Structural Geotechnical Report

Proposed IL Route 72 Intersection Reconstruction
IL Route 72 and State Street
Hampshire, Kane County, IL

Reinforced Concrete Box Culverts

Prepared for:

Illinois Department of Transportation

IDOT PTB 187-005
Contract: P-91-557-11

Project Design Engineer:
Lochmueller Group

Prepared by:

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August 17, 2020

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August 17, 2020

Ms. Elizabeth S. Witt, P.E.
Project Engineer - Associate
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Troy, IL 62294

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Dear Ms. Witt:

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 recommendations for the proposed improvements. The site investigation included advancing four (4) borings to depths of 25 feet.

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

Sincerely,

Thomas E. Kasang

Dawn Edgell

Thomas E. Kasang, E.I.T
Project Engineer

Dawn Edgell, P.E.
Senior Project Engineer

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1.0 INTRODUCTION

On behalf of the Illinois Department of Transportation (IDOT), Lochmueller Group retained GSG Consultants, Inc. (GSG) to complete a geotechnical investigation and to provide recommendations regarding the proposed IL Route 72 Intersection Reconstruction. The site is located at the intersection of IL Route 72 and State Street in Hampshire, Illinois **(Project Location Map with Proposed Reconstruction – Exhibit 1)**.

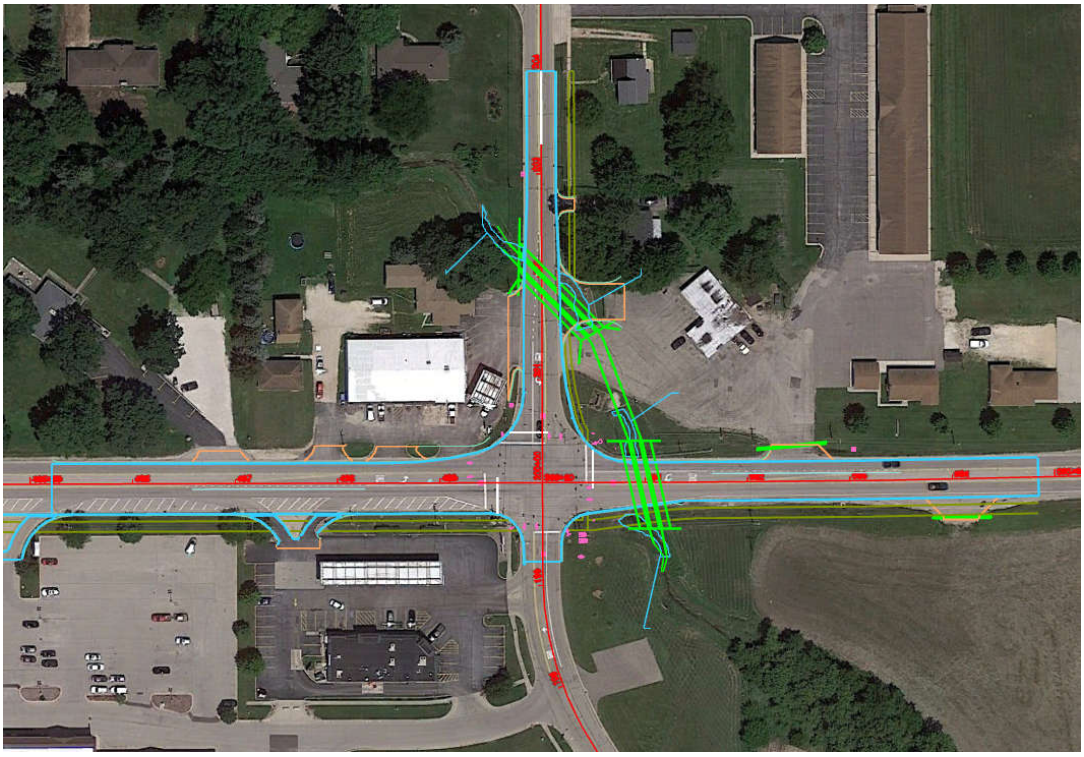


Exhibit 1: Project Location Map with Proposed Reconstruction

1.1 Existing Site Conditions

There are three (3) existing drainage structures which will be replaced as part of the proposed IL Route 72 Intersection Reconstruction project.

- A 7'x 4' concrete box culvert, 57'-3" long, under Illinois Route 72 (SN 045-0240) conveying Hampshire Creek Tributary;
- A 5-foot diameter elliptical corrugated metal pipe (CMP) under the entrance to the Chick-n-Dip restaurant;

- A cast-in-place concrete single 6' x 4' box culvert conveying Hampshire Creek Tributary below State Street.

Additionally, temporary span wire traffic signals are currently use at the intersection and will be replaced with permanent traffic signals.

1.2 Proposed Reconstruction

According to the proposed preliminary plan drawings provided by Lochmueller Group dated 08/10/2020 (**Appendix A**), the three (3) existing drainage structures will be consolidated into two (2) new structures. The culvert under IL Route 72 will be replaced with a triple 8' x 5' reinforced concrete box (RCB) culvert; the culvert under State Street, and the CMP culvert will be replaced with a single 8' x 6' and double 6' x 6' RCB culvert. A 12-foot wide channel, with 1V:3H side slopes, is proposed to connect these structures to convey the Hampshire Creek Tributary under IL Route 72 and State Street. **Table 1** presents a summary of the proposed new drainage structures.

Table 1 – Summary of Proposed Culverts

Proposed Structure	Proposed Structure No.	Proposed Stationing at Structure Center	Upstream Invert Elevation (ft. MSL)	Downstream Invert Elevation (ft. MSL)	Slope (%)	Total Length (feet)
3 - 8' x 5' RCB Culvert	045-2107	500+99.77[1]	889.63	889.33	0.34	87
1 - 8' x 6' RCB Culvert and 2- 6' x 6' RCB Culvert	045-6032	201+93.80[2]	888.67	888.22	0.44	101

[1] Based on existing IL Route 72 Stationing
[2] Based on existing State Street Stationing

1.3 Regional Geology

GSG reviewed several published documents to determine the regional geological setting of the site. The subject area is located in Kane County, in Hampshire, Illinois. The project area consists

of deposits primarily from the Equality Formation of the Hudson and Wisconsin Glacial Age. The surficial geologic deposits in the area consist silty clay, sand, silt, and gravel extending to approximately 150 to 200 feet below ground surface, at which point bedrock is generally encountered. Underlying the surficial deposits, the bedrock is predominately from the Maquoketa Formation Group, which consists of shale and limestone.

The subject area is located approximately 30 miles northeast of the Sandwich Fault Zone. The Sandwich fault zone is one of the longest fault zones in Illinois and runs along a southeast-northwest track for approximately 85 miles, from Manhattan in Will County to Oregon in Ogle County. The fault zone has a maximum displacement of approximately 800 feet at its midpoint in southeastern DeKalb County and is approximately ½ to 2 miles in width.

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 soil investigation was conducted between March 23 and March 26, 2020 and included advancing a total of four (4) soil borings to depths 25 feet. The borings were completed through the existing pavement on IL Route 72 and State Street. The soil boring locations were selected by GSG based on the proposed plans provided by Lochmueller Group and completed at locations based on field conditions and site accessibility. **Table 2** presents a list of the borings completed along with their location information.

Table 2 – Summary of Subsurface Exploration Borings

Boring	Location	Station	Offset (feet)/ Direction	Existing Ground Elevation (ft)	Depth (ft)
CB-1	State Street	202+41	7.56 LT	896.7	25
CB-2	State Street	201+24	12.88 RT	896.8	25
CB-4	IL Route 72	501+47	23.09 RT	896.9	25
OSB-1/CB-3	IL Route 72	500+64	17.31 LT	896.8	25

The existing ground surface elevations for the borings were based on the field survey performed by GSG. The approximate locations of the soil borings are shown on the Boring Location Plan and Subsurface Profile **(Appendix B)**.

The soil borings were drilled using a truck mounted CME-75 drill rig using 3¼-inch I.D. hollow stem augers and automatic hammers. 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 depths of 25 feet. 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, 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 in the area of the proposed culverts. Moisture content tests (ASTM D2216 / AASHTO T-265) were performed on representative soil samples. 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 shown along with the field test results in the **Soil Boring Logs (Appendix C)**.

2.3 Subsurface Conditions

This section provides a brief description of the soils encountered in the borings performed. 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. 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.

Culvert under State Street – SN 045-6032

Borings CB-1 and CB-2 were drilled in the vicinity of the proposed culvert under State Street. The surface elevations of these borings were 896.7 and 896.8 feet.

The borings were drilled through the existing pavement on State Street, and initially noted 10 and 11 inches of asphalt. Beneath the asphalt, silty clay existing fill soils were encountered to a depth of 3.5 feet below grade. The existing fill soils were underlain by soft to hard brown silty clay soils, to depths of 9.5 and 17 feet below grade, followed by very loose to loose brown sand

to depths of 18.5 and 21.5 feet below grade. These soils were underlain by very stiff brown and gray silty clay to a depth of 21.5 feet below grade in boring CB-1 and to the termination depth in boring CB-2. Medium dense to dense brown sand was encountered to the termination depth in boring CB-1. Cobbles were encountered from 16 to 17.5 feet below grade in boring CB-2

The unconfined compressive strength values of the upper cohesive soils (above approx. elevation 887 feet) ranged between 0.42 tsf and 1.75 tsf. The unconfined compressive strength values of the lower cohesive soils (below approx. elevation 887 feet) ranged between 1.67 tsf and 4.5 tsf. The SPT blow count 'N' values of the granular soils ranged between 2 and 41 bpf.

Culvert under IL Route 72 – SN 045-2107

Borings OSB-1/CB-3 and CB-4 were drilled in the vicinity of the proposed culvert under IL Route 72. The surface elevations of these borings were 896.8 and 896.9 feet.

The borings were drilled through the existing pavement on IL Route 72. Boring OSB-1/CB-3 initially noted 7 inches of asphalt over 7 inches of concrete, and boring CB-4 initially noted 3 inches of asphalt. Beneath the pavement layers, silty clay existing fill soils were encountered to a depth of 3.5 feet below grade. The existing fill soils were underlain by loose to medium dense brown sand and sandy loam, which extended to a depth of 8.5 feet below grade. Boring CB-4 also noted stiff brown silty clay from 3.5 to 6.5 feet below grade. The brown sand and sandy loam were followed by medium stiff to very stiff brown and gray silty clay, interbedded with sand seams. These soils extended to the boring termination depths of 25 feet. Cobbles were encountered from 6 to 7.5 feet and 16 to 17.5 feet below grade in boring OSB-1/CB-3, and at 18.5 to 20 feet and 21 to 22.5 feet in boring CB-4.

The unconfined compressive strength values of the upper cohesive soils (above approx. elevation 883 feet) ranged between 0.83 tsf and 1.75 tsf. The unconfined compressive strength values of the lower cohesive soils (below approx. elevation 883 feet) ranged between 1.25 tsf and 3.12 tsf. The SPT blow count 'N' values of the granular soils ranged between 4 and 25 bpf.

2.4 Groundwater Conditions

Water levels were checked in each boring to determine the general groundwater conditions present at the site and were measured while drilling and after each boring was completed.

Groundwater was encountered in all borings while drilling at depths ranging from 8.5 to 18.5 feet (elevations of 884.6 to 878.3 feet), generally within the sand layers and lenses encountered in the borings. These water levels were likely perched water within the isolated and confined granular layers. Groundwater was not encountered after drilling in any of the boring locations.

Based on the color change from brown to gray, it is anticipated that the long-term groundwater level is below the depth of the borings. The water level the in the vicinity of the proposed culverts may rise to near the level of Hampshire Creek Tributary. 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 ANALYSIS

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

3.1 Derivation of Soil Parameters for Design

GSG determined the geotechnical parameters to be used for the project design based on the results of the field and laboratory test data on individual boring logs as well as our experience. Unit weights, friction angles and shear strength parameters were estimated using standard penetration test (SPT) results for the fill and cohesionless soils and in-situ and laboratory test results for cohesive soils. The SPT values were corrected for hammer efficiency and overburden weight. 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 hammers for the truck mounted CME-75 drill was estimated to be approximately 94% based on GSG's most recent calibrations records. The correction for hammer efficiency is a direct ratio of relative efficiencies. The following equation should be used in calculating the corrected blow counts for the purposes of design and analysis:

$$N_{60} = N_{Field}*(94/60) \text{ (CME-75)}$$

*Where the N_{Field} value is the field recorded blow counts during drilling activities.

Based on the field investigation data collected, generalized soil parameters for the soils for use in design are presented in **Tables 3a** and **3b.**

Table 3a – Summary of Soil Parameters
(Culvert below State Street - Boring CB-1 & CB-2)

Depth / Elevation Range (feet)	Soil Description	In situ Unit Weight γ (pcf)	Undrained		Drained	
			Cohesion c (psf)	Friction Angle ϕ (°)	Cohesion c (psf)	Friction Angle ϕ (°)
	New Engineered Clay Fill	125	1,000	0	50	25
	New Engineered Granular Fill	125	0	30	0	30
1.0-3.5 (896.0-893.5)	FILL Brown Silty Clay	129	950	0	0	25
3.5-9.0 (893.5-888.0)	Soft to Medium Stiff Brown Silty Clay	127	750	0	0	27
9.0-20.0 (888.0-877.0)	Very Loose to Loose Brown Sand	116	0	30	0	30
9.0-17.0 (888.0-880.0)[2]	Very Stiff Brown Silty Clay	135	3,100	0	125	28
20.0-25.0 (877.0-872.0)	Very Stiff Brown and Gray Silty Clay	133	2,600	0	100	28
22.0-25.0 (875.0-872.0)[1]	Medium Dense to Dense Brown Sand	134	0	38	0	38

[1] Soil Parameters only for CB-1
[2] Soil Parameters only for CB-2

Table 3b – Summary of Soil Parameters
(Culvert below IL Route 72 - Boring OSB-1/CB-3 & CB-4)

Depth / Elevation Range (feet)	Soil Description	In situ Unit Weight γ (pcf)	Undrained		Drained	
			Cohesion c (psf)	Friction Angle ϕ (°)	Cohesion c (psf)	Friction Angle ϕ (°)
	New Engineered Clay Fill	125	1,000	0	50	25
	New Engineered Granular Fill	125	0	30	0	30
1.0-3.5 (896.0-893.5)	FILL Brown and Black Silty Clay	132	1,200	0	50	25
3.5-6.5 (893.5-890.5)[1]	Stiff Brown and Gray Silty Clay	130	1,000	0	50	27
3.5-8.5 (893.5-880.5)	Loose to Medium Dense Brown Sand	124	0	34	0	34
8.5-13.5 (888.5-883.5)	Medium Stiff to Stiff Brown Silty Clay	131	1,000	0	50	27
13.5-25.0 (883.5-872.0)	Stiff to Very Stiff Brown and Gray Silty Clay	138	1,900	0	75	28
13.5-15.5 (883.5-881.5)[1]	Loose Brown Sand	113	0	30	0	30
23.5-25.0 (873.5-872)[1]	Medium Dense Brown Sand	132	0	37	0	37

[1] Soil Parameters only for CB-4

3.2 Slope Stability

IDOT requires that slope stability analysis be performed in areas where the cut or fill heights will exceed 15 feet in height. For the proposed culverts and channel, it is anticipated that the maximum cut and fill height will be less than 10 feet; therefore, no slope stability analysis was required for this report.

4.0 GEOTECHNICAL DESIGN RECOMMENDATIONS

This section provides the results of GSG's geotechnical evaluation of the existing foundation system and design recommendations in accordance with the most current AASHTO LRFD 8th Edition (2017) and IDOT Geotechnical Manual (2015). The foundations for the proposed culverts must provide sufficient support to resist the dead and live loads.

4.1 General Culvert Recommendations

There are two different types of culvert alternatives that can be considered – a precast concrete box culvert and a cast-in-place concrete culvert. Generally, precast box culverts are more economical however may be limited due to the existing site conditions and construction considerations. Due to the relatively poor loose soils anticipated at the bearing level of the proposed culverts, cast-in-place concrete culverts are a more suitable option for this site. Based on the approved plan drawings provided by Lochmueller Group (dated 08/10/2020), each structure is proposed to be a cast-in-place concrete culvert.

4.2 Culvert Foundation Recommendations

GSG evaluated the soils for the proposed culverts. The recommendations in this report are based on approved plan drawings provided by Lochmueller Group (dated 08/10/2020). GSG's evaluation included recommending construction recommendations for the installation of new culverts under IL Route 72 and State Street. For the design of the foundations for the culvert, the total live load, impact loads, and dead loads, including the load of the overburden soils, should be considered. Design should be completed in accordance with the design hydraulics report and the IDOT Culvert Manual (2017).

GSG evaluated the soils at bearing grade for the base of the proposed box culverts. For the culvert under State Street, the subsurface investigation noted stiff brown silty clay at the proposed bearing grade (887.8 to 887.4 feet). For the culvert under IL Route 72, the subsurface investigation noted loose to medium dense brown sand at the proposed bearing grade (888.8 to 888.5 feet).

The subgrade soils at bearing grade should be evaluated per the guidelines provided in Section 8.9 of IDOT Geotechnical Manual (2015) for suitability/workability prior to placing any portion of the proposed culvert structure. Loose saturated granular soils were noted at the invert

depths of the proposed culvert under IL Route 72. This material will provide sufficient subgrade stability for the proposed construction of the culvert under IL Route 72. However, if a precast box culvert is considered, according to Section 540, IDOT SSRBC (2016) a minimum of 6-inches of porous granular material may be provided as bedding material which will serve as a working platform for box culverts.

Settlement of the culverts depend on the foundation size and bearing resistance, as well as the strength and compressibility characteristics of the underlying bearing soil. **Table 4** presents the estimated total and differential settlement of the proposed structures. If the total or differential settlement presented below is not acceptable, a treatment of removal and replacement should be implemented.

Table 4 –Estimated Settlement of Proposed Culverts

Proposed Structure	Anticipated Bearing Elevation (feet)	Estimated Settlement at Culvert Inlet (inches)	Estimated Settlement at Culvert Outlet (inches)	Estimated Differential Settlement (inches)
SN 045-6032 Culvert under State Street	887.8 to 887.4	<1.0	<0.5	0.5
SN 045-2107 Culvert under IL Route 72	888.8 to 888.5	1.0	<1.5	0.5

4.3 Wingwall Recommendations

The proposed structures are current shown on the approved design plans as cast-in-place culverts. The recommended wingwall design for these structures is the use of horizontal cantilever walls. The wingwalls will be attached to the culvert walls as part of the structural design, rather than supported on the poor subgrade soils. Based on the approved design plans, the northwest wingwall for SN 045-6032 will be 21'-6" in length and a horizontal cantilever wall may not be suitable for this longer wall. Therefore, a L-Type cantilever wingwall is proposed at this location that will be supported by a combination of structural connection to the culvert box and the foundation soils. The subgrade soils at bearing grade should be evaluated per the

guidelines provided in Section 8.9 of IDOT Geotechnical Manual (2015) for suitability/workability prior to placing any portion of the proposed structure.

Wingwalls should be designed based on the information and typical sections shown in Section 4.2 of the IDOT Culvert Manual (IDOT 2017). Headwalls should be designed based on the information provided in Section 4.1.5 of the IDOT Culvert Manual (IDOT 2017).

4.4 Proposed Channel

GSG understands that a 12-foot wide, approximately 125-foot long channel, is proposed to connect the proposed culverts and convey Hampshire Creek Tributary. The channel will be constructed with 1V:3H side slopes. The bottom of the channel will range between 890.33 feet at the outlet of the culvert under IL Route 72 and 889.67 feet at the inlet of the culvert under State Street. Based on the soil exploration, the soils encountered near these elevations within borings CB-1 and CB-2 are classified as cohesive in nature (silty clay), and the soils within OSB-1/CB-3 and CB-4 are granular in nature (sand). In accordance with Section 281, IDOT SSRBC (2016) a minimum of 6-inches of Gradation RR1 and RR2 riprap should be provided as bedding material, which will serve as erosion protection. No riprap shall be placed until the preparation has been designed and approved by a professional engineer.

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 (SSRBC) (2016), the IDOT Culvert Manual (2017) and the IDOT Subgrade Stability Manual (2005). Any deviation from the requirements in the manuals above should be approved by the design engineer.

5.1 Site Preparation

Any topsoil encountered during construction should be stripped and stockpiled as per Section 211.03 of the IDOT Standard Specifications for Road and Bridge Construction (SSRBC). The topsoil should be separated from other materials being stockpiled onsite for reuse or haul off. Base coarse aggregate encountered at the site should be evaluated to determine suitability for reuse as general fill. The contractor should not mix the existing base course materials, if any, with existing subgrade soils during the stripping and stockpiling activities. The subgrade below the base course should be evaluated in accordance with the Pavement Subgrade Preparation section of this report.

5.2 Scour Considerations

The design scour elevation should be taken at the bottom of the cutoff walls. To help prevent local erosion, it is recommended to place stone riprap at the end of the culverts. This will help prevent sediments from entering and accumulating in the culvert, reduce long term maintenance, and provide protection to the streambed at the interface.

5.3 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. Surcharge loads from the excavated materials,

construction equipment, and vehicles should be included in the design of the excavation system. Excavation near existing structures and underground utilities should be performed with extreme care to avoid undermining existing structures.

If water seepage occurs during excavation or where wet conditions are encountered such that the water cannot be removed with conventional sumping, GSG recommends 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 consisting of granular materials such as IDOT CA-6.

5.4 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 SSRBC (2016). 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 of softening subgrade soils. All backfill materials around the culvert must be pre-approved by the site engineer. Backfill materials for undercut areas beneath the culvert should be placed in 8 inches loose lifts and should be compacted to 95% of the maximum dry density as determined by AASTHO T-180, Modified Proctor Method.

5.5 Groundwater Management

it is anticipated that the long-term groundwater level is below the depth of the borings. However, the water level the in the vicinity of the proposed culverts may rise to near the level of Hampshire Creek Tributary, in addition to the perched water levels observed in the confined granular layers within the borings. GSG does anticipates that groundwater related issues may occur during construction activity due to the extent of the proposed improvements for the culvert and the anticipated time frame for the excavation construction. 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 the excavations on the shorelines 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.

5.6 Temporary Soil Retention

Temporary soil retention may be needed to install the proposed culverts. The Temporary Soil Retention System (TSRS) 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. The design of the temporary earth retention system is the responsibility of the contractor. The contractor should submit the TSRS plans to the structural design team for review prior to commencing construction of the TSRS.

6.0 LIMITATIONS

This report has been prepared for the exclusive use of the Illinois Department of Transportation and its consultant team. The recommendations provided in the report are specific to the project described herein and are based on the information obtained from the soil boring locations within the proposed project limits. 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

GENERAL PLANS, ELEVATIONS, AND DETAILS

APPROVED
AUG 10 2020
AS A BASIS FOR PREPARATION OF DETAILED PLANS

BENCH MARK:
B.M. #1 NGS Disc in Northwest Corner of IL 72 and State Street. Elev. 896.86
N: 1,974,916.2286 E: 930,813.1875

Existing Structure:
S.N. 045-0240 carrying F.A.P. Route 557 / Illinois Route 72 (Oak Knoll Drive) over Hampshire Creek Tributary C, was built in 1924 and Widened in 1998. The structure consists of a cast-in-place reinforced concrete single box culvert with cast-in-place reinforced concrete wingwalls. Culvert Length is 57'-3" from outside of headwall to outside of headwall. At the south end of the structure, the opening is 7'-0" wide by 4'-0" high. At the north end of the structure, the opening is 6'-0" wide by 4'-0" high. The existing structure to be removed and replaced.

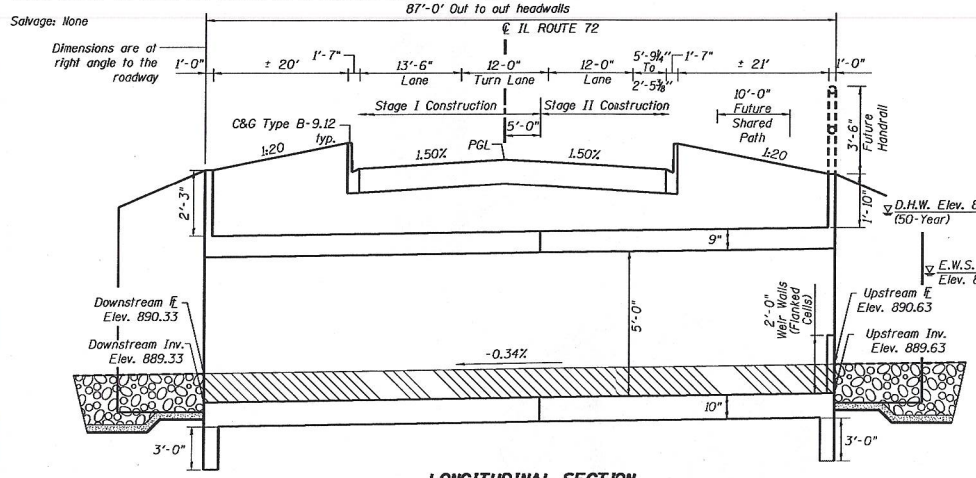
Traffic control: One lane in each direction will be maintained utilizing staged construction.

Salvage: None

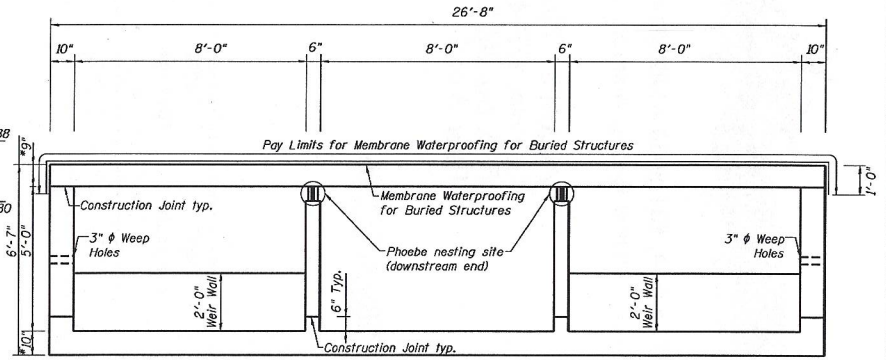
WATERWAY INFORMATION

Drainage Area = 1.6 Square Miles — Low Grade Elev. 897.67

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	240	28.0	80.0	895.05	2.83	0.02	897.88	895.07
Design	50	442	28.0	80.0	895.88	2.37	0.42	898.25	896.30
Base	100	529	28.0	80.0	896.14	2.25	1.35	898.39	897.49
Max. Calc.	500	732	28.0	80.0	896.67	2.10	2.10	898.77	898.77

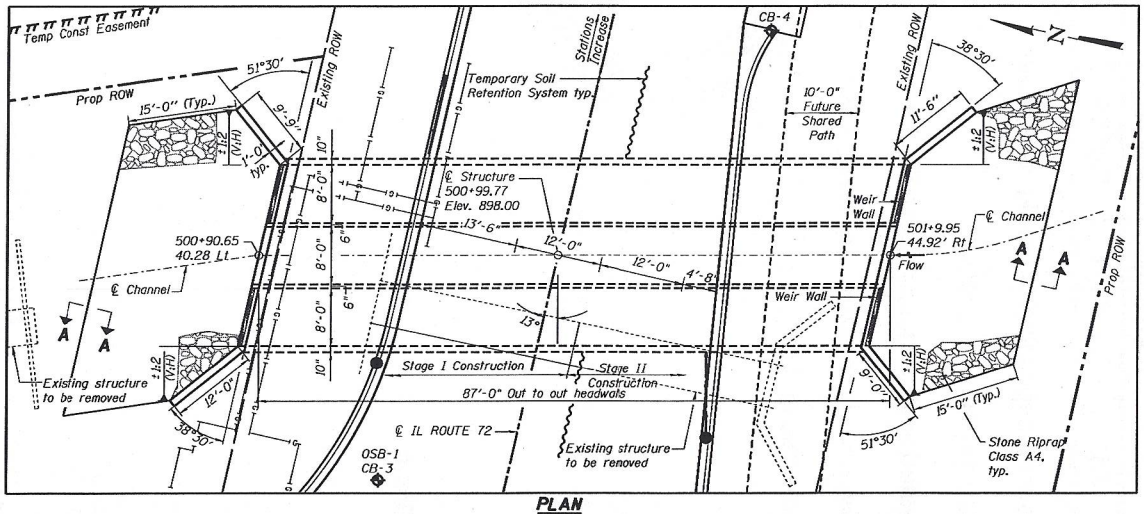


LONGITUDINAL SECTION



CROSS-SECTION: C.I.P. CULVERT

* May be refined in final design



PLAN

DESIGN SPECIFICATIONS

2017 AASHTO LRFD Bridge Design Specifications, 8th Edition

DESIGN STRESSES

FIELD UNITS

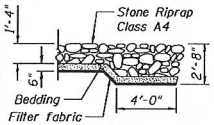
f'c = 3,500 psi
fy = 60,000 psi (Reinforcement)

HIGHWAY CLASSIFICATION

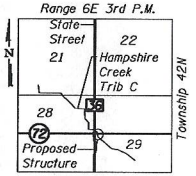
F.A.P. Rte. 557 (IL Rte 72)
Functional Class: Other Principal Arterial
ADT: 11,800 (2020); 14,000 (2040)
ADTT: 496 (2020); 588 (2040)
DHV: 885 (2020); 1,125 (2040)
Design Speed: 50 m.p.h.
Posted Speed: 45 m.p.h.
Two-Way Traffic (2 lanes)
Directional Distribution: 45 (SB) / 55 (NB)

LOADING HL-93

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



SECTION A-A



LOCATION SKETCH

GENERAL PLAN AND ELEVATION
ILLINOIS ROUTE 72 OVER
HAMPSHIRE CREEK TRIBUTARY C
F.A.P. RTE. 557 - SECTION 32R-DR-1
KANE COUNTY
STATION 500+99.77
STRUCTURE NO. 045-2107

MODEL: $MODELNAME$
FILE NAME: $FILE$

Bowman CONSULTING
311 S. Wacker Drive, Suite 1600, Chicago, Illinois 60606

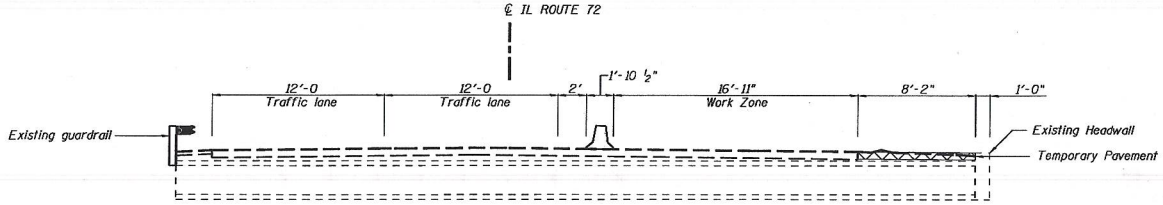
$DATE$ $TIME$

USER NAME =	DESIGNED - KJH	REVISED -
	CHECKED - AJN	REVISED -
PLOTSCALE =	DRAWN - JWM	REVISED -
PLOTDATE =	CHECKED - AJN	REVISED -

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

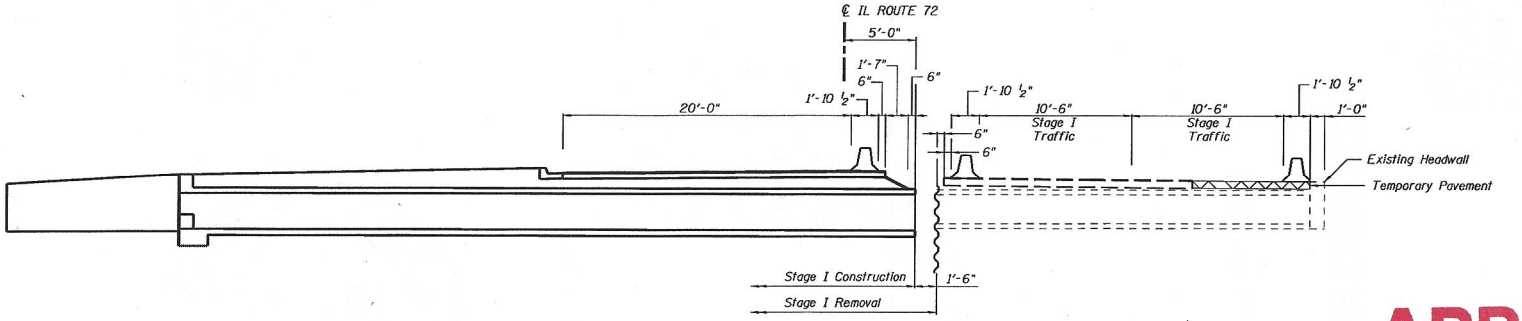
BOX CULVERT
STRUCTURE NO. 045-2107
SHEET 1 OF 2 SHEETS

F.A.P RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
557	32R-DR-1	KANE	-	-
		CONTRACT NO.		
	ILLINOIS FED. AID PROJECT			



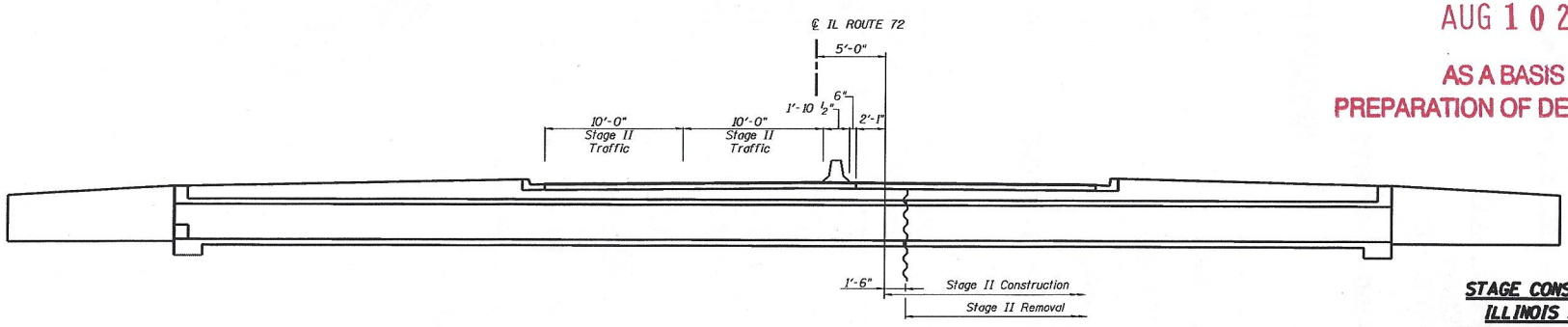
PRE-STAGE CONSTRUCTION

(Looking Upstation dimensions are at right angles to roadway)



STAGE I CONSTRUCTION

(Looking Upstation dimensions are at right angles to roadway)



STAGE II CONSTRUCTION

(Looking Upstation dimensions are at right angles to roadway)

APPROVED

AUG 1 0 2020

AS A BASIS FOR
PREPARATION OF DETAILED PLANS

STAGE CONSTRUCTION DETAIL
ILLINOIS ROUTE 72 OVER
HAMPSHIRE CREEK TRIBUTARY C
F.A.P. RTE. 557 - SECTION 32R-DR-1
KANE COUNTY
STATION 500+99.77
STRUCTURE NO. 045-2107

MODEL: $MODELNAME$
FILE NAME: $FILE$

$DATE$ $TIME$

Bowman CONSULTING
311 S. Wacker Drive, Suite 1900,
Chicago, Illinois 60606

USER NAME =	DESIGNED - KJH	REVISED -	
	CHECKED - AJN	REVISED -	
PLOT SCALE =	DRAWN - JWM	REVISED -	
PLOT DATE =	CHECKED - AJN	REVISED -	

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

BOX CULVERT
STRUCTURE NO. 045-2107
SHEET 2 OF 2 SHEETS

F.A.P RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
557	32R-DR-1	KANE	-	-
		CONTRACT NO.		
		ILLINOIS FED. AID PROJECT		

APPROVED

AUG 10 2020

AS A BASIS FOR PREPARATION OF DETAILED PLANS

BENCH MARK:
B.M. #1 NGS Disc in Northwest Corner of IL 72 and State Street. Elev. 896.86
N: 1,974,916.2286 E: 930,813.1875

Existing Structure:
The structure carrying F.A.P. Route 0098 / County Highway 36 (State Street) over Hampshire Creek Tributary C is a cast-in-place reinforced concrete single box culvert with cast-in-place reinforced concrete wingwalls. The original construction plans were unable to be located. The approximate dimensions are the following: Culvert Length is 39'-6" from outside of headwall to ouside of headwall. The measured opening is 6'-0" and 4'-0" wide. The east and west wingwalls are parallel to the headwall and vary in length from 4'-10" to 8'-0". Existing structure to be removed and replaced.

Traffic control: Road to be closed, traffic detoured..

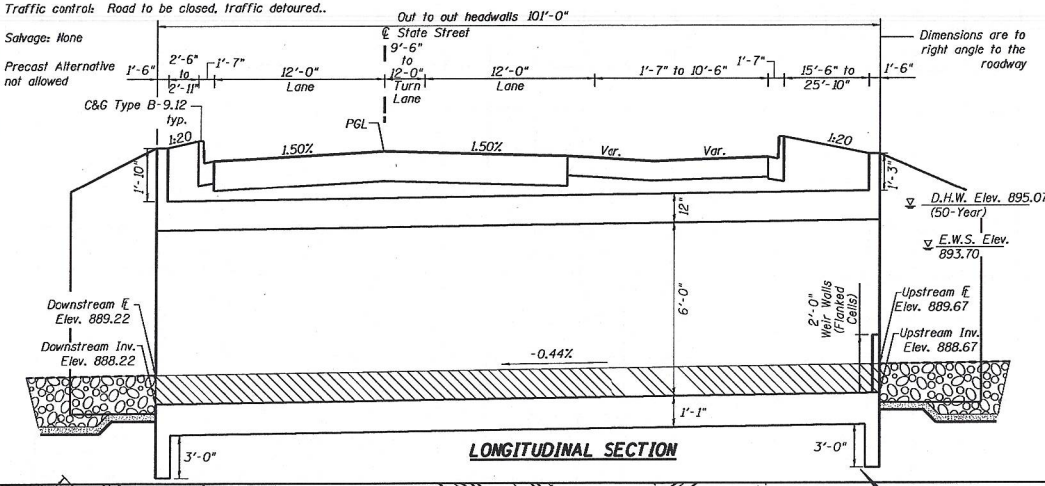
Salvage: None

Precast Alternative not allowed

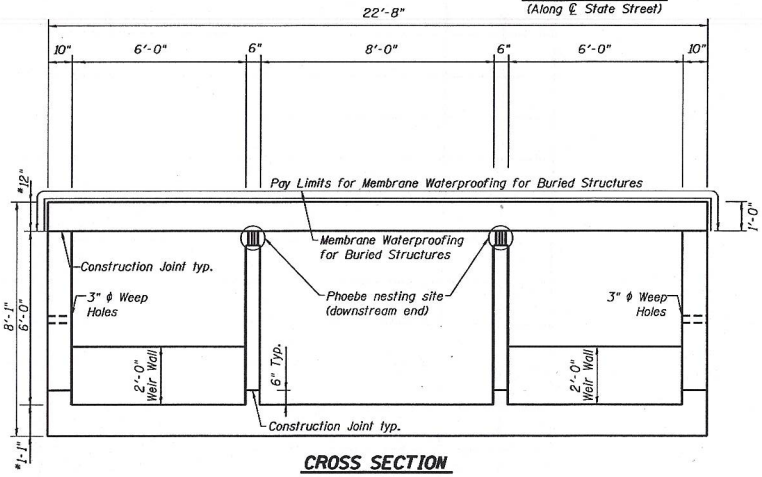
WATERWAY INFORMATION

Drainage Area = 1.6 Square Miles — Low Grade Elev. 896.29

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	240	25.5	78.4	894.19	3.01	0.00	897.20	894.19
Design	50	442	28.0	88.0	895.07	2.63	0.12	897.70	895.19
Base	100	529	28.0	88.0	895.36	2.46	0.51	897.82	895.87
Max. Calc.	500	732	28.0	88.0	895.99	2.23	1.32	898.22	897.31

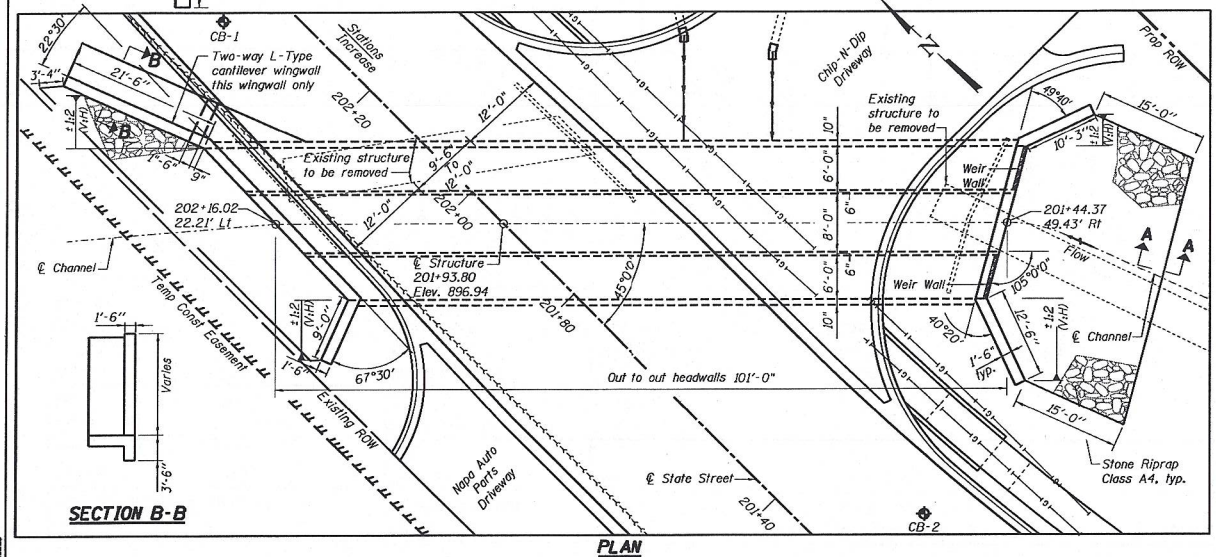


LONGITUDINAL SECTION



CROSS SECTION

* May be refined in final design



PLAN

SECTION B-B

DESIGN SPECIFICATIONS

2017 AASHTO LRFD Bridge Design Specifications, 8th Edition

DESIGN STRESSES

FIELD UNITS

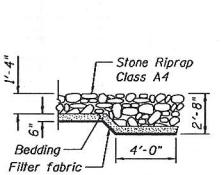
f'c = 3,500 psi
fy = 60,000 psi (Reinforcement)

HIGHWAY CLASSIFICATION

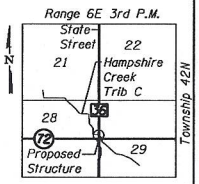
F.A.P. Rte. 0098 (State Street)
Functional Class: Major Collector
ADT: 5,133 (2020); 7,000 (2040)
ADTT: 62 (2020); 84 (2040)
DHV: 595 (2020); 785 (2040)
Design Speed: 35 m.p.h.
Posted Speed: 30 m.p.h.
Two-Way Traffic (2 lanes)
Directional Distribution: 50/50

LOADING HL-93

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



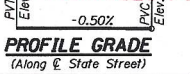
SECTION A-A



LOCATION SKETCH

PROFILE GRADE

(Along ℄ State Street)



GENERAL PLAN AND ELEVATION
STATE STREET OVER
HAMPSHIRE CREEK TRIBUTARY C
F.A.P. RTE. 0098 - SECTION 32R-DR-1
KANE COUNTY
STATION 201+93.80
STRUCTURE NO. 045-6032

MODEL: $MODELNAME$
FILE NAME: $FILE$

Bowman CONSULTING
311 S. Wacker Drive, Suite 1200, Chicago, Illinois 60606

$DATE$ $TIME$

USER NAME =	DESIGNED - KJH	REVISED -	
	CHECKED - AJN	REVISED -	
PLOT SCALE =	DRAWN - JWM	REVISED -	
PLOT DATE =	CHECKED - AJN	REVISED -	

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

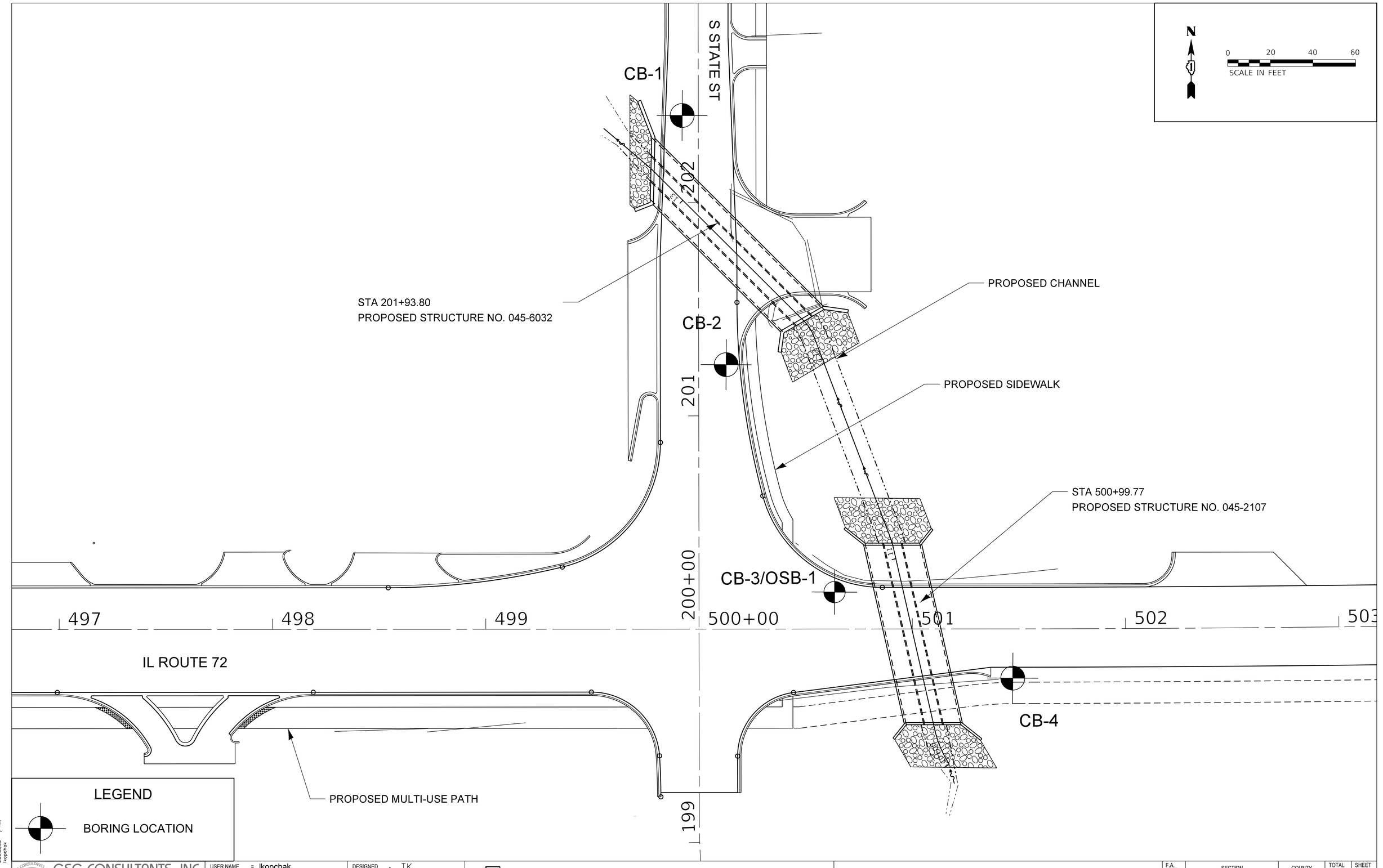
BOX CULVERT
STRUCTURE NO. 045-6032
SHEET 1 OF 1 SHEETS

F.A.P. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
98	32R-DR-1	KANE	151	115
		CONTRACT NO.		
	ILLINOIS	FED. AID PROJECT		

APPENDIX B

BORING LOCATION PLAN

AND SUBSURFACE PROFILE



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PLOT DATE = 6/18/2020
TIME = 11:04:49 AM
SHEET SIZE = $SHEETSIZE$
PLOT SCALE = 200.0000 ' / in.
USER NAME = lkopchak

GSG CONSULTANTS, INC.
Engineers, Scientists & Construction Managers
623 Cooper Court Schaumburg, IL 60173
Tel: 630.994.2600
"Integrity| Quality| Reliability"

USER NAME = lkopchak		DESIGNED - TK	
SHEET SIZE = 17x11 (in.)		DRAWN - LK	
PLOT SCALE = N/A		CHECKED - TK	
PLOT DATE = 6/18/2020		DATE - 06/16/2020	

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

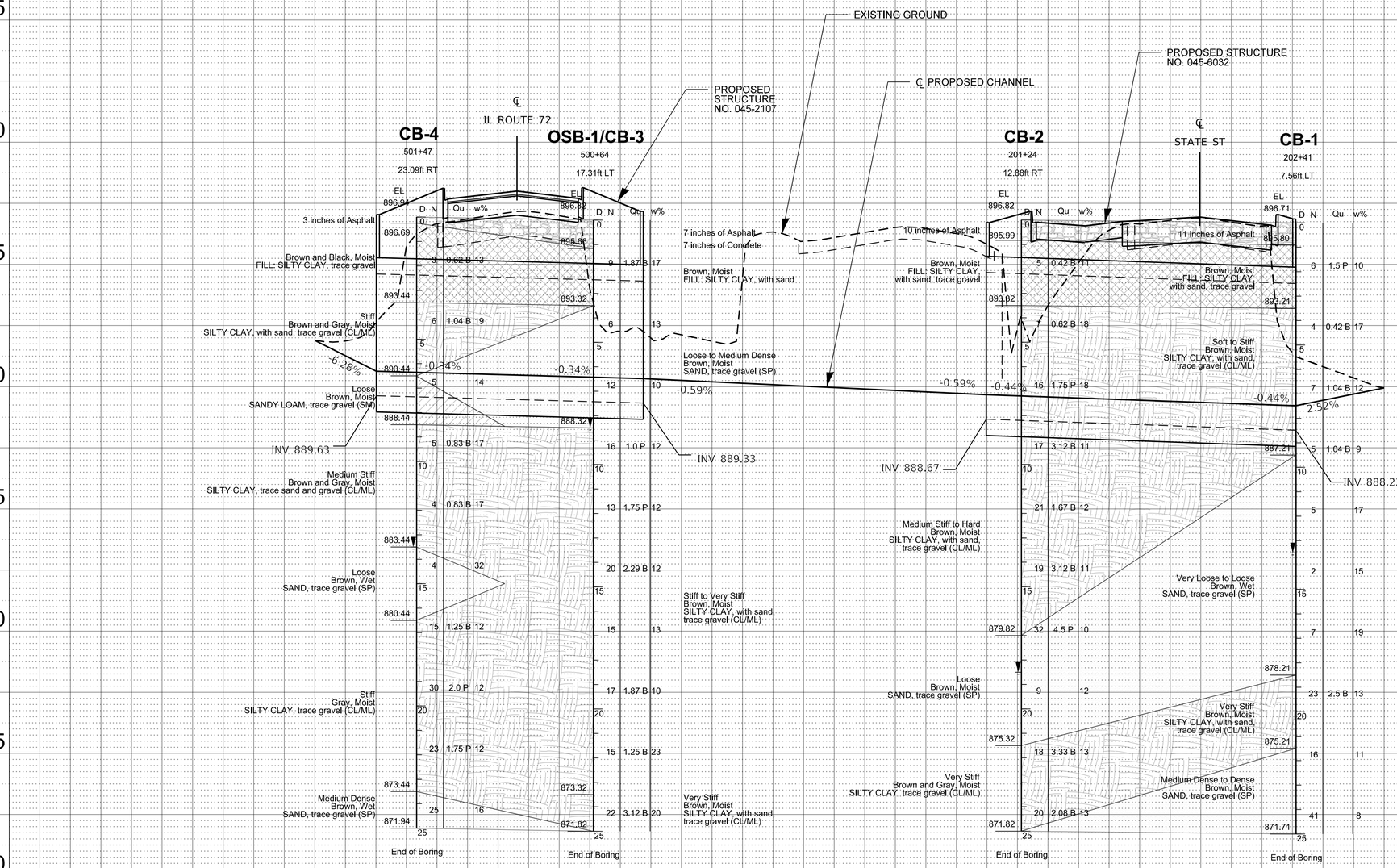
BORING LOCATION PLAN
IL ROUTE 72 AND STATE STREET

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

F.A. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
	32R-DR-1	KANE	1	1
		CONTRACT NO.		
	ILLINOIS	FED. AID PROJECT		

LEGEND

PAVEMENT	FILL: SAND / GRAVEL	SANDY CLAY / LOAM	APPROXIMATE EXTENT OF PROPOSED UNDERCUT TO BE FIELD VERIFED
BASE COURSE	SILTY CLAY	CLAYEY SAND / SILT	
TOPSOIL	SAND/ GRAVEL	ORGANIC SILTY CLAY	
FILL: CLAY / SILTY CLAY	SILT / SILTY LOAM	BEDROCK	



NOTE:

STATIONING BASED ON PROPOSED CHANNEL STATIONS

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SHEET SIZE = $SHEETSIZE$
PLOT SCALE = 10.0000 ' / in.
USER NAME = lkopchak

GSG CONSULTANTS, INC.
Engineers, Scientists & Construction Managers
623 Cooper Court Schaumburg, IL 60173
Tel: 630.994.2600
"Integrity| Quality| Reliability"

USER NAME	= lkopchak	DESIGNED	- TK
SHEET SIZE	= 17x11 (in.)	DRAWN	- LK
PLOT SCALE	= N/A	CHECKED	- TK
PLOT DATE	= 6/18/2020	DATE	- 06/18/2020

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

BORING PLAN AND PROFILE
IL ROUTE 72 AND STATE ST

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

F.A. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
	32R-DR-1	KANE	1	1
		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 3/26/20

ROUTE IL Route 72 **DESCRIPTION** IL Route 72 at State Street **LOGGED BY** PS

SECTION 32R-DR-1 **LOCATION** Hampshire, IL, **SEC.** , **TWP.** , **RNG.** ,
Latitude 42.0889778, **Longitude** -88.5301358

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

STRUCT. NO. 045-6032
Station 201+93.80

BORING NO. CB-1
Station 202+41
Offset 7.56ft LT
Ground Surface Elev. 896.71 ft

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

Groundwater Elev.:
First Encounter 883.2 ft ▼
Upon Completion N/A ft
After N/A **Hrs.** N/A ft

	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
11 inches of Asphalt				
895.80				
Brown, Moist		7		
FILL: SILTY CLAY, with sand, trace gravel		3 3	1.5 P	10
893.21				
Soft to Stiff		1		
Brown, Moist		1	0.4	17
SILTY CLAY, with sand, trace gravel (CL/ML)	-5	3	B	
		2		
		3 4	1.0 B	12
		3		
887.21		2	1.0	9
Very Loose to Loose	-10	3	B	
Brown, Wet		3		
SAND, trace gravel (SP)		2 3		17
▼		1		
		1		15
	-15	1		
		1		
		2		19
		5		
878.21		10		
		10	2.5	13
	-20	13	B	

	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
Very Stiff				
Brown, Moist				
SILTY CLAY, with sand, trace gravel (CL/ML) *(continued)*		10		
875.21		10		11
Medium Dense to Dense		6		
Brown, Moist				
SAND, trace gravel (SP)				
		20		
		24		8
871.71	-25	17		
End of Boring				
	-30			
	-35			
	-40			

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

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

SOIL BORING LOG

Date 3/26/20

ROUTE IL Route 72 **DESCRIPTION** IL Route 72 at State Street **LOGGED BY** PS

SECTION 32R-DR-1 **LOCATION** Hampshire, IL, **SEC.** , **TWP.** , **RNG.** ,
Latitude 42.0886573, **Longitude** -88.5300588

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

STRUCT. NO. 045-6032
Station 201+93.80

BORING NO. CB-2
Station 201+24
Offset 12.88ft RT
Ground Surface Elev. 896.82 ft

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

Groundwater Elev.:
First Encounter 878.3 ft ▼
Upon Completion N/A ft
After N/A **Hrs.** N/A ft

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Description
				10 inches of Asphalt
				895.99
	4			Brown, Moist
	2	0.4	11	FILL: SILTY CLAY, with sand,
	3	B		trace gravel
				893.32
	2			Medium Stiff to Hard
	3	0.6	18	Brown, Moist
-5	4	B		SILTY CLAY, with sand, trace
				gravel (CL/ML)
	7			
	7	1.8	18	
	9	P		
				Sand seam at 7.5 feet
	8			
	8	3.1	11	
-10	9	B		
	9			
	10	1.7	12	
	11	B		
	5			
	9	3.1	11	
-15	10	B		
	10			Cobbles at 16-17.5 feet
	18	4.5	10	
	14	P		879.82
				Loose
				Brown, Moist
▼	7			SAND, trace gravel (SP)
	5		12	
-20	4			

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Description
				Loose
				Brown, Moist
	6			SAND, trace gravel (SP)
				875.32
	8	3.3	13	*(continued)*
	10	B		Very Stiff
				Brown and Gray, Moist
				SILTY CLAY, trace gravel
	6			(CL/ML)
	8	2.1	13	
-25	12	B		
				871.82
				End of Boring
-30				
-35				
-40				

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

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

SOIL BORING LOG

Date 3/24/20

ROUTE IL Route 72 **DESCRIPTION** IL Route 72 at State Street **LOGGED BY** PS

SECTION 32R-DR-1 **LOCATION** Hampshire, IL, **SEC.** , **TWP.** , **RNG.** ,
Latitude 42.0882548, **Longitude** -88.5295625

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

STRUCT. NO. 045-2107
Station 500+99.77

BORING NO. CB-4
Station 501+47
Offset 23.09ft RT
Ground Surface Elev. 896.94 ft

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

Groundwater Elev.:
First Encounter 883.4 ft ▼
Upon Completion N/A ft
After N/A **Hrs.** N/A ft

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Description
				3 inches of Asphalt 896.69
	2			Brown and Black, Moist FILL: SILTY CLAY, trace gravel
	2	0.6	13	
	1	B		
				893.44
	2			Stiff
	2	1.0	19	Brown and Gray, Moist SILTY CLAY, with sand, trace
-5	4	B		gravel (CL/ML)
				890.44
	3			
	2		14	Loose Brown, Moist SANDY LOAM, trace gravel (SM)
				888.44
	2			Medium Stiff
	2	0.8	17	Brown and Gray, Moist SILTY CLAY, trace sand and
-10	3	B		gravel (CL/ML)
	1			
	2	0.8	17	
	2	B		
				883.44 ▼
	2			Loose
	2		32	Brown, Wet SAND, trace gravel (SP)
-15	2			
	5			
				880.44
	7	1.3	12	Stiff
	8	B		Gray, Moist SILTY CLAY, trace gravel (CL/ML)
	6			Cobbles at 18.5-20 feet
	13	2.0	12	
-20	17	P		

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Description
				Stiff Gray, Moist SILTY CLAY, trace gravel (CL/ML) *(continued)*
	6			
	10	1.8	12	Cobbles at 21-22.5 feet
	13	P		
				873.44
	9			Medium Dense
	13		16	Brown, Wet SAND, trace gravel (SP)
-25	12			871.94
				End of Boring
-30				
-35				
-40				

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

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

SOIL BORING LOG

Date 3/24/20

ROUTE IL Route 72 **DESCRIPTION** IL Route 72 at State Street **LOGGED BY** PS

SECTION 32R-DR-1 **LOCATION** Hampshire, IL, **SEC.** , **TWP.** , **RNG.** ,
Latitude 42.088365, **Longitude** -88.5298707

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

STRUCT. NO. 045-2107
Station 500+99.77

BORING NO. OSB-1/CB-3
Station 500+64
Offset 17.31ft LT
Ground Surface Elev. 896.82 ft

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

Groundwater Elev.:
First Encounter 888.3 ft ▼
Upon Completion N/A ft
After N/A **Hrs.** N/A ft

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Description
				7 inches of Asphalt 7 inches of Concrete
				895.66
	3			Brown, Moist FILL: SILTY CLAY, with sand
	4 5	1.9 B	17	
				893.32
	3			Loose to Medium Dense Brown, Moist SAND, trace gravel (SP)
	3 3		13	
-5				
	6			Cobbles at 6-7.5 feet
	6 6		10	
				888.32 ▼
	7			Stiff to Very Stiff Brown, Moist SILTY CLAY, with sand, trace gravel (CL/ML)
	11 5	1.0 P	12	
-10				
	6			
	6 7	1.8 P	12	
	7			
	9 11	2.3 B	12	
-15				
	8			Cobbles at 16-17.5 feet
	7 8		13	
	4			
	8 9	1.9 B	10	
-20				

DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)	Description
				Stiff to Very Stiff Brown, Moist SILTY CLAY, with sand, trace gravel (CL/ML) *(continued)*
	3			
	7 8	1.3 B	23	
				873.32
	8			Very Stiff Brown, Moist SILTY CLAY, with sand, trace gravel (CL/ML)
	7 15	3.1 B	20	
-25				871.82
				End of Boring
-30				
-35				
-40				

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