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GEOTECHNICAL EXPLORATION/FASIBILITY STUDY REPORT FOR
New Concrete Ramp to Existing Pedestrian Bridge at 111 N. River Street
Batavia, Illinois

PROJECT NUMBER 2024-1301-14G

Prepared For

Mr. Jason Holy
V3 Companies
7325 Janes Avenue
Woodridge, IL 60517

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Mr. Jason Holy
V3 Companies
7325 Janes Avenue
Woodridge, IL 60517

Date: 11/29/2024

RE: Geotechnical Exploration/Feasibility Study Report for
New Concrete Ramp to Existing Pedestrian Bridge (Peace Bridge)
Located at 111 N. River Street
Batavia, Illinois

Dear Mr.Holy:

Following your written authorization on October 1, 2024, of our proposal dated August 9, 2024; we have completed this geotechnical exploration. Enclosed you will find the results of our field exploration, related laboratory testing, and geotechnical report. This report is the instrument of service defined in our proposal; we are also submitting electronic copies.

We have enjoyed working with you on this phase of the project. Should you have any questions or if we can be of further assistance, please do not hesitate to contact us.

Sincerely,
NASHnal Soil Testing, LLC

Umar T. Ahmad, PE
Registered Professional Engineer, Illinois
Registration # 062-055148

UMAR T. AHMAD
062-055148
REGISTERED PROFESSIONAL ENGINEER OF
ILLINOIS

Expires 11/30/2025

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GEOTECHNICAL EXPLORATION/FASIBILITY STUDY REPORT FOR New Concrete Ramp to Existing Pedestrian Bridge (Peace Bridge) Located at 111 N. River Street Batavia, IL

PROJECT NUMBER 2024-1301-14G

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INTRODUCTION

It is our understanding that the Village of Batavia is planning to build a concrete ramp to existing pedestrian bridge (Peace Br at 111 N. River Street in Batavia.

At the time of our initial site visit, the area next to the Fox River Trail pedestrian bridge over the Fox River was covered with grass & brushes. We understand that the Village of Batavia is planning to build a new concrete ramp to this existing pedestrian bridge.

The topography of the site was observed to be relatively flat with surface elevations ranging from 660 to 669 between our borings. Elevation was assigned based on GPS coordinates provided by the client and Google Earth. We strongly recommend that your project surveyor tie these elevations to National Geodetic Vertical Datum.

To evaluate the subsurface soil profile for the client requested to drill three (3) soil borings to a depth of 20 feet BEG.

Based upon our findings in this subsurface investigation, we believe that there are no major limiting geotechnical concerns present in the profile for the new bridge construction. Careful evaluation of the soils at the bottom of the open trench will be required during the construction.

SCOPE OF SERVICES

The purpose of this report is to describe the soil and groundwater conditions encountered in our geotechnical exploration, review and evaluate these conditions with respect to the proposed project and present our recommendations for subgrade support and earthwork design and construction. Our scope of services for this project, as outlined in our proposal, is limited to the following elements.

1. Exploration of the subsurface soil by drilling and sampling three (3) soil borings extending to a depth of 20.0 feet BEG.

2. Laboratory testing of selected samples for index classification and strength purposes and visual/manual classification of all recovered samples.

3. Development of Geotechnical recommendations, and preparation of this report presenting our findings, evaluations, and recommendations.

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FIELD EXPLORATION PROCEDURES

A total of three (3) soil borings extending to a depth of 3.5 to 7.5 feet BEG. The drilled soil boring locations are shown on the enclosed Plate 2 (Boring Location Diagram). The client specified the number, depth, and the locations of the borings.

The borings were drilled with a track mounted Geoprobe, using hollow stem augers to advance the borehole. The soil sampling was performed in accordance with the split-barrel procedure (ASTM: D 1586) with an automatic hammer, and in-situ undisturbed samples were retrieved using a split spoon sampler. The crew prepared field logs noting the drilling and sampling methods along with Standard Penetration Test values (N-values, “blows per foot”), observed groundwater levels, and preliminary soil classifications. Representative samples of the recovered soils were placed in sealed jars to reduce moisture loss before being submitted to our laboratory for examination, testing, and final classification by a Geotechnical Engineer.

If present, groundwater levels in the boreholes were measured during and after drilling. The levels of any encountered water are noted on the respective logs. The observed groundwater levels are discussed under the “Groundwater Conditions” section of this report. The drill crew backfilled the boreholes with soil cuttings after completing the groundwater measurements.

LABORATORY TESTING AND CLASSIFICATION

A Geotechnical Engineer initiated the laboratory classification program by examining each sample to determine the major and minor components, while also noting the color, degree of saturation, and lenses or seams found in the samples. The Engineer directed that selected samples be tested for moisture content and unconfined compressive strength (by hand penetrometer). The test results are shown on the respective logs in the Appendix.

The Geotechnical Engineer visually/manually classified the soils on the basis of texture and plasticity in accordance with the Unified Soil Classification System (USCS). The capital letters in parentheses following the written soil descriptions on the boring logs are estimated group symbols based on this system. A chart describing the properties of the groups under this system is also included in the Appendix. After the classification, the Geotechnical Engineer grouped the soils by type into the strata shown on the boring logs. The stratification lines shown are approximate, *in situ*, as the transition between soil types may be abrupt or gradual in both the horizontal and vertical directions.

Soil samples will be retained for ninety (90) days after the date of this report. Please notify us if there is a desire to have the samples retained beyond this period; otherwise, the samples will be discarded.

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SITE CONDITIONS

Topography/Surface Features

At the time of our initial site visit, the area next to the Fox River Trail pedestrian bridge over the Fox River was covered with grass and brushes. We understand that the Village of Batavia is planning to build a new concrete ramp to this existing pedestrian bridge.

Soil Conditions

The soils encountered are shown on the borehole log in the Appendix of this report. The soil characteristics have been established only at specific boring locations and under environmental conditions at the time of our field exploration. Variations in the soil stratigraphy, compressive strength of the soil, and moisture content were encountered; and additional variations probably exist between and around the borings. The nature and extent of these variations would not become evident until exposed by construction excavation.

In general, underlying the surficial silty clay topsoil and fill soils, the site is predominately formed of stiff to very stiff silty and sandy clay, loose to dense sand and gravel (weathered bedrock). The soil profile described below is a generalized description of the conditions encountered at the boring location. The borehole log should be referred to for more specific information.

In boring B-1, approximately 4 inches of topsoil (TS) was noted at the surface followed by medium dense, gray sandy gravel (weathered rock) (SP-GP) to an approximate depth of 3.5 feet BEG. Drilling was terminated at 3.5 feet BEG due to the auger refusal at bedrock. No Free groundwater was encountered during or after drilling.

In boring B-2, approximately 3 inches of topsoil (TS) was noted at the surface followed by loose, dark brown topsoil mix fill (FILL) to an approximate depth of 3.5 feet BEG. Drilling was terminated at 3.5 feet BEG due to the auger refusal at bedrock. No Free groundwater was encountered during or after drilling.

In boring B-3, approximately 4 inches of topsoil (TS) was noted at the surface followed by loose, dark brown topsoil mix fill (FILL) to an approximate depth of 6.0 feet BEG followed by very dense, light brown sandy gravel weathered rock (Rock) to an approximate depth of 7.5 feet BEG. Drilling was terminated at 7.5 feet BEG due to the auger refusal at bedrock. No Free groundwater was encountered during or after drilling.

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Groundwater Conditions

Groundwater level observations were made during and upon completion of drilling. No Free groundwater was encountered at all borings during or after drilling.

It should be noted that groundwater levels are subject to seasonal and long-term variations in response to climatic conditions and man-made influences. Groundwater levels particularly in less permeable cohesive soils (clay) like those found at the site occasionally, may not have had adequate time to stabilize prior to backfilling the boreholes. The hydrostatic groundwater level and any perched water levels will vary in elevation seasonally and annually depending on local amounts of precipitation, evaporation, surface-runoff, infiltration, and land use. If detailed information about the groundwater levels is required, we recommend installing piezometers or monitoring wells to permit long-term observation of the groundwater levels and the fluctuations in these levels.

Brown and gray coloration is typically an indication of a semi-permanent groundwater table. The brown and gray coloration of clay soils is indicative of oxidation whereas the gray coloration is indicative of a lack of oxidation which tends to occur below the lowest level of groundwater.

REVIEW AND RECOMMENDATIONS

Discussion

Based upon our analysis of the soil conditions, limited laboratory analysis and the available project information, the following recommendations were developed. If the project characteristics are changed from those assumed herein, our recommendations should be reviewed to see whether any modifications are needed. Any areas found to be unsuitable within foundation excavation should be undercut further and replaced with newly approved compacted granular fill material.

Site Preparation

After excavation for the ramp, the exposed, naturally occurring subgrade soils should be observed and tested by a Geotechnical Engineer or an experienced Materials Technician from **NASHnal Soil Testing, LLC** office to identify unsuitable soils if encountered. Existing above and underground utilities, if encountered/located withing the proposed construction areas, if affected by construction activities, should be relocated prior to excavation. Debris generated from the demolition of underground utilities, including abandoned pipes, structures, should be removed from the site as construction proceeds.

The exposed, naturally occurring subgrade soil should be observed and tested by a Geotechnical Engineer or an experienced Materials Technician from **NASHnal Soil Testing, LLC** office to identify the unsuitable soils. The subgrade soil should be carefully observed, and any unsuitable or unstable materials should be removed from the pavement subgrade areas. If perched water is encountered or if rain or snowfall occurs, dewatering may be required in these areas when exposed or if subjected to any other form of water infiltration that would saturate the area.

To backfill the over-excavated areas if any under the foundation, we recommend using imported granular material meeting the gradation requirements of IDOT CA-6. Clayey soils can also be used as backfill, however, it is difficult to compact clayey soils in the narrow trenches in order to achieve the project specifications.

Granular fill meeting the CA-6 gradation specifications should be placed in 8 to 10-inch loose lifts and compacted to at least 95% of the maximum Modified Proctor dry density (ASTM: D 1557). If used, clayey materials should be placed in 6 to 8-inch loose lifts and compacted to at least 95% of the maximum Modified Proctor dry density (ASTM: D 1557) or 98% of the maximum Standard Proctor dry density (ASTM: D 698). Please refer to the notes in the report Appendix concerning placement of compacted fill soils.

Foundation Support

NST evaluated the shallow (Spread, Slab or Pier) foundation system for the proposed ramp. Based on the subsurface conditions encountered and the preliminary design information provided by the structural engineer, the proposed ramp can be supported by shallow foundation system.

The footings for the proposed ramp can be supported at a depth of about 3.5 to 4 feet below the exterior finish grade. As revealed by the soil borings, the existing soils at the proposed footing subgrade will mostly be comprised of dense to very dense sandy gravel (SP-GP) weathered bedrock at all of our borings. When any unsuitable fill material is encountered within the proposed ramp's footprint, an appropriate oversize zone will be required to be removed. Void created in doing so should be backfilled with compacted granular fill. Any existing utilities or drain tiles, if encountered should also be removed and trenches should be backfilled with compacted granular fill.

Care should be exercised so as not to disturb the bearing soils encountered at the bottom of excavation. The exposed foundation subgrade should be carefully observed by our representative to verify that the footings will be placed on suitable bearing materials. Representative hand auger borings should be performed in the excavations (if placed on soil) to verify that the materials at the foundation subgrade resemble those described on the Boring Logs. Any unsuitable, mixed, unstable, or low bearing soils should be completely removed from the footing areas. The required excavation to remove the low bearing or unstable soils should be carried out covering a zone within a 1 horizontal to 1 vertical plane extended downward and outward from the outer limits of the proposed footings. Over excavated areas should be backfilled with compacted load-bearing fill as mentioned previously.

In our opinion, the proposed ramp may be supported on spread, slab or pier footings after the recommended site preparation and foundation bearing materials observation has been

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completed. For frost protection, footings for the structure should bear at least 4.0 feet below exterior ground surface. Provided that all the unsuitable/unstable soils are removed from the foundation areas or soils have been upgraded and foundations are placed on properly compacted load bearing fill placed to remove the unstable materials, The shallow ramp footings can be proportioned for a maximum net allowable bearing pressure of 3,000 pounds per square foot (psf) for Pier or Slab footing. This refers to the pressure transmitted to the soil in excess of the pressure from the adjacent depth of overburden.

We recommend that ramp footings should have a minimum width of 48 inches, regardless of the contact pressure, to preclude shear distortion. The recommended bearing pressure would provide a factor of safety of at least 3 with respect to the bearing capacity of the bearing strata. We estimate that the maximum building settlement would be about one inch, with differential settlement about 3/4 of this amount, if the bearing stratum is not wet, frozen, or disturbed at the time of construction. As an alternative to the compacted granular soil backfill, the undercuts can also be backfilled using lean (low strength) concrete and would not require lateral over-sizing.

For standard ramp foundation system, we recommend that the backfill around new foundations and in utility trenches (if any) be granular material, for relative ease of compaction in confined spaces. The fill should be placed in loose lifts about 4 to 6 inches thick and uniformly compacted with manually operated equipment to at least 95% of the maximum Modified Proctor dry density (ASTM D1557).

CONSTRUCTION CONSIDERATIONS

Groundwater

Based on the conditions found in the borings, no groundwater is expected during the excavation for footings or during the soil improvement process. Any water which enters excavations from perched groundwater seepage, surface run-off, or direct precipitation, must be promptly pumped out. Water must not be allowed to pond on the subgrade soils since it could soften and disturb them. The contractor should be prepared to handle both surface and groundwater encountered during the construction. The contractor shall plan an appropriate dewatering scheme so that all construction activities are performed in dry and stable conditions, especially to avoid potential post construction settlement in sandy materials with shallow groundwater.

Structural fill and concrete should not be placed in standing water or on wet or disturbed soils. Placing fill, asphalt, or concrete into standing water or over disturbed soil can trap softened soil under the structure and lead to excessive post-construction settlement/cracking & rutting, even if the softened zone is only a few inches thick.

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Equipment Selection/Soil Disturbance

The soil types at this site, particularly the silty clays when they are saturated or during freeze/thaw conditions, could be disturbed by construction equipment. It is the contractor's responsibility to choose equipment and work procedures, which will not unduly disturb the subgrade soils in the construction and landscaped areas. The contractor should also route construction traffic away from areas of planned pavement and slabs, to minimize soil disturbance.

If the equipment that is chosen causes rutting or pumping of the soil, it is the contractor's responsibility to switch to other types of equipment. The responsibility to properly select construction equipment to avoid disturbing soil on the site lies solely with the contractor. A note to this effect should be included in the project specifications.

Winter Construction

If the construction of this project begins or extends into the winter, the contractors must take special precautions. Only unfrozen fill and backfill should be used, and contractors may charge extra for importing unfrozen soil or keeping stockpiles of backfill from freezing. Clay soil will be especially difficult to work with under cold wet and/or freezing conditions. Placement of fill and/or asphalt/concrete must not be permitted on frozen soil, and the bearing soils or subgrade should not be allowed to freeze after the concrete is placed. All footing excavations should be protected from freezing conditions and maintained free of ponded water before asphalt/concrete placement. The footings should be cast as soon as possible after excavation is prepared and backfilled as soon as possible after the concrete has attained its strength.

Construction Safety

All excavations must comply with the requirements of OSHA 29 CFR, Part 1926, Subpart P "Excavations and Trenches." This document states that excavation safety is solely the responsibility of the contractor; the determination of SAFE slopes for excavation and trenches is to be made by the contractor’s “competent person.” Reference to this OSHA requirement should be included in the job specifications. The temporary excavation slopes greater than 5 feet in depth should conform to OSHA regulations. In general, such slopes should not be steeper than 1.5 horizontal to 1 vertical (OSHA Soil Type C), unless shoring is used.

The responsibility to provide safe working conditions on this site for earthwork, construction, or any associated operations, is not borne in any manner by NASHnal Soil Testing, LLC.

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Field Observation and Testing

Proper observation and testing during the construction phase of this project is an integral part of our recommendations. On-site observation during site preparation, fill placement, compaction, and footing construction, should be done by qualified personnel from **OUR** office. Exposed soils in excavations for backfill should be tested by means of hand auguring, and with a Dynamic Cone Penetrometer (DCP) in granular soils or a Static Cone Penetrometer (SCP) in clayey soils.

Proposed fill materials should be submitted to our lab for Proctor compaction tests, and tests to check compliance with our recommendations and project specifications. A representative number of field density tests should be taken in compacted fill to aid in judging its suitability. The building materials should be tested in accordance with the project specifications. We would be pleased to provide the testing services for this project.

GENERAL QUALIFICATIONS

This report has been prepared based on the soil and groundwater conditions found in our borings and on the design data that you have related to us. This report is intended solely for this project at the specific locations identified in the Introduction and Scope of Services. If there are any changes in size, scope, elevation, structural loads, location, use or nature of the structure from those discussed in the introduction of this report, or if our understanding of the project is incorrect or incomplete, we should be given the opportunity to review or modify our recommendations. If changes are made in the design and we are not given the opportunity to review these changes relative to our recommendations and to respond in writing, or we are not provided the opportunity to confirm the soil conditions are as expressed in this report during the construction of this project, our recommendations will not be considered valid. No specific efforts were performed to determine the thickness of the topsoil layer, the topsoil thickness given in our logs is an estimate. If the true thickness of topsoil is required, we recommend that numerous detailed hand augur probes be performed throughout this parcel.

For this geotechnical exploration, we drilled three (3) soil boring in the specified areas. Variations in the subsurface conditions may be found during construction, and it is probable that additional variations exist on the site that cannot be determined from our boring or the site reconnaissance. These variations, which could include greater or shallower depths of unsuitable soils than found at our borings, would not become apparent until the excavation is started. No warranty, express or implied, is presented in this report with respect to the soil and groundwater conditions on this site.

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STANDARD OF CARE

The recommendations and opinions contained in this report are based on our interpretation of the subsurface conditions and represent our professional judgment. These judgments were determined in accordance with currently accepted engineering practices at this time and location, by professionals working under similar time and budget constraints. No other warranty is implied or intended.

Prepared by:

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Registered Professional Engineer, Illinois
Registration # 062-055148

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APPENDIX

SITE LOCATION DIAGRAM (Plate No. 1)

BORING LOCATION DIAGRAMS (Plate No. 2)

BORING LOGS (Plate No. 3 to 5)

KEY TO TEST DATA

CLASSIFICATION OF SOILS

NOTES ON PLACEMENT OF COMPACTED FILL

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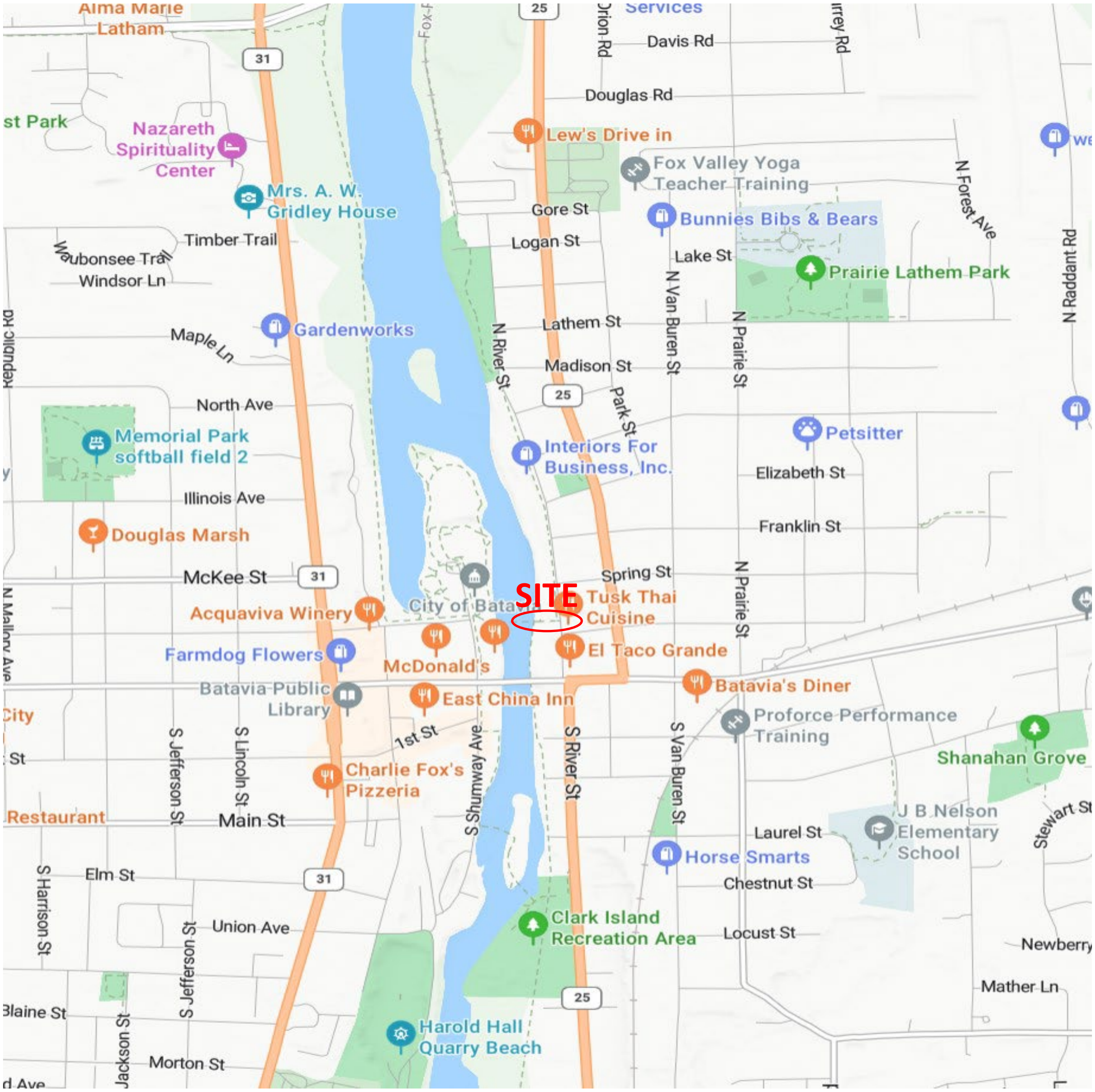
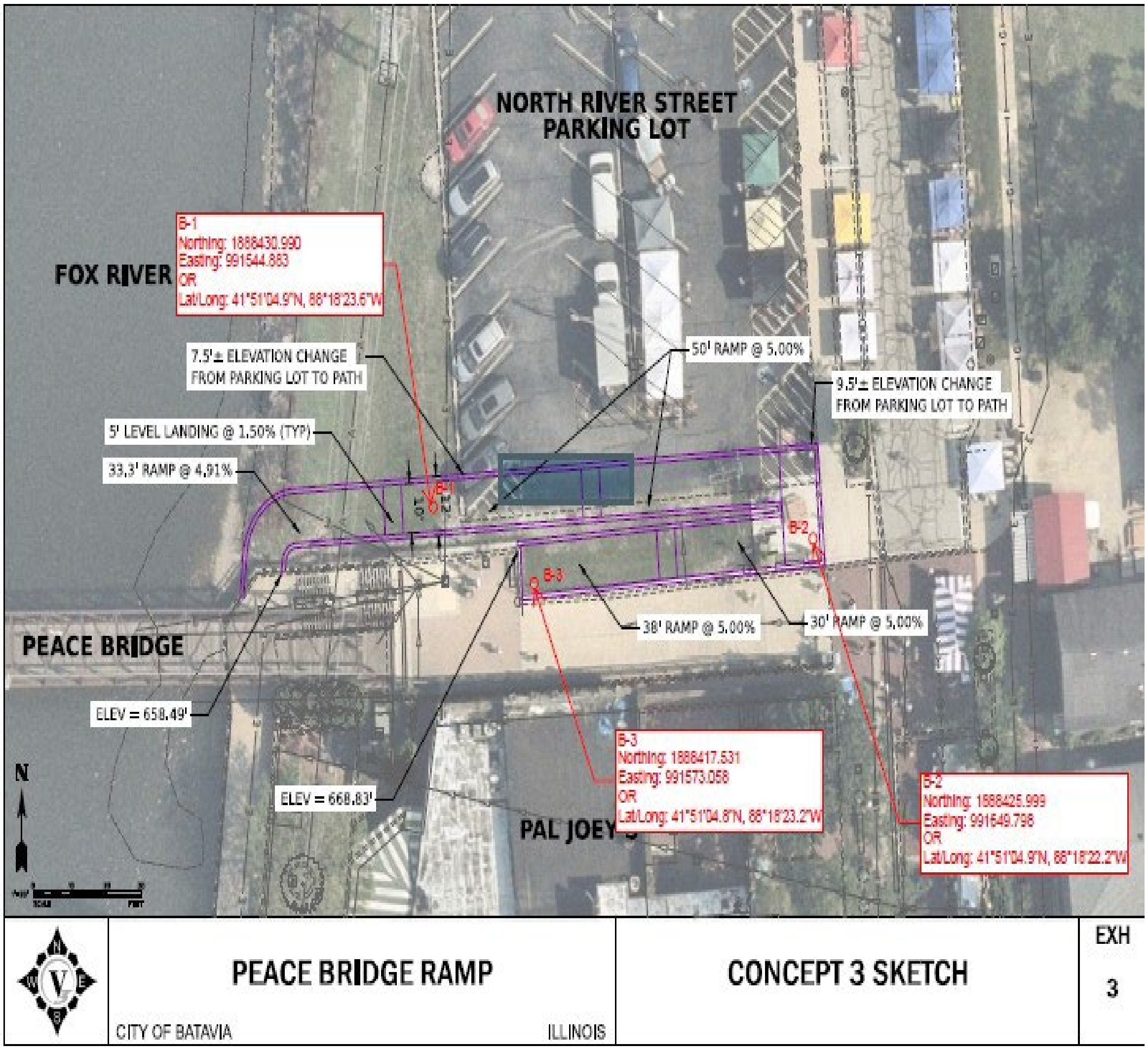


2024-1301-14G **Plate No. 1**

New Concrete Ramp to Existing Pedestrian Bridge at
111 N. River Street
Batavia, IL-60510



2024-1301-14G

Plate No. 2

New Concrete Ramp to Existing Pedestrian Bridge at
111 N. River Street
Batavia, IL-60510
Boring Location Diagram

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BOREHOLE LOG		Number B-1
Client	V3 Companies	**Plate 3**
Location	Ramp to Existing Pedestrian Bridge-111 N. River St., Batavia, IL-60510	
Job Number	2024-1301-14G	
Drill Rig Type	Geoprobe 7822	
Sampler Type	Split Spoon (SS)	
Boring Location	See Plate 2 (1888430.990N, 991544.883 E)	
Boring Elevation (ft)	660.00	**Date:** 11/20/2024

Sample #	Sampling Method	Qp (tsf)	Sample Recovery (in)	Moisture Content (%)	Driving Resistance Blows/Ft (N)	Depth (ft)	Sample Depth	Graphic	Soil Description	Elevation (ft)
						0.5		TS	**4 inches of Top Soil**	659.50
						1.0		SP-GP	**Gray Sandy Gravel (SP-GP)**	659.00
						1.5			Medium Dense-Weathered Bedrock	658.50
1	SS	N/A	2.0	NA	25.0	2.0				658.00
						2.5				657.50
						3.0				657.00
						3.5			Auger Refusal at 3.5' - Bedrock	656.50

End of Boring at 3.5'

Water Level While Drilling : None

Water Level After Drilling : None

Cave In Depth : None

Note: Soil group symbol and group name are determined based on visual classification. Plasticity index and liquid limit were estimated using ASTM D2488 due to insufficient material availability

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BOREHOLE LOG

Number **B-2**

Client	V3 Companies **Plate 4**
Location	Ramp to Existing Pedestrian Bridge-111 N. River St., Batavia, IL-60510
Job Number	2024-1301-14G
Drill Rig Type	Geoprobe 7822
Sampler Type	Split Spoon (SS)
Boring Location	See Plate 2 (1888425.999N, 991649.798 E)
Boring Elevation (ft)	669.00 **Date:** 11/20/2024

Sample #	Sampling Method	Qp (tsf)	Sample Recovery (in)	Moisture Content (%)	Driving Resistance Blows/Ft (N)	Depth (ft)	Sample Depth	Graphic	Soil Description	Elevation (ft)
						0.5		TS	**3 inches of Top Soil**	668.50
						1.0		FILL	**Dark Brown Topsoil Mix Fill (FILL)**	668.00
						1.5			Traces Gravel and Rock-Loose	667.50
1	SS	N/A	18.0	25.1	7.0	2.0				667.00
						2.5				666.50
						3.0				666.00
					50/4"	3.5			Auger Refusal at 3.5' - Bedrock	665.50

End of Boring at 3.5'

Water Level While Drilling : None

Water Level After Drilling : None

Cave In Depth : None

Note: Soil group symbol and group name are determined based on visual classification. Plasticity index and liquid limit were estimated using ASTM D2488 due to insufficient material availability

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BOREHOLE LOG — **Number B-3**

Client	V3 Companies	**Plate 5**
Location	Ramp to Existing Pedestrian Bridge-111 N. River St., Batavia, IL-60510	
Job Number	2024-1301-14G	
Drill Rig Type	Geoprobe 7822	
Sampler Type	Split Spoon (SS)	
Boring Location	See Plate 2 (1888417.531N, 991573.058 E)	
Boring Elevation (ft)	664.00	**Date:** 11/20/2024

Sample #	Sampling Method	Qp (tsf)	Sample Recovery (in)	Moisture Content (%)	Driving Resistance Blows/Ft (N)	Depth (ft)	Sample Depth	Graphic	Soil Description	Elevation (ft)
						0.5		TS	**4 inches of Top Soil**	663.50
						1.0		FILL	**Dark Brown Topsoil mix Fill (FILL)**	663.00
						1.5			Traces Gravel and Rock-Loose	662.50
1	SS	N/A	12.0	27.4	7.0	2.0				662.00
						2.5				661.50
						3.0				661.00
						3.5				660.50
						4.0				660.00
2	SS	N/A	6.0	24.8	9.0	4.5				659.50
						5.0				659.00
						5.5				658.50
						6.0				658.00
						6.5		ROCK	**Light Brown Weathered Rock (Rock)**	657.50
3	SS	N/A	2.0	4.8	50/3"	7.0			Weatherd Rock-Very Dense	657.00
						7.5			Auger Refusal at 7.5' - Bedrock	656.50

End of Boring at 7.5'

Water Level While Drilling : None

Water Level After Drilling : None

Cave In Depth : None

Note: Soil group symbol and group name are determined based on visual classification. Plasticity index and liquid limit were estimated using ASTM D2488 due to insufficient material availability

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KEY TO TEST DATA

DRILLING & SAMPLING SYMBOLS:

SL	=	SS with Liner
SS	=	Split Spoon — 1%" I.D., 2" O.D., unless otherwise noted
ST	=	Shelby Tube — 2" O.D., unless otherwise noted
PA	=	Power Auger
DB	=	Diamond Bit — NX: BX: AX
AS	=	Auger Sample
JS	=	Jar Sample
VS	=	Vane Shear
ST	=	3" Shelby Tube
HS	=	Hollow Stem Auger
WS	=	Wash Sample
FT	=	Fish Trail
RB	=	Rock Bit
BS	=	Bulk Sample
PM	=	Pressuremeter test—in situ

Standard "N" Penetration = Blows per foot of a 140 pound hammer falling *30* inches on a 2-inch OD split spoon, except where noted.

WATER TABLE MEASUREMENT SYMBOLS

WL	=	Water Level
WCI	=	Cave In
DCI	=	Dry Cave In
WS	=	While Sampling
WD	=	While Drilling
BC	=	Before Casing Removal
ACR	=	After Casing Removal
AB	=	After Boring

Water levels indicated on the boring logs are the levels measured in the boring at the times indicated. In pervious soils, the indicated elevations are considered reliable ground water levels. In impervious soils, the accurate determination of ground water elevations is not possible even after several days observation, and additional evidence of ground water elevations must be sought.

GRADATION DESCRIPTION & TERMINOLOGY

Coarse Grained or Granular Soils have more than 50% of their dry weight retained on a #200 sieve; they are described as: boulders, cobbles, gravel or sand. Fine Grained Soils have less than 50% of their dry weight retained on *a* #200 sieve; they are described as: clays or clayey silts if they are cohesive, and silts if they are non-cohesive. In addition to gradation, granular soils are defined on the basis of their relative in-place density and fine grained soils on the basis of their strength or consistency, and their plasticity.

Major Component Of Sample	Size Range	Descriptive Term(s) (Of Components Also Present in Sample)	Percent of Dry Weight
Boulders	Over 8 in. (200mm)	Trace	1 — 9 .
Cobbles	8 in. to *3* in. (200mm to 75mm)	Little	10 — 19
Gravel	*3* in. to #4 sieve (75mm to 2mm)	Some	20 — 34
Sand	#4 to #200 sieve (2mm to .074mm)	And	35 — 50
Silt	Passing #200 sieve (0.074mm to 0.005mm)		
Clay	Smaller than 0.005mm		

CONSISTENCY OF COHESIVE SOILS

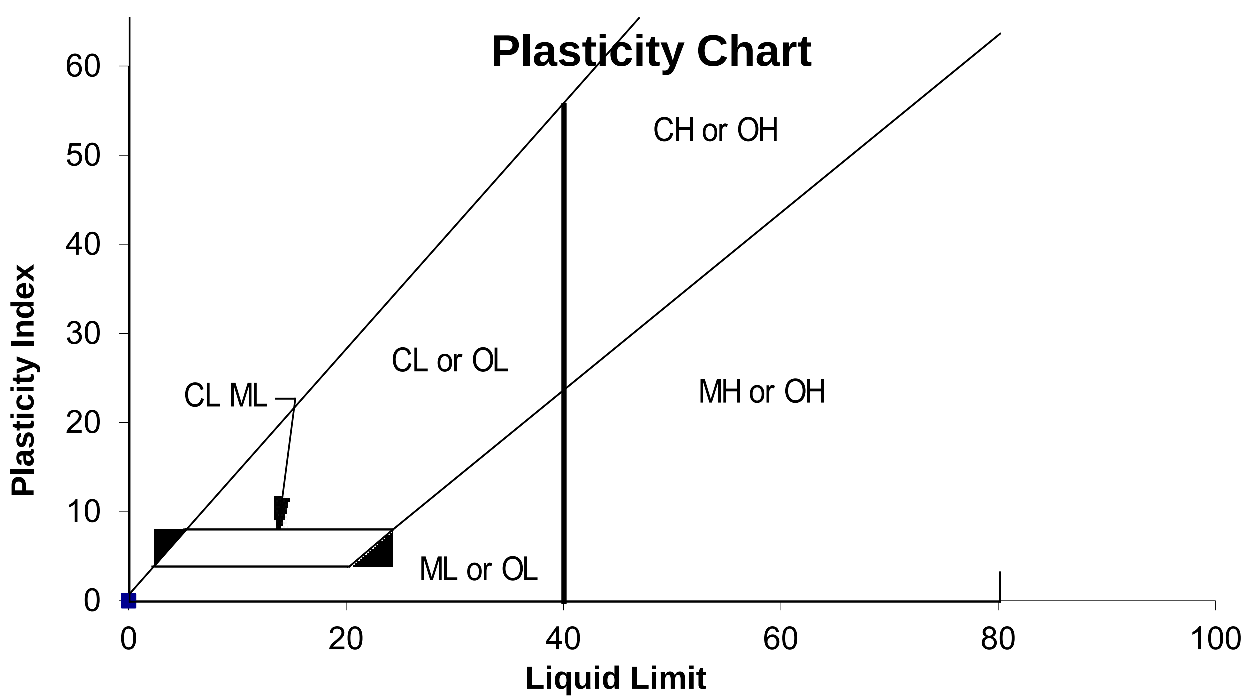
Unconfined Comp. Strength, Qu, tsf	Consistency
<0.25 —	Very Soft
0.25— 0.49	Soft
0.50 — 0.99	Medium (Firm)
1.00— 1.99	Stiff
2.00 — 3.99	Very Stiff
4.00 — 8.00	Hard
>8.00	Very Hard

RELATIVE DENSITY OF GRANULAR SOILS

N — Blows/ft.	Relative Density
0 — 3	Very Loose
4 — 9	Loose
10 — 29	Medium Dense
30 — 49	Dense
50 — 80	Very Dense
80 +	Extremely Dense

UNIFIED SOIL CLASSIFICATION CHART

CRITERIA FOR ASSIGNING GROUP NAMES & GROUP SYMBOLS USING LABORATORY TEST RESULTS				Soil Classification: Group Symbol	Soil Classification: Group Name
COURSE-GRAINED SOILS More than 50% retained on #200 Sieve	**GRAVELS** More than 50% of course fractions are retained on #4 sieve	**CLEAN GRAVELS** Less than 5% fines	Cu ≤ 4 and 1 ≤ Cc ≤ 3	**GW**	Well Graded Gravel
			Cu < 4 and/or 1 > Cc > 3	**GP**	Poorly Graded Gravel
		GRAVELS With more than 12% fines	Fines classify as ML or MH	**GM**	Silty Gravel
			Fines classify as CL or CH	**GC**	Clayey Gravel
	SANDS 50% or more of course fractions passes #4 sieve	**CLEAN SANDS** Less than 5% fines	Cu ≤ 6 and 1 ≤ Cc ≤ 3	**SW**	Well Graded Sand
			Cu < 6 and/or 1 > Cc > 3	**SP**	Poorly Graded Sand
		SANDS With more than 12% fines	Fines classify as ML or MH	**SM**	Silty Sand
			Fines classify as CL or CH	**SC**	Clayey Sand
FINE-GRAINED SOILS 50% or More Passed the #200 Sieve	**SILTS & CLAYS** Liquid Limit Lower than 50%	Inorganic	PI > 7 and plots on or above "A" line	**CL**	Non to Low Plasticity Clay
			PI < 4 and plots below "A" line	**ML**	Silt
		Organic	$\frac{\text{Liquid Limit (Oven Dried)}}{\text{Liquid Limit (Not Dried)}} < 0.75$	**OL**	Organic Clay or Silt
	SILTS & CLAYS Liquid Limit 50% or Higher	Inorganic	PI plots on or above "A" line	**CH**	Highly Plastic Clay
			PI plots below "A" line	**MH**	Elastic Silt
		Organic	$\frac{\text{Liquid Limit (Oven Dried)}}{\text{Liquid Limit (Not Dried)}} < 0.75$	**OH**	Organic Clay or Silt
Highly Organic Soils		Primarily organic material, darker and with organic odor		**PT**	Peat



NOTES ON PLACEMENT OF COMPACTED FILL SOIL

GENERAL

The placement of compacted fill for support of foundations, floor slabs, pavements, or earth structures should be carried out by an experienced excavator with the proper equipment. The excavator must be prepared to adapt his procedures, equipment, and materials to the type of project, to weather conditions, and the structural requirements of the architect and engineer. Methods and materials used in summer may not be applicable in winter; fill used in dry excavations may not be suitable in wet excavations or during periods of precipitation; proposed fill soil may require wetting or drying for proper placement and compaction. Conditions may also vary during the course of a project or in different areas of the site. These needs should be addressed in the project drawings and specifications.

EXCAVATION/BACKFILL BELOW THE WATER TABLE

It is common to have to excavate and replace unsuitable soils below the water table for site correction. As a general rule of prudent construction technique, we recommend that excavation/backfill below the water table not be permitted, unless the excavation is dewatered. Numerous problems can develop when this procedure is attempted without dewatering.

- Inability of the equipment operators and soil technicians to observe that all unsuitable soil/materials have been removed from the base of the excavation.
- Inability to observe and measure that proper lateral oversizing is provided.
- Inability to prevent or correct sloughing of excavation sidewalls, which can result in unsuitable soils trapped within the select backfill.
- Inability of the contractor to adequately and uniformly compact the backfill.
- Possibility of disturbance of the suitable soils at the base of the excavation.

The dewatering methods, normally chosen at the contractor's option, should follow prudent construction practice. Excavations in clay can often be dewatered with sump pits and pumps; this technique would not be applicable for excavation extending into permeable granular soil, especially for depths significantly below the water table. Dewatering granular soils should normally be done with well points or wells. When dewatering is needed, we strongly recommend that the procedures be discussed at pre-bid or pre-construction meetings. The architect and engineer should review the dewatering technique chosen by the contractor before construction starts; it should not be left until excavation is under way.

The selection of proper backfill materials is important when working in dewatered excavations. Even with dewatering, the base is usually wet and the contractor must be careful not to disturb the base. We recommend that the first lifts of backfill be a clean medium to course grain sand with less than 5% passing the #200 sieve. The use of silty sand, clayey sand, or cohesive/semi-cohesive soils is not recommended for such situations. The excavator should be required to submit samples of the proposed material(s) he plans to use as backfill before the fill is hauled to the site, so that it can be tested for suitability.

WINTER EARTHWORK CONSTRUCTION

Winter earthwork presents its own range of problems, which must be overcome; the situation may be complicated by the need for dewatering discussed above.

During freezing conditions, the fill used must not be frozen when delivered to the site. It also must not be allowed to freeze during or after compaction. Since the ability to work the soil while keeping it from freezing depends in part on the soil type, the specifications should require the contractor to submit a sample of his proposed fill before construction starts, for laboratory testing. If the soil engineer and structural engineer determine that it is not suitable, it should be rejected. In general, silty sand, clayey sand, and cohesive/semi-cohesive soils should not be used as fill under freezing conditions. All frozen soil of any type should be rejected for use as compacted fill.

It is important that compacted fill be protected from freezing after it is placed. The excavator should be required to submit a plan for protecting the soil. The plan should include details on the type and amount of material (straw, blankets, extra loose fill, topsoil, etc.) proposed for use as frost protection. The need to protect the soil from freezing is ongoing throughout construction and applies both before and after concrete is placed, until backfilling for final frost protection is completed. Foundations placed on frozen soil can experience heaving and significant settlement, rotation, or other movement as the soil thaws. Such movement can also occur if the soil is allowed to freeze after the concrete is placed and then allowed to thaw. The higher the percentage of fines (clay and silt, P-200 material) in the fill, the more critical is the need for protection from freezing.