, Illinois
IDOT PTB 195-024

Prepared by: ________________
Rachel Miller, P.E.
Project 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 INTRODUCTION

GSG Consultants, Inc. (GSG) completed a geotechnical investigation for the replacement of the proposed IL 78 Bridge over Plum River in Jo Daviess 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.

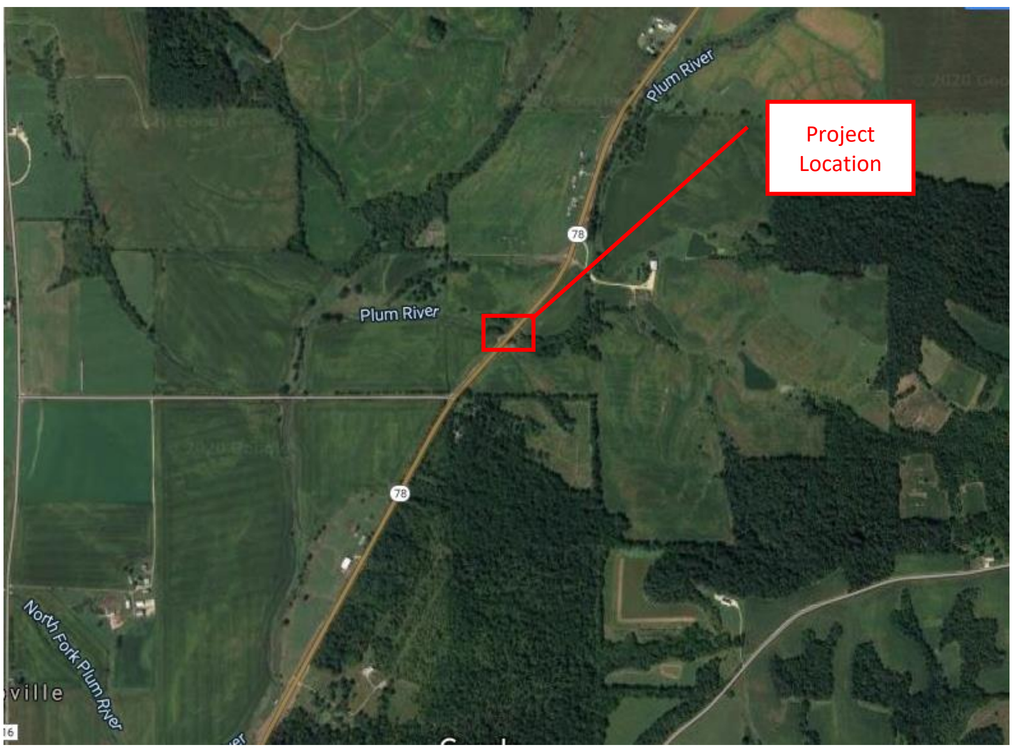


Exhibit 1 Project Location Map

1.1 Existing Bridge Information

The existing IL 78 Bridge over Plum River has a two-span PPC Deck Beam superstructure on pile-supported, stub-type abutments and a center, solid wall pier supported on a spread footing. The existing bridge structure has a designated Structure Number (SN) of 043-0040. It was originally constructed in 1925 as SBI Route 40, Section 10B and was replaced in 1981. The back-to-back abutment bridge length measures 155'-6" and the out-to-out deck width is 36'-0". The entire structure is proposed to be removed and replaced with a new structure using stage construction. The back of the north abutment is at approximate elevation 729.9 feet and the south abutment is at elevation 730.5 feet. The bottom of the pile cap at the north abutment is at approximate elevation 721.8 feet and the bottom of the pile cap at the south abutment is at approximate elevation 722.4 feet.

1.2 Proposed Project Information

Based on the proposed TSL sheets dated 2/23/2021 **(Appendix A)**, a two-span bridge (SN 043-0081) carrying IL 78 will be constructed to cross over Plum River.

The new bridge will be a two-span, 36" PPC IL beam structure supported on integral abutments and a center pier within the river. The bridge will include two driving lanes and shoulders. The proposed bridge will be approximately 193'-3" in length from back-to-back of the abutments, with an out-to-out deck width of 34'-10". It is anticipated that the new abutments will be supported on driven steel pile foundations set into bedrock. The center pier will be supported on a drilled shaft socketed into bedrock within the river. The existing guardrail will be removed and replaced, and a streambank stabilization system will be installed along Plum River, extending along about 500 feet of the river east of the bridge. The existing southern abutment will be removed to a depth of 1 foot below the proposed streambed elevation. The streambed and side slopes of the creek will be regraded in the area of the proposed new abutment.

1.3 Site Conditions

The existing site includes the existing roadway (IL 78), which spans over Plum River. The existing roadway includes two (2) lanes – one northbound and one southbound. Exhibits 2a and 2b show the views from the bridge location, looking north and south along Illinois 78.

Exhibit 2a: Structure 043-0040, looking north from bridge

Exhibit 2b: Structure 043-0040, looking south from bridge

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 subsurface exploration completed by GSG for the bridge was completed on October 8 and 9, 2020. A preliminary investigation was completed by IDOT in 2012; soil boring logs from the preliminary investigation are attached in **Appendix E**. The GSG investigation included advancing two (2) soil borings for the proposed bridge abutments to depths ranging from 36.5 to 37.0 feet, including fifteen feet of rock coring at each location. The preliminary IDOT borings were completed near the abutments and at the center pier location within the creek. The locations of the new soil borings were selected by GSG, and were completed based on field conditions, the locations of borings previously drilled by IDOT, and accessibility. **Table 1** presents a list of the borings completed.

Table 1 – Summary of Subsurface Exploration

Boring ID	Location	Depth (feet)	Surface Elevation (feet)
BSB-1	North Abutment	37.0	728.5
BSB-2	South Abutment	36.5	729.2
B-1*	Center Pier	25.5	721.0
B-2*	South Abutment	36.5	728.9
B-3*	North Abutment	36.5	728.9

*IDOT borings completed in 2012

The existing ground surface elevations shown in the soil boring logs were obtained by GSG's field crew using hand-held GPS equipment. The approximate locations of the soil borings are shown on the Boring Location Map & Subsurface Profiles **(Appendix B)**.

The soil borings were drilled using truck mounted CME 75 rig equipped with 3¼-inch I.D. hollow stem augers and an automatic hammer. Soil sampling was performed according to AASHTO T 206, "Penetration Test and Split Barrel Sampling of Soils." Soil samples were obtained at 2.5-foot intervals to refusal on bedrock at a depth of 20.5 to 21.0 feet below existing grade. 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 using rotary method drilling procedures with a five-foot, diamond bit, NX split core barrel in accordance with ASTM D2113. The collected bedrock cores were also evaluated in the field for texture, physical condition, recovery percentage, Rock Quality Designation (RQD), and field hardness. The extracted samples were visually inspected and classified and the Rock Quality Designation (RQD) was determined by totaling all sections with a length in excess of four inches (4”) and dividing it by the total length of the core run.

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 D4318 / AASHTO T-89 / AASHTO T-90
- Sieve Analysis ASTM D422
- Organic Content ASTM D2974 / AASHTO T-267
- Unconfined Compressive Strength on Rock ASTM D2938

The laboratory tests were performed in accordance with test procedures outlined in the IDOT Geotechnical Manual (2015), 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 D-Laboratory Test Results** and are also shown along with the field test results in **Appendix C-Soil Boring 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. The observed soil conditions were generally consistent with those noted in the 2012 IDOT soil boring logs.

North Abutment Boring

Boring BSB-1 was drilled in the vicinity of the existing north abutment. The ground surface elevation of this boring was 728.5 feet.

Boring BSB-1 noted sand fill soils at the boring surface to a depth of 1.5 feet below grade, underlain by dark gray silty clay fill to 5.5 feet and brown, gray, and black clayey silt fill to about 10.5 feet. Below the fill soils, the boring noted stiff brown and gray silty clay to a depth of 13 feet below existing grade, followed by medium dense to loose, dark gray and brown sand until refusal on weathered limestone bedrock at 21 feet. At the 2012 IDOT boring location B-3, refusal on limestone bedrock was observed at 21.5 feet. Clay seams and gravel seams were noted between depths of 17 to 18.5 feet. The limestone bedrock was then cored from 22 to 37 feet. The bedrock consisted of moderately weathered gray and brown limestone, with horizontal fractures and vugs. The Rock Quality Designation (RQD) ranged from 36% (within the top 7 feet) to 75% (for the bottom of 8 feet), Poor to Fair.

The unconfined compressive strength of the fill materials ranged from 0.5 to 1.5 tsf. The unconfined compressive strength of the native cohesive soils (silty clay) was about 1.0 tsf, and the SPT blow count 'N' values of the native sand ranged from 10 to 14 blows per foot (bpf).

South Abutment Boring

Boring BSB-2 was drilled in the vicinity of the existing south abutment. The ground surface elevation of this boring was 729.2 feet.

The boring noted 14 inches of asphalt underlain by silty clay fill soils to a depth of 10.5 feet below grade. Below the fill soils, the south abutment boring noted medium stiff, brown silty clay to a depth of 13 feet. Underlying the native clay, gray and brown, loose to extremely dense sand was observed until encountering split spoon refusal on limestone bedrock at a depth of 20.5 feet. At the 2012 IDOT boring location B-2, refusal on limestone bedrock was observed at 21.5 feet. Rock fragments were noted at a depth of 19 feet. The bedrock was drilled to a depth of 21.5 feet, and then cored to a depth of 36.5 feet. The bedrock consisted of moderately weathered and fractured gray and brown limestone. Occasional vugs and sand seams were noted within the cores. The Rock Quality Designation (RQD) ranged from 61% (top 10 feet) to 70% (bottom 5 feet), Fair. The compressive strength of a representative sample of the limestone was 11,800 psi.

The unconfined compressive strength of the fill materials ranged from 0.3 to 1.0 tsf, with moisture contents ranging from 27 to 35 percent. The unconfined compressive strength value of the native cohesive soils (silty clay) was about 0.8 tsf and the SPT blow count 'N' values of the granular sand ranged between 6 bpf and 50 blows for 3 inches.

Refusal was encountered on bedrock in boring BSB-1 at a depth of 21.0 feet and in boring BSB-2 at a depth of 20.5 feet, where rock coring was then performed. The RQD values were determined according to ASTM D 6032, "Standard Test Method for Determining Rock Quality Designation (RQD) of Rock Core" as per the IDOT geotechnical manual. The relation between the RQD values and in situ Rock quality is presented in **Table 2** (IDOT Geotechnical Manual, Table 4.4.6.2.2-1)

Table 2 - Rock Quality Designation

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

Laboratory photographs of the rock cores are included with the boring logs in **Appendix B**. **Table 3** provides a summary of the bedrock cores.

Table 3 – Bedrock Summary

Location	Core Run / Length	Approximate Depth (Ft)	Boring(s)	Recovery (%)	RQD (%)	Rock Quality Designation	Depth (ft)/ Compressive Strength (psi)
North Abutment	1 / 7	22.0-29.0	BSB-1	100	36	Poor	N/A
North Abutment	2 / 8	29.0-37.0	BSB-1	100	75	Fair	N/A
South Abutment	1 / 10	21.5-31.5	BSB-2	91	61	Fair	26.0-27.0 / 11,800
South Abutment	2 / 5	31.5-36.5	BSB-2	100	70	Fair	N/A

2.4 Groundwater Conditions

Water levels were checked in each boring to determine the general groundwater conditions present at the site and were measured while drilling and after each boring was completed. Due to the method of drilling, groundwater was not encountered at the two boring locations during drilling or after drilling was completed.

Based on the moisture contents of the granular soils observed above the bedrock, and the proximity of Plum River it is anticipated that the long term groundwater level may be within this zone or near the top of bedrock, between elevation 709 and 707 feet. 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

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 for the CME 75 drill rig was estimated to be approximately 91%, based on GSG's most recent calibrations records. The correction for hammer efficiency is a direct ratio of relative efficiencies. The following equations should be used in calculating the corrected blow counts for the purposes of design and analysis:

$$N_{60} = N_{Field}*(91/60) \text{ for CME 75 Drill Rig}$$

*Where the N_{Field} value is the number of blow counts recorded during sampling activities

3.2 Settlement

Based on the Phase 1 project report (dated July 21, 2020) provided to GSG, it is understood that the existing embankments will need to be widened to accommodate the widened bridge lanes and shoulders. Based on the observed site grades it is assumed that about 5 to 9 feet of new engineered fill will be necessary for the embankment widening.

GSG completed settlement analysis for the proposed embankment expansion using a maximum assumed embankment height of 7 feet at the north and south abutments and an assumed embankment length of 50 feet and width of 32 feet. The estimated settlement of the expanded embankment will be about 0.3 to 0.4 inches. Accordingly, downdrag is not anticipated to be a significant issue in areas where pile foundations are constructed within the new embankment.

IDOT's policies requires performing slope stability analyses for any areas having a cut depth or fill height greater than or equal to 15 feet. The cut required for the new slope below the new abutment will be less than 10 feet, with a slope of 1:2 (V:H). The remaining cut and fill operations are not anticipated to exceed 15 feet for the proposed bridge reconstruction. Therefore, slope stability analysis is not required for this new bridge structure.

3.3 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 270 feet, with no single span longer than 133 feet, therefore, a global Site Class Definition was determined for this project, and was found to be Soil Site Class D. 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 0.117g and the S_{D1} was determined to be 0.063g. The results are summarized in **Table 4**.

Table 4 – Seismic Parameters

Building Code Reference	PGA	S_{DS}	S_{D1}
2017 AASHTO Guide Specifications for LRFD Seismic Bridge Design	0.031g	0.111g	0.074g

3.4 Scour

Per the IDOT Bridge Manual (2012), scour would not be applicable to the abutment locations if the abutment end slopes are designed with armored embankments (slopewalls). This can be accomplished by having end slopes of 2:1 (H:V) lined with Class A4 or A5 stone riprap which would be considered an adequate level of protection for the abutments.

Flooding in July of 2011 caused scour issues at the south abutment, and some migration of the river channel was observed. It is understood that a 500-foot long streambank stabilization system will be installed along the northeast side of the Plum River to help address scour issues in this area.

Table 5 shows the bottom of the elevations for scour events. Based on the soil conditions of the borings predominately consisting of granular soils along the river bottom, scour reductions due to cohesive materials are not anticipated.

Table 5 – Design Scour Data for Plum River

Event/Limit State	Design Scour Elevations (ft)			Item 113
	S. Abut	Pier	N. Abut	
Q100	722.28	710.50	721.70	8
Q200	722.28	710.50	721.70	
Design	722.28	710.50	721.70	
Check	722.28	710.50	721.70	

The elevation for scour shown in **Table 5** were used to calculate the reduction in pile and drilled shaft capacities due to the effect of scour. It is recommended that scour counter measures be implemented as specified in the IDOT Bridge Manual and IDOT Drainage Manual, and as recommended in the final hydraulic report for this project.

3.5 Integral Abutment Feasibility

Integral abutment feasibility was checked for the bridge in accordance with ABD 19.8and the IDOT Integral Abutment Feasibility Analysis spreadsheet. A total bridge structure length of 192 feet with spans of about 91.5 feet and 102 feet and an 15.0˚ skew (equivalent to the existing bridge skew) were used for analysis. Concrete IL36-2438 beams were assumed, and about 5 piles per abutment were assumed for the purpose of this analysis. Soil boring data was used from BSB-1 and BSB-2 to calculate the weighted average Qu for the soil profiles 10 feet below the estimated abutment invert elevations. The average Qu values were 1.2 to 1.5 tsf, therefore the controlling expansion length was adjusted using a pile stiffness modifier of about 0.9 to 1.0 to give effective expansion lengths (EELs) of 92.26 and 99.74 feet. Based on the analyses, all pile types within the Integral Abutment Feasibility Analysis sheet are suitable for the proposed integral abutment design, including 12", 14" and 16" diameter shell piles, HP8x36, HP10x42, HP12x53, HP10x57, HP12x63, HP12x74, HP14x73, HP12x84, HP14x89, HP14x102, and HP14x117.

4.0 GEOTECHNICAL BRIDGE DESIGN RECOMMENDATIONS

The foundations for the proposed bridge must provide sufficient support to resist the dead and live loads, as well as seismic loading. The foundation design recommendations presented within this section were completed per the AASHTO LRFD 8th Edition (2017).

4.1 Bridge Foundation Recommendations

GSG evaluated deep foundation system for the proposed bridge. GSG's evaluation included shallow spread footings, drilled shafts, and driven piles. The results of the evaluation are presented below.

4.1.1 Shallow Foundations

Based on the soils encountered, the new span length and the anticipated loads, shallow foundations are not anticipated to be a feasible option for the proposed substructure of the bridges. 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

Based on the preliminary GPE plan, drilled shafts may be considered for design at the center pier location within the river. GSG anticipates that the drilled shafts will be socketed within competent bedrock. Techniques will be required to keep the water and sandy soils from infiltrating into the shaft while constructing. Based on the 2012 Bridge Manual section on Individually Encased Bent Piers, a removable form system or permanent casing may be considered for the center pier of the bridge. Drilled shaft recommendations can be found in *Section 4.2* of this report.

4.1.3 Driven Pile Foundations

Driven H-piles are considered a viable option for this bridge. Due to the relatively shallow presence of bedrock, metal shell piles should not be considered due to the risk of damage during installation. Driving shoes for the H-piles, in accordance with Section 1006.05 (e) of the IDOT Standard Specifications for Road and Bridge Construction (SSRBC), should be considered if the estimated driving depth is below elevation 711 feet to guard against damage in the extremely dense sand, cobbles, and underlying bedrock. Design recommendation for driven piles is provided in *Section 4.3* of this report.

4.2 Drilled Shaft Design Recommendation

If drilled shafts are selected for design as a deep foundation system, the drilled shafts may be designed to bear on or socket into the limestone bedrock. Drilled shafts bearing on bedrock should be straight shaft, with no bell, and should be placed on top of solid bedrock. Drilled shafts onto/into limestone bedrock is feasible at the pier location. Based on the laboratory test result, the compressive strength obtained from testing intact rock specimen from BSB-2 was 11,800 psi (1,699 ksf), which is indicative of hard rock. The following design recommendation should be used for the axial resistance of the drilled shafts:

- Based on the boring logs, the bottom of Plum River is predominantly granular soils which will be prone to caving in. Temporary casing seated into the competent bedrock, anticipated to be present at a depth of 2 feet below the surface of the weathered bedrock, will be required.
- The maximum nominal side friction of the competent rock socket should be estimated based on the concrete compressive strength since the uniaxial compressive strength of rock (11,800 psi) exceeds the concrete strength of 4,000 or 5,000 psi (AASHTO 10.8.3.5.4). The nominal side resistance of 4,000 psi and 5,000 psi concrete is 34.94 and 39.0 ksf, respectively.
- The nominal tip resistance can be estimated using (AASHTO 10.8.3.5.4c-1) if the rock below the base of the drilled shaft is either intact or tightly jointed. Based on the rock core collected, competent intact rock is present to a depth of 15 feet. The nominal bearing resistance of the drilled shaft should not exceed the compressive strength of the shaft concrete. Therefore, the nominal tip resistance is 1,440 ksf and 1,800 ksf for 4,000 and 5,000 psi concrete strength.
- The axial resistance of a drilled shaft shall be estimated using either the shaft side resistance or the tip resistance. A resistance factor of 0.50 shall be used as per AASHTO Table 10.5.5.2.4-1.

Settlement is considered to be negligible for drilled shafts based on limestone bedrock.

4.3 Driven Pile Foundation Design Recommendation

This section presents pile foundation design recommendations assuming the potential for downdrag within new embankment areas is negligible. Please notify GSG if more than 7 feet of filling is anticipated within the expanded embankment as greater fill heights may induce additional settlement and pile downdrag.

The Modified IDOT static method-excel spreadsheet was used to estimate the pile lengths at various axial geotechnical resistances for driven piles per IDOT AGMU Memo 10.2. The factored resistance includes a resistance factor of 0.7 for piles set into rock. No geotechnical losses due to downdrag or liquefaction were included in the axial pile capacity calculations. Due to the risk of damage to metal shell piles during driving to the bedrock, we recommend utilizing only H-piles for this project.

The estimated pile lengths are based on the TSL base of abutment elevations of about 721.70 and 722.28 feet. 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.

Tables 6a and 6b include a summary of potentially recommended pile lengths and capacities of typical pile selections at the abutment boring locations. It is understood that, based on the shallow depth of bedrock, piles will be driven into rock.

Table 6a – North Abutment Pile Design (BSB-1)

Pile Section	Nominal Required Bearing (Kips)	Factored Resistance Available (Kips)*	Estimated Pile Length (FT)**	Pile End Bearing Stratum
HP12x53 (Max. R_N = 418 Kips)	418	292	18.2	2.5 feet Limestone
HP14x89 (Max. R_N = 705 Kips)	705	493	19.2	4 feet Limestone
HP14x117 (Max. R_N = 929 Kips)	929	650	20.2	5 feet Limestone

*Resistance factor of 0.7 for axial capacity of rock socket piles based on article 6.5.4.2 of AASHTO LRFD Bridge Design Specifications (2020)

****** Estimated pile length is based on assuming the pile cut off elevation: 722.70 ft., and ground elevation at beginning of pile driving: 721.70 ft.

Table 6b – South Abutment Pile Design (BSB-2)

Pile Section	Nominal Required Bearing (Kips)	Factored Resistance Available (Kips)*	Estimated Pile Length (FT)**	Pile End Bearing Stratum
HP12x53 (Max. R_N = 418 Kips)	418	292	16.0	2.5 feet Limestone
HP14x89 (Max. R_N = 705 Kips)	705	493	17.0	3.5 feet Limestone
HP14x117 (Max. R_N = 929 Kips)	929	650	18.5	5 feet Limestone

*Resistance factor of 0.7 for axial capacity of rock socket piles based on article 6.5.4.2 of AASHTO LRFD Bridge Design Specifications (2020)

****** Estimated pile length is based on assuming the pile cut off elevation: 723.28 ft., and ground elevation at beginning of pile driving: 722.28 ft.

It is anticipated that it may be required for the driven piles to be set in rock to meet the axial and lateral loads for the bridge. Setting the piles into rock can also be used to increase the axial capacity. For piles set in rock, the nominal capacity of the pile is 100% of its yield strength. A rock socket should be specified large enough to provide sufficient room for placement of concrete to encase the pile. The minimum socket length should be checked to carry both the axial and lateral loads. Design of the axial pile capacity of piles set into bedrock is similar to rock socketed drilled shaft design. When piles are set into rock, IDOT Special Provision GBSP 56 should be provided in the contract documents.

4.4 Lateral Load Resistance

Lateral loadings applied to deep foundations are typically resisted by the soil/structure interaction, pile flexure, or a combination of these factors. Section 3.10.1.10 of the 2012 IDOT Bridge Manual requires performing detailed structure interaction analysis if the factored lateral loading per pile exceeds 3 kips. The analysis shall determine actual pile moment and deflection to determine the selected pile adequacy for the existing loadings. **Tables 7a and 7b**, provide generalized soil parameters for the entire site and includes recommended lateral soil modulus and soil strain parameters that can be used for deep foundation analysis via the p-y curve method based on the encountered subsurface conditions.

Table 7a – Lateral Load Resistance Soil Parameters North Abutment (BSB-1)

Depth / Elevation Range (feet)	Soil Description	Lateral Modulus of Subgrade Reaction (pci)	Soil Strain (ε_{50})
	New Engineered Clay Fill	500	0.007
	New Engineered Granular Fill	90	N/A
0-1.5 (728.5-727)	Fill Br Sand	25	N/A
1.5-5.5 (727-723)	Fill Dk Gr Silty Clay	620	0.007
5.5-10.5 (723-718)	Fill Br, Gr, Blk Silty Clay	100	0.01
10.5-13 (718-715.5)	Br, Gr Stiff Silty Clay	100	0.007
13-21 (715.5-707.5)	Dk Gr, Br Loose to Med Dense Sand	60	N/A

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

Table 7b – Lateral Load Resistance Soil Parameters South Abutment (BSB-2)

Depth / Elevation Range (feet)	Soil Description	Lateral Modulus of Subgrade Reaction (pci)	Soil Strain (ε_{50})
	New Engineered Clay Fill	500	0.007
	New Engineered Granular Fill	90	N/A
1-8 (728-721)	Fill Dk Gr Silty Clay	30	0.02
8-10.5 (721-718.5)	Fill Br, Gr, Blk Silty Clay	100	0.007

Depth / Elevation Range (feet)	Soil Description	Lateral Modulus of Subgrade Reaction (pci)	Soil Strain (ε_{50})
10.5-13 (718.5-716)	Br Med Stiff to Stiff Silty Clay	100	0.01
13-20.5 (716-708.5)	Gr, Br Loose to Ex Dense Sand	125	N/A

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

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 (2016). Any deviation from the requirements in the manuals above should be approved by the design engineer.

5.1 Existing Utilities

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

5.2 Site Excavation

Site excavations are expected to encounter various types of soils as described in the Subsurface Exploration section of this report. 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 Groundwater Management

The Plum River elevation is anticipated to be heavily influenced by seasonal rain falls or melting snow. GSG anticipates that groundwater/river will be an issue during construction activity due to the extent of the proposed improvements and the anticipated time frame for the excavation construction. Based on the 2012 Bridge Manual section on Individually Encased Bent Piers, a removable form system or permanent casing may be considered for the center pier of the bridge. If the removable forms system exceeds 10 ft, a permanent casing can be used for the remaining length.

Based on the moisture contents of the granular soils observed above the bedrock, and the proximity of Plum River it is anticipated that the long term groundwater level may be within this zone or near the top of bedrock, between elevation 709 and 707 feet. Perched water is also likely within the existing fill materials. If rainwater run-off or groundwater is accumulated at the base of excavations, the contractor should remove accumulated water using conventional sump pit and pump procedures and maintain a dry and stable excavation. The location of the sump should be determined by the contractor based on field conditions. During earthmoving activities at the site, grading should be performed to ensure that drainage is maintained throughout the construction period. Water should not be allowed to accumulate in the foundation area either during or after construction. Undercut and excavated areas should be sloped toward one corner to facilitate removal of any collected rainwater or surface run-off. Grades should be sloped away from the excavations to minimize runoff from entering.

If water seepage occurs during excavations or where wet conditions are encountered such that the water cannot be removed with conventional sumping, we recommend placing open grade stone similar to IDOT CA-7 to stabilize the bottom of the excavation below the water table. The CA-7 stone should be placed 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 beneath the footings should be backfilled using approved structural fill.

5.4 Pile Installation

Based on the variance in top-of-rock elevations at the 2012 and 2020 soil boring locations (between about El. 707.5 feet and 716 feet) it is recommended test piles be utilized at the site. The test-piles are installed based on the preliminary driving criteria in order to evaluate site conditions and are inspected in accordance with the IDOT Standard for Road and Bridge Construction. All pile installation should be completed in accordance with the IDOT SSRBC Section 512.15.

5.5 Temporary Sheeting, Soil Retention and Stage Construction

According to the current plans, the existing bridge will be removed in two stages. Due to the proximity of the removal to the construction activities, it is anticipated that a soil retention system may be necessary for the construction of the north and south abutments. Based on the soil profile and Temporary Sheet Pile Design Chart, a temporary sheet pile system could be used for the north abutment (area of BSB-1), assuming a retained height of about 10 feet or less. Based on the Temporary Sheet Pile Design Chart, a temporary sheet pile system is not feasible for the south abutment (area of BSB-2), and a temporary soil retention system (TSRS) will be required.

6.0 LIMITATIONS

This report has been prepared for the exclusive use of Illinois DOT and its Design Section Engineer. 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

TSL DRAWINGS 2/23/21

Benchmark: Metal disc at Station 326+53.34, 29.94' Left, Elevation 732.93. Metal disc at Station 311+71.76, 26.90' Right, Elevation 730.10.

Existing Structure: S.N. 043-0040 was originally built in 1925 as SBI Route 40, Section 10B. The original structure was a two-span reinforced concrete girder and deck supported by closed concrete abutments and a solid wall pier founded on spread footings. In 1982 the original structure was removed and replaced as F.A.P. Route 642 Section 10 BR-3 with a two-span PPC Deck Beam superstructure founded on pile-supported stub-type abutments and a solid wall pier on a spread footing. The existing structure is 155'-6" bk to bk of abutments and 36'-0" wide out to out of deck. The structure is to be removed and replaced utilizing stage construction.

No Salvage

APPROVED

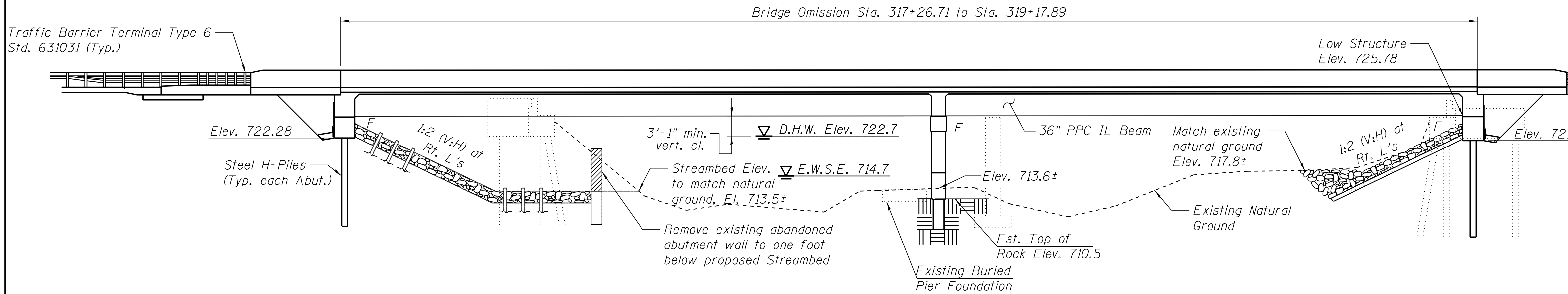
FEBRUARY 24, 2021

AS A BASIS FOR
PREPARATION OF DETAILED PLANS

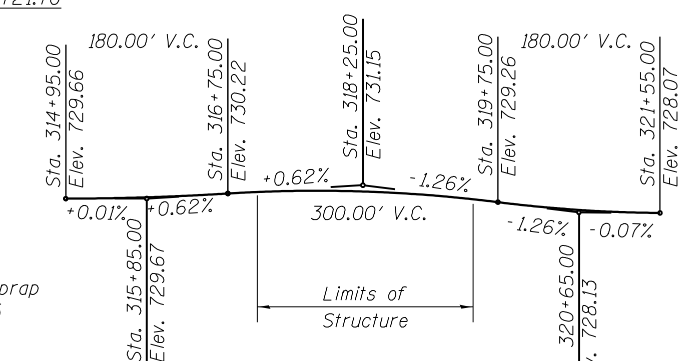
WATERWAY INFORMATION

Drainage Area = 13.8 sq. mi. Low Grade Elev. 728.1 @ Sta. 321+00

Flood	Freq. Yr.	Q C.F.S.	Opening Sq. Ft. Exist.	Opening Sq. Ft. Prop.	Nat. H.W.E.	Head - Ft. Exist.	Head - Ft. Prop.	Headwater El. Exist.	Headwater El. Prop.
	10	2270	613	636	722.0	2.0	2.0	724.0	724.0
Design	50	3710	706	737	722.7	3.0	2.9	725.7	725.6
Base	100	4380	747	781	723.0	4.3	3.2	727.3	726.2
Overtopping	200	4800	774	811	723.2	4.9	4.9	728.1	728.1
Max. Calc.	-	-	-	-	-				

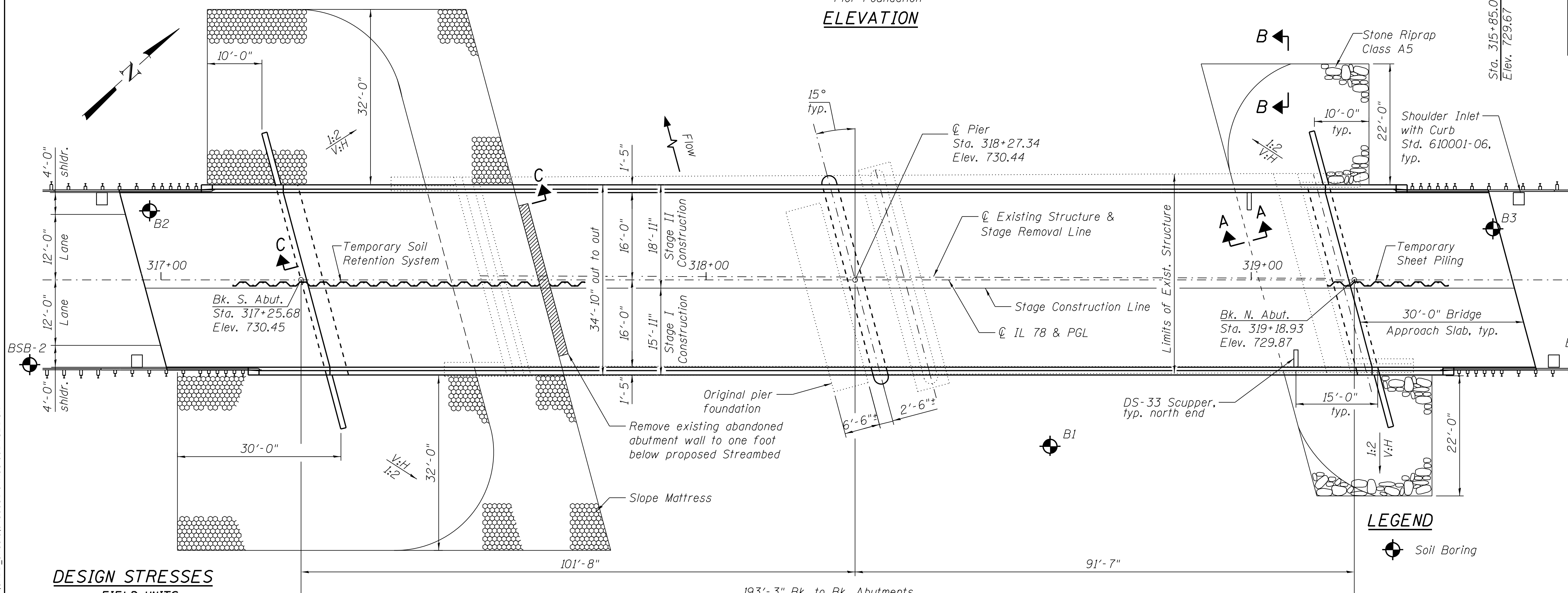


ELEVATION



PROFILE GRADE

(Along ℄ IL 78)



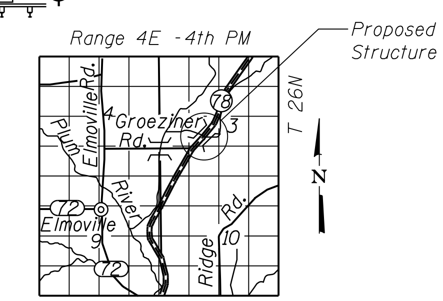
PLAN

DESIGN SPECIFICATIONS

2020 AASHTO LRFD Bridge Design Specifications, 9th Edition.

HIGHWAY CLASSIFICATION

F.A.P. Rte. 642 - IL Rte. 78
Functional Class: Major Collector
ADT: 775(2019); 550 (2040)
ADTT: 124 (2019); 88 (2040)
DHV: 55 (2040)
Design Speed: 60 m.p.h.
Posted Speed: 55 m.p.h.
Two-Way Traffic
Directional Distribution: 50:50



LOCATION SKETCH

LEGEND

Soil Boring

DESIGN STRESSES

FIELD UNITS

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

PRECAST PRESTRESSED UNITS

f'c = 8,500 psi
f'ci = 6,500 psi
fpu = 270,000 psi (0.6" ϕ Low Relaxation Strands)
fpbt = 202,300 psi (0.6" ϕ Low Relaxation Strands)

DESIGN SCOUR ELEVATION TABLE

	S. Abut.	Pier	N. Abut.	Item 113
Q100	722.28	710.50	721.70	8
Q200	722.28	710.50	721.70	
Design	722.28	710.50	721.70	
Check	722.28	710.50	721.70	

LOADING HL-93

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

Notes:
1. See Roadway Plans for river training and bank stabilization details.
2. See Sheet 2 for Sections A-A through C-C.

SEISMIC DATA

Seismic Performance Zone (SPZ) = 1
Design Spectral Acceleration at 1.0 sec. (S_{D1}) = 0.074g
Design Spectral Acceleration at 0.2 sec. (S_{DS}) = 0.111g
Soil Site Class = D

GENERAL PLAN & ELEVATION
ILLINOIS ROUTE 78 OVER PLUM RIVER
F.A.P. ROUTE 642 - SECTION 10BR-5
JO DAVIESS COUNTY
STATION 318+27.34
STRUCTURE NO. 043-0081

MODEL: Default
FILE NAME: E:\2017-2\Struct\3. TSL update\CADD\CADD_Sheets\0430081-64H58-001-TSL.DGN

LIN ENGINEERING, LTD.
Consulting Engineers
Springfield, Illinois

USER NAME =	DESIGNED - HzT	REVISED -
	CHECKED - MTH	REVISED -
PLOT SCALE =	DRAWN - DAS	REVISED -
PLOT DATE = 2/23/2021	CHECKED - MTH	REVISED -

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

SHEET 1 OF 2 SHEETS

F.A.P. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
642	10BR-5	JO DAVIESS	2	1

CONTRACT NO. 64H58

ILLINOIS | FED. AID PROJECT

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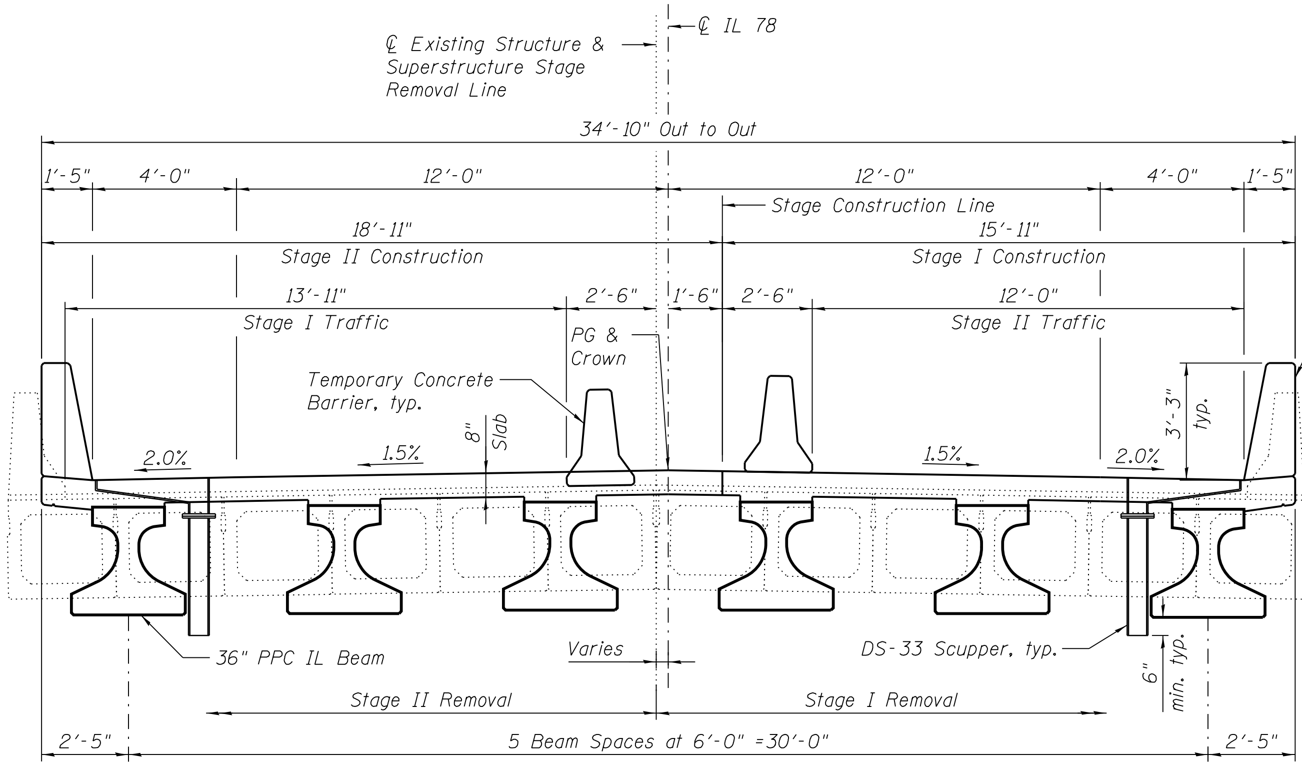
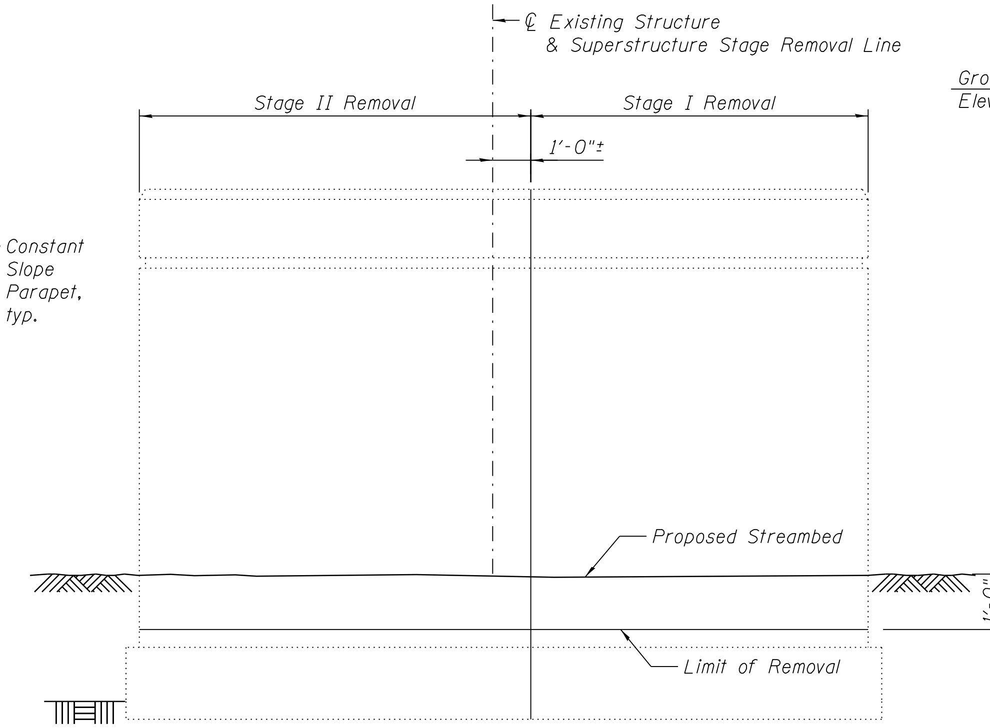
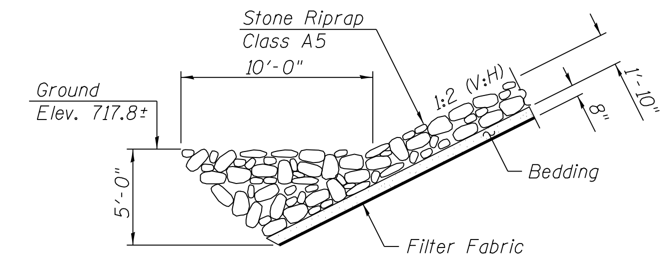


CROSS SECTION
(Looking North)

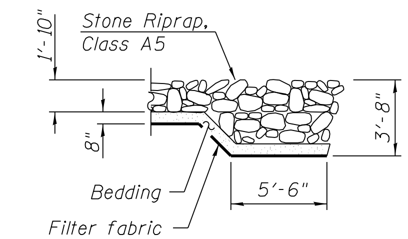
Note:
The condition of the existing deck beams for the duration of Stage I traffic should be verified during final design. If the condition warrants, the proposed staging sequence shall be re-evaluated. If a beam replacement or beam support contract is required, the designer shall provide the necessary plans.



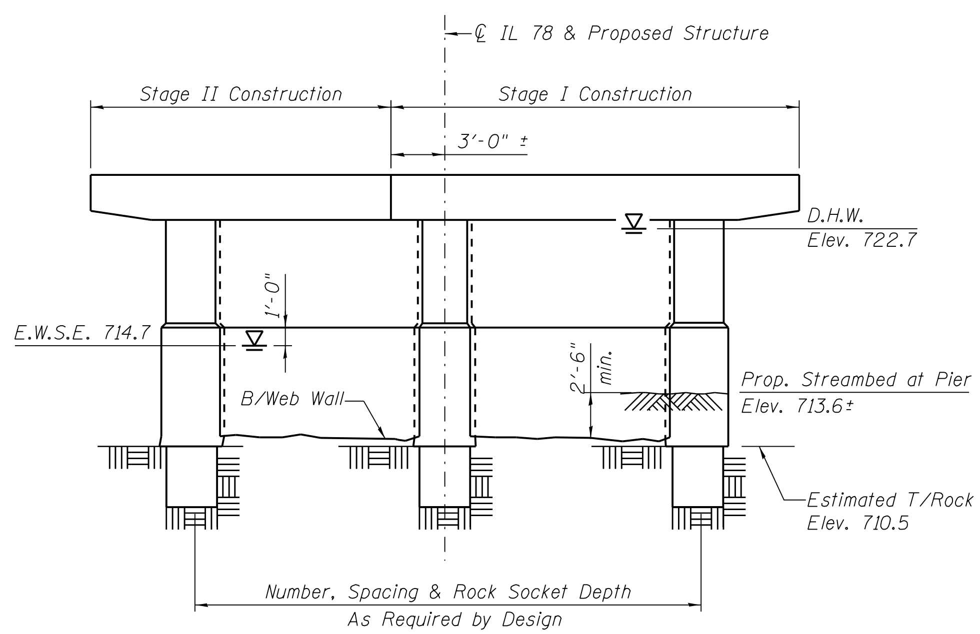
EXISTING PIER SKETCH
(Looking North)



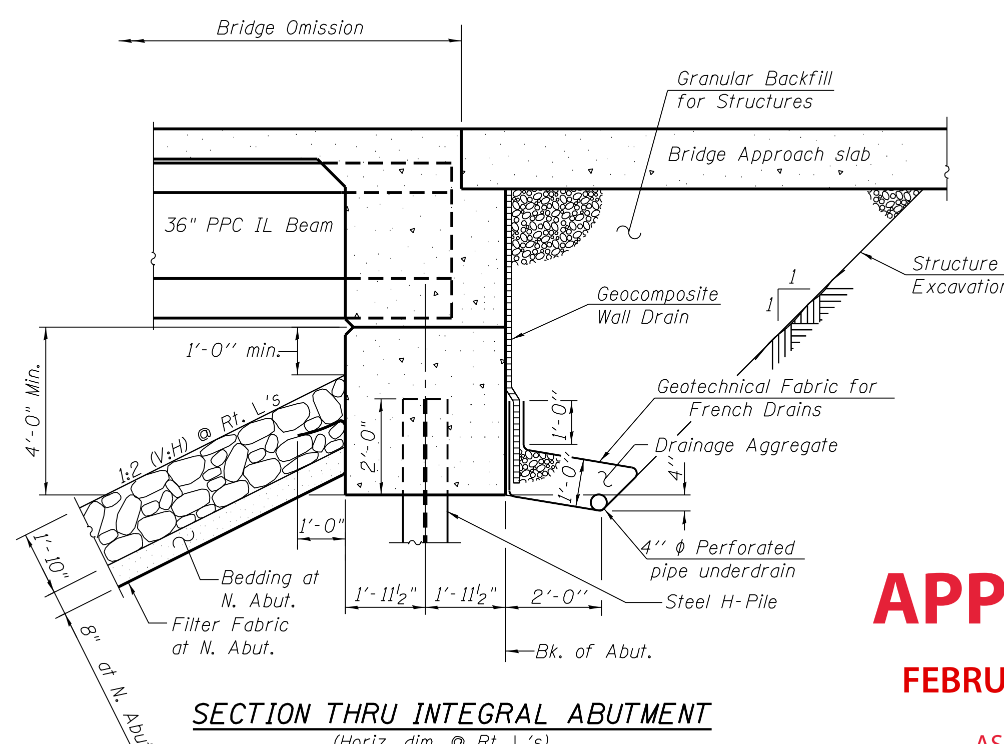
SECTION A-A



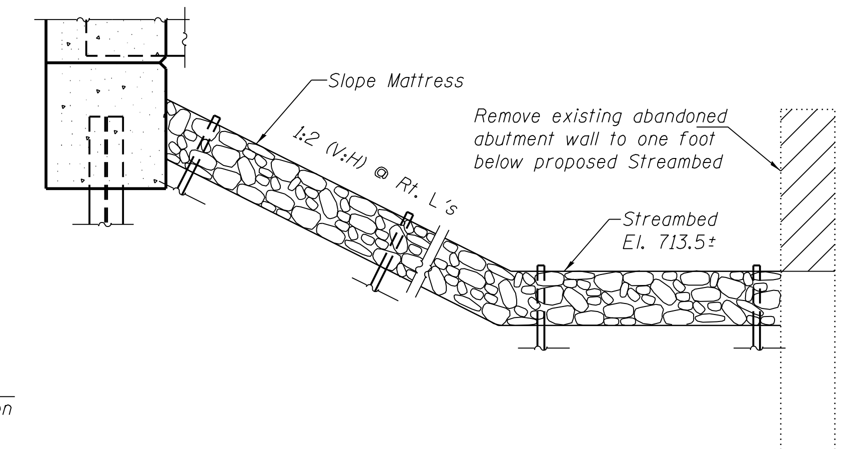
SECTION B-B



PIER SKETCH
(Looking North)



SECTION THRU INTEGRAL ABUTMENT
(Horiz. dim. @ Rt. L's)
N. Abut. shown, S. Abut. similar except as noted.
See Section C-C for slope protection at S. Abut.



SECTION C-C
(Horiz. dim. @ Rt. L's)

APPROVED

FEBRUARY 24, 2021

AS A BASIS FOR
PREPARATION OF DETAILED PLANS

DETAILS
ILLINOIS ROUTE 78 OVER PLUM RIVER
F.A.P. ROUTE 642 - SECTION 10BR-5
JO DAVIESS COUNTY
STATION 318+27.34
STRUCTURE NO. 043-0081

MODEL: Default
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LIN ENGINEERING,LTD.
Consulting Engineers
Springfield, Illinois

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	CHECKED - MTH	REVISED -	
PLOT SCALE =	DRAWN - DAS	REVISED -	
PLOT DATE = 2/23/2021	CHECKED - MTH	REVISED -	

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

SHEET 2 OF 2 SHEETS

F.A.P. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
642	10BR-5	JO DAVIESS	2	2

CONTRACT NO. 64H58

ILLINOIS | FED. AID PROJECT

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APPENDIX B

BORING LOCATION PLAN AND SOIL PROFILE

LEGEND

GSG SOIL BORINGS

MODEL: Default
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GSG CONSULTANTS, INC.
623 Cooper Court • Schaumburg, IL 60173
Tel: 630.994.2600 • Fax: 312.733.5612
www.gsgconsultants.com
Integrity | Quality | Reliability

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	DRAWN - NN	REVISED -	
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PLOT DATE = 11/10/2020	DATE - 10/28/2020	REVISED -	

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

PTB195–024 IL 78 OVER PLUM RIVER
BORING LOCATION PLAN

SCALE: AS NOTED	SHEET 1 OF 1 SHEETS	STA.	TO STA.

F.A. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
		COOK	2	1
		CONTRACT NO. 195-024		
		ILLINOIS	FED. AID PROJECT	

PROFILE

SURVEYED	PLOTTED	GRADES CHECKED	B.M. NOTED	STRUCTURE NOTATNS CHKD

NOTE BOOK NO. — DATE — BY

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GSG CONSULTANTS, INC.
623 Cooper Court • Schaumburg, IL 60173
Tel: 630.994.2600 • Fax: 312.733.5612
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STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

PTB195-024 IL 78 OVER PLUM RIVER
SOIL PROFILE

SCALE: AS NOTED | SHEET 1 OF 1 SHEETS | STA. TO STA.

F.A. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
		COOK	2	2

CONTRACT NO. 195-024
ILLINOIS | FED. AID PROJECT

APPENDIX C

SOIL BORING LOGS

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

SOIL BORING LOG

Date 10/9/20

ROUTE IL Route 78 **DESCRIPTION** IL Route 78 over Plum River **LOGGED BY** MH

SECTION FAP Route 642 (IL 78) **LOCATION** Stockton, IL, **SEC.** , **TWP.** , **RNG.** ,
Latitude 42.274684, **Longitude** -90.029938

COUNTY Jo Daviess **DRILLING METHOD** MUD ROTARY **HAMMER TYPE** AUTO

STRUCT. NO. SN 043-0081
Station 318+24.75

BORING NO. BSB-1
Station 319+76
Offset 15.30ft SE
Ground Surface Elev. 728.53 ft

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

Groundwater Elev.:
First Encounter None ft
Upon Completion N/A ft
After N/A **Hrs.** N/A ft

Description	Elev.	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
Brown, Moist FILL: SAND, with gravel	727.03				
Dark Gray, Moist to Very Moist FILL: SILTY CLAY, trace sand			2 3 4	1.5 P	24
		-5	2 2 2	1.0 P	29
	723.03				
Brown, Gray and Black, Very Moist FILL: CLAYEY SILT, with fine sand, trace organics			2 2 2	0.8 B	29
		-10	2 2 3	0.5 P	46
	718.03				
Stiff Gray and Brown, Very Moist SILTY CLAY, trace sand (CL/ML)			1 1 2	1.0 B	45
	715.53				
Medium Dense to Loose Dark Gray and Brown, Wet to Moist SAND, with gravel, little silt (SP)		-15	4 6 8		20
Clay seam at 17 feet			2 2 8		23
Gravel seam at 18.5 feet		-20	2 3 7		13

Description	Elev.	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
	707.53				
WEATHERED LIMESTONE Top of Rock at 21 feet	706.53				
LIMESTONE, Gray and Brown, Moderately Weathered, Highly Fractured, Some Vugs Run 1: 22 to 29 feet Recovery: 100% RQD: 36%		-25			
	699.53				
LIMESTONE, Gray, Slightly Weathered, Moderately Fractured, Some Vugs Run 2: 29 to 37 feet Recovery: 100% RQD: 75%		-30			
		-35			
	691.53				
End of Boring		-40			

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

BBS, form 137 (Rev. 8-99)

IL 78 over Plum River
Boring Number: BSB-1
Jo Daviess County, IL

Depth = 22.0 ft
Elev. = 707.53 ft

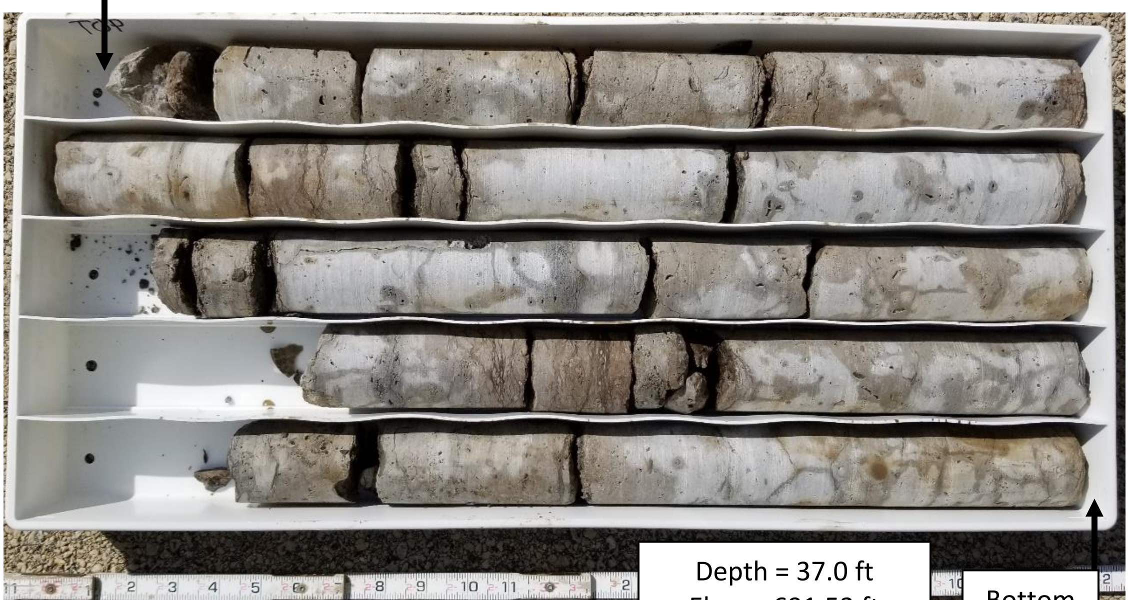
Top

Top

Depth = 29.0 ft
Elev. = 699.53 ft

Depth = 29.0 ft
Elev. = 699.53 ft

Bottom



Depth = 37.0 ft
Elev. = 691.53 ft

Bottom

Boring No.	Run	Depth (ft)	Recovery (%)	RQD (%)	RQD Classification	Description
BSB-1	1	22.0 – 29.0	100	36	Poor	Gray and Brown Limestone Moderately Weathered, Highly Fractured, Some Vugs
BSB-1	2	29.0 – 37.0	100	75	Fair	Gray Limestone, Slightly Weathered, Moderately Fractured, Some Vugs

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

SOIL BORING LOG

Date 10/8/20

ROUTE IL Route 78 **DESCRIPTION** IL Route 78 over Plum River **LOGGED BY** MH

SECTION FAP Route 642 (IL 78) **LOCATION** Stockton, IL, **SEC.** , **TWP.** , **RNG.** ,
Latitude 42.274101, **Longitude** -90.030644

COUNTY Jo Daviess **DRILLING METHOD** MUD ROTARY **HAMMER TYPE** AUTO

- **STRUCT. NO.** SN 043-0081
- **Station** 318+24.75
- **BORING NO.** BSB-2
- **Station** 316+61
- **Offset** 15.40ft SE
- **Ground Surface Elev.** 729.16 ft

- **Surface Water Elev.** N/A ft
- **Stream Bed Elev.** N/A ft
- **Groundwater Elev.:**
- **First Encounter** None ft
- **Upon Completion** N/A ft
- **After** N/A **Hrs.** N/A ft

Description	Elev.	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
14 inches of Asphalt	727.99				
Dark Gray, Very Moist FILL: SILTY CLAY, trace sand			3 2 2		
		-5	1 1 2	0.3 P	35
	721.16		2 2 2	0.3 P	28
Brown, Gray and Black, Very Moist FILL: SILTY CLAY, trace sand	718.66	-10	3 3 5	1.0 P	27
Medium Stiff Brown, Moist SILTY CLAY, trace sand (CL)	716.16		1 1 1	0.8 B	20
Loose to Extremely Dense Gray and Brown, Wet to Moist SAND, with silt, trace gravel (SP)		-15	2 2 4		26
			12 21 20		13
Rock Fragments at 19 feet		-20	3 50/3		18

Description	Elev.	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
	708.66				
Top of Rock at 20.5 feet	707.66				
LIMESTONE, Gray and Brown, Moderately Weathered and Fractured, Run 1: 21.5 to 31.5 feet Recovery: 91% RQD: 61% 2-inch Brown Sand seam at 24.5 feet Compressive Strength at 26-27 feet: 11,800 psi		-25 -30			
	697.66				
LIMESTONE, Gray, Moderately Weathered and Fractured, Some Vugs Run 2: 31.5 to 36.5 feet Recovery: 100% RQD: 70%		-35			
	692.66				
End of Boring		-40			

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

IL 78 over Plum River
Boring Number: BSB-2
Jo Daviess County, IL

Depth = 21.5 ft
Elev. = 707.66 ft

Top

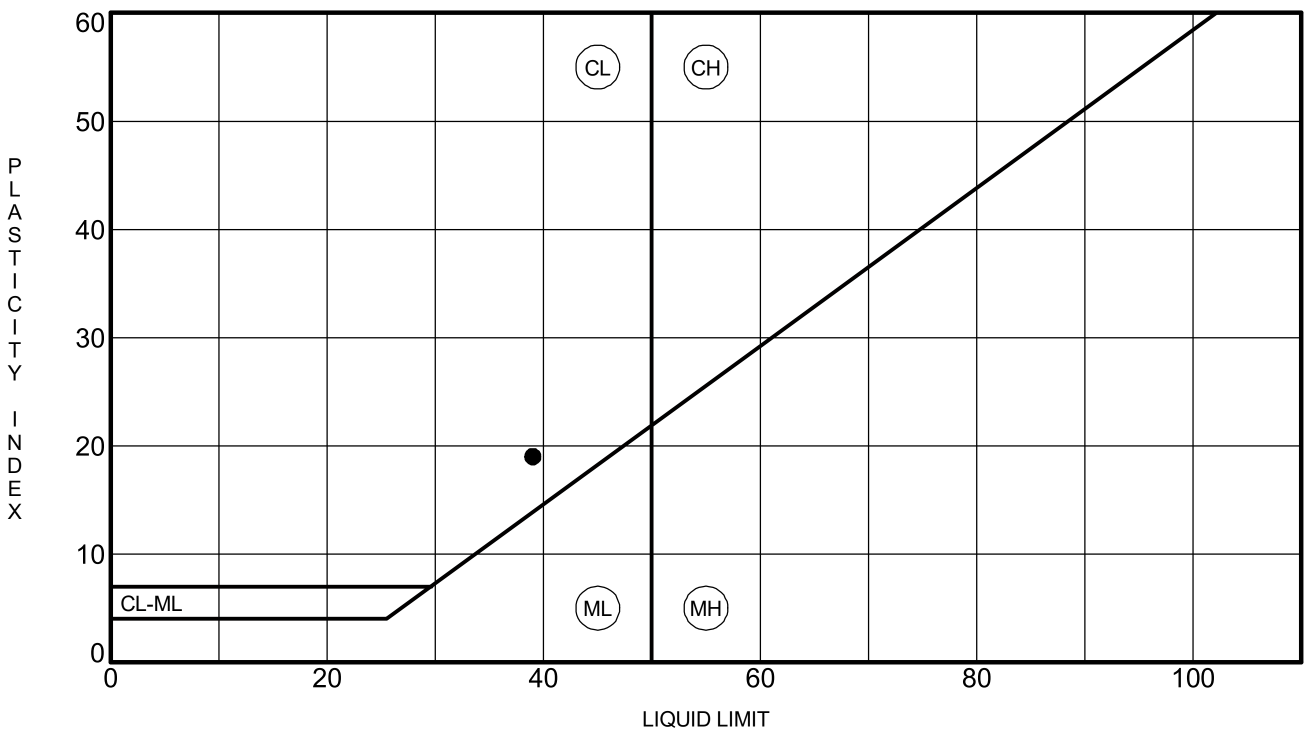
Top

Depth = 31.5 ft
Elev. = 697.66 ft

Boring No.	Run	Depth (ft)	Recovery (%)	RQD (%)	RQD Classification	Description
BSB-2	1	21.5’ – 31.5’	91	61	Fair	Gray and Brown Limestone, Moderately Weathered and Fractured, Sand seam at 24.5 feet
BSB-2	2	31.5’ – 36.5’	100	70	Fair	Gray Limestone, Moderately Weathered and Fractured, Some Vugs

APPENDIX D

LABORATORY TEST RESULTS



	Specimen Identification		LL	PL	PI	Fines	Classification
●	**BSB-2**	**11.00**	**39.0**	**20.0**	**19.0**		

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

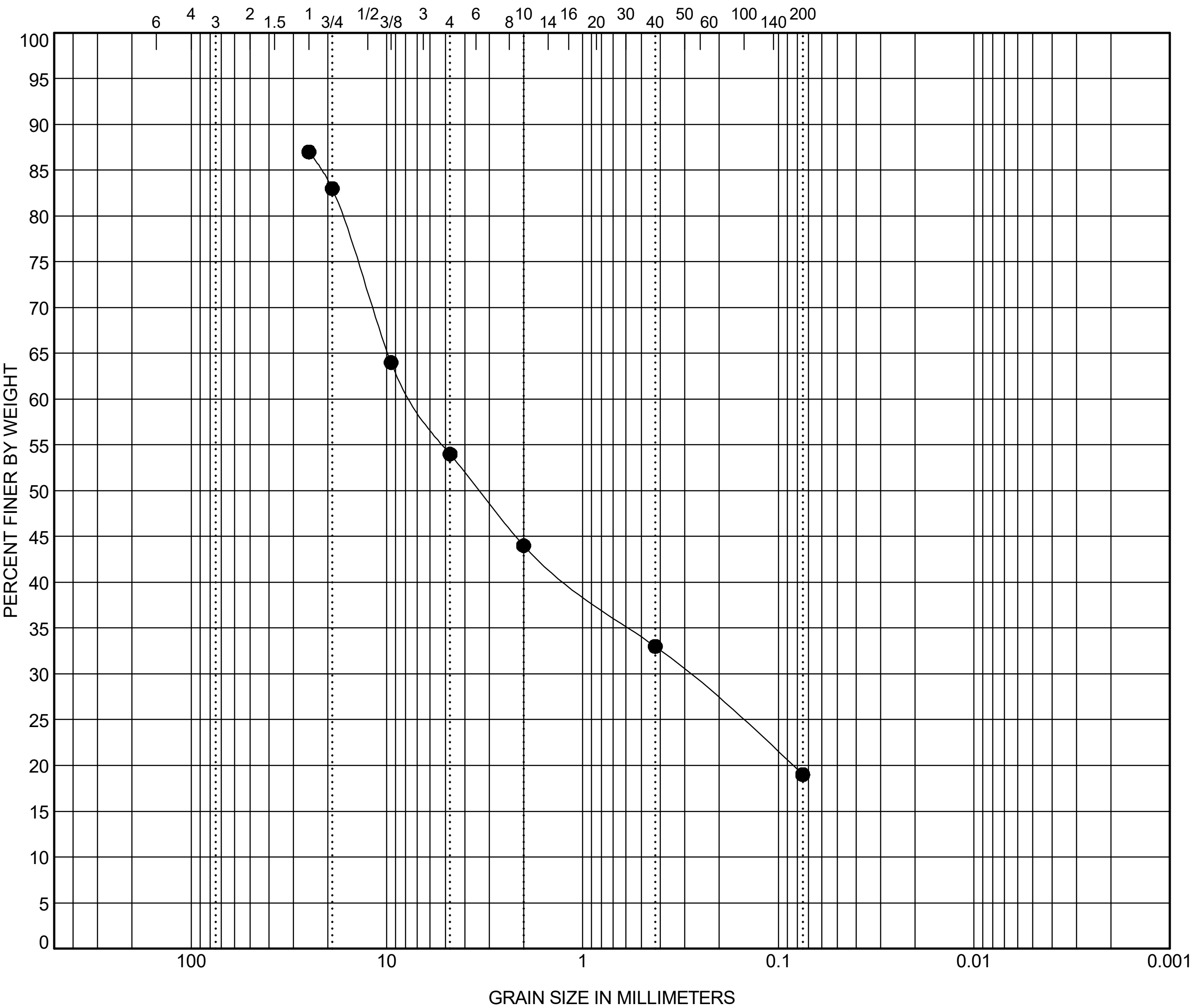
ATTERBERG LIMITS' RESULTS

Route: IL Route 78

Section: FAP Route 642 (IL 78)

County: Jo Daviess

U.S. SIEVE OPENING IN INCHES | U.S. SIEVE NUMBERS | HYDROMETER



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	**BSB-1**	**13.50**	**SAND**					

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**BSB-1**	**13.50**	**25**	**7.2**	**0.293**		**33.0**	**35.0**	**19.0**	

Illinois Department of Transportation

Division of Highways
GSG Consultants, Inc.

GRAIN SIZE DISTRIBUTION

Route: IL Route 78

Section: FAP Route 642 (IL 78)

County: Jo Daviess

GRAIN SIZE IL 78 OVER PLUM RIVER.GPJ IL DOT.GDT 11/4/20

Organic Content Results

Boring ID	Sample Depth (ft)	Organic Content (%)	Soil Classification
BSB-1	6-7.5	3.4	ML/CL Fill

APPENDIX E

IDOT SOIL BORING LOGS (2012)

COPY

Illinois Department of Transportation

To:	Kevin F. Marchek	Attn:	Masood Ahmad
From:	John H. Wegmeyer	By:	Jan R. Twardowski
Subject:	Structure Borings		
Date:	August 11, 2014		

Route: FA 642
Section: 10 BR-3
County: Jo Daviess
Job No.: P92-030-12
Description: IL 78 over the Plum River

Attached are the second revisions to the boring logs for the bridge structure carrying IL 78 over the Plum River. The Station of B-2 was corrected using the new Station of 318+37 for the center of the existing bridge, resulting in a Station of 317+18 for this boring.

In addition, the offset of Boring B-3 was corrected to reflect its location, left of centerline.

The elevation datum was taken from existing plans and the coordinates of each boring was included.

If you have any questions, please contact Tim Bratt at 815/284-5435.

Jt8-11-14-2
Attachment
c: Consultant
Soils File

Illinois Department of Transportation
Division of Highways
Illinois Department of Transportation

SOIL BORING LOG

Date 5/22/12

ROUTE FA 642 DESCRIPTION 043-0040 IL 78 Bridge over Plum River, .2 m. N. of Groeziner Road LOGGED BY W. Garza

SECTION 10 BR-3 LOCATION Pleasant Valley - 3SW, SEC. , TWP. 26N, RNG. 4E

COUNTY Jo Daviess DRILLING METHOD Hollow Stem Auger HAMMER TYPE B-53 Diedrich Automatic

STRUCT. NO. 043-0040
Station 318+37

BORING NO. B-1
Station 318+64
Offset 31.00ft Rt CL
Ground Surface Elev. 721.0 ft

Surface Water Elev. 716.0 ft
Stream Bed Elev. 712.0 ft

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

Description	Elev.	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
-90.030302 42.274548 VERY STIFF brown SILTY CLAY LOAM				2.1 P	21
	718.50				
MEDIUM brown SANDY LOAM			2 3 6	0.6 P	29
	716.50	-5			
MEDIUM tan dirty weathered LIMESTONE			3 10 9		17
	714.00				
DENSE tan dirty weathered LIMESTONE	712.00		6 13 21		
		-10			
VERY DENSE tan weathered LIMESTONE Auger Refusal @ 10.5'	710.50		100/2"		
Borehole continued with rock coring.		-15			
		-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
Illinois Department of Transportation

ROCK CORE LOG

Date 5/22/12

ROUTE FA 642 DESCRIPTION 043-0040 IL 78 Bridge over Plum River, .2 m. N. of Groeziner Road LOGGED BY W. Garza

SECTION 10 BR-3 LOCATION Pleasant Valley - 3SW, SEC. , TWP. 26N, RNG. 4E

COUNTY Jo Daviess CORING METHOD

STRUCT. NO. 043-0040
Station 318+37

CORING BARREL TYPE & SIZE

Core Diameter 2 in
Top of Rock Elev. 714.00 ft
Begin Core Elev. 710.50 ft

BORING NO. B-1
Station 318+64
Offset 31.00ft Rt CL
Ground Surface Elev. 721.0 ft

Description	Elev.	DEPTH (ft)	CORE (#)	RECOVERY (%)	R.Q.D. (%)	CORE TIME (min/ft)	STRENGTH (tsf)
Dolomite: tan-buff, aphanitic, dense, vuggy, displaying minor laminations and vertical fracturing. t.s.f.: 707.7 to 707.2	710.50		1	100	32	3.4	963
	705.50	-15					
Dolomite: as above. t.s.f.: 702.7 to 702.2			2	100	48	2.4	1156
	700.50	-20					
Dolomite: as above. t.s.f.: 698.2 to 697.7			3	100	57	2.4	1390
	695.50	-25					
End of Boring		-30					

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

Illinois Department of Transportation
Division of Highways
Illinois Department of Transportation

SOIL BORING LOG

Date 5/23/12

ROUTE FA 642 DESCRIPTION 043-0040 IL 78 Bridge over Plum River, .2 m. N. of Groeziner Road LOGGED BY W. Garza

SECTION 10 BR-3 LOCATION Pleasant Valley - 3SW, SEC. , TWP. 26N, RNG. 4E

COUNTY Jo Daviess DRILLING METHOD Hollow Stem Auger HAMMER TYPE B-53 Diedrich Automatic

STRUCT. NO.	043-0040
Station	318+37
BORING NO.	B-2
Station	317+18
Offset	12.00ft Lt CL
Ground Surface Elev.	728.9 ft
Surface Water Elev.	716.0 ft
Stream Bed Elev.	712.0 ft
Groundwater Elev.:	
First Encounter	711.4 ft ▼
Upon Completion	ft
After ___ Hrs.	ft

Description	Elev.	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
-90.030694 42.274212 3.5" Asphalt 7.5" Concrete				0.6 P	21
MEDIUM black SILTY CLAY LOAM	726.40				
MEDIUM dark gray SILTY CLAY LOAM	724.90		3 2 8	0.5 P	28
		-5			
SOFT gray SILTY LOAM	722.40		2 2 3	0.4 P	35
STIFF black SILTY LOAM with 16% ORGANICS	719.90		2 3 6	1.1 P	49
		-10			
STIFF light brown SILTY CLAY LOAM	717.40		5 4 5	1.3 B	24
SOFT tan LOAM with LIMESTONE fragments	714.40		1 2 2	0.3 B	32
		-15			
MEDIUM tan moist weathered LIMESTONE	712.40		4 4 8		
▼ MEDIUM tan weathered LIMESTONE	709.90		4 7 8		
		-20			
VERY DENSE tan weathered LIMESTONE Auger Refusal @ 21.5'	707.40		18 100/8"		
Borehole continued with rock coring.					
		-25			
		-30			
		-35			
		-40			

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

Illinois Department of Transportation
Division of Highways
Illinois Department of Transportation

ROCK CORE LOG

Date 5/23/12

ROUTE FA 642 DESCRIPTION 043-0040 IL 78 Bridge over Plum River, .2 m. N. of Groeziner Road LOGGED BY W. Garza

SECTION 10 BR-3 LOCATION Pleasant Valley - 3SW, SEC. , TWP. 26N, RNG. 4E

COUNTY Jo Daviess CORING METHOD

STRUCT. NO. 043-0040
Station 318+37

CORING BARREL TYPE & SIZE

BORING NO. B-2
Station 317+18
Offset 12.00ft Lt CL
Ground Surface Elev. 728.9 ft

Core Diameter 2 in
Top of Rock Elev. 714.40 ft
Begin Core Elev. 707.40 ft

Description	Elev.	DEPTH (ft)	CORE (#)	RECOVERY (%)	R.Q.D. (%)	CORE TIME (min/ft)	STRENGTH (tsf)
Dolomite: tan-buff, vuggy, fractured and laminated with no testable segments.	707.40	-25	1	90	10	8.4	
Dolomite: as above, with minor laminations and vertical fractures. t.s.f.: 699.3 to 698.8	702.40	-30	2	100	75	2.8	1195
Dolomite: as above. t.s.f.: 695.3 to 694.6	697.40	-35	3	100	55	2.8	1062
End of Boring	692.40	-40					

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

Illinois Department of Transportation
Division of Highways
Illinois Department of Transportation

SOIL BORING LOG

Date 5/24/12

ROUTE FA 642 DESCRIPTION 043-0040 IL 78 Bridge over Plum River, .2 m. N. of Groeziner Road LOGGED BY W. Garza

SECTION 10 BR-3 LOCATION Pleasant Valley - 3SW, **SEC.** , **TWP.** 26N, **RNG.** 4E

COUNTY Jo Daviess DRILLING METHOD Hollow Stem Auger HAMMER TYPE B-53 Diedrich Automatic

STRUCT. NO. 043-0040
Station 318+37

BORING NO. B-3
Station 319+45
Offset 9.00ft Lt CL
Ground Surface Elev. 728.9 ft

Surface Water Elev. ___ ft
Stream Bed Elev. ___ ft

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

Description	Elev.	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
-90.030220 42.274843 10.3" Asphalt, 9.5" Concrete	726.40				
MEDIUM black SILTY CLAY LOAM	724.90		1 2 2	0.5 P	35
		-5			
MEDIUM brown SILTY LOAM	722.40		1 2 3	0.7 P	31
STIFF brown SILTY LOAM	719.90		2 3 4	1.0 P	35
		-10			
MEDIUM dark brown SILTY CLAY LOAM	717.40		2 2 4	0.8 P	34
SOFT brown/tan LOAM with LIMESTONE fragments with 10% ORGANICS	714.40		2 4 11	0.3 P	35
		-15			
MEDIUM brown/tan dirty weathered LIMESTONE	712.40		5 6 6		
STIFF olive-green CLAY LOAM with LIMESTONE fragments	709.90		6 6 10	2.0 P	16
		-20			

Description	Elev.	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
VERY DENSE tan weathered LIMESTONE	707.40		9 11 100/3"		
Borehole continued with rock coring.					
		-25			
		-30			
		-35			
		-40			

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

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ROCK CORE LOG

Date 5/24/12

ROUTE FA 642 DESCRIPTION 043-0040 IL 78 Bridge over Plum River, .2 m. N. of Groeziner Road LOGGED BY W. Garza

SECTION 10 BR-3 LOCATION Pleasant Valley - 3SW, SEC. , TWP. 26N, RNG. 4E

COUNTY Jo Daviess CORING METHOD

STRUCT. NO. 043-0040
Station 318+37

CORING BARREL TYPE & SIZE

Core Diameter 2 in
Top of Rock Elev. 714.40 ft
Begin Core Elev. 707.40 ft

BORING NO. B-3
Station 319+45
Offset 9.00ft Lt CL
Ground Surface Elev. 728.9 ft

Description	Elev.	DEPTH (ft)	CORE (#)	RECOVERY (%)	R.Q.D. (%)	CORE TIME (min/ft)	STRENGTH (tsf)
Dolomite: tan-buff, dense, vuggy with some fracturing. t.s.f.: 705.4 to 705.0	707.40	-25	1	100	22	1.8	967
Dolomite: as above. t.s.f.: 697.8 to 697.4	702.40	-30	2	100	53	2.4	944
Dolomite: as above, though more massively bedded. t.s.f.: 695.9 to 695.4	697.40	-35	3	80	43	3.6	1181
End of Boring	692.40	-40					

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