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Structural Geotechnical Report
Bridge Construction Project
Devon Avenue Over I-94
Cook Couty
Structure Number: 016-0834 (Existing)
Structure Number: 016-0840 (Proposed)
Section: FAI 94 22 Structure 1
Project: 17VU (753)

Prepared For

Illinois Department of Transportation

Project Design Engineer Team:
Baxter & Woodman

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Mr. Denis Hogan, P.E.
Baxter & Woodman
8678 Ridgefield Road
Crystal Lake, IL-60012

Date:12-7-2023

RE: **Structural Geotechnical Report**
Bridge Construction Project
Devon Avenue Over I-94
Cook Couty
Structure Number: 016-0834 (Existing)/016-0840 (Proposed)

Dear Mr. Hogan:

Following your authorization on March 9, 2023; we have completed this Structural Geotechnical Report for the above referenced project. The report provides a brief description of the site investigation, site conditions and foundation recommendations. The site investigation included advancing fifteen (15) soil borings for the bridge improvements to depths ranging from 3.5 to 87 feet. The foundation recommendations include supporting the proposed abutments and piers on driven piles or drilled shafts.

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
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OF
ILLINOIS

Expires 11/30/2025

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Structural Geotechnical Report

Bridge Construction Project

PTB 204-11, Job No. D-91-157-22, FAI 94

Route: FAP 1349 (Devon Avenue), Cook County

Structure Number: 016-0834 (Existing) /016-0840 (Proposed)

INTRODUCTION

NASHnal Soil Testing LLC (NST) completed a geotechnical investigation for the construction of a new Devon Avenue Bridge over I-94 in Cook 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

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EXISTING AND PROPOSED STRUCTURE INFORMATION

The existing bridge at Devon Avenue, Structure number 016-0834, was first constructed in 1949 and was reconstructed in 1979. The bridge consists of a 4-span structure with 2 approach slabs. The main spans of the existing bridge structure consist of steel continuous beams with a cast-in-place concrete deck. The total length of the structure is 231.2 feet with the largest span of 63.0 feet, and an out-to-out deck width of 68.2 feet. Bridge information was provided by the latest Structure Summary Report.

The existing bridge will be reconstructed, and preliminary TS&L information has been provided regarding the new proposed bridge by Baxter & Woodman.

SITE CONDITIONS

Devon Road runs east-west and crosses over I-94 from residential area to the west and commercial area to the east. The embankment side slopes on the east and west sides of the bridge appear to be approximately 1:2 (V:H) from the abutments as shown in Exhibits 2 and 3.

Exhibit 2 Devon Avenue over I-94 (Eastbound on I-94)

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Exhibit 3 Devon Avenue over I-94 (Westbound on I-94)

SCOPE OF SERVICES

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

1. Exploration of the subsurface soil and groundwater conditions by drilling and sampling fifteen (15) soil borings extending to a depths ranging from 10 to 87 feet below the existing ground surface (BEG).

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

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

FIELD EXPLORATION PROCEDURES

A total of fifteen (15) soil borings were drilled. Five bridge borings were drilled to a depth of 84-87 feet below existing grade, with two at 3.5* ft, one at 5.0* feet and seven borings to a depth 20.0 feet below existing grade. The drilled soil boring locations are shown on the enclosed Plates 1 & 2 (Boring Location Diagrams). The client specified the number, depths, and locations of the borings.
*Borings encountered obstructions

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The borings were drilled using a track-mounted Mobile B-57 drill rig, using hollow stem augers to advance the boreholes. 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-maintained field logs noting the drilling and sampling methods, along with Standard Penetration 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 AASHTO Soil Classification System. The 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 drilling. Please notify us if there is a desire to have the samples retained beyond this period; otherwise, the samples will be discarded.

Groundwater Conditions

Groundwater level observations were made during and upon completion of drilling. Free groundwater was not encountered during or after drilling in any of our borings. 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, may not have had adequate time to stabilize prior to backfilling the boreholes. The hydrostatic groundwater level and any perched water levels will

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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 a piezometer or monitoring wells to permit long-term observation of the groundwater levels and the fluctuations in these levels.

Gray coloration is typically an indication of a semi-permanent groundwater table. The brown/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.

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.

A Subsurface Exploration Program

The site subsurface exploration was conducted between September 20 and November 4, 2023. The borings included advancing a total of fifteen (15) standard penetration test (SPT) borings within the vicinity of the proposed bridge pier and abutment locations. The locations of the soil borings were provided by Baxter & Woodman and were completed based on field conditions and accessibility. Table 1 presents a list of the borings completed along with their location information.

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Table 1 – Summary of Subsurface Exploration

Boring ID	Location	Offset	Boring Date	Depth (feet)	Surface Elevation (feet)	Bottom Depth Elevation
RB-01	52+22.09	20.41 LT	9/25/23	5*	616.936	611.936
BB-02	51+51.93	21.48 RT	9/21/23	85	619.307	534.307
WB-03	50+42.00	56.36 RT	9/28/23	20	603.877	583.877
BB-04	48+38.17	21.20 RT	9/20/23	85	619.158	534.158
BB-05	48+51.11	22.58 LT	9/22/23	85	619.855	534.855
RB-06	47+58.23	22.64 LT	9/22/23	3*	615.976	612.976
BB-07	51+29.63	23.75 LT	9/25/23	85	620.501	535.5
WB-08	50+29.40	81.24 RT	9/28/23	20	603.455	583.455
WB-09	50+80.83	80.47 LT	9/29/23	20	603.877	583.877
WB-10	49+64.09	63.79 LT	9/29/23	20	603.679	583.679
WB-11	49+26.02	48.60 RT	9/29/23	20	603.578	583.578
BB-12	50+17.00	39.00 RT	11/28/23	3.5 *	603.53	600.03
BB-13	50+45.00	60.28 LT	11/4/23	87	603.76	516.76
B-14	55+42.65	25.13 LT	10/2/23	20	611.501	591.501
B-15	53+97.17	24.85 LT	10/2/23	20	612.421	592.421

*Borings encountered obstructions at the depth noted

The existing ground surface elevations and station numbers shown in the soil boring logs were provided by Baxter & Woodman. The approximate locations of the soil borings are shown on the Boring Location Map.

The soil borings were drilled using a truck mounted Mobile B-57 drill rig. All the borings were drilled using 3¼-inch I.D. hollow stem augers. Soil sampling was performed according to AASHTO T 206, "Penetration Test and Split Barrel Sampling of Soils." Soil samples were obtained at 2.5-foot intervals to a minimum depth of 20 feet below existing grade, and 5-foot intervals thereafter. NASHnal Soil Testing 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.

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B Laboratory Testing Program

All samples were inspected in the laboratory to verify the field classifications. A laboratory testing program was undertaken to characterize and determine engineering properties of the subsurface soils encountered in the area of the proposed bridge.

The following laboratory tests were performed on representative soil samples:

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

The laboratory tests were performed in accordance with test procedures outlined in the IDOT Geotechnical Manual (1999), and per ASTM and AASHTO requirements. Based on the laboratory test results, the soils encountered were classified according to the AASHTO and the Illinois Division of Highways (IDH) classification systems. The results of the laboratory testing program are included in the Appendix.

SUBSURFACE CONDITIONS

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

ROADWAY

RB-1, Station 52+22.09-20.41' LT:

The Boring RB-1 was drilled in the westbound lane 2 before the approach slab on WB Devon Avenue. At RB-1, approximately 6 inches of asphalt (AS) and 12 inches of Aggregate Base (CONC) were noted at the surface followed by very stiff, brown SILTY CLAY (A-4) to an approximate depth of 3.5 feet below existing grade BEG. Underlying the brown SILTY CLAY (A-4), very stiff, dark brown SILTY CLAY (A-4) was encountered to the boring termination depth of 5.0 feet BEG. The boring was terminated at 5.0 feet below grade due to obstruction. No free groundwater was encountered during or after drilling.

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RB-6, Station 47+58.23-22.64 LT:

The Boring RB-6 was drilled in the East approach slab at westbound Devon. At RB-6, approximately 8 inches of asphalt (AS) and 8 inches of crushed concrete (CONC) were noted at the surface followed by loose, brown SAND AND GRAVEL (A-1-a) to the boring termination depth of 3.5 feet BEG. The boring was terminated at 3.5 feet BEG due to obstruction. No free groundwater was encountered during or after drilling.

RETAING WALLS/ABUTMENT WING WALLS

WB-3, Station 50+42-81.36 RT:

The WB-3 was drilled at westbound I-94 shoulder, South of Devon Ave. At WB-3 approximately 16 inches of asphalt (AS) and 12 inches of aggregate base (AGG) were noted at the surface followed by loose to very loose, brown SAND (A-1-b) to an approximate depth of 8.5 feet BEG followed by stiff, brown AILTY CLAY (A-4) to an approximate depth of 13.5 feet BEG. Underlying the brown SILTY CLAY (A-4), stiff to very stiff, gray SILTY CLAY (A-4) was encountered to the boring termination depth of 20.0 feet BEG. No free groundwater was encountered during or after drilling.

WB-8, Station 50+29.40-Offset 81.24' RT:

The Boring WB-8 was drilled at westbound I-94 shoulder, South of Devon Ave. (South of boring WB-3). At WB-8 approximately 16 inches of asphalt (AS) was noted at the surface followed by medium dense, brown SAND (A-1-b) to an approximate depth of 3.0 feet BEG. Underlying the brown SAND (A-1-b), stiff to very stiff, brown LEAN CLAY (A-6) was encountered to the boring termination depth of 20.0 feet BEG. No free groundwater was encountered during or after drilling.

WB-9, Station 50+80.83-80.47 LT:

The WB-9 was drilled at westbound I-94 shoulder, North of Devon Ave. At WB-9 approximately16 inches of asphalt (AS) was noted at the surface followed by medium dense, brown and gray GRAVEL (A-1-b) to an approximate depth of 3.5 feet BEG followed by hard, gray LEAN CLAY (A-6) to the boring termination depth of 20.0 feet BEG. No free groundwater was encountered during or after drilling.

WB-10, Station 49+64.09-63.79 LT:

The WB-10 was drilled at eastbound I-94 shoulder, North of Devon Ave. At WB-10 approximately16 inches of asphalt (AS) was noted at the surface followed by medium dense to dense, gray GRAVEL (A-1-b) to an approximate depth of 6.0 feet BEG followed by hard, gray SILTY CLAY (A-4) to the boring termination depth of 20.0 feet BEG. No free groundwater was encountered during or after drilling.

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WB-11, Station 49+26.02-48.60 RT:

The WB-11 was drilled at eastbound I-94 shoulder, South of Devon Ave. At WB-11 approximately16 inches of asphalt (AS) was noted at the surface followed by medium dense, gray GRAVEL (A-1-b) to an approximate depth of 3.0 feet BEG followed by loose, brown SAND (A-1-b) to an approximate depth of 6.0 feet BEG. Underlying the brown SAND (A-1-b), stiff to very stiff, gray SILTY CLAY (A-4) was encountered to the boring termination depth of 20.0 feet BEG. No free groundwater was encountered during or after drilling.

BRIDGE

BB-2, Station 51+51.93-21.48 RT:

The BB-2 was drilled at the exiting Bridge Approach at Devon eastbound Lane 2, E of I-94. At BB-2 approximately 7.5 inches of asphalt (AS), 11 inches of concrete (CON) and 8 inches of aggregate base (AGG) were noted at the surface followed by very dense, brown SILTY GRAVEL (A-1-b) to an approximate depth of 11.0 feet BEG. Underlying the brown SILTY GRAVEL (A-1-b), stiff, brown and gray SILTY CLAY (A-4) was encountered to an approximate depth of 13.5 feet BEG followed by stiff, brown LEAN CLAY (A-6) to an approximate depth of 16.0 BEG. Underlying the brown LEAN CLAY (A-6), stiff, brownish gray SILTY CLAY (A-4) was encountered to an approximate depth of 18.5 feet BEG followed by firm to hard, gray SILTY CLAY (A-4) to an approximate depth of 63.5 feet BEG. Underlying the gray, SILTY CLAY (A-4), hard, LEAN CLAY (A-6) was encountered to an approximate depth of 78.5 feet BEG followed by very hard, gray SILTY CLAY (A-4) HARD PAN to the boring termination depth of 85.0 feet BEG. No sample was recovered between 28.5 and 33.5 feet BEG due to possible boulders. No free groundwater was encountered during or after drilling.

BB-4, Station 48+38.17-21.20 RT:

The BB-4 was drilled at the exiting Bridge Approach at Devon eastbound Lane 2, W of I-94. At BB-4 approximately 6 inches of asphalt (AS), 12 inches of concrete (CON) and 6 inches of aggregate base (AGG) were noted at the surface followed by loose to very loose, brown SAND (A-1-b) to an approximate depth of 8.5 feet BEG. Underlying the brown SAND (A-1-b), medium dense, brown SAND (A-1-a) was encountered to an approximate depth of 11.0 feet BEG followed by very loose, brown SAND (A-1-b) to an approximate depth of 13.5 BEG. Underlying the brown SAND (A-1-b), loose, brown SAND (A-1-a) was encountered to an approximate depth of 16.0 feet BEG followed by very stiff, brown and gray SILTY CLAY (A-4) to an approximate depth of 18.5 feet BEG. Underlying the brown and gray, SILTY CLAY (A-4), hard to very stiff, gray SILTY CLAY (A-4) was encountered to an approximate depth of 33.5 feet BEG followed by very stiff to hard, gray LEAN CLAY (A-6) to an approximate depth of 63.5 feet BEG. Underlying the gray LEAN CLAY (A-6), very stiff, gray SILTY CLAY (A-4) was encountered to an approximate depth of 75.0 feet BEG followed by very hard, gray LEAN CLAY (A-6) HARDPAN was encountered to the boring termination depth of 85.0 feet BEG. No sample was recovered between 28.5 and 33.5 feet BEG due to possible boulders. No free groundwater was encountered during or after drilling.

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BB-5, Station 48+51.11-22.58 LT:

The BB-5 was drilled at the exiting Bridge Approach at Devon westbound Lane 1, W of I-94. At BB-5 approximately 8.5 inches of asphalt (AS), 9.5 inches of concrete (CON) and 6 inches of aggregate base (AGG) were noted at the surface followed by stiff, brown SILTY CLAY (A-4) to an approximate depth of 3.5 feet BEG. Underlying the brown SILTY CLAY (A-4), medium dense, brown SAND (A-1-a) was encountered to an approximate depth of 6.0 feet BEG followed by very stiff, brown SILTY CLAY (A-4) to an approximate depth of 8.5 BEG. Underlying the brown SILTY CLAY (A-4), medium dense, brown and gray SILTY SAND (A-1-b) was encountered to an approximate depth of 13.5 feet BEG followed by stiff to hard, gray LEAN CLAY (A-6) to an approximate depth of 43.5 feet BEG. Underlying the gray LEAN CLAY (A-6), very stiff to hard, gray SILTY CLAY (A-4) was encountered to an approximate depth of 63.5 feet BEG followed by very stiff to hard, gray LEAN CLAY (A-6) HARD PAN to an approximate depth of 83.5 feet BEG. Underlying the gray LEAN CLAY (A-6) HARD PAN, very dense, gray STONE FRAGMENTS (A-1) was encountered to the boring termination depth of 85.0 feet BEG. No free groundwater was encountered during or after drilling.

BB-7, Station 51+29.6-Offset 23.75' LT:

The Boring BB-7 was drilled at the exiting Bridge Approach at Devon westbound Lane 1, E of I-94. At BB-7 approximately 9 inches of asphalt (AS), 9 inches of concrete (CON) and 6 inches of aggregate base (AGG) were noted at the surface followed by stiff, brown and gray SANDY CLAY (A-4) to an approximate depth of 6.0 feet BEG. Underlying the brown and gray SANDY CLAY (A-4), stiff, brown SILTY CLAY (A-4) was encountered to an approximate depth of 8.5 feet BEG followed by very stiff, brown and gray LEAN CLAY (A-6) to an approximate depth of 11.0 BEG. Underlying the brown and gray LEAN CLAY (A-6), very soft to every stiff, gray LEAN CLAY (A-6) was encountered to an approximate depth of 63.5 feet BEG followed by, hard to very stiff, gray SILTY CLAY (A-5) to an approximate depth of 73.5 feet BEG. Underlying the gray SILTY CLAY (A-5), very stiff, gray LEAN CLAY (A-6) was encountered to an approximate depth of 78.5 feet BEG followed by very dense, gray STONE FRAGMENTS, GRAVEL AND SAND (A-1) altered Bedrock to the boring termination depth of 84.0 feet BEG. No free groundwater was encountered during or after drilling.

BB-12-Eliminated:

The BB-12 was eliminated due to obstructions encountered at about 3.5 feet, after several attempts of drilling at and near the proposed boring location, south of bridge in eastbound left shoulder, eastbound lane 1, westbound shoulder and westbound lane 1.

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BB-13, Station 50+45.0-60.28 LT:

The BB-13 was drilled on I-94 N. of Devon Ave. At BB-13 approximately 4.0 inches of asphalt (AS), and 11.0 inches of concrete (CON) were noted at the surface followed by extremely dense, AGGTREGATE FILL (AGG-FILL), very stiff to hard, gray SILTY CLAY (A-4) to an approximate depth of 48.5 BEG. Underlying the gray SILTY CLAY (A-4), very stiff to very hard, gray LEAN CLAY (A-6) to an approximate depth of 63.5 feet BEG. No sample was recovered between 63.5-and 68.5 feet BEG due to possible boulders followed by, very hard, Gray lean clay (A-6) HARDPAN to the boring termination depth of 71.5 feet BEG. No free groundwater was encountered during or after drilling. Underlying the Gray LEAN CLAY (A-6) HARDPAN, well cemented, light gray to gray, thinly bedded, slightly weathered, fine to medium grained limestone bed rock was encountered to the boring termination depth of 87.0 feet BEG. No free groundwater was encountered during or after drilling.

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. This section provides NST's geotechnical analysis and recommendations for the design of the proposed bridge, retaining wall and the mast arm traffic signal based on the results of the field exploration, and laboratory testing.

Site Preparation

Due to the elevation difference within the proposed bridge foundation area, cut or fill may have to be accomplished in site grading. Prior to the site grading all existing pavement and existing retaining wing walls (if any) should be removed and debris should be properly disposed of outside the construction area. 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 utilizes, including abandoned pipes, structures, should be removed from the site as construction proceeds.

The exposed, upgraded subgrade soil and pile driving operation should be observed and tested by a Geotechnical Engineer or an experienced Materials Technician from **IDOT Engineering** office to identify for unsuitable soils. When excavating for footings, the subgrade soil should be carefully observed, and any unsuitable or unstable materials should be removed from the footing areas. 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.

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In order to fill any over-excavated areas especially under the wing wall foundation, we recommend using imported granular material meeting the graduation requirements of IDOT CA-6. Clays should not be used as the backfill under the foundations as backfill in the narrow trenches is difficult to compact to the project specifications below the footing areas. 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

It is our understanding that a bridge along with wing walls, signal mast arms and access roadways, will be constructed at this project site. Based on the soil borings, the existing soils are mostly comprised of hard to stiff to extremely dense silty clay & bedrock. Based on the above soil condition, we recommend the following types of foundations for various proposed construction:

BRIDGE STRUCTURE:

Derivation of Soil Parameters for Design

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

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

Table 2 – Summary of Soil Parameters

Approximate Elevation (feet)	Soil Description	In situ Unit Weight γ (pcf)	Undrained		Drained	
			Cohesion c (psf)	Friction Angle ϕ (Degrees)	Cohesion c (psf)	Friction Angle ϕ (Degrees)
555'- 540'	Gray Silty Clay (A-6) (BB-2) East Abut.	131	1200	14	500	26
559'- 536' 605'- 576'	Gray Lean Clay (A-6) (BB-5) West Abut.	122	1000	11	400	22
597'- 532'	Gray Lean Clay (A-6) (BB-13) Center Pier	123	1300	12	150	28

Settlement

The existing side slopes of I-94 are about 1:2 (V:H) towards the north and south side of Devon Avenue. The roadway profile will be raised and widened, and new fill will be placed in the vicinity of the bridge to an estimated depth of 0-4 feet.

Slope Stability

The proposed abutment side slopes below the new bridge will be about 1:10 (V:H) from the north and south abutments of Devon Avenue down to I-94, side slopes in the north and south directions (perpendicular to Devon Avenue) will be about 1:2 (V:H). Based on the geometry for the proposed improvement, the existing slopes will not change significantly. No slope stability analysis is required for the existing slopes.

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.

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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 of 210'-0", with no single span longer than 200 feet, therefore, a global Site Class Definition was determined for this project, and was found to be Soil Site Class C. The Seismic Performance Zone (SPZ) was determined using Figure 2.3.10-2 in the IDOT Bridge Manual and was found to be Seismic Performance Zone 1.

The Seismic Design maps were used to determine the short (S_{DS}) and long (S_{D1}) period design spectral acceleration coefficients. Given the site location and materials encountered, the potential for liquefaction is minimal. The short term (S_{DS}), long term (S_{D1}) period design spectral acceleration coefficients and (PGA) Peak Ground Acceleration were determined using the Seismic Design Maps as shown in the table below:

Seismic Parameters

Building Code Reference	PGA	SDS	SD1
AASHTO Guide for LRFD Seismic Bridge Design	0.057g	0.122g	0.098g

Scour

The bridge structure carrying Devon Avenue crosses over I-94 and no waterways are in the vicinity of the proposed project; therefore, scour will not be a concern for this project.

The foundations for the proposed bridge construction must provide sufficient support to resist the dead and live loads, as well as seismic loading provided in the preliminary information by Baxter & Woodman. The foundation design recommendations were completed per the AASHTO LRFD 9th Edition.

Bridge Foundation Recommendations

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

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Driven Pile Foundations

Deep foundations consisting of driven piles are considered a feasible option for the proposed bridge. Piles considered for this site are H-piles.

The following tables summarize the estimated pile lengths at various axial resistances for H-piles of various common sizes for each substructure.

Center Pier Pile Design BB-13

Estimated Pile Length	**Steel HP 12 X 63** (Max. R_N = 497 kips)		**Steel HP 12 X 74** (Max. R_N = 589 kips)		**Steel HP 12 X 84** (Max. R_N = 664 kips)	
	R_N (kips)	R_F (kips)	R_N (kips)	R_F (kips)	R_N (kips)	R_F (kips)
53	430	237	437	240	443	244
58	455	250	462	254	469	258
68	457	251	463	255	470	259

Center Pier Pile Design BB-13

Estimated Pile Length	**Steel HP 14 X 89** (Max. R_N = 705 kips)		**Steel HP 14 X 102** (Max. R_N = 810 kips)		**Steel HP 14 X 117** (Max. R_N = 929 kips)	
	R_N (kips)	R_F (kips)	R_N (kips)	R_F (kips)	R_N (kips)	R_F (kips)
43	398	219	402	221	407	224
48	435	240	441	242	446	245
53	529	291	536	295	543	298
68	558	307	565	311	572	315

NOTES:
RN = Nominal Required Bearing; RF = Factored Resistance
Available Pile cut off elevation = 606.76 feet
Ground surface elevation against pile during driving, i.e. B/footing = 603.76
Rock Bearing Capacity = 80 KSF

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East Abutment Pile Design BB-02

Estimated Pile Length	Steel HP 12 X 63 (Max. R_N = 497 kips)		Steel HP 12 X 74 (Max. R_N = 589 kips)		Steel HP 12 X 84 (Max. R_N = 664 kips)	
	R_N (kips)	R_F (kips)	R_N (kips)	R_F (kips)	R_N (kips)	R_F (kips)
53	276	153	283	156	287	158
58	326	181	334	184	339	187
68	375	208	384	211	389	214
73	N/A	N/A	506	278	515	283
78	N/A	N/A	519	285	528	290

East Abutment Pile Design BB-02

Estimated Pile Length	Steel HP 14 X 89 (Max. R_N = 705 kips)		Steel HP 14 X 102 (Max. R_N = 810 kips)		Steel HP 14 X 117 (Max. R_N = 929 kips)	
	R_N (kips)	R_F (kips)	R_N (kips)	R_F (kips)	R_N (kips)	R_F (kips)
63	404	222	409	225	414	228
68	464	255	470	259	476	262
73	610	336	617	339	627	345
78	632	348	639	351	649	357

NOTES:
RN = Nominal Required Bearing.
RF = Factored Resistance
Available Pile cut off elevation = 619.31 feet
Ground surface elevation against pile during driving, i.e. B/footing = 619.31
Rock Bearing Capacity = 80 KSF

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East Abutment Pile Design BB-07

Estimated Pile Length	Steel HP 12 X 63 (Max. R_N = 497 kips)		Steel HP 12 X 74 (Max. R_N = 589 kips)		Steel HP 12 X 84 (Max. R_N = 664 kips)	
	R_N (kips)	R_F (kips)	R_N (kips)	R_F (kips)	R_N (kips)	R_F (kips)
53	360	198	366	201	371	204
58	388	213	394	216	399	220
63	415	228	421	232	427	235
68	450	247	456	251	462	254
73	N/A	N/A	510	281	518	285
78	N/A	N/A	523	288	531	292

East Abutment Pile Design BB-07

Estimated Pile Length	Steel HP 14 X 89 (Max. R_N = 705 kips)		Steel HP 14 X 102 (Max. R_N = 810 kips)		Steel HP 14 X 117 (Max. R_N = 929 kips)	
	R_N (kips)	R_F (kips)	R_N (kips)	R_F (kips)	R_N (kips)	R_F (kips)
53	445	245	451	248	457	251
58	475	261	481	264	487	268
63	504	277	510	281	516	284
68	545	300	551	303	558	307
73	618	340	626	344	634	349
78	633	348	641	353	649	357

NOTES:
RN = Nominal Required Bearing.
RF = Factored Resistance
Available Pile cut off elevation = 623.50 feet
Ground surface elevation against pile during driving, i.e. B/footing = 620.50
Rock Bearing Capacity = 80 KSF

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West Abutment Pile Design BB-04

Estimated Pile Length	Steel HP 12 X 63 (Max. R_N = 497 kips)		Steel HP 12 X 74 (Max. R_N = 589 kips)		Steel HP 12 X 84 (Max. R_N = 664 kips)	
	R_N (kips)	R_F (kips)	R_N (kips)	R_F (kips)	R_N (kips)	R_F (kips)
53	347	191	352	194	358	197
58	359	197	364	200	369	203
68	371	204	376	207	381	210
73	N/A	N/A	483	265	490	269
78	N/A	N/A	496	273	503	277

West Abutment Pile Design BB-04

Estimated Pile Length	Steel HP 14 X 89 (Max. R_N = 705 kips)		Steel HP 14 X 102 (Max. R_N = 810 kips)		Steel HP 14 X 117 (Max. R_N = 929 kips)	
	R_N (kips)	R_F (kips)	R_N (kips)	R_F (kips)	R_N (kips)	R_F (kips)
53	430	236	435	239	441	243
58	437	240	443	243	448	246
63	447	246	452	249	457	251
73	585	322	593	326	601	330
78	600	330	608	335	616	339

NOTES:
RN = Nominal Required Bearing; RF = Factored Resistance
Available Pile cut off elevation = 622.16 feet
Ground surface elevation against pile during driving, i.e. B/footing = 619.16
Rock Bearing Capacity = 80 KSF

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West Abutment Pile Design BB-05

Estimated Pile Length	Steel HP 12 X 63 (Max. R_N = 497 kips)		Steel HP 12 X 74 (Max. R_N = 589 kips)		Steel HP 12 X 84 (Max. R_N = 664 kips)	
	R_N (kips)	R_F (kips)	R_N (kips)	R_F (kips)	R_N (kips)	R_F (kips)
53	315	173	320	176	325	179
58	344	189	349	192	354	195
63	374	206	380	209	385	212
68	436	240	443	244	449	247
73	450	247	456	251	463	255
78	477	263	485	267	492	271

West Abutment Pile Design BB-05

Estimated Pile Length	Steel HP 14 X 89 (Max. R_N = 705 kips)		Steel HP 14 X 102 (Max. R_N = 810 kips)		Steel HP 14 X 117 (Max. R_N = 929 kips)	
	R_N (kips)	R_F (kips)	R_N (kips)	R_F (kips)	R_N (kips)	R_F (kips)
53	390	215	395	217	401	220
58	422	232	427	235	432	238
63	456	251	461	254	467	257
68	535	294	542	298	549	302
73	552	303	559	307	566	311
78	588	323	595	327	603	332

NOTES:
RN = Nominal Required Bearing; RF = Factored Resistance
Available Pile cut off elevation = 622.86 feet
Ground surface elevation against pile during driving, i.e. B/footing = 619.86
Rock Bearing Capacity = 80 KSF

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

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

The actual pile length and capacity should be evaluated based on test piles installed in accordance with the specifications provided in Section 512.15 of IDOT Standard Specifications for Road and Bridge Construction. Per section 3.10.1.11 of the IDOT Bridge Manual (2023), 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.

Lateral Load Resistance

Lateral loadings applied to pile foundations are typically resisted by battering selected piles, the soil/structure interaction, pile flexure, or a combination of these factors. Section 3.10.1.10 of the 2023 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. The Table below provides recommended lateral soil modulus and soil strain parameters that can be used for laterally loaded pile analysis via the p-y curve method based on the encountered subsurface conditions.

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Lateral Resistance Parameters

Approximate Elevation (feet)	Soil Description	In situ Unit Weight γ (pcf)	Cohesion c (psf)	Friction Angle ϕ (Degrees)	Subgrade Modulus (pci)	Horizontal Strain Factor e_{50}
616' – 610'	Clay Fill (BB-2 only)	117	1,000	0	75	0.01
616'– 610'	Sand Fill (BB-4 only)	N/A	0	35	100	N/A
601' - 597'	Aggregate Fill (BB-13 only)	N/A	0	34	40	N/A
597' - 533'	Stiff Lean Clay (BB-13 only)	120	70	28	1000	0.007
618' – 609'	Sandy Silty Clay (BB-7 only)	115	1,500	0	500	0.007
609'-557'	Lean Clay (BB-7 only)	112	500	27	750	0.02
605'- 576'	Lean Clay (BR-5 only)	123	850	27	350	0.02

Based on the preliminary TS&L provided to NST by Baxter & Woodman, the proposed side slopes grades for the new bridge will be similar to the existing slopes with similar elevations. NST completed the settlement analysis of the proposed embankment load. It is anticipated that settlement of the native clays due to the embankments will be negligible but maximum possible could be 0.5 inch approximately.

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Retaining Wall Foundation:

Allowed wall types include the following:
1. Mechanically stabilized earth (MSE) walls with segmental precast concrete facing
2. Prefabricated modular block facing,
3. Cast-in-place (CIP) reinforced concrete cantilever walls, or CIP concrete gravity retaining walls.
4. Wing Walls

An IDOT geotechnical engineer, or an experienced person responsible/answerable to that engineer, shall observe wall foundation excavations immediately prior to foundation construction to confirm and document that contractor removed all undesirable materials (if encountered) and that the foundations bear on satisfactory material. Backfill for retaining wall is to be constructed using conventional construction methods. For MSE type walls, provide backfill material composed of durable, non-degradable, non-compressible material.
For other wall types, provide an internal drainage material behind the wall to assure positive drainage and prevent undesirable hydrostatic pressure build-up. Compact the backfill material as required for stability by design engineer. Place the backfill for the entire height of the wall or coordinate with the wall design, as needed, to provide positive lateral drainage. We understand that the design of the retaining wall will be completed by the Client. We have assumed that the wall design will satisfy internal stability modes and is the responsibility of the wall designer.

Care should be exercised so as not to disturb the bearing materials encountered at the bottom of the excavation. The exposed foundation subgrade should be carefully observed by IDOT's geotechnical engineer's representative to verify that the new footings will be placed on suitable bearing materials. Representative hand auger borings should be performed in the excavations to verify that the materials at the foundation subgrade resemble those described on the Boring Logs.

If encountered, any unsuitable, mixed, or low bearing soils at the footing elevation such as the soils encountered at borings B-3 and B-8 may require an undercut of 4-5 foot 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 retaining wall structure may be supported on the conventional isolated spread/column footings after the recommended site preparation and foundation bearing materials observation has been completed. For frost protection, footings for the retaining wall should bear at least 3.5 feet below the ground surface, provided that they are supported on competent materials and will not be subjected to freezing weather during or after construction.

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Based on the Load and Resistance Factored Design (LRFD) methodology, standard spread footings for the retaining wall can be proportioned for a Nominal Bearing Resistance (qn): 5000 psf with a Resistance Factor (φb) of 0.77 and Factored Bearing Resistance (qR): = 6500 psf.

We also determined that the service bearing pressure of 5000 psf to be used for the settlement to be less than 1.0 inches for this 15.0'-16.0' high retaining wall. Wall to be designed for an active lateral earth pressure of 45 pcf /foot of equivalent fluid pressure.

Abutment Wingwall Foundation:

It is our understanding that cast-in-place (CIP) reinforced concrete walls, or CIP concrete gravity walls are proposed to be constructed as abutment wing walls. An IDOT geotechnical engineer, or an experienced person responsible/answerable to that engineer, shall observe wall foundation excavations immediately prior to foundation construction to confirm and document that contractor removed all undesirable materials (if encountered) and that the foundations bear on satisfactory material. Backfill for wing wall is to be constructed using conventional construction methods.

For all wall types, provide an internal drainage material behind the wall to assure positive drainage and prevent undesirable hydrostatic pressure build-up. Compact the backfill material as required for stability by design engineer. Place the backfill behind the wall or coordinate with the wall design, as needed, to provide positive lateral drainage.

We understand that the design of the wing wall will be completed by the Client. We have assumed that the wall design will satisfy internal stability modes and is the responsibility of the wall designer.

Care should be exercised as not to disturb the bearing materials encountered at the bottom of the excavation. The exposed foundation subgrade should be carefully observed by IDOT's geotechnical engineer's representative to verify that the new footings will be placed on suitable bearing materials. Representative hand auger borings should be performed in the excavations to verify that the materials at the foundation subgrade resemble those described on the Boring Logs.

If encountered, any unsuitable, mixed, 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

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with compacted load-bearing fill as mentioned previously.

In our opinion, the proposed wing wall structure may be supported on the conventional isolated spread/column footings after the recommended site preparation and foundation bearing materials observation has been completed. For frost protection, footings for the retaining wall should bear at least 3.5 feet below the ground surface, provided that they are supported on competent materials and will not be subjected to freezing weather during or after construction.

Based on the Load and Resistance Factored Design (LRFD) methodology, standard spread footings for the retaining wall can be proportioned for a Nominal Bearing Resistance (qn): 5400 psf with a Resistance Factor (φb) of 0.55 and Factored Bearing Resistance (qR): = 3000 psf.

We also determined that the service bearing pressure of 3000 psf to be used for the settlement to be less than 1.0 inch for this proposed wing wall.

Mast Arm Traffic Signal Foundation:

It is our understanding that two (2) cantilever mast arm signals will be installed at NE and NW sides of Cicero Avenue at Cicero Avenue & Devon Avenue intersection, within the project limit. It is understood that all the proposed foundation designs will adhere to the requirements of the OSC-A-9 of the IDOT Sign Structure Manual. The foundation diameters range from 36 to 42 inches, and the depths range from 17 to 33.5 feet. The geotechnical criteria for use of the standard foundation details specify that the foundation shaft length and diameter should be designed based the mast arm length, cantilever length/weight, soil composition and average strength. The criteria for the application of the standard detail states that the foundations only apply to sites which have cohesive soils along the length of the shaft with an average unconfined compressive strength (Qu) greater than 1.25 tsf. If the soils encountered during drilling the foundation excavation fail to meet the requirement of the standard details, the district geotechnical engineer should be contacted to determine if a revised foundation design will be required.

Based on the soil exploration and testing program, asphalt and crushed aggregate material was found within the upper 1 foot of soil in both borings within the frost penetration depth. The lateral resistance of the upper 3.5 feet of soils in the frost penetration zone should be neglected in design. Due to the presence of predominately high strength cohesive soils within the borings, the foundation standards should still be applied for each traffic signal location.

The soils information shown in boring logs B-14 & B15 should be used to verify foundations for each mast arm traffic signal. Soils must be visually inspected at each location to match those identified in the boring logs; if different soils are encountered during construction the engineer

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must be notified to provide revised parameters. Both borings contain predominately cohesive material with intermittent layers of lean and sandy materials.

Based on the soils encountered in the borings, and the information in the IDOT Sign Manual, the foundations for the mast arm traffic signal structures may be designed using the standard details. If a special design is required, the design soil parameters for each of the traffic signal locations should reference the Boring B-14 & B-15. If the soils encountered during the foundation excavation fail to meet the requirements of the standard detail, then the District Geotechnical Engineer should be contacted to determine if a revised foundation design is required.

The drilled shaft (caisson) construction should be completed in accordance with IDOT Standard Specification for Road and Bridge Construction, drilled shaft Section 516. The temporary casing construction method should be applied where sandy, lean or granular material is present within the proposed shaft depth. The temporary casing may be required to prevent caving or excessive deformation of the hole, especially in the areas where silt is encountered. Drilled shaft construction with the use of a temporary casing should be completed in accordance with article 516.06 (c) in the IDOT Standard Specification for Road and Bridge Construction.

Drilled shafts for the proposed mast arm traffic signal structure are normally loaded laterally by wind forces and cantilever load. The ability of the shaft to resist these loads is dependent on the size of the shaft diameter and the passive pressures that develop in the soils along the shaft. Lateral loads on the drilled shafts should be analyzed for the maximum moments and lateral deflections. Software such as L-Pile and COM624 are normally used to determine the required shaft depth to resist the lateral loads, and the actual maximum moment and the anticipated shaft deflection. If the shaft deflection is excessive or if the embedment is inadequate to provide support, the shaft embedment could be increased to help address these issues. The shaft diameter should be increased if the deflection or the maximum moment is higher than the shaft designed resistance.

Temporary casing is not anticipated due to the nature of lean clay encountered; however, contractor is advised to carry at least 15 feet of temporary casing during construction of both signal foundations. A permanent casing covering the entire shaft length is recommended for both foundations. It is recommended that the concrete be ready on site as the caisson excavation is completed, so that the concrete can be placed immediately after completing the excavation. This diminishes the potential of water buildup in the bottom of the shaft if encountered. Bottom cleanliness of the drilled shaft excavation should be observed from the ground surface with the use of flood light or down-hole camera. Workers should not enter the shaft to manually clean the base of the shaft due to safety reasons.

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CONSTRUCTION CONSIDERATIONS

All work performed for the proposed project should conform to the requirements in the IDOT Standard Specifications for Road and Bridge Construction. Any variation from the IDOT manuals requirements should be approved by the design engineer.

Groundwater

Based on the conditions found in our borings, groundwater is not expected to be encountered during the excavation 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 foundation bearing soils or 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.

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

Equipment Selection/Soil Disturbance

The soil types at this site, particularly the silty clayey gravels and gravelly sands, 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 soil 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 construction of this project begins or extends into the winter, the contractors must take special

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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 foundation concrete must not be permitted on frozen soil, and the bearing soil or subgrade should not be allowed to freeze after concrete is placed. All footing excavations should be protected from freezing conditions and maintained free of pond water before 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, building construction, or any associated operations, is not borne in any manner by NASHnal Soil Testing, LLC.

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, pile driving and footing construction, should be done by qualified personnel from **Geotechnical Engineer's** office. Exposed soils in excavations for backfill should be tested by means of hand auguring, and with a Dynamic Cone Penetrometer (DCP) in sandy 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.

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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 building 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 topsoil layer, the topsoil thickness given in our logs is an estimate. If 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 fifteen (15) soil borings in the specified areas. Variations in the subsurface conditions were found, and it is probable that additional variations exist on the site that cannot be determined from our borings 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 excavation is started. No warranty, express or implied, is presented in this report with respect to the soil and groundwater conditions on this site.

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: _____

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

Expires 11/30/2025

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APPENDIX

BORING LOCATION DIAGRAMS (Plate No. 1 & 2)

BORING LOGS (Plate No. 3 - Plate No. 26)

ROCK CORE-BORING BB-13

ROCK CORE COMPRESSIVE STRENGTH

ATTERBERG LIMITS

UNCONFINED COMPRESSIVE STRENGTH

PILE DATA

(Center Pier BB-13 Input Data, BB13-Pile Design Table)

(East Abutment B2 Input Data, B-2-Pile Design Table)

(East Abutment B7 Input Data, B-7-Pile Design Table)

(West Abutment B4 Input Data, B-4-Pile Design Table)

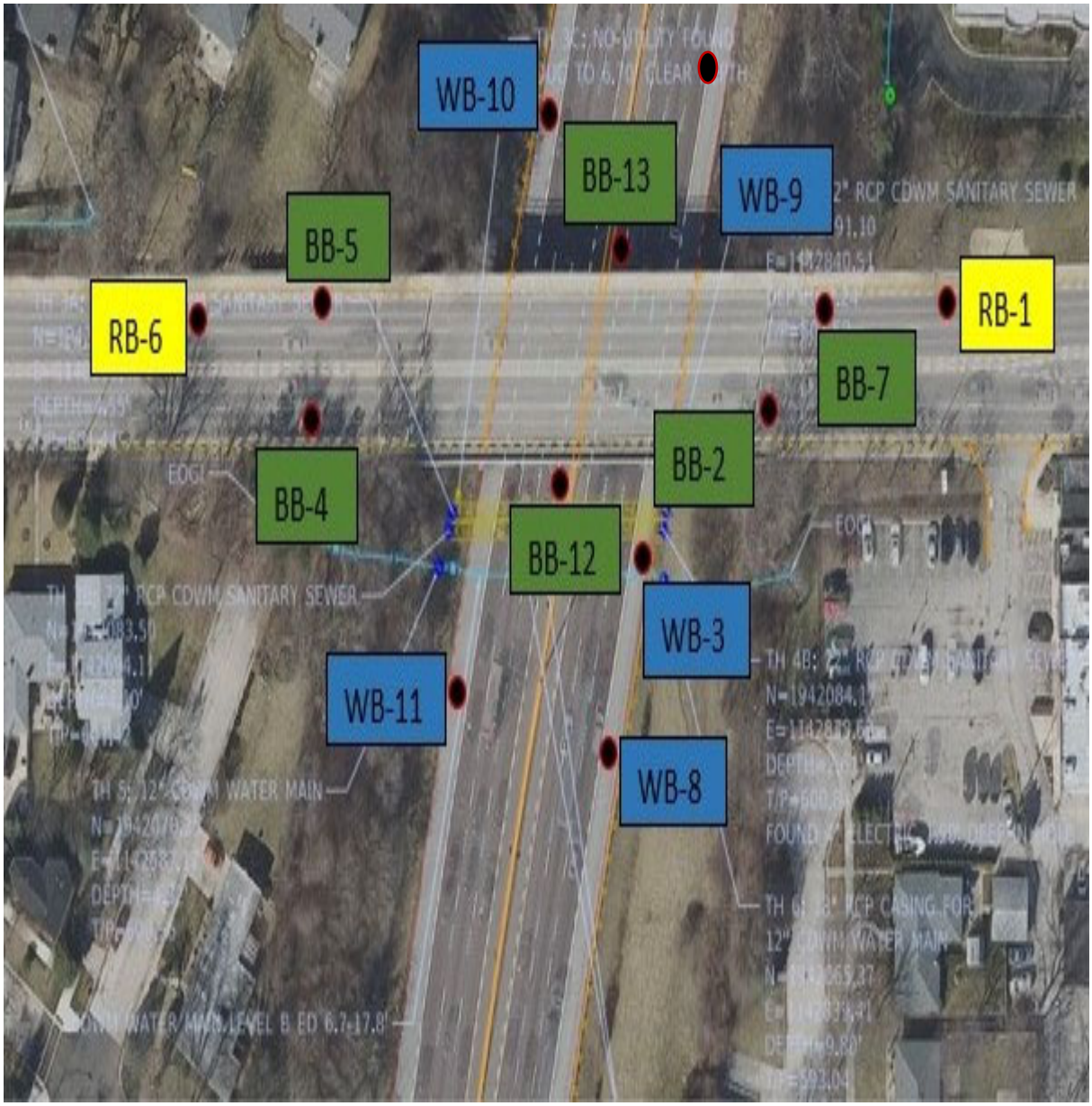
(West Abutment B5 Input Data, B-5-Pile Design Table)

KEY TO TEST DATA

CLASSIFICATION OF SOILS

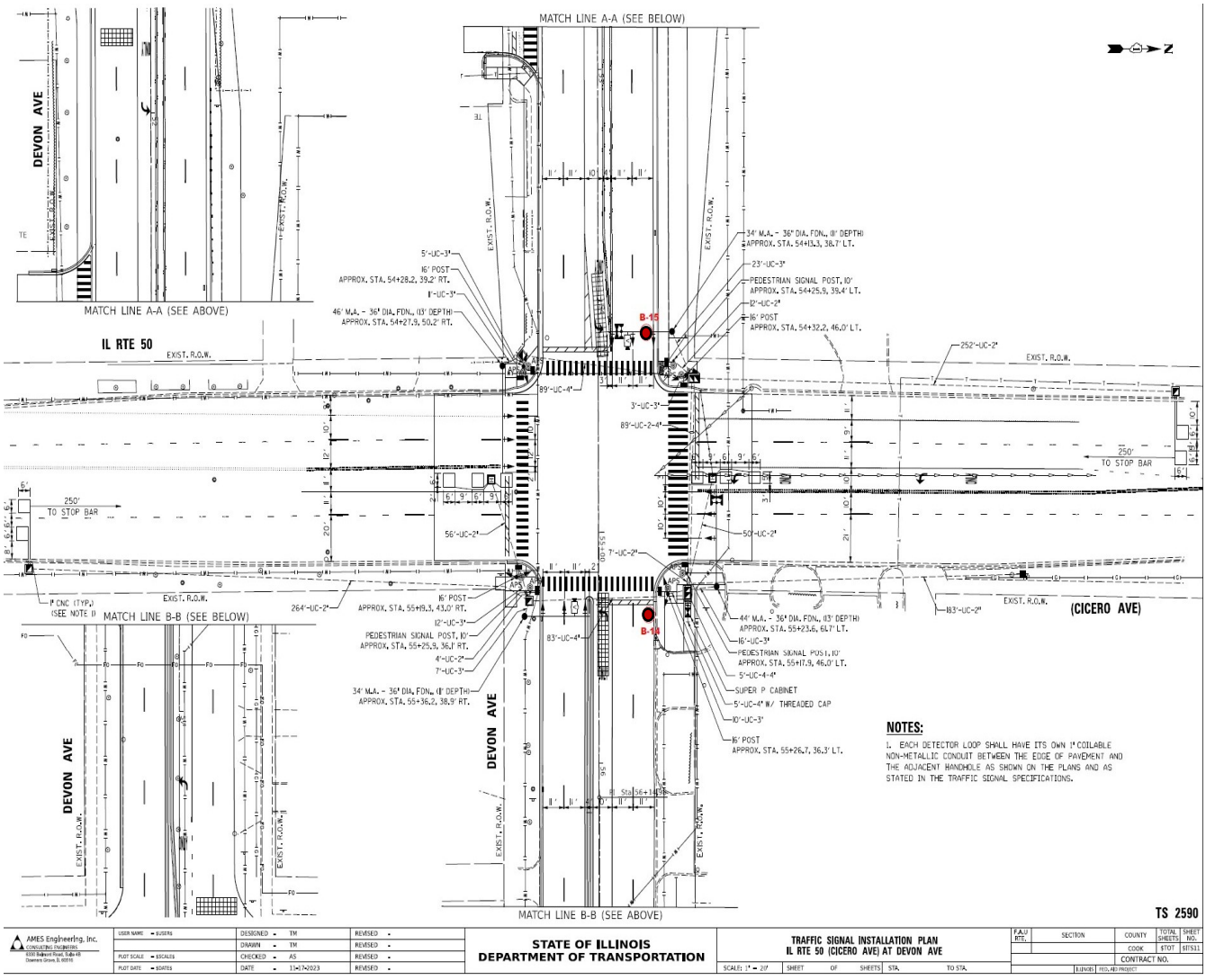
NOTES ON PLACEMENT OF COMPACTED FILL

23856 W. Andrew Rd., Unit 103, Plainfield, L 60585, Phone: (630) 780-5201, Fax: (630) 429-9099



2023-1279-01G **Plate No. 1**

PTB 204 Item 11 (P-91-157-226)
Devon Avenue Bridge Over I-94
Structure Number: 016-0834
Site Location Diagram for B1 through B13



2023-1279-01G **Plate No. 2**

PTB 204 Item 11 (P-91-157-226)
Devon Avenue Bridge Over I-94
Structure Number: 016-0834
Boring Location Diagram for B14 & B15

NASHnal SOIL TESTING

23856 W. Andrew Rd., Unit 103, Plainfield, IL

BOREHOLE LOG

Number RB-1

Plate 3

Client	Baxter and Woodman, Inc.
Location	Devon Ave. Bridge over I-94-STA 52+22.09 (1942164.122N,1143011.703E)
Job Number	Job No. P-91-157-226; Contract No. 62R63
Drill Rig Type	Mobile B-57
Sampler Type	Split Spoon (SS)
Boring Location	STA 52+22.09 with offset 20.41' LT-See Plate 1
Boring Elevation (ft)	616.94 **Date:** 9/25/2023

Sample # /RUN #	Sampling Method	Rimac Qu (tsf)	Sample Recovery (IN)	Moisture Content (%)	SPT Valuese Blows/6 In	Depth (ft)	Sample Depth	Graphic	Soil Description	Elevation (ft)
						0.5		AS	**6 inches asphlat**	616.44
						1.0		AGG	**12 inches of Aggregate Base**	615.94
						1.5				615.44
						2.0		A-4	**Brown Silty Clay (A-4)**	614.94
1	SS	2.000	10	18	3, 2, 4	2.5			Trace Sand , Very Stiff	614.44
						3.0			**Unit Weight 129.3 pcf**	613.94
						3.5				613.44
						4.0		A-4	**Dark Brown Silty Clay (A-4)**	612.94
						4.5			Trace Sand and Gravel, Very Stiff	612.44
2	SS	3.250	8	14.8	5, 32, 11	5.0				611.94

End of boring : Obstraction was encountered at 5.0 ft below grade.

Note: Soil group symbol and group name are determined based on visual classification, plasticity index and liquid limit wherever material was available using ASTM D2488 & D4318

NASHnal SOIL TESTING

23856 W. Andrew Rd., Unit 103, Plainfield, IL

BOREHOLE LOG

Number BB-2 A

Plate 4

Client	Baxter and Woodman, Inc.
Location	Devon Ave. Bridge over I-94-STA 51+51.93 (1942122.02N,1142941.671)
Job Number	Job No. P-91-157-226; Contract No. 62R63
Drill Rig Type	Mobile B-57
Sampler Type	Split Spoon (SS)
Boring Location	STA 51+51.93 with offset 21.48' RT-See Plate 1
Boring Elevation (ft)	619.31 **Date:** 9/25/2023

Sample # /RUN #	Sampling Method	Rimac Qu (tsf)	Sample Recovery (in)	Moisture Content (%)	SPT Valuese Blows/6 In	Depth (ft)	Sample Depth	Graphic	Soil Description	Elevation (ft)
						0.5		AS	**7.5" of Asphalt, 11" of Concrete,8" of Aggregate**	618.81
						1.0		CONC	**11" of Concrete**	618.31
						1.5				617.81
1	SS	0.605	12	15.5	6, 3, 3	2.0		AGG	**8" of Aggregate Base**	617.31
						2.5			**Brown and Gray Silty Clay (A-4)**	616.81
						3.0			Trace Sand and Gravel, Stiff	616.31
						3.5			**Unit Weight 116.5 pcf**	615.81
						4.0				615.31
2	SS	2..419	16	16.2	2, 3,3	4.5			**Unit Weight 116.6 pcf**	614.81
						5.0			Very Stiff	614.31
						5.5		A-4		613.81
						6.0				613.31
						6.5				612.81
3	SS	1.008	17	22.4	2, 1, 3	7.0			**Unit Weight 115.4 pcf**	612.31
						7.5				611.81
						8.0				611.31
						8.5				610.81
						9.0			**Brown Silty Gravel (A-1-b)**	610.31
4	SS	N/A	1	N/A	50/1	9.5			Very Dense	609.81
						10.0		GM		609.31
						10.5				608.81
						11.0				608.31
						11.5			**Brown and Gray Silty Clay (A-4)**	607.81
5	SS	1.000	11	20.8	4, 2, 3	12.0			with Sand , Stiff	607.31
						12.5		A-4	**Unit Weight 112.3 pcf**	606.81
						13.0				606.31
						13.5				605.81
						14.0			**Brown Lean Clay (A-6)**	605.31
6	SS	1.250	18	22.5	3, 2, 4	14.5			Trace Gravel, Stiff	604.81
						15.0		A-6		604.31
						15.5				603.81
						16.0				603.31
						16.5			**Brownish Gray Silty Clay (A-4)**	602.81
7	SS	1.512	18	18.5	3, 4, 5	17.0			trace Sand and Gravel, Stiff	602.31
						17.5		A-4	**Unit Weight 121.0 pcf**	601.81
						18.0				601.31
						18.5				600.81
						19.0			**Gray Silty Clay (A-4)**	600.31
8	SS	1.750	12	19.2	2, 3, 4	19.5			Trace Sand and Gravel, Stiff	599.81
						20.0			**Unit Weight 120.2 pcf**	599.31
						20.5				598.81
						21.0				598.31
						21.5				597.81
9	SS	2.620	18	19.1	5, 6, 13	22.0				597.31
						22.5			**Unit Weight 114.8 pcf**	596.81
						23.0				596.31
						23.5		A-4		595.81
						24.0				595.31
10	SS	2.419	18	17.3	5, 6, 8	24.5				594.81
						25.0			**Unit Weight 120.4 pcf**	594.31
						25.5				593.81
						26.0				593.31
						26.5				592.81
11	SS	2.318	16	11.3	4, 6, 7	27.0				592.31
						27.5			**Unit Weight 128.6 pcf**	591.81
						28.0				591.31
						28.5				590.81
						29.0				590.31
12	SS	N/A	NR	N/A	6, 7, 10	29.5		NR	**No recovery**	589.81
						30.0			**Possible Boulders**	589.31

Broing Continued

Note: Soil group symbol and group name are determined based on visual classification, plasticity index and liquid limit wherever material was available using ASTM D2488 & D4318

NASHnal SOIL TESTING

23856 W. Andrew Rd., Unit 103, Plainfield, IL

BOREHOLE LOG

Number BB-2 B

Plate 5

Client	Baxter and Woodman, Inc.
Location	Devon Ave. Bridge over I-94-STA 51+51.93 (1942122.02N,1142941.671)
Job Number	Job No. P-91-157-226; Contract No. 62R63
Drill Rig Type	Mobile B-57
Sampler Type	Split Spoon (SS)
Boring Location	STA 51+51.93 with offset 21.48' RT-See Plate 1
Boring Elevation (ft)	619.31 **Date:** 9/25/2023

Sample # /RUN #	Sampling Method	Rimac Qu (tsf)	Sample Recovery (in)/%	Moisture Content (%)	SPT Valuese Blows/6 In	Depth (ft)	Sample Depth	Graphic	Soil Description	Elevation (ft)
						30.5		NR	**No recovery**	588.81
						31.0			**Possible Boulders**	588.31
						31.5				587.81
						32.0				587.31
						32.5				586.81
						33.0				586.31
						33.5				585.81
						34.0		A-4	**Gray Silty Clay (A-4)**	585.31
13	SS	0.750	2	20.1	5, 6, 9	34.5			Trace Sand & Gravel, Firm	584.81
						35.0				584.31
						35.5				583.81
						36.0				583.31
						36.5				582.81
						37.0				582.31
						37.5				581.81
						38.0				581.31
						38.5				580.81
						39.0				580.31
14	SS	1.250	9	22.6	7, 8, 9	39.5			**Unit Weight 105.5 pcf**	579.81
						40.0			Stiff	579.31
						40.5				578.81
						41.0				578.31
						41.5				577.81
						42.0				577.31
						42.5				576.81
						43.0				576.31
						43.5				575.81
						44.0				575.31
15	SS	3.225	17	12.8	9, 11, 12	44.5			**Unit Weight 133.7 pcf**	574.81
						45.0			Very Stiff	574.31
						45.5				573.81
						46.0				573.31
						46.5				572.81
						47.0				572.31
						47.5				571.81
						48.0				571.31
						48.5				570.81
						49.0				570.31
16	SS	4.636	18	16.7	7, 9, 13	49.5			**Unit Weight 125.0 pcf**	569.81
						50.0			Hard	569.31
						50.5				568.81
						51.0				568.31
						51.5				567.81
						52.0				567.31
						52.5				566.81
						53.0				566.31
						53.5				565.81
						54.0				565.31
17	SS	1.411	16	22.1	5, 7, 10	54.5			**Unit Weight 124.5 pcf**	564.81
						55.0			Stiff	564.31
						55.5				563.81
						56.0				563.31
						56.5				562.81
						57.0				562.31
						57.5				561.81
						58.0				561.31
						58.5				560.81
						59.0				560.31
18	SS	3.527	18	14.1	8, 9, 14	59.5			**Unit Weight 126.5 pcf**	559.81
						60.0				559.31

Boring Continued

Note: Soil group symbol and group name are determined based on visual classification, plasticity index and liquid limit wherever material was available using ASTM D2488 & D4318

NASHnal SOIL TESTING

23856 W. Andrew Rd., Unit 103, Plainfield, I

BOREHOLE LOG

Number BB-2 C

Plate 6

Client	Baxter and Woodman, Inc.
Location	Devon Ave. Bridge over I-94-STA 51+51.93 (1942122.02N,1142941.671)
Job Number	Job No. P-91-157-226; Contract No. 62R63
Drill Rig Type	Mobile B-57
Sampler Type	Split Spoon (SS)
Boring Location	STA 51+51.93 with offset 21.48' RT-See Plate 1
Boring Elevation (ft)	619.31 **Date:** 9/25/2023

Sample # /RUN #	Sampling Method	Rimac Qu (tsf)	Sample Recovery (in)/%	Moisture Content (%)	SPT Valuese Blows/6 In	Depth (ft)	Sample Depth	Graphic	Soil Description	Elevation (ft)
						60.5		A-4	**Gray Silty Clay (A-4)**	558.81
						61.0				558.31
						61.5				557.81
						62.0				557.31
						62.5				556.81
						63.0				556.31
						63.5				555.81
						64.0		A-6	**Gray Lean Clay (A-6)**	555.31
19	SS	5.946	18	14.6	13, 17, 18	64.5			trace Sand & Gravel, Hard	554.81
						65.0			**Unit Weight 135.8 pcf**	554.31
						65.5				553.81
						66.0				553.31
						66.5				552.81
						67.0				552.31
						67.5				551.81
						68.0				551.31
						68.5				550.81
						69.0				550.31
20	SS	4.132	18	14.3	9, 12, 16	69.5			Hard	549.81
						70.0			**Unit Weight 130.0 pcf**	549.31
						70.5				548.81
						71.0				548.31
						71.5				547.81
						72.0				547.31
						72.5				546.81
						73.0				546.31
						73.5				545.81
						74.0				545.31
21	SS	4.837	18	12.4	22, 29, 35	74.5			Hard	544.81
						75.0			**Unit Weight 128.6 pcf**	544.31
						75.5				543.81
						76.0				543.31
						76.5				542.81
						77.0				542.31
						77.5				541.81
						78.0				541.31
						78.5				540.81
						79.0		A-4	**Gray Silty Clay (A-4)**	540.31
22	SS	12.000+	3		50/4	79.5			with Gravel and Sand Trace Clay	539.81
						80.0			Possible Hard Pan	539.31
						80.5				538.81
						81.0				538.31
						81.5				537.81
						82.0				537.31
						82.5				536.81
						83.0				536.31
						83.5				535.81
						84.0				535.31
23	SS	12.000+	3		50/3	84.5				534.81
						85.0				534.31

End of Boring 85'

Water Level While Drilling : Dry

Water Level After Drilling : Dry

Cave In Depth : None

Note: Soil group symbol and group name are determined based on visual classification, plasticity index and liquid limit wherever material was available using ASTM D2488 & D4318

NASHnal SOIL TESTING

23856 W. Andrew Rd., Unit 103, Plainfield,

BOREHOLE LOG

Number WB-3

Plate 7

Client	Baxter and Woodman, Inc.
Location	Devon Ave. Bridge over I-94-STA 50+42.00 (1942103.75N,1142933.521E)
Job Number	Job No. P-91-157-226; Contract No. 62R63
Drill Rig Type	Mobile B-57
Sampler Type	Split Spoon (SS)
Boring Location	STA 50+42.00 offset 81.36' RT-See Plate 1
Boring Elevation (ft)	603.88 **Date:** 9/25/2023

Sample # /RUN #	Sampling Method	Rimac Qu (tsf)	Sample Recovery (in)/%	Moisture Content (%)	SPT Valuese Blows/6 In	Depth (ft)	Sample Depth	Graphic	Soil Description	Elevation (ft)
						0.5		AS	**16 Inches of Asphalt**	603.38
						1.0				602.88
						1.5				602.38
						2.0		AGG	**12 Inches of Aggregate Base AGG**	601.88
1	SS	N/A	8	N/A	12, 30, 18	2.5			Dense	601.38
						3.0		A-1-b	**Brown Sand (A-1-b)**	600.88
						3.5				600.38
						4.0				599.88
2	SS	N/A	12	N/A	5, 3, 4	4.5			Loose	599.38
						5.0				598.88
						5.5				598.38
						6.0				597.88
						6.5				597.38
3	SS	N/A	10	N/A	3, 2, 1	7.0			Very Loose	596.88
						7.5				596.38
						8.0				595.88
						8.5				595.38
						9.0		A-4	**Brown Silty Clay (A-4)**	594.88
4	SS	1.512	15	19.3	3, 4, 6	9.5			Trace Sand & Gravel, Stiff	594.38
						10.0			**Unit Weight 117.7 pcf**	593.88
						10.5				593.38
						11.0				592.88
						11.5				592.38
5	SS	1.915	13	21.5	4, 5, 5	12.0				591.88
						12.5			**Unit Weight 111.8 pcf**	591.38
						13.0				590.88
						13.5				590.38
						14.0		A-6	**Gray Lean Clay (A-6)**	589.88
6	SS	1.510	6	19.5	3, 5, 5	14.5			Trace Sand & Gravel, Stiff	589.38
						15.0			**Unit Weight 119.9 pcf**	588.88
						15.5				588.38
						16.0				587.88
						16.5				587.38
7	SS	2.217	12	19.2	4, 6, 10	17.0			Very Stiff	586.88
						17.5			**Unit Weight 122.2 pcf**	586.38
						18.0				585.88
						18.5				585.38
						19.0				584.88
8	SS	2.116	18	17.4	6, 5, 9	19.5			Very Stiff	584.38
						20.0			**Unit Weight 129.2 pcf**	583.88

End of Boring 20'

Water Level While Drilling : Dry

Water Level After Drilling : Dry

Cave In Depth : None

Note: Soil group symbol and group name are determined based on visual classification, plasticity index and liquid limit wherever material was available using ASTM D2488 & D4318

NASHnal SOIL TESTING

23856 W. Andrew Rd., Unit 103, Plainfield

BOREHOLE LOG

Number BB-4A

Plate 8

Client	Baxter and Woodman, Inc.
Location	Devon Ave. Bridge over I-94-STA 48+38.17 (1942121.34N,1142627.907E)
Job Number	Job No. P-91-157-226; Contract No. 62R63
Drill Rig Type	Mobile B-57
Sampler Type	Split Spoon (SS)
Boring Location	STA 48+38.17 with offset 21.20' RT-See Plate 1
Boring Elevation (ft)	619.16 **Date:** 9/25/2023

Sample # /RUN #	Sampling Method	Rimac Qu (tsf)	Sample Recovery (in)/%	Moisture Content (%)	SPT Valuese Blows/6 In	Depth (ft)	Sample Depth	Graphic	Soil Description	Elevation (ft)
						0.5		AS	**6" of Asphalt**	618.66
						1.0		CONC	**12" of Concrete**	618.16
						1.5				617.66
1	SS	N/A	10.00	N/A	6, 3, 4	2.0		AGG	**6" of Aggregate Base AGG**	617.16
						2.5		A-1-b	**Brown Sand (A-1-b)**	616.66
						3.0			Loose	616.16
						3.5				615.66
						4.0				615.16
2	SS	N/A	14.00	N/A	3, 3, 3	4.5				614.66
						5.0				614.16
						5.5				613.66
						6.0				613.16
						6.5				612.66
3	SS	N/A	10.00	N/A	1, 1, 1	7.0			Very Loose	612.16
						7.5				611.66
						8.0				611.16
						8.5				610.66
						9.0		A-1-a	**Brown Sand (A-1-a)**	610.16
4	SS	N/A	11	N/A	3, 5, 6	9.5			With Gravel, trace Clay, Medium Dense	609.66
						10.0				609.16
						10.5				608.66
						11.0				608.16
						11.5		A-1-b	**Brown Sand (A-1-b)**	607.66
5	SS	N/A	9	N/A	1, 1, 2	12.0			Very Loose	607.16
						12.5				606.66
						13.0				606.16
						13.5				605.66
						14.0		A-1-a	**Brown Sand (A-1-a)**	605.16
6	SS	N/A	8	N/A	1, 2, 2	14.5			Trace Clay and Gravel, Loose	604.66
						15.0				604.16
						15.5				603.66
						16.0				603.16
						16.5		A-64	**Brown and Gray Silty Clay (A-4)**	602.66
7	SS	2.419	13	16.7	3, 4, 6	17.0			Trace Sand and Gravel, Very Stiff	602.16
						17.5			**Unit Weight 124.9 pcf**	601.66
						18.0				601.16
						18.5				600.66
						19.0		A-4	**Gray Silty Clay (A-6)**	600.16
8	SS	3.930	15	17.4	4, 5, 7	19.5			Trace Sand and Gravel, Very Stiff	599.66
						20.0			**Unit weight 118.2 pcf**	599.16
						20.5				598.66
						21.0				598.16
						21.5				597.66
9	SS	3.628	15	16.3	4, 6, 7	22.0				597.16
						22.5			**Unit weight 122.0 pcf**	596.66
						23.0				596.16
						23.5				595.66
						24.0				595.16
10	SS	2.419	17	18.3	4, 5, 8	24.5				594.66
						25.0			**Unit weight 126.2 pcf**	594.16
						25.5				593.66
						26.0				593.16
						26.5				592.66
11	SS	2.016	18	21.9	3, 6, 7	27.0				592.16
						27.5			**Unit weight 115.4 pcf**	591.66
						28.0				591.16
						28.5				590.66
						29.0				590.16
12	SS	2.318	18	19.5	5, 5, 8	29.5				589.66
						30.0			**Unit weight 120.3 pcf**	589.16

Boring Continued

Note: Soil group symbol and group name are determined based on visual classification, plasticity index and liquid limit wherever material was available using ASTM D2488 & D4318

NASHnal SOIL TESTING

23856 W. Andrew Rd., Unit 103, Plainfield

BOREHOLE LOG

Number BB-4B

Plate 9

Client	Baxter and Woodman, Inc.
Location	Devon Ave. Bridge over I-94-STA 48+38.17 (1942121.34N,1142627.907E)
Job Number	Job No. P-91-157-226; Contract No. 62R63
Drill Rig Type	Mobile B-57
Sampler Type	Split Spoon (SS)
Boring Location	STA 48+38.17 with offset 21.20' RT-See Plate 1
Boring Elevation (ft)	619.16 **Date:** 9/25/2023

Sample # /RUN #	Sampling Method	Rimac Qu (tsf)	Sample Recovery (in)/%	Moisture Content (%)	SPT Valuese Blows/6 In	Depth (ft)	Sample Depth	Graphic	Soil Description	Elevation (ft)
						30.5		A-4		588.66
						31.0				588.16
						31.5				587.66
						32.0				587.16
						32.5				586.66
						33.0				586.16
						33.5				585.66
						34.0		A-6	**Gray Lean Clay (A-6)**	585.16
13	SS	2.620	18	15	7, 8, 9	34.5			Trace Gravel, Very Stiff	584.66
						35.0			**Unit Weight 125.2 pcf**	584.16
						35.5				583.66
						36.0				583.16
						36.5				582.66
						37.0				582.16
						37.5				581.66
						38.0				581.16
						38.5				580.66
						39.0				580.16
14	SS	3.527	18	15.3	7, 8, 9	39.5				579.66
						40.0			**Unit Weight 141.6 pcf**	579.16
						40.5			Very Stiff	578.66
						41.0				578.16
						41.5				577.66
						42.0				577.16
						42.5				576.66
						43.0				576.16
						43.5				575.66
						44.0				575.16
15	SS	3.430	4	19.7	6, 9, 12	44.5				574.66
						45.0				574.16
						45.5				573.66
						46.0				573.16
						46.5				572.66
						47.0				572.16
						47.5				571.66
						48.0				571.16
						48.5				570.66
						49.0				570.16
16	SS	4.636	18	21.0	9, 8, 12	49.5			Hard	569.66
						50.0			**Unit Weight 121.3 pcf**	569.16
						50.5				568.66
						51.0				568.16
						51.5				567.66
						52.0				567.16
						52.5				566.66
						53.0				566.16
						53.5				565.66
						54.0				565.16
17	SS	5.543	18	13.1	9, 8, 12	54.5			Hard	564.66
						55.0			**Unit Weight 131.7 pcf**	564.16
						55.5				563.66
						56.0				563.16
						56.5				562.66
						57.0				562.16
						57.5				561.66
						58.0				561.16
						58.5				560.66
						59.0				560.16
18	SS	5.744	18	14.9	8, 11, 14	59.5			Hard	559.66
						60.0			**Unit Weight 128.3 pcf**	559.16

Boring Continued

Note: Soil group symbol and group name are determined based on visual classification, plasticity index and liquid limit wherever material was available using ASTM D2488 & D4318

NASHnal SOIL TESTING

23856 W. Andrew Rd., Unit 103, Plainfield, IL

BOREHOLE LOG

Number BB-4C

Plate 10

Client	Baxter and Woodman, Inc.
Location	Devon Ave. Bridge over I-94-STA 48+38.17 (1942121.34N,1142627.907E)
Job Number	Job No. P-91-157-226; Contract No. 62R63
Drill Rig Type	Mobile B-57
Sampler Type	Split Spoon (SS)
Boring Location	STA 48+38.17 with offset 21.20' RT-See Plate 1
Boring Elevation (ft)	619.16 **Date:** 9/25/2023

Sample # /RUN #	Sampling Method	Rimac Qu (tsf)	Sample Recovery (in)/%	Moisture Content (%)	SPT Valuese Blows/6 In	Depth (ft)	Sample Depth	Graphic	Soil Description	Elevation (ft)
						60.5		A-6		558.66
						61.0				558.16
						61.5				557.66
						62.0				557.16
						62.5				556.66
						63.0				556.16
						63.5				555.66
						64.0		A-4	**Gray Silty Clay (A-4)**	555.16
15	SS	3.628	16	21.2	10, 8, 13	64.5			Trace Sand and Gravel, Very Stiff	554.66
						65.0			**Unit Weight 114.8 pcf**	554.16
						65.5				553.66
						66.0				553.16
						66.5				552.66
						67.0				552.16
						67.5				551.66
						68.0				551.16
						68.5				550.66
						69.0				550.16
16	SS	2.000	17	17.9	8, 11, 14	69.5			Very Stiff	549.66
						70.0			**Unit Weight 126.8 pcf**	549.16
						70.5				548.66
						71.0				548.16
						71.5				547.66
						72.0				547.16
						72.5				546.66
						73.0				546.16
						73.5				545.66
						74.0				545.16
17	SS	11.590	18	11.9	11, 12, 15	74.5				544.66
						75.0			**Unit Weight 134.7 pcf**	544.16
						75.5		A-6	**Gray Lean Clay (A-6)**	543.66
						76.0			with Sand and Gravel	543.16
						76.5			**Possible Hard Pan**	542.66
						77.0				542.16
						77.5				541.66
						78.0				541.16
						78.5				540.66
						79.0				540.16
18	SS	N/A	4	12.4	50/5	79.5			Very Hard	539.66
						80.0			**Possible Rock**	539.16
						80.5				538.66
						81.0				538.16
						81.5				537.66
						82.0				537.16
						82.5				536.66
						83.0				536.16
						83.5				535.66
						84.0				535.16
19	SS	N/A	N/A	N/A	50/2	84.5			Very Hard	534.66
						85.0			**Possible Rock**	534.16

End of Boring 85'

Water Level While Drilling : Dry

Water Level After Drilling : Dry

Cave In Depth : None

Note: Soil group symbol and group name are determined based on visual classification, plasticity index and liquid limit wherever material was available using ASTM D2488 & D4318

NASHnal SOIL TESTING

23856 W. Andrew Rd., Unit 103, Plainfield

BOREHOLE LOG

Number BB-5A

Plate 11

Client	Baxter and Woodman, Inc.
Location	Devon Ave. Bridge over I-94-STA 48+51.11 (1942165.163N,1142640.715E)
Job Number	Job No. P-91-157-226; Contract No. 62R63
Drill Rig Type	Mobile B-57
Sampler Type	Split Spoon (SS)
Boring Location	STA 48+51.11 with offset 22.58' LT-See Plate 1
Boring Elevation (ft)	619.86 **Date:** 9/25/2023

Sample # /RUN #	Sampling Method	Rimac Qu (tsf)	Sample Recovery (in)/%	Moisture Content (%)	SPT Valuese Blows/6 In	Depth (ft)	Sample Depth	Graphic	Soil Description	Elevation (ft)
						0.5		AS	**8.5 Inches of Asphalt**	619.36
						1.0		CONC	**9.5 Inches of Concrete**	618.86
						1.5				618.36
1	SS	1.510	7	19.7	3, 3, 3	2.0		AGG	**6 Inches of Aggregate Base AGG**	617.86
						2.5		A-4	**Brown Silty Clay (A-4)**	617.36
						3.0			Trace Sand and Gravel	616.86
						3.5				616.36
						4.0		A-1-a	**Brown Sand (A-1-a)**	615.86
2	SS	N/A	6	15.2	3, 6, 9	4.5			Medium Dense	615.36
						5.0				614.86
						5.5				614.36
						6.0				613.86
						6.5		A-4	**Brown Silty Clay (A-4)**	613.36
3	SS	3.000	11	18.1	6, 7, 8	7.0			Very Stiff	612.86
						7.5			**Unit Weight 111.6 pcf**	612.36
						8.0				611.86
						8.5				611.36
						9.0		A-1-b	**Brown and Gray Silty Sand (A-1-b)**	610.86
4	SS	N/A	1	22.1	50/1	9.5			Medium Dense , possible boulder	610.36
						10.0			**Unit Weight 111.6 pcf**	609.86
						10.5				609.36
						11.0				608.86
						11.5				608.36
5	SS	N/A	5	24.6	6, 9, 8	12.0				607.86
						12.5				607.36
						13.0				606.86
						13.5				606.36
						14.0		A-6	**Gray Lean Clay (A-6)**	605.86
6	SS	1.000	6	23.9	6, 5, 7	14.5			Trace Gravel, Stiff	605.36
						15.0				604.86
						15.5				604.36
						16.0				603.86
						16.5				603.36
7	SS	5.341	11	17.7	7, 8, 10	17.0			Hard	602.86
						17.5			**Unit Weight 123.7 pcf**	602.36
						18.0				601.86
						18.5				601.36
						19.0			Very Stiff	600.86
8	SS	3.527	16	17.8	8, 9, 11	19.5			**Unit Weight 128.9 pcf**	600.36
						20.0				599.86
						20.5				599.36
						21.0				598.86
						21.5				598.36
9	SS	2.419	12	20.1	6, 8, 9	22.0			Very Stiff	597.86
						22.5			**Unit Weight 110.4 pcf**	597.36
						23.0				596.86
						23.5				596.36
						24.0				595.86
10	SS	2.217	16	18.2	5, 6, 7	24.5			Very Stiff	595.36
						25.0			**Unit Weight 127.2 pcf**	594.86
						25.5				594.36
						26.0				593.86
						26.5				593.36
11	SS	2.620	18	20.4	5, 7, 8	27.0				592.86
						27.5			**Unit Weight 112.2 pcf**	592.36
						28.0				591.86
						28.5				591.36
						29.0				590.86
12	SS	2.519	18	19.5	6, 5, 7	29.5			Very Stiff	590.36
						30.0			**Unit Weight 120.3 pcf**	589.86

Boring continued

Note: Soil group symbol and group name are determined based on visual classification, plasticity index and liquid limit wherever material was available using ASTM D2488 & D4318

NASHnal SOIL TESTING

23856 W. Andrew Rd., Unit 103, Plainfield

BOREHOLE LOG

Number BB-5 B

Plate 12

Client	Baxter and Woodman, Inc.
Location	Devon Ave. Bridge over I-94-STA 48+51.11 (1942165.163N,1142640.715E)
Job Number	Job No. P-91-157-226; Contract No. 62R63
Drill Rig Type	Mobile B-57
Sampler Type	Split Spoon (SS)
Boring Location	STA 48+51.11 with offset 22.58' LT-See Plate 1
Boring Elevation (ft)	619.86 **Date:** 9/25/2023

Sample # /RUN #	Sampling Method	Rimac Qu (tsf)	Sample Recovery (in)/%	Moisture Content (%)	SPT Valuese Blows/6 In	Depth (ft)	Sample Depth	Graphic	Soil Description	Elevation (ft)
						30.5				589.36
						31.0				588.86
						31.5				588.36
						32.0				587.86
						32.5				587.36
						33.0				586.86
						33.5				586.36
						34.0			**Gray Lean Clay (A-6)**	585.86
9	SS	2.116	18	19.4	5, 6, 8	34.5			Trace Gravel, Very Stiff	585.36
						35.0			**Unit Weight 127.6 pcf**	584.86
						35.5				584.36
						36.0				583.86
						36.5				583.36
						37.0		A-6		582.86
						37.5				582.36
						38.0				581.86
						38.5				581.36
						39.0				580.86
10	SS	2.620	15	14.7	6, 7, 9	39.5			Very Stiff	580.36
						40.0			**Unit Weight 129.5 pcf**	579.86
						40.5				579.36
						41.0				578.86
						41.5				578.36
						42.0				577.86
						42.5				577.36
						43.0				576.86
						43.5				576.36
						44.0			**Gray Sandy Silty Clay (A-4)**	575.86
11	SS	2.519	18	16.9	10, 16, 18	44.5			Very Stiff	575.36
						45.0			**Unit Weight 133.1 pcf**	574.86
						45.5				574.36
						46.0				573.86
						46.5				573.36
						47.0				572.86
						47.5				572.36
						48.0				571.86
						48.5				571.36
						49.0				570.86
12	SS	4.334	18	18.2	11, 14, 17	49.5			Hard	570.36
						50.0			**Unit Weight 126.5 pcf**	569.86
						50.5				569.36
						51.0				568.86
						51.5				568.36
						52.0		A-4		567.86
						52.5				567.36
						53.0				566.86
						53.5				566.36
						54.0				565.86
13	SS	3.527	18	16.3	5, 9, 11	54.5			Very Stiff	565.36
						55.0			**Unit Weight 133.5 pcf**	564.86
						55.5				564.36
						56.0				563.86
						56.5				563.36
						57.0				562.86
						57.5				562.36
						58.0				561.86
						58.5				561.36
						59.0			Hard	560.86
14	SS	5.241	13	12.8	17, 10, 15	59.5			**Unit Weight 118.6 pcf**	560.36
						60.0				559.86

Boring Continued

Note: Soil group symbol and group name are determined based on visual classification, plasticity index and liquid limit wherever material was available using ASTM D2488 & D4318

NASHnal SOIL TESTING

23856 W. Andrew Rd., Unit 103, Plainfield,

BOREHOLE LOG

Number BB-5C

Plate 13

Client	Baxter and Woodman, Inc.
Location	Devon Ave. Bridge over I-94-STA 48+51.11 (1942165.163N,1142640.715E)
Job Number	Job No. P-91-157-226; Contract No. 62R63
Drill Rig Type	Mobile B-57
Sampler Type	Split Spoon (SS)
Boring Location	STA 48+51.11 with offset 22.58' LT-See Plate 1
Boring Elevation (ft)	619.86 **Date:** 9/25/2023

Sample # /RUN #	Sampling Method	Rimac Qu (tsf)	Sample Recovery (in)/%	Moisture Content (%)	SPT Valuese Blows/6 In	Depth (ft)	Sample Depth	Graphic	Soil Description	Elevation (ft)
						60.5				559.36
						61.0				558.86
						61.5				558.36
						62.0				557.86
						62.5				557.36
						63.0				556.86
						63.5				556.36
						64.0			**Gray Lean Clay (A-6)**	555.86
15	SS	4.334	17	15.9	13, 12, 17	64.5			Trace Sand and Gravel, Hard	555.36
						65.0			**Unit Weight 126.9 pcf**	554.86
						65.5				554.36
						66.0				553.86
						66.5				553.36
						67.0				552.86
						67.5				552.36
						68.0				551.86
						68.5				551.36
						69.0				550.86
16	SS	3.628	18	20	7, 10, 15	69.5			Very Stiff	550.36
						70.0			**Unit Weight 109.0 pcf**	549.86
						70.5				549.36
						71.0				548.86
						71.5				548.36
						72.0		A-6		547.86
						72.5				547.36
						73.0				546.86
						73.5				546.36
						74.0				545.86
17	SS	5.543	18	9.8	32, 41, 50	74.5			With Sand and Gravel, Hard	545.36
						75.0			**Unit Weight 124.9 pcf**	544.86
						75.5			Possible Hard Pan	544.36
						76.0				543.86
						76.5				543.36
						77.0				542.86
						77.5				542.36
						78.0				541.86
						78.5				541.36
						79.0				540.86
18	SS	5.600	8	11.2	46, 50/4	79.5			Hard	540.36
						80.0			**Hard Pan**	539.86
						80.5				539.36
						81.0				538.86
						81.5				538.36
						82.0				537.86
						82.5				537.36
						83.0				536.86
						83.5				536.36
						84.0			**Stone Fragments, Gravel and Sand (A-1)**	535.86
19	SS	N/A	2	N/A	50/2	84.5		A-1	Very Dense	535.36
						85.0			**Bed Rock**	534.86

End of Boring 85'

Water Level While Drilling : Dry

Water Level After Drilling : Dry

Cave In Depth : None

Note: Soil group symbol and group name are determined based on visual classification, plasticity index and liquid limit wherever material was available using ASTM D2488 & D4318

NASHnal SOIL TESTING

23856 W. Andrew Rd., Unit 103, Plainfield

BOREHOLE LOG

Number RB-6

Plate 14

Client	Baxter and Woodman, Inc.
Location	Devon Ave. Bridge over I-94-STA 47+58.23 (1942164.942N,1142547.835E)
Job Number	Job No. P-91-157-226; Contract No. 62R63
Drill Rig Type	Mobile B-57
Sampler Type	Split Spoon (SS)
Boring Location	STA 47+58.23 with offset 22.64' LT-See Plate 1
Boring Elevation (ft)	619.86 **Date:** 9/25/2023

Sample # /RUN #	Sampling Method	Rimac Qu (tsf)	Sample Recovery (in)/%	Moisture Content (%)	SPT Valuese Blows/6 In	Depth (ft)	Sample Depth	Graphic	Soil Description	Elevation (ft)
						0.5		AS	**8 Inches Asphalt**	619.36
						1.0		CONC	**8 Inches Concrete**	618.86
						1.5			**Brown Sand and Gravel (A-1-a)**	618.36
1	SS	NR	8	N/A	5, 4, 3	2.0		A-1-a	Loose	617.86
						2.5				617.36
						3.0				616.86
						3.5				616.36

Boring terminted at 3.5 Feet
An obstruction was encountered while drilling at 3.5 feet.
Second attempt obstraction at 3.0 feet

Note: Soil group symbol and group name are determined based on visual classification, plasticity index and liquid limit wherever material was available using ASTM D2488 & D4318

NASHnal SOIL TESTING

23856 W. Andrew Rd., Unit 103, Plainfield

BOREHOLE LOG

Number BB-7A

Plate 15

Client	Baxter and Woodman, Inc.
Location	Devon Ave. Bridge over I-94-STA 51+29.63 (1942167.179N,1142919.233E)
Job Number	Job No. P-91-157-226; Contract No. 62R63
Drill Rig Type	Mobile B-57
Sampler Type	Split Spoon (SS)
Boring Location	STA 51+29.63 with offset 23.75' LT-See Plate 1
Boring Elevation (ft)	620.5 **Date:** 9/25/2023

Sample # /RUN #	Sampling Method	Rimac Qu (tsf)	Sample Recovery (in)/%	Moisture Content (%)	SPT Valuese Blows/6 In	Depth (ft)	Sample Depth	Graphic	Soil Description	Elevation (ft)
						0.5		AS	**9 Inches of Asphalt**	620.00
						1.0		CONC	**9 Inches of Concrete**	619.50
						1.5		AGG	**6 Inches of Aggregate Base AGG**	619.00
1	SS	1.500	7	16.6	3, 2, 2	2.0			**Brown and Gray Sandy Silty Clay (A-4)**	618.50
						2.5			Stiff	618.00
						3.0			**Unit Weight 114.5 pcf**	617.50
						3.5				617.00
						4.0		A-4		616.50
2	SS	1.310	10	23.0	3, 4, 3	4.5				616.00
						5.0			**Unit Weight 107.3 pcf**	615.50
						5.5				615.00
						6.0				614.50
						6.5			**Brown Silty Clay (A-4)**	614.00
3	SS	1.612	18	17.9	4, 3, 4	7.0		A-4	Trace Gravel, Stiff	613.50
						7.5			**Unit Weight 119.0 pcf**	613.00
						8.0				612.50
						8.5				612.00
						9.0			**Dark Brown Lean Clay (A-6)**	611.50
4	SS	2.519	15	15.4	5, 7, 8	9.5		A-6	Trace Gravel, Very Stiff	611.00
						10.0			**Unit Weight 113.0 pcf**	610.50
						10.5				610.00
						11.0				609.50
						11.5			**Gray Lean Clay (A-6)**	609.00
5	SS	2.721	12	20.4	4, 4, 5	12.0			Trace Sand and Gravel , Very Stiff	608.50
						12.5			**Unit Weight 108.1 pcf**	608.00
						13.0				607.50
						13.5				607.00
						14.0			Very soft	606.50
6	SS	<0.250	15	25.1	WOH	14.5				606.00
						15.0				605.50
						15.5				605.00
						16.0				604.50
						16.5			Very Stiff	604.00
7	SS	3.500	17	16.8	ST	17.0			**Unit Weight 123.3 pcf**	603.50
						17.5				603.00
						18.0				602.50
						18.5				602.00
						19.0				601.50
8	SS	3.225	18	19.0	7, 10, 13	19.5			Very Stiff	601.00
						20.0			**Unit Weight 123.9 pcf**	600.50
						20.5				600.00
						21.0		A-6		599.50
						21.5				599.00
9	SS	2.923	17	17.0	5, 7, 10	22.0			**Unit Weight 121.2 pcf**	598.50
						22.5				598.00
						23.0				597.50
						23.5				597.00
						24.0				596.50
10	SS	2.822	16	17.7	5, 5, 9	24.5			**Unit Weight 121.6 pcf**	596.00
						25.0				595.50
						25.5				595.00
						26.0				594.50
						26.5			Stiff	594.00
11	SS	1.814	18	19.3	5, 7, 8	27.0			**Unit Weight 118.7 pcf**	593.50
						27.5				593.00
						28.0				592.50
						28.5				592.00
						29.0			Stiff	591.50
12	SS	1.612	18	20.9	4, 5, 7	29.5			**Unit Weight 119.9 pcf**	591.00
						30.0				590.50

Boring Continued

Note: Soil group symbol and group name are determined based on visual classification, plasticity index and liquid limit wherever material was available using ASTM D2488 & D4318

NASHnal SOIL TESTING

23856 W. Andrew Rd., Unit 103, Plainfield

BOREHOLE LOG

Number BB-7B

Plate 16

Client	Baxter and Woodman, Inc.
Location	Devon Ave. Bridge over I-94-STA 51+29.63 (1942167.179N,1142919.233E)
Job Number	Job No. P-91-157-226; Contract No. 62R63
Drill Rig Type	Mobile B-57
Sampler Type	Split Spoon (SS)
Boring Location	STA 51+29.63 with offset 23.75' LT-See Plate 1
Boring Elevation (ft)	620.5 **Date:** 9/25/2023

Sample # /RUN #	Sampling Method	Rimac Qu (tsf)	Sample Recovery (in)/%	Moisture Content (%)	SPT Valuese Blows/6 In	Depth (ft)	Sample Depth	Graphic	Soil Description	Elevation (ft)
						30.5				590.00
						31.0				589.50
						31.5				589.00
						32.0				588.50
						32.5				588.00
						33.0				587.50
						33.5			**Gray Lean Clay (A-6)**	587.00
						34.0			**Trace Gravel**	586.50
13	SS	2.519	18	19.8	4, 6, 6	34.5			Stiff	586.00
						35.0			**Unit Weight 118.9 pcf**	585.50
						35.5				585.00
						36.0				584.50
						36.5				584.00
						37.0				583.50
						37.5				583.00
						38.0				582.50
						38.5				582.00
						39.0				581.50
14	SS	4.233	16	16.3	6, 10, 14	39.5			Very Stiff	581.00
						40.0			**Unit Weight 128.4 pcf**	580.50
						40.5				580.00
						41.0				579.50
						41.5				579.00
						42.0				578.50
						42.5				578.00
						43.0				577.50
						43.5				577.00
						44.0				576.50
15	SS	4.233	18	16.0	7, 8, 13	44.5				576.00
						45.0		A-6	**Unit Weight 123.2 pcf**	575.50
						45.5				575.00
						46.0				574.50
						46.5				574.00
						47.0				573.50
						47.5				573.00
						48.0				572.50
						48.5				572.00
						49.0				571.50
16	SS	4.535	18	15.6	9, 12, 16	49.5			Very Stiff	571.00
						50.0			**Unit Weight 120.0 pcf**	570.50
						50.5				570.00
						51.0				569.50
						51.5				569.00
						52.0				568.50
						52.5				568.00
						53.0				567.50
						53.5				567.00
						54.0				566.50
17	SS	3.225	15	25.3	9, 5, 7	54.5			Stiff	566.00
						55.0			**Unit Weight 116.9 pcf**	565.50
						55.5				565.00
						56.0				564.50
						56.5				564.00
						57.0				563.50
						57.5				563.00
						58.0				562.50
						58.5				562.00
						59.0			With Sand, Stiff	561.50
18	SS	5.543	18	14.4	9, 11, 17	59.5			**Unit Weight 132.1 pcf**	561.00
						60.0				560.50

Boring Continued

Note: Soil group symbol and group name are determined based on visual classification, plasticity index and liquid limit wherever material was available using ASTM D2488 & D4318

NASHnal SOIL TESTING

23856 W. Andrew Rd., Unit 103, Plainfield,

BOREHOLE LOG

Number B-7 C

Plate 17

Client	Baxter and Woodman, Inc.
Location	Devon Ave. Bridge over I-94-STA 51+29.63 (1942167.179N,1142919.233E)
Job Number	Job No. P-91-157-226; Contract No. 62R63
Drill Rig Type	Mobile B-57
Sampler Type	Split Spoon (SS)
Boring Location	STA 51+29.63 with offset 23.75' LT-See Plate 1
Boring Elevation (ft)	620.5 **Date:** 9/25/2023

Sample # /RUN #	Sampling Method	Rimac Qu (tsf)	Sample Recovery (in)/%	Moisture Content (%)	SPT Valuese Blows/6 In	Depth (ft)	Sample Depth	Graphic	Soil Description	Elevation (ft)
						60.5				560.00
						61.0				559.50
						61.5				559.00
						62.0		A-6		558.50
						62.5				558.00
						63.0				557.50
						63.5				557.00
						64.0			**Gray Silty Clay (A-5)**	556.50
19	SS	4.535	18.00	14.8	9, 12, 16	64.5			trace Sand & Gravel, Hard	556.00
						65.0			**Unit Weight 133.7 pcf**	555.50
						65.5				555.00
						66.0				554.50
						66.5				554.00
						67.0				553.50
						67.5				553.00
						68.0				552.50
						68.5				552.00
						69.0		A-5		551.50
20	SS	3.527	18.00	15.5	11, 12, 16	69.5			**Unit Weight 121.8 pcf**	551.00
						70.0			Very Stiff	550.50
						70.5				550.00
						71.0				549.50
						71.5				549.00
						72.0				548.50
						72.5				548.00
						73.0				547.50
						73.5				547.00
					10, 19, 21	74.0			**Gray Lean Clay (A-6)**	546.50
21	SS	3.525	14.00	12.7	40	74.5			with Crushed Limestone and Sand, Very Stiff	546.00
						75.0			**Unit Weight 124.9 pcf**	545.50
						75.5				545.00
						76.0				544.50
						76.5		A-6		544.00
						77.0				543.50
						77.5				543.00
						78.0				542.50
						78.5				542.00
						79.0			**Stone Fragments Gravel and Sand (A-1)**	541.50
22	SS	N/A	NA	N/A	50/1	79.5			Very Dense	541.00
						80.0			**Altered Bed Rock**	540.50
						80.5				540.00
						81.0				539.50
						81.5		A-1		539.00
						82.0				538.50
						82.5				538.00
						83.0				537.50
						83.5				537.00
23	SS	N/A	8.00	4	43, 50/4	84.0			Bed Rock-Boring terminated at 84.0'	536.50

End of Boring 84'

Water Level While Drilling : Dry
Water Level After Drilling : Dry
Cave In Depth : None

Note: Soil group symbol and group name are determined based on visual classification, plasticity index and liquid limit wherever material was available using ASTM D2488 & D4318

NASHnal SOIL TESTING

23856 W. Andrew Rd., Unit 103, Plainfield

BOREHOLE LOG

Number WB-8

Plate 18

Client	Baxter and Woodman, Inc.
Location	Devon Ave. Bridge over I-94-STA 50+29.40 (1942061.89N,1142819.318E)
Job Number	Job No. P-91-157-226; Contract No. 62R63
Drill Rig Type	Mobile B-57
Sampler Type	Split Spoon (SS)
Boring Location	STA 50+29.40 with offset 81.24' RT-See Plate 1
Boring Elevation (ft)	603.46 **Date:** 9/25/2023

Sample # /RUN #	Sampling Method	Rimac Qu (tsf)	Sample Recovery (in)/%	Moisture Content (%)	SPT Valuese Blows/6 In	Depth (ft)	Sample Depth	Graphic	Soil Description	Elevation (ft)
						0.5		AS	**16 Inches of Asphalt**	602.96
						1.0				602.46
						1.5				601.96
1	SS	N/A	10	N/A	8, 9, 8	2.0		A-1-b	**Brown Sand (A-1-b)**	601.46
						2.5			with Gravel, medium dense	600.96
						3.0				600.46
						3.5				599.96
						4.0		A-6	**Grey Lean Clay (A-6)**	599.46
2	SS	1.000	5	23.4	3, 4, 4	4.5			Trace Gravel, Stiff	598.96
						5.0			**Unit Weight 117.8 pcf**	598.46
						5.5				597.96
						6.0				597.46
						6.5			Very Stiff	596.96
3	SS	2.519	18	15.9	3, 5, 5	7.0			**Unit Weight 117.8 pcf**	596.46
						7.5				595.96
						8.0				595.46
						8.5				594.96
						9.0			Stiff	594.46
4	SS	1.814	15	16.4	4, 3, 5	9.5			**Unit Weight 117.8 pcf**	593.96
						10.0				593.46
						10.5				592.96
						11.0				592.46
						11.5				591.96
5	SS	1.612	18	18.8	3, 4, 3	12.0			**Unit Weight 117.8 pcf**	591.46
						12.5				590.96
						13.0				590.46
						13.5				589.96
						14.0				589.46
6	SS	1.310	17	19.7	4, 3, 4	14.5			**Unit Weight 104.1 pcf**	588.96
						15.0				588.46
						15.5				587.96
						16.0				587.46
						16.5				586.96
7	SS	2.116	18	17.5	3, 4, 5	17.0			Very Stiff	586.46
						17.5				585.96
						18.0				585.46
						18.5				584.96
						19.0			Stiff	584.46
8	SS	1.411	18	18.7	4, 5, 5	19.5			**Unit Weight 127.6 pcf**	583.96
						20.0				583.46

End of Boring 20'

Water Level While Drilling : Dry

Water Level After Drilling : Dry

Cave In Depth : None

Note: Soil group symbol and group name are determined based on visual classification, plasticity index and liquid limit wherever material was available using ASTM D2488 & D4318

NASHnal SOIL TESTING

23856 W. Andrew Rd., Unit 103, Plainfield

BOREHOLE LOG

Number WB-9

Plate 19

Client	Baxter and Woodman, Inc.
Location	Devon Ave. Bridge over I-94-STA 50+80.83 (1942223.754N,1142870.26E)
Job Number	Job No. P-91-157-226; Contract No. 62R63
Drill Rig Type	Mobile B-57
Sampler Type	Split Spoon (SS)
Boring Location	STA 50+80.83 with offset 80.47' LT-See Plate 1
Boring Elevation (ft)	603.88 **Date:** 9/28/2023

Sample # /RUN #	Sampling Method	Rimac Qu (tsf)	Sample Recovery (in)/%	Moisture Content (%)	SPT Valuese Blows/6 In	Depth (ft)	Sample Depth	Graphic	Soil Description	Elevation (ft)
						0.5		AS	**16 Inches of Asphalt**	603.38
						1.0				602.88
						1.5			**Brown and Gray Gravel (A-1-b)**	602.38
1	SS	N/A	13	N/A	13, 10, 15	2.0			with Sand	601.88
						2.5		A-1-b		601.38
						3.0				600.88
						3.5				600.38
						4.0			**Gray Lean Clay (A-6)**	599.88
2	SS	4.535	12	13.4	5, 6, 5	4.5			Trace Gravel, Hard	599.38
						5.0			**Unit Weight 124.0 pcf**	598.88
						5.5				598.38
						6.0				597.88
						6.5				597.38
3	SS	2.822	18	15.9	4, 5, 6	7.0			Very Stiff	596.88
						7.5			**Unit Weight 120.2 pcf**	596.38
						8.0				595.88
						8.5				595.38
						9.0				594.88
4	SS	3.023	18	17.7	4, 4, 5	9.5				594.38
						10.0			**Unit Weight 120.4 pcf**	593.88
						10.5				593.38
						11.0				592.88
						11.5				592.38
5	SS	2.318	18	16.6	5, 4, 6	12.0		A-6		591.88
						12.5			**Unit Weight 117.1 pcf**	591.38
						13.0				590.88
						13.5				590.38
						14.0				589.88
6	SS	1.713	18	19.8	3, 5, 5	14.5			With Gravel, Stiff	589.38
						15.0			**Unit Weight 127.2 pcf**	588.88
						15.5				588.38
						16.0				587.88
						16.5				587.38
7	SS	2.217	18	19.0	4, 5, 7	17.0				586.88
						17.5			**Unit Weight 118.7 pcf**	586.38
						18.0				585.88
						18.5				585.38
						19.0				584.88
8	SS	2.519	18	17.6	5, 6, 8	19.5				584.38
						20.0			**Unit Weight 123.3 pcf**	583.88

End of Boring 20'

Water Level While Drilling : Dry

Water Level After Drilling : Dry

Cave In Depth : None

Note: Soil group symbol and group name are determined based on visual classification, plasticity index and liquid limit wherever material was available using ASTM D2488 & D4318

NASHnal SOIL TESTING

23856 W. Andrew Rd., Unit 103, Plainfield,

BOREHOLE LOG

Number WB-10

Plate 20

Client	Baxter and Woodman, Inc.
Location	Devon Ave. Bridge over I-94-STA 49+64.09 (11942206.72N,1142753.564E)
Job Number	Job No. P-91-157-226; Contract No. 62R63
Drill Rig Type	Mobile B-57
Sampler Type	Split Spoon (SS)
Boring Location	STA 49+64.09 with offset 63.79' LT-See Plate 1
Boring Elevation (ft)	603.68 **Date:** 9/25/2023

Sample # /RUN #	Sampling Method	Rimac Qu (tsf)	Sample Recovery (in)/%	Moisture Content (%)	SPT Valuese Blows/6 In	Depth (ft)	Sample Depth	Graphic	Soil Description	Elevation (ft)
						0.5		AS	**16 Inches of Asphalt**	603.18
						1.0				602.68
						1.5			**Gray Gravel (A-1-b)**	602.18
1	SS	N/A	11	N/A	7, 9, 10	2.0			with Sand, medium dense	601.68
						2.5				601.18
						3.0				600.68
						3.5		A-1-b		600.18
						4.0				599.68
2	SS	N/A	14	N/A	13, 15, 17	4.5			Dense	599.18
						5.0				598.68
						5.5				598.18
						6.0				597.68
						6.5			**Gray Silty Clay (A-4)**	597.18
3	SS	3.023	13	17.4	3, 4, 7	7.0			Trace Sand and Gravel, Very Stiff	596.68
						7.5			Unit weight 120.3	596.18
						8.0				595.68
						8.5				595.18
						9.0				594.68
4	SS	2.016	18	13.7	3, 3, 4	9.5			Unit weight 141.7	594.18
						10.0				593.68
						10.5				593.18
						11.0				592.68
						11.5			Stiff	592.18
5	SS	1.915	17	16.6	3, 4, 5	12.0			Unit weight 124.4	591.68
						12.5				591.18
						13.0		A-4		590.68
						13.5				590.18
						14.0				589.68
6	SS	1.512	16	16.6	4, 4, 5	14.5			Unit weight 120.4	589.18
						15.0				588.68
						15.5				588.18
						16.0				587.68
						16.5			Very Stiff	587.18
7	SS	2.116	17	14.4	3, 5, 5	17.0			Unit weight 120.9	586.68
						17.5				586.18
						18.0				585.68
						18.5				585.18
						19.0			Stiff	584.68
8	SS	1.500	8	19.1	4, 6, 7	19.5			Unit Weight 112.5	584.18
						20.0				583.68

End of Boring 20'

Water Level While Drilling : Dry
Water Level After Drilling : Dry
Cave In Depth : None

Note: Soil group symbol and group name are determined based on visual classification, plasticity index and liquid limit wherever material was available using ASTM D2488 & D4318

NASHnal SOIL TESTING

23856 W. Andrew Rd., Unit 103, Plainfield,

BOREHOLE LOG

Number WB-11

Plate 21

Client	Baxter and Woodman, Inc.
Location	Devon Ave. Bridge over I-94-STA 49+26.02 (1942094.213N,1142715.84E)
Job Number	Job No. P-91-157-226; Contract No. 62R63
Drill Rig Type	Mobile B-57
Sampler Type	Split Spoon (SS)
Boring Location	STA 49+26.02 with offset 48.60' RT-See Plate 1
Boring Elevation (ft)	603.58 **Date:** 9/25/2023

Sample # /RUN #	Sampling Method	Rimac Qu (tsf)	Sample Recovery (in)/%	Moisture Content (%)	SPT Valuese Blows/6 In	Depth (ft)	Sample Depth	Graphic	Soil Description	Elevation (ft)
						0.5		AS	**16 Inches of Asphalt**	603.08
						1.0				602.58
						1.5			**Gray Gravel (A-1-b)**	602.08
1	SS	N/A	11	N/A	12, 14, 15	2.0		A-1-b	with Sand, medium dense	601.58
						2.5				601.08
						3.0				600.58
						3.5				600.08
						4.0			**Brown Sand (A-1-b)**	599.58
2	SS	N/A	6	N/A	6, 4, 2	4.5		A-1-b	Trace Gravel, Loose	599.08
						5.0				598.58
						5.5				598.08
						6.0				597.58
						6.5			**Gray Silty Clay (A-4)**	597.08
3	SS	1.713	15	13.8	3, 2, 3	7.0			Trace Sand and Gravel, Stiff	596.58
						7.5			**Unit weight 125.3**	596.08
						8.0				595.58
						8.5				595.08
						9.0				594.58
4	SS	2.217	18	16.4	4, 3, 5	9.5			Very Stiff	594.08
						10.0			**Unit weight 118.0**	593.58
						10.5				593.08
						11.0				592.58
						11.5				592.08
4	SS	2.016	18	16.2	4, 5, 6	12.0				591.58
						12.5			**Unit weight 120.5**	591.08
						13.0		A-4		590.58
						13.5				590.08
						14.0				589.58
5	SS	2.016	18	19.0	3, 4, 5	14.5				589.08
						15.0			**Unit weight 116.5**	588.58
						15.5				588.08
						16.0				587.58
						16.5				587.08
4	SS	1.915	15	18.2	4, 5, 7	17.0			Stiff	586.58
						17.5			**Unit weight 116.10**	586.08
						18.0				585.58
						18.5				585.08
						19.0				584.58
6	SS	2.318	17	19.0	5, 7, 8	19.5			Very Stiff	584.08
						20.0			**Unit Weight 113.0**	583.58

End of Boring 20'

Water Level While Drilling : Dry

Water Level After Drilling : Dry

Cave In Depth : None

Note: Soil group symbol and group name are determined based on visual classification, plasticity index and liquid limit wherever material was available using ASTM D2488 & D4318

NASHnal SOIL TESTING

23856 W. Andrew Rd., Unit 103, Plainfield

BOREHOLE LOG

Number BB-13A

Plate 22

Client	Baxter and Woodman, Inc.
Location	Devon Ave. Bridge over I-94-STA 50+45.00 (41.997414,-87.74990)
Job Number	Job No. P-91-157-226; Contract No. 62R63
Drill Rig Type	Mobile B-57
Sampler Type	Split Spoon (SS)
Boring Location	STA 50+45.00 with offset 60.28' LT-See Plate 1
Boring Elevation (ft)	603.76 **Date:** 11/4/2023

Sample # /RUN #	Sampling Method	Rimac Qu (tsf)	Sample Recovery (in)/%	Moisture Content (%)	SPT Valuese Blows/6 In	Depth (ft)	Sample Depth	Graphic	Soil Description	Elevation (ft)
						0.5		AS	**4.0 Inches of Asphalt**	603.26
						1.0		CONC	**11 Inches of Concrete**	602.76
						1.5		CONC		602.26
1	SS	NA	3	NA	50/3"	2.0		AGG FILL	**Concrete and Asphalt Fill (AGG FILL)**	601.76
						2.5		AGG FILL	Extreamly Dense	601.26
						3.0		AGG FILL		600.76
						3.5		AGG FILL		600.26
						4.0		AGG FILL	**Aggregate Fill (AGG FILL)**	599.76
2	SS	N/A	5	NA	50/5"	4.5		AGG FILL	Gravel, Boulder, Cobble Mix-Extreamly Dense	599.26
						5.0		AGG FILL		598.76
						5.5		AGG FILL		598.26
						6.0		AGG FILL		597.76
						6.5		A-6	**Gray Lean Clay (A-6)**	597.26
3	SS	3.124	16	27.8	3, 6, 7	7.0		A-6	Very Stiff	596.76
						7.5		A-6	**Unit Weight 107.7 pcf**	596.26
						8.0		A-6		595.76
						8.5		A-6		595.26
						9.0		A-6		594.76
4	SS	2.923	16	15.0	3, 5, 7	9.5		A-6		594.26
						10.0		A-6	**Unit Weight 127.5 pcf**	593.76
						10.5		A-6		593.26
						11.0		A-6		592.76
						11.5		A-6		592.26
5	SS	3.830	18	21.2	2, 5, 6	12.0		A-6		591.76
						12.5		A-6	**Unit Weight 112.5 pcf**	591.26
						13.0		A-6		590.76
						13.5		A-6		590.26
						14.0		A-6		589.76
6	SS	3.830	16	18.8	3, 4, 5	14.5		A-6		589.26
						15.0		A-6	**Unit Weight 118.7 pcf**	588.76
						15.5		A-6		588.26
						16.0		A-6		587.76
						16.5		A-6		587.26
7	SS	1.915	16	20.2	2, 4, 5	17.0		A-6	Stiff	586.76
						17.5		A-6	**Unit Weight 118.4 pcf**	586.26
						18.0		A-6		585.76
						18.5		A-6		585.26
						19.0		A-6		584.76
8	SS	1.000	6	22.7	5, 8, 7	19.5		A-6	Stiff	584.26
						20.0		A-6		583.76
						20.5		A-6		583.26
						21.0		A-6		582.76
						21.5		A-6		582.26
9	SS	1.915	18	19.4	2, 5, 6	22.0		A-6	Stiff	581.76
						22.5		A-6	**Unit Weight 112.6 pcf**	581.26
						23.0		A-6		580.76
						23.5		A-6		580.26
						24.0		A-6		579.76
10	SS	2.016	18	22.2	7, 7, 7	24.5		A-6	Very Stiff	579.26
						25.0		A-6	**Unit Weight 107.9 pcf**	578.76
						25.5		A-6		578.26
						26.0		A-6		577.76
						26.5		A-6		577.26
11	SS	2.923	15	14.9	4, 8, 9	27.0		A-6		576.76
						27.5		A-6	**Unit Weight 128.5 pcf**	576.26
						28.0		A-6		575.76
						28.5		A-6		575.26
						29.0		A-6		574.76
12	SS	4.132	18	15.8	5, 10, 15	29.5		A-6	Hard	574.26
						30.0		A-6	**Unit Weight 130.3 pcf**	573.76

Boring continued

Note: Soil group symbol and group name are determined based on visual classification, plasticity index and liquid limit wherever material was available using ASTM D2488 & D4318

NASHnal SOIL TESTING

23856 W. Andrew Rd., Unit 103, Plainfield,

BOREHOLE LOG

Number BB-13B

Plate 23

Client	Baxter and Woodman, Inc.
Location	Devon Ave. Bridge over I-94-STA 50+45.00 (41.997414,-87.74990)
Job Number	Job No. P-91-157-226; Contract No. 62R63
Drill Rig Type	Mobile B-57
Sampler Type	Split Spoon (SS)
Boring Location	STA 50+45.00 with offset 60.28' LT-See Plate 1
Boring Elevation (ft)	603.76 **Date:** 11/4/2023

Sample # /RUN #	Sampling Method	Rimac Qu (tsf)	Sample Recovery (in)/%	Moisture Content (%)	SPT Valuese Blows/6 In	Depth (ft)	Sample Depth	Graphic	Soil Description	Elevation (ft)
						30.5				573.26
						31.0				572.76
						31.5				572.26
						32.0				571.76
						32.5				571.26
						33.0				570.76
						33.5				570.26
						34.0			Hard	569.76
13	SS	4.837	16	20	4, 8, 16	34.5			**Unit Weight 117.8 pcf**	569.26
						35.0				568.76
						35.5				568.26
						36.0				567.76
						36.5				567.26
						37.0				566.76
						37.5				566.26
						38.0				565.76
						38.5				565.26
						39.0				564.76
14	SS	2.721	16	16.9	7, 7, 9	39.5			Very Stiff	564.26
						40.0			**Unit Weight 126.5 pcf**	563.76
						40.5				563.26
						41.0				562.76
						41.5				562.26
						42.0				561.76
						42.5				561.26
						43.0				560.76
						43.5				560.26
						44.0				559.76
15	SS	4.233	14	14.1	6, 9, 10	44.5			Hard	559.26
						45.0		A-6	**Unit Weight 124.4 pcf**	558.76
						45.5				558.26
						46.0				557.76
						46.5				557.26
						47.0				556.76
						47.5				556.26
						48.0				555.76
						48.5				555.26
						49.0				554.76
16	SS	2.721	13	15.5	6, 10, 10	49.5			Very Stiff	554.26
						50.0			**Unit Weight 124.0 pcf**	553.76
						50.5				553.26
						51.0				552.76
						51.5				552.26
						52.0				551.76
						52.5				551.26
						53.0				550.76
						53.5				550.26
						54.0				549.76
17	SS	2.923	18	30.8	4, 4, 5	54.5				549.26
						55.0			**Unit Weight 111.8 pcf**	548.76
						55.5				548.26
						56.0				547.76
						56.5				547.26
						57.0				546.76
						57.5				546.26
						58.0				545.76
						58.5				545.26
						59.0				544.76
18	SS	5.845	18	11.6	24, 29, 22	59.5			Hard	544.26
						60.0			**Unit Weight 132.6 pcf**	543.76

Boring continued

Note: Soil group symbol and group name are determined based on visual classification, plasticity index and liquid limit wherever material was available using ASTM D2488 & D4318

NASHnal SOIL TESTING

23856 W. Andrew Rd., Unit 103, Plainfield

BOREHOLE LOG

Number BB-13C

Plate 24

Client	Baxter and Woodman, Inc.
Location	Devon Ave. Bridge over I-94-STA 50+45.00 (41.997414,-87.74990)
Job Number	Job No. P-91-157-226; Contract No. 62R63
Drill Rig Type	Mobile B-57
Sampler Type	Split Spoon (SS)
Boring Location	STA 50+45.00 with offset 60.28' LT-See Plate 1
Boring Elevation (ft)	603.76 **Date:** 11/4/2023

Sample # /RUN #	Sampling Method	Rimac Qu (tsf)	Sample Recovery (in)/%	Moisture Content (%)	SPT Valuese Blows/6 In	Depth (ft)	Sample Depth	Graphic	Soil Description	Elevation (ft)
						60.5				543.26
						61.0				542.76
						61.5				542.26
						62.0				541.76
						62.5				541.26
						63.0				540.76
						63.5				540.26
						64.0			No Recovery-Possible Rock	539.76
19	SS	NA	1	NA	50/1"	64.5				539.26
						65.0				538.76
						65.5				538.26
						66.0		A-6		537.76
						66.5				537.26
						67.0				536.76
						67.5				536.26
						68.0				535.76
						68.5				535.26
						69.0				534.76
20	SS	7.962	5	16.9	50/5"	69.5			Very Hard	534.26
						70.0			**Hard Pan**	533.76
						70.5				533.26
						71.0				532.76
						71.5				532.26
						72.0			**Rock Type: Limestone**	531.76
						72.5			Well Cemented, Light Gray to Gray	531.26
						73.0			Thinly Bedded, Slightly Weathered	530.76
						73.5			Fine to Medium Grained	530.26
						74.0			**RQD %=86**	529.76
						74.5				529.26
						75.0				528.76
						75.5				528.26
						76.0				527.76
						76.5				527.26
						77.0				526.76
						77.5				526.26
						78.0				525.76
						78.5				525.26
						79.0				524.76
						79.5		ROCK		524.26
						80.0				523.76
						80.5				523.26
						81.0				522.76
						81.5				522.26
						82.0				521.76
						82.5				521.26
						83.0				520.76
						83.5				520.26
						84.0				519.76
						84.5				519.26
						85.0				518.76
						85.5				518.26
						86.0				517.76
						86.5				517.26
						87.0				516.76

End of Boring 87.0'

Water Level While Drilling : Dry

Water Level After Drilling : Dry

Cave In Depth : None

Note: Soil group symbol and group name are determined based on visual classification, plasticity index and liquid limit wherever material was available using ASTM D2488 & D4318

NASHnal SOIL TESTING

23856 W. Andrew Rd., Unit 103, Plainfield, IL

BOREHOLE LOG

Number B-14

Plate 25

Client	Baxter and Woodman, Inc.
Location	Devon Ave. Bridge over I-94-STA 55+42.65 (1942169.825N,1143332.244E)
Job Number	Job No. P-91-157-226; Contract No. 62R63
Drill Rig Type	Mobile B-57
Sampler Type	Split Spoon (SS)
Boring Location	STA 55+42.65 with offset 25.13' LT-See Plate 2
Boring Elevation (ft)	611.50 **Date:** 9/25/2023

Sample # /RUN #	Sampling Method	Rimac Qu (tsf)	Sample Recovery (in)/%	Moisture Content (%)	SPT Valuese Blows/6 In	Depth (ft)	Sample Depth	Graphic	Soil Description	Elevation (ft)
						0.5		AS	**6 Inches of Asphalt**	611.00
						1.0		AGG	**6 Inches of Aggregate Base**	610.50
						1.5			**Brown and Gray Lean Clay (A-6)**	610.00
1	SS	0.750	16	20.5	6, 4, 2	2.0			With Sand and Gravel, Soft	609.50
						2.5			**Unit weight 115.7**	609.00
						3.0				608.50
						3.5		A-6		608.00
						4.0				607.50
2	SS	1.209	18	22.6	3, 4, 3	4.5			**Unit weight 116.7**	607.00
						5.0				606.50
						5.5				606.00
						6.0				605.50
						6.5			**Brown Silt (A-4)**	605.00
3	SS	3.500	18	20.0	3, 5, 6	7.0			Trace Sand and Gravel	604.50
						7.5		A-4	**Unit weight 115.3**	604.00
						8.0				603.50
						8.5				603.00
						9.0			**Gray Lean Clay (A-6)**	602.50
4	SS	2.512	18	15.2	3, 4, 5	9.5			With Sand, Stiff	602.00
						10.0			**Unit weight 130.2**	601.50
						10.5				601.00
						11.0				600.50
						11.5				600.00
5	SS	2.016	18	16.9	4, 4, 5	12.0			Very Stiff	599.50
						12.5			**Unit weight 114.6**	599.00
						13.0				598.50
						13.5			**WL- WD**	598.00
						14.0				597.50
6	SS	1.411	18	15.0	3, 5, 6	14.5		A-6	Stiff	597.00
						15.0			**Unit weight 132.6**	596.50
						15.5				596.00
						16.0				595.50
						16.5				595.00
7	SS	2.217	18	18.7	4, 5, 7	17.0			Very Stiff	594.50
						17.5			**Unit weight 116.3**	594.00
						18.0				593.50
						18.5				593.00
						19.0				592.50
8	SS	2.419	18	17.6	5, 4, 6	19.5				592.00
						20.0			**Unit Weight 123.8** **WL-AD**	591.50

End of Boring 20'

Water Level While Drilling : 13.5 feet

Water Level After Drilling : 20.0 feet

Cave In Depth : None

Note: Soil group symbol and group name are determined based on visual classification, plasticity index and liquid limit wherever material was available using ASTM D2488 & D4318

NASHnal SOIL TESTING

23856 W. Andrew Rd., Unit 103, Plainfield, IL

BOREHOLE LOG

Number B-15

Plate 26

Client	Baxter and Woodman, Inc.
Location	Devon Ave. Bridge over I-94-STA 53+97.17 (1942169.1N,1143186.761E)
Job Number	Job No. P-91-157-226; Contract No. 62R63
Drill Rig Type	Mobile B-57
Sampler Type	Split Spoon (SS)
Boring Location	STA 53+97.17 with offset 24.85 LT'-See Plate 2
Boring Elevation (ft)	612.42 **Date:** 9/25/2023

Sample # /RUN #	Sampling Method	Rimac Qu (tsf)	Sample Recovery (in)/%	Moisture Content (%)	SPT Valuese Blows/6 In	Depth (ft)	Sample Depth	Graphic	Soil Description	Elevation (ft)
						0.5		AS	**6 Inches of Asphalt**	611.92
						1.0		AGG	**6 Inches of Aggregate Base**	611.42
						1.5			**Brown and Gray Lean Clay (A-6)**	610.92
1	SS	1.750	11	15.1	6, 6, 11	2.0			With Sand and Gravel, Stiff	610.42
						2.5				609.92
						3.0				609.42
						3.5		A-6		608.92
						4.0				608.42
2	SS	1.500	18	12.9	8, 9, 5	4.5			**Unit weight 116.1**	607.92
						5.0				607.42
						5.5				606.92
						6.0				606.42
						6.5			**Brown Silty Clay (A-4)**	605.92
3	SS	1.814	18	20.7	7, 7, 10	7.0			Trace Sand and Gravel, Stiff	605.42
						7.5		A-4	**Unit weight 122.8**	604.92
						8.0				604.42
						8.5				603.92
						9.0			**Gray Silty Clay (A-4)**	603.42
4	SS	3.628	14	15.2	4, 5, 7	9.5			With Sand, Very Stiff	602.92
						10.0		A-4		602.42
						10.5				601.92
						11.0				601.42
						11.5			**Gray Leany Clay (A-6)**	600.92
5	SS	3.527	18	15.6	4, 6, 7	12.0			With Sand, Very Stiff	600.42
						12.5			**Unit weight 120.2**	599.92
						13.0				599.42
						13.5				598.92
						14.0				598.42
6	SS	3.023	18	17.4	4, 5, 6	14.5				597.92
						15.0			**Unit weight 119.9**	597.42
						15.5				596.92
						16.0		A-6	**WL- WD**	596.42
						16.5				595.92
7	SS	3.023	18	16.8	5, 5, 6	17.0				595.42
						17.5			**Unit weight 120.4**	594.92
						18.0				594.42
						18.5				593.92
						19.0				593.42
8	SS	1.411	17	19.4	4, 4, 7	19.5			Stiff	592.92
						20.0			**Unit Weight 121.6** **WL-AD**	592.42

End of Boring 20'

Water Level While Drilling : 16.0 feet.

Water Level After Drilling : 20.0 feet

Cave In Depth : None

Note: Soil group symbol and group name are determined based on visual classification, plasticity index and liquid limit wherever material was available using ASTM D2488 & D4318

Boring BB-13 (71.5'-81.5')-RQD 86%

NASHnal Soil Testing, LLC

23856 W. Andrew Rd., Unit 103, Plainfield, IL 60585

Tel: (630) 780-5201, Fax: (630)429-9099

Rock Core-Compressive Strength

Job No. P-91-157-226; Contract No. 62R63 **Project** Devon Avenue Bridge over I-94 (Edens Expwy) **Date Sampled** 11/4/2023 **Date Received** 11/4/2023

Page: 1 of 1 **Location** Boring BB-13, STA 50+45.00 (41.997414, -87.74990) **Client** Baxter and Woodman, Inc. **Date Tested** 12/6/2023

Summary of Test Results

Sample ID. No.	Location	Date	Length (Inch)	Diameter (Inch)	Area ($Inch^2$)	Load (LB)	Compressive Strength (PSI)
C1	Boring BB-13, STA 50+45.00 (41.997414,-87.74990)	11/4/2023	4.01	2.00	3.14	51,900	16,529
C2	Boring BB-13, STA 50+45.00 (41.997414,-87.74990)	11/4/2023	3.97	2.00	3.14	62,310	19,844

Remarks:

Project Manager: **Umar T. Ahmad, PE**

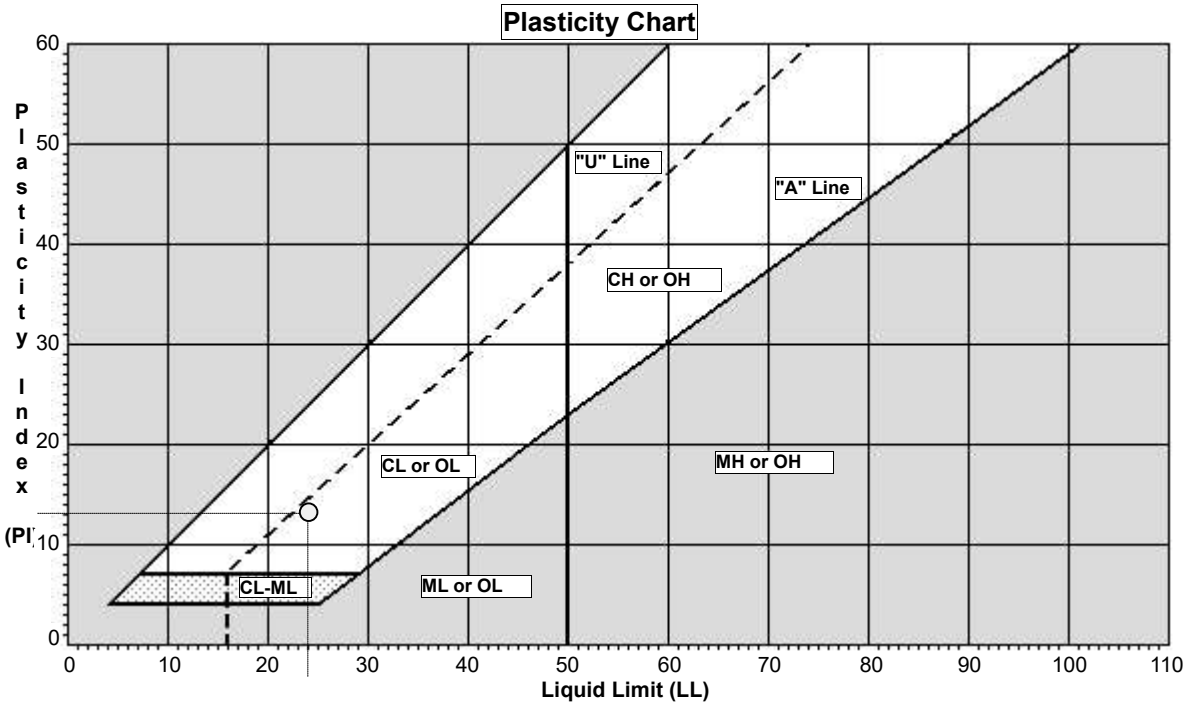
Report On: Proctor **Lab No: 17182-7**

Project No: 2023-1279-01G **Cust No:** 1279 **Page 1 of 1**

Client: Baxter & Woodman
Project: Devon Avenue Bridge over I-94 (Edens Expwy), Chicago IL
Report No: 007
Location: Devon Ave. Bridge over I-94-STA 51+51.93 (1942122.02N,1142941.671E)-B2, Samples 18-21

Report Date: 12/04/2023
Test Date: 11/20/2023

Material: Gray Lean Clay (CL)



Orig: Baxter & Woodman Attn: David S. Boyd
(1-ec copy)
1-cc Laboratory

Respectfully Submitted,

Umar T. Ahmad, PE

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

12/07/2023

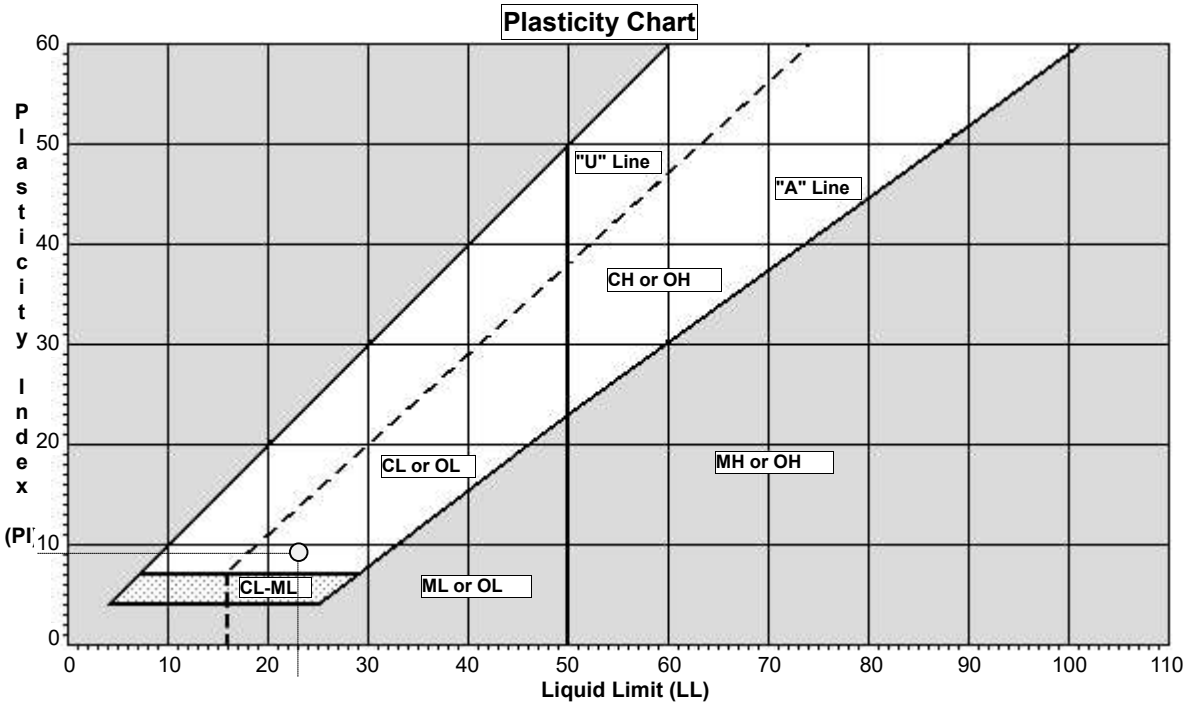
Report On: Proctor **Lab No: 17182-8**

Project No: 2023-1279-01G **Cust No:** 1279 **Page 1of 1**

Client: Baxter & Woodman
Project: Devon Avenue Bridge over I-94 (Edens Expwy), Chicago IL
Report No: 008
Location: Devon Ave. Bridge over I-94-STA 48+38.17 (1942121.34N,1142627.907E)-B4, Samples 15 & 16

Report Date: 12/04/2023
Test Date: 11/20/2023

Material: Gray Lean Clay (CL)



Orig: Baxter & Woodman Attn: David S. Boyd
(1-ec copy)
1-cc Laboratory

Respectfully Submitted,

Umar T. Ahmad, PE

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

12/07/2023

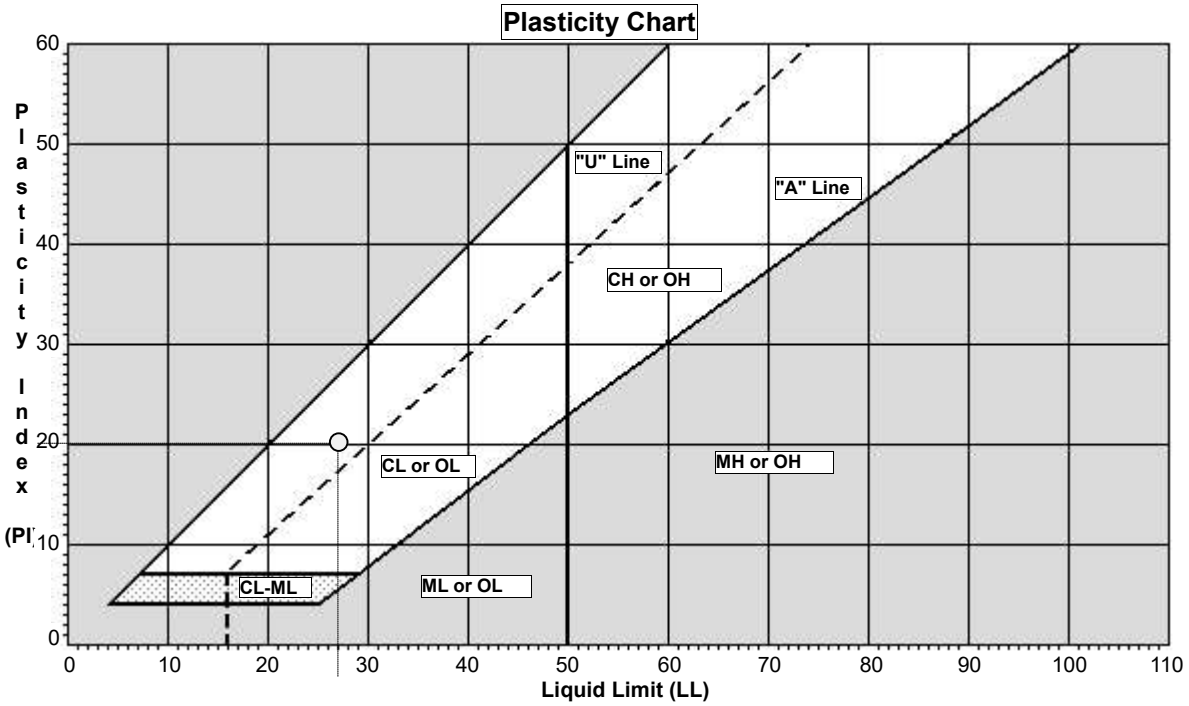
Report On: Proctor **Lab No: 17182-9**

Project No: 2023-1279-01G **Cust No:** 1279 **Page 1 of 1**

Client: Baxter & Woodman
Project: Devon Avenue Bridge over I-94 (Edens Expwy), Chicago IL
Report No: 009
Location: Devon Ave. Bridge over I-94-STA 48+51.11 (1942165.163N,1142640.715E)-B5, Samples 21 & 22

Report Date: 12/04/2023
Test Date: 11/20/2023

Material: Gray Lean Clay (CL)



Orig: Baxter & Woodman Attn: David S. Boyd
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1-cc Laboratory

Respectfully Submitted,

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

Umar T. Ahmad, PE

12/07/2023

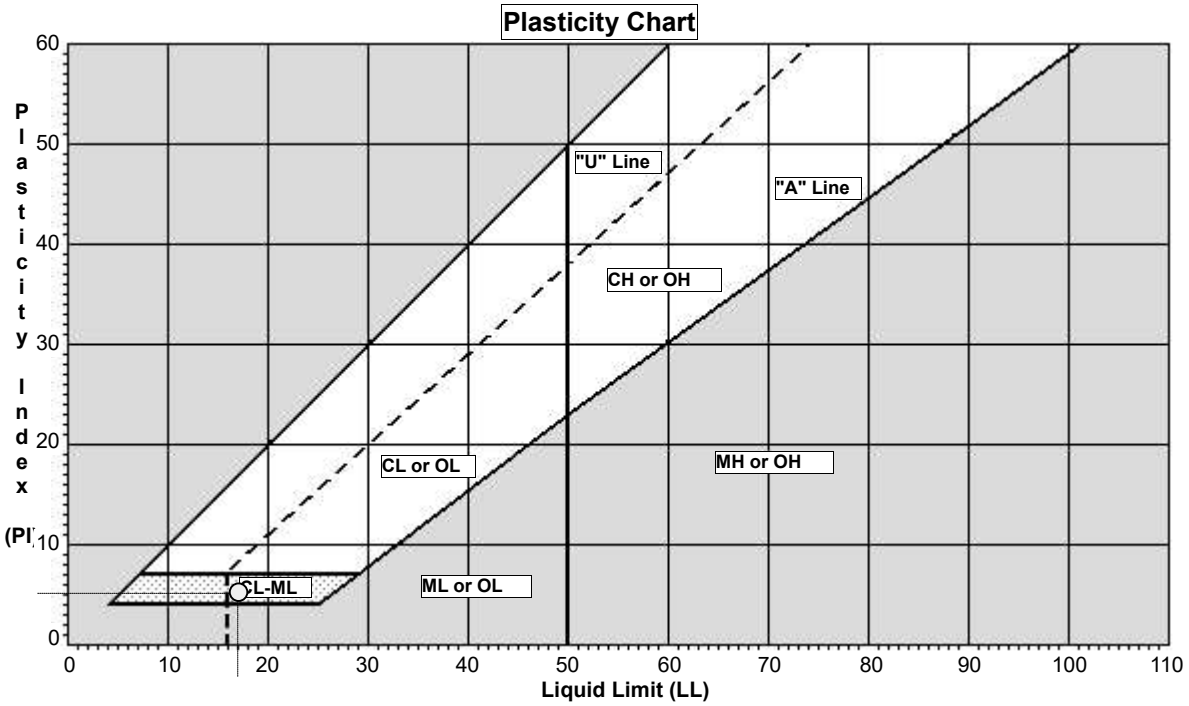
Report On: Proctor **Lab No: 17182-10**

Project No: 2023-1279-01G **Cust No:** 1279 **Page 1 of 1**

Client: Baxter & Woodman
Project: Devon Avenue Bridge over I-94 (Edens Expwy), Chicago IL
Report No: 010
Location: Devon Ave. Bridge over I-94-STA 51+29.63 (1942167.179N,1142919.233E) B-7, Samples 15-16

Report Date: 12/04/2023
Test Date: 11/20/2023

Material: Gray Silty Clay (CL-ML)



Orig: Baxter & Woodman Attn: David S. Boyd
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1-cc Laboratory

Respectfully Submitted,

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

Umar T. Ahmad, PE

12/07/2023

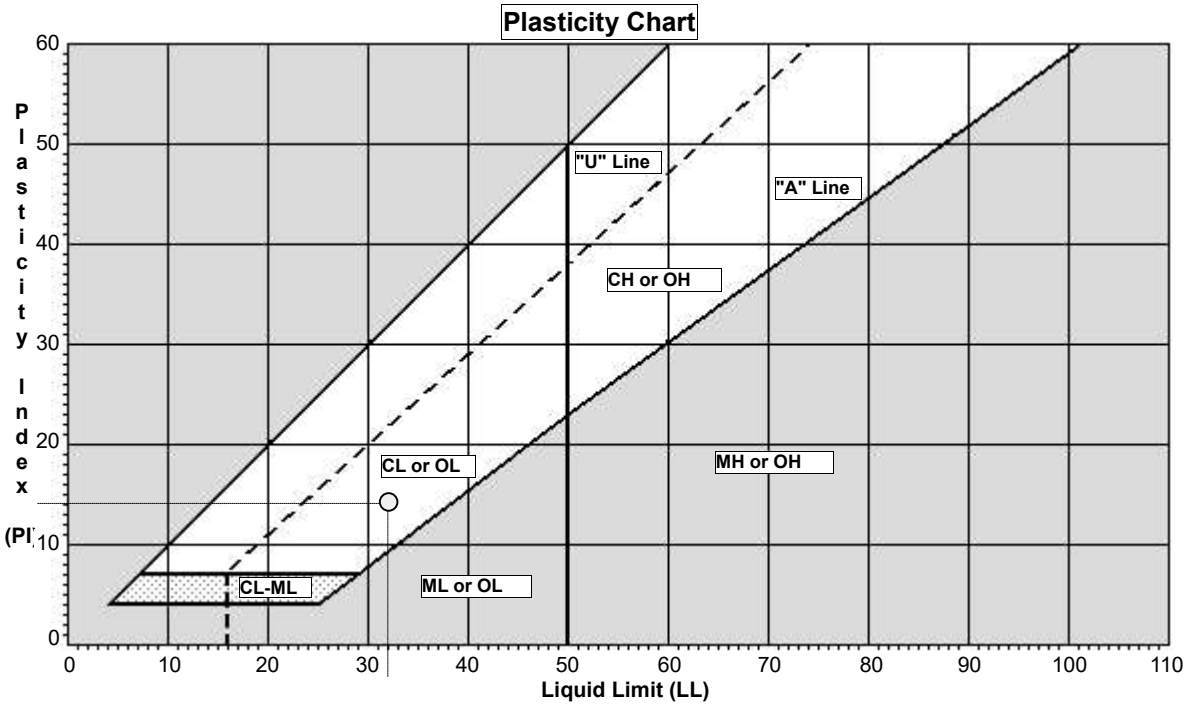
Report On: Proctor **Lab No: 17182**

Project No: 2023-1279-01G **Cust No:** 1279 **Page 1 of 1**

Client: Baxter & Woodman
Project: Devon Avenue Bridge over I-94 (Edens Expwy), Chicago IL
Report No: 001
Location: Devon Ave. Bridge over I-94-STA 50+80.83 (1942223.754N,1142870.26E)-B9, Samples 4 & 5

Report Date: 12/04/2023
Test Date: 11/20/2023

Material: Gray Lean Clay (CL)



Orig: Baxter & Woodman Attn: David S. Boyd
(1-ec copy)
1-cc Laboratory

Respectfully Submitted,

Umar T. Ahmad, PE

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

12/07/2023

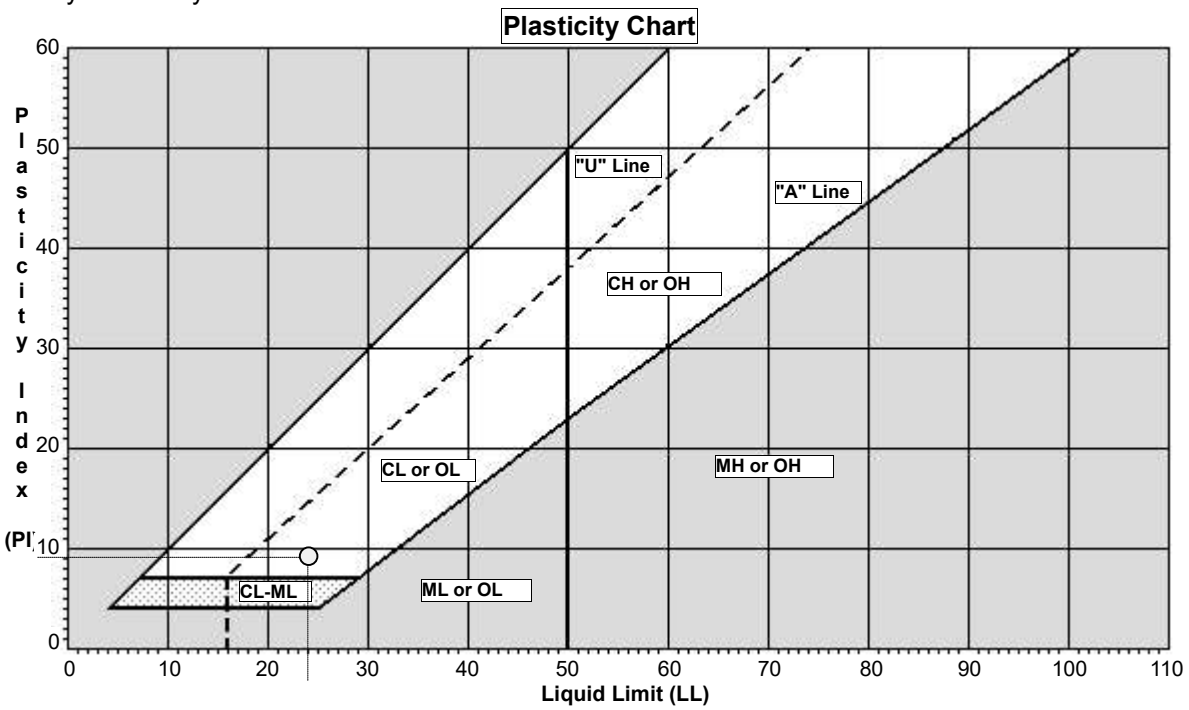
Report On: Proctor **Lab No: 17182-3**

Project No: 2023-1279-01G **Cust No:** 1279 **Page 1 of 1**

Client: Baxter & Woodman
Project: Devon Avenue Bridge over I-94 (Edens Expwy), Chicago IL
Report No: 002
Location: Devon Ave. Bridge over I-94-STA 50+80.83 (1942223.754N,1142870.26E)-B10, Samples 4&5

Report Date: 12/04/2023
Test Date: 11/20/2023

Material: Gray Lean Clay



Orig: Baxter & Woodman Attn: David S. Boyd
(1-ec copy)
1-cc Laboratory

Respectfully Submitted,

Umar T. Ahmad, PE

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

12/07/2023

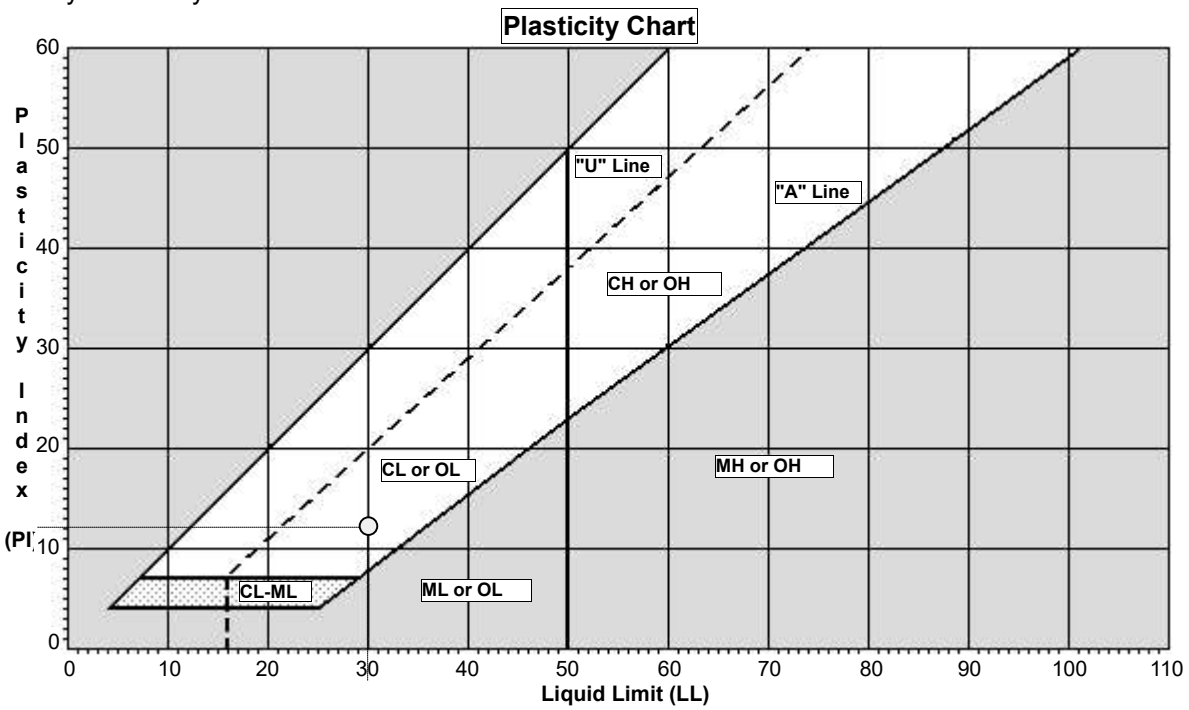
Report On: Proctor **Lab No: 17182-2**

Project No: 2023-1279-01G **Cust No:** 1279 **Page 1 of 1**

Client: Baxter & Woodman
Project: Devon Avenue Bridge over I-94 (Edens Expwy), Chicago IL
Report No: 003
Location: Devon Ave. Bridge over I-94-STA 50+45.00 (41.997414,-87.74990-B-13, Samples 15-17

Report Date: 12/04/2023
Test Date: 11/20/2023

Material: Gray Lean Clay



Orig: Baxter & Woodman Attn: David S. Boyd
(1-ec copy)
1-cc Laboratory

Respectfully Submitted,

Umar T. Ahmad, PE

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

12/07/2023

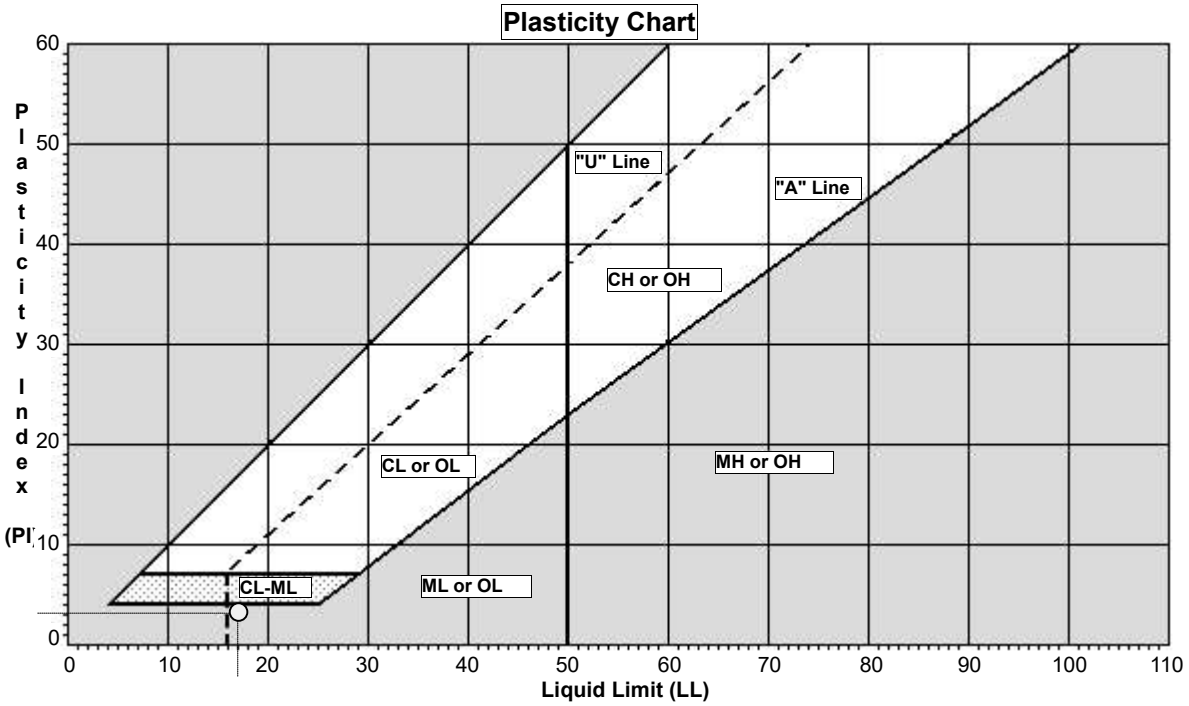
Report On: Proctor **Lab No: 17182-4**

Project No: 2023-1279-01G **Cust No:** 1279 **Page 1of 1**

Client: Baxter & Woodman
Project: Devon Avenue Bridge over I-94 (Edens Expwy), Chicago IL
Report No: 004
Location: Devon Ave. Bridge over I-94-STA 55+42.65 (1942169.825N,1143332.244E) B14, Sample 3

Report Date: 12/04/2023
Test Date: 11/20/2023

Material: Brown Silt



Orig: Baxter & Woodman Attn: David S. Boyd
(1-ec copy)
1-cc Laboratory

Respectfully Submitted,

Umar T. Ahmad, PE

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

12/07/2023

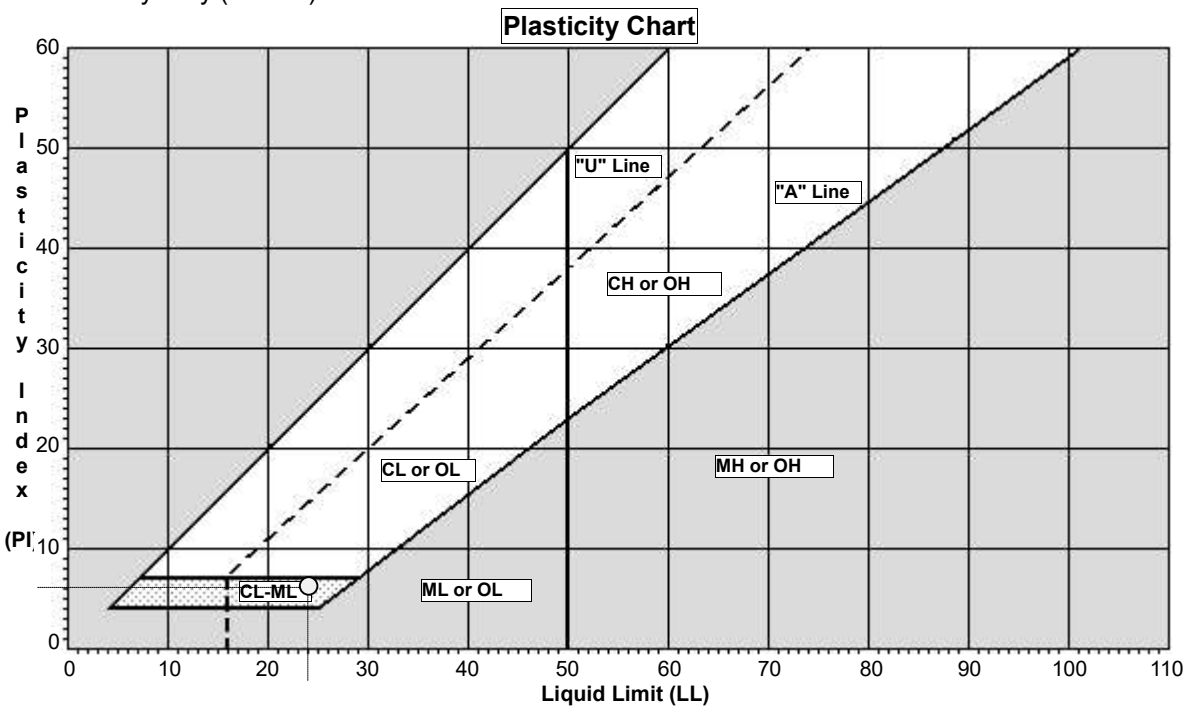
Report On: Proctor **Lab No: 17182-5**

Project No: 2023-1279-01G **Cust No:** 1279 **Page 1 of 1**

Client: Baxter & Woodman
Project: Devon Avenue Bridge over I-94 (Edens Expwy), Chicago IL
Report No: 005
Location: Devon Ave. Bridge over I-94-STA 53+97.17 (1942169.1N,1143186.761E) B15, Sample 3

Report Date: 12/04/2023
Test Date: 11/20/2023

Material: Brown Silty Clay (CL-ML)



Orig: Baxter & Woodman Attn: David S. Boyd
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1-cc Laboratory

Respectfully Submitted,

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

Umar T. Ahmad, PE

12/07/2023

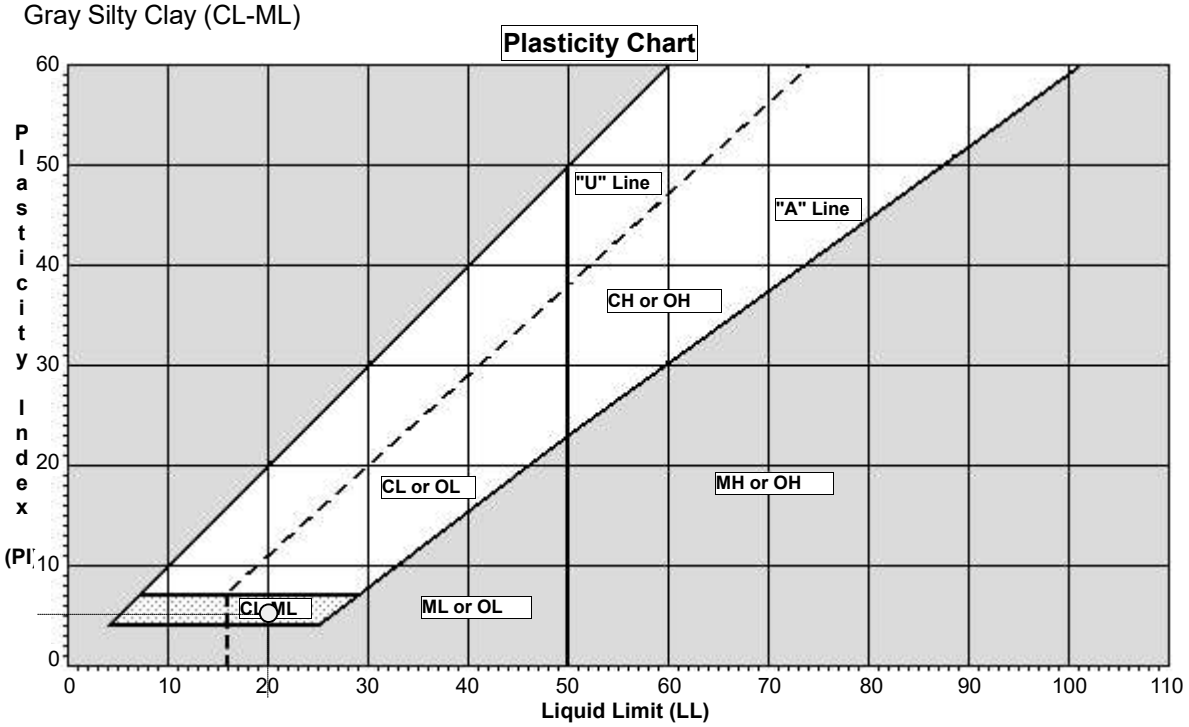
Report On: Proctor **Lab No: 17182-6**

Project No: 2023-1279-01G **Cust No:** 1279 **Page 1of 1**

Client: Baxter & Woodman
Project: Devon Avenue Bridge over I-94 (Edens Expwy), Chicago IL
Report No: 006
Location: Devon Ave. Bridge over I-94-STA 53+97.17 (1942169.1N,1143186.761E) B15, Sample 4

Report Date: 12/04/2023
Test Date: 11/20/2023

Material: Gray Silty Clay (CL-ML)



Orig: Baxter & Woodman Attn: David S. Boyd
(1-ec copy)
1-cc Laboratory

Respectfully Submitted,

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

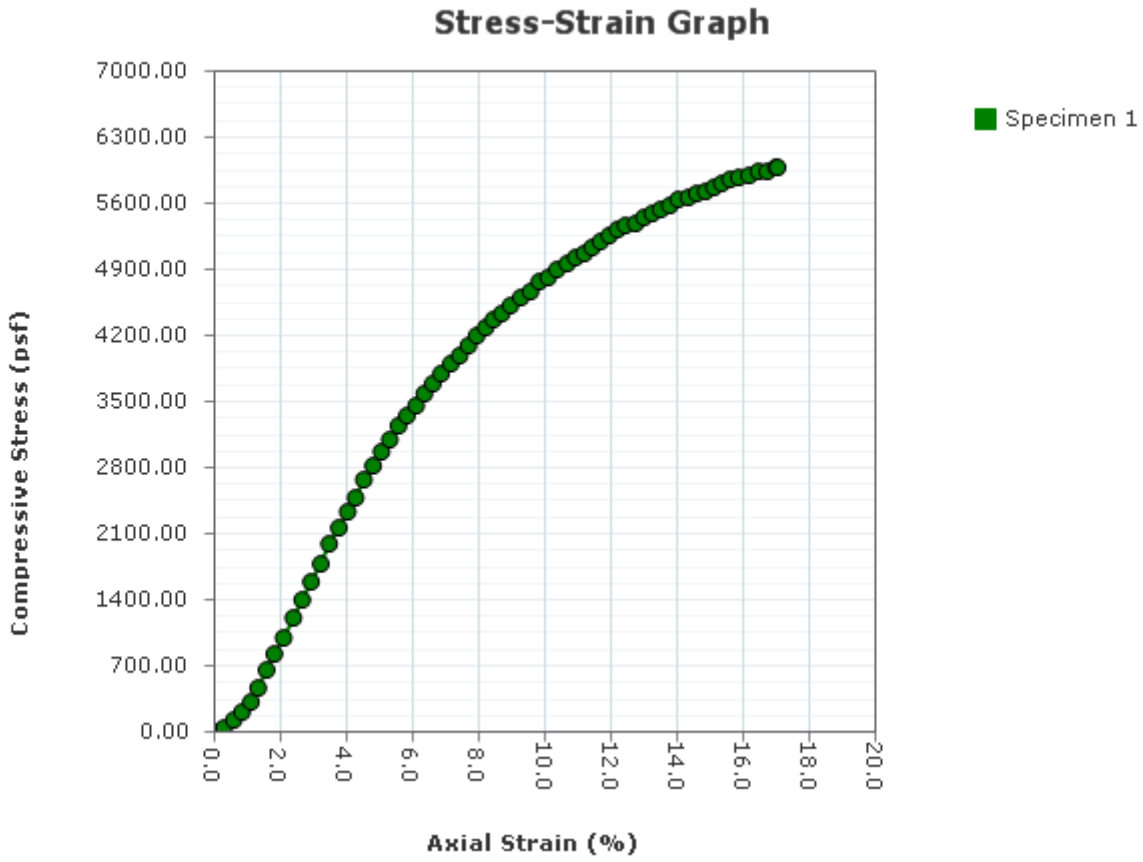
Umar T. Ahmad, PE

12/07/2023

REPORT CREATED BY ElmTree SYSTEM

Unconfined Compression Test

Unconfined



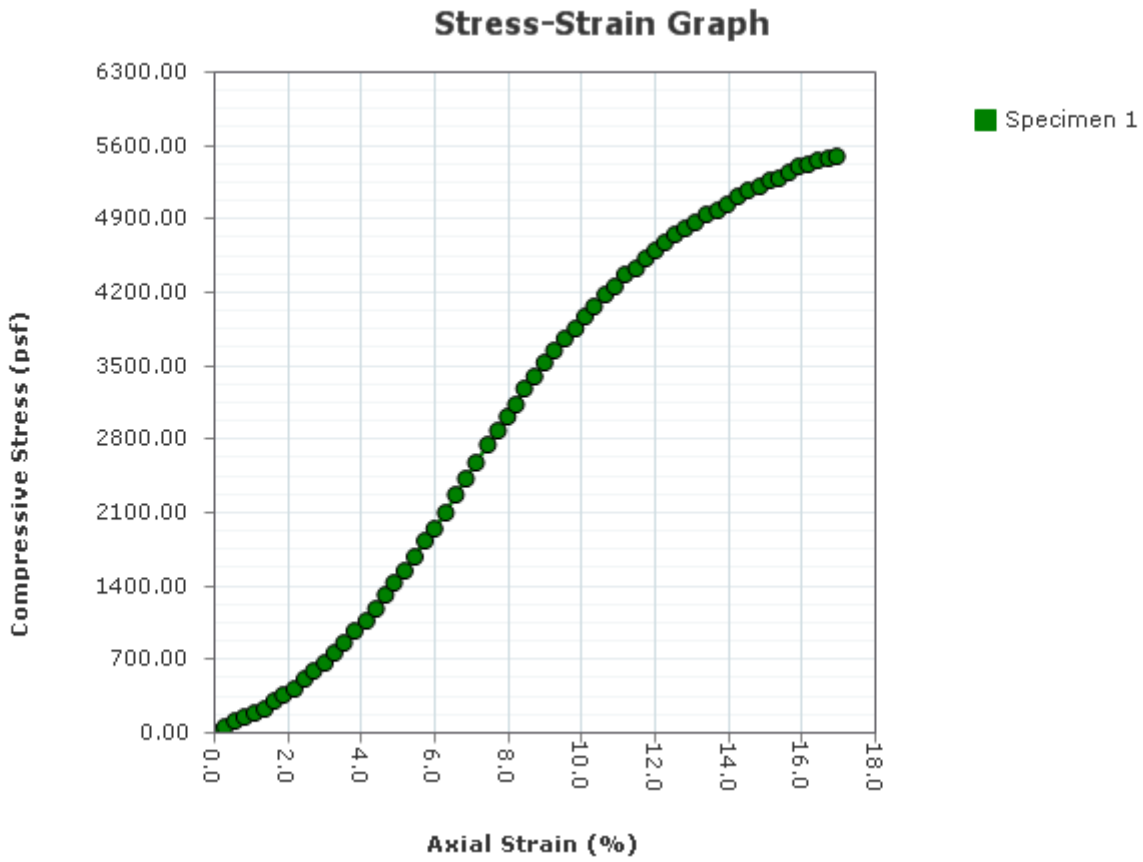
Project:	FAI 94 (Edens Expwy) at Devon Avenue
Project Number:	2023-1279-01G
Received Date:	9/21/2023
Sampling Date:	9/21/2023
Sample Number:	18
Sample Depth:	53.5-55.0 ft
Boring Number:	B-2
Location:	
Client Name:	Baxter and Woodman
Remarks:	

Unconfined Compression Test

Project Name: FAI 94 (Edens Expwy) at Devon Avenue Project Number: 2023-1279-01G

Test Date: 10/9/2023

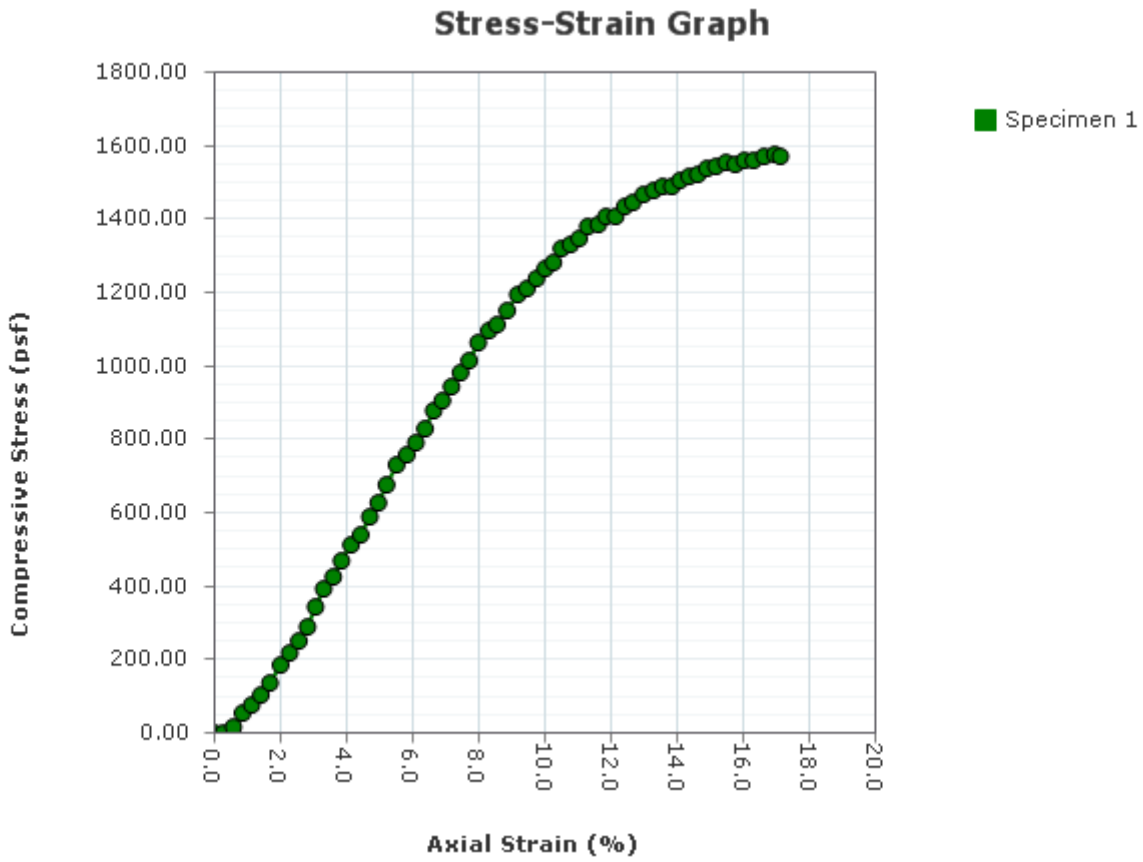
Unconfined



Project:	FAI 94 (Edens Expwy) at Devon Avenue
Project Number:	2023-1279-01G
Received Date:	9/21/2023
Sampling Date:	9/21/2023
Sample Number:	20
Sample Depth:	63.5-65.0 ft
Boring Number:	B-2
Location:	
Client Name:	Baxter and Woodman
Remarks:	

Unconfined Compression Test

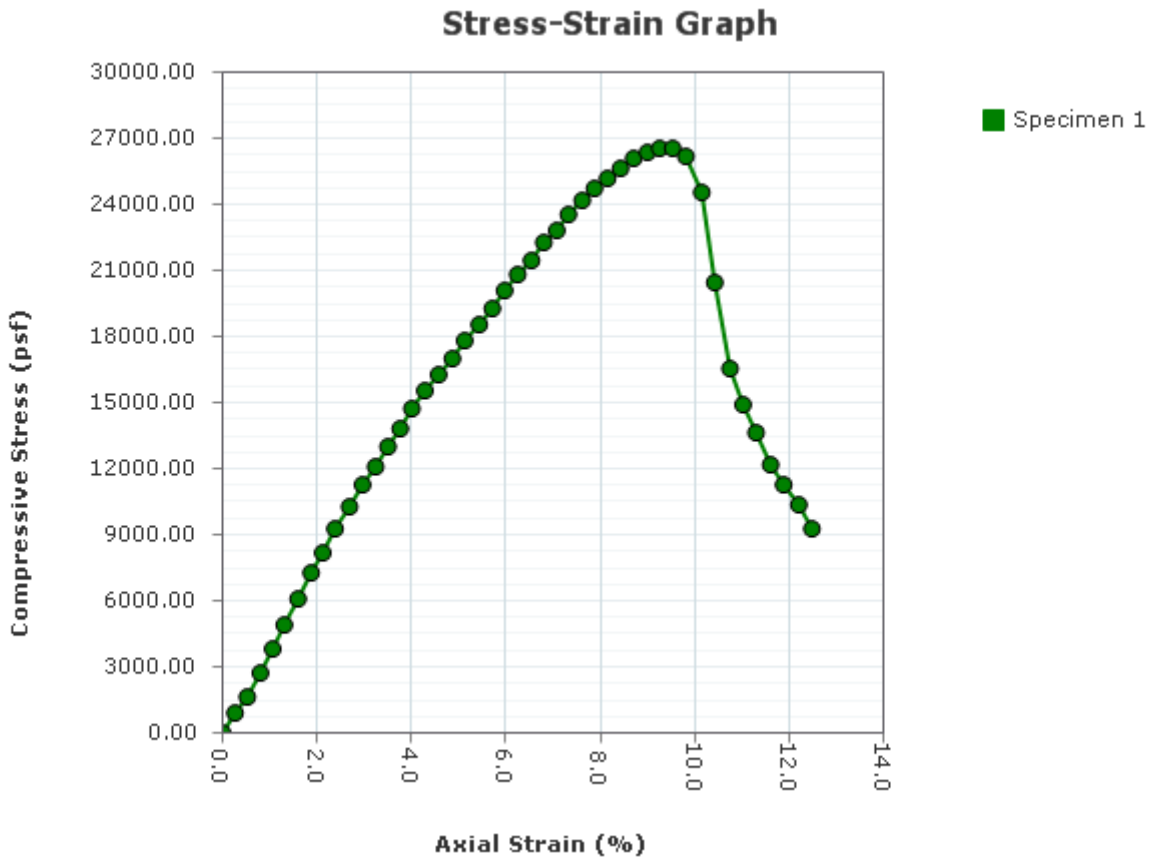
Unconfined



Project:	FAI 94 (Edens Expwy) at Devon Avenue
Project Number:	2023-1279-01G
Received Date:	9/20/2023
Sampling Date:	9/20/2023
Sample Number:	18
Sample Depth:	53.5-55.0 ft
Boring Number:	B-4
Location:	
Client Name:	Baxter and Woodman
Remarks:	

Unconfined Compression Test

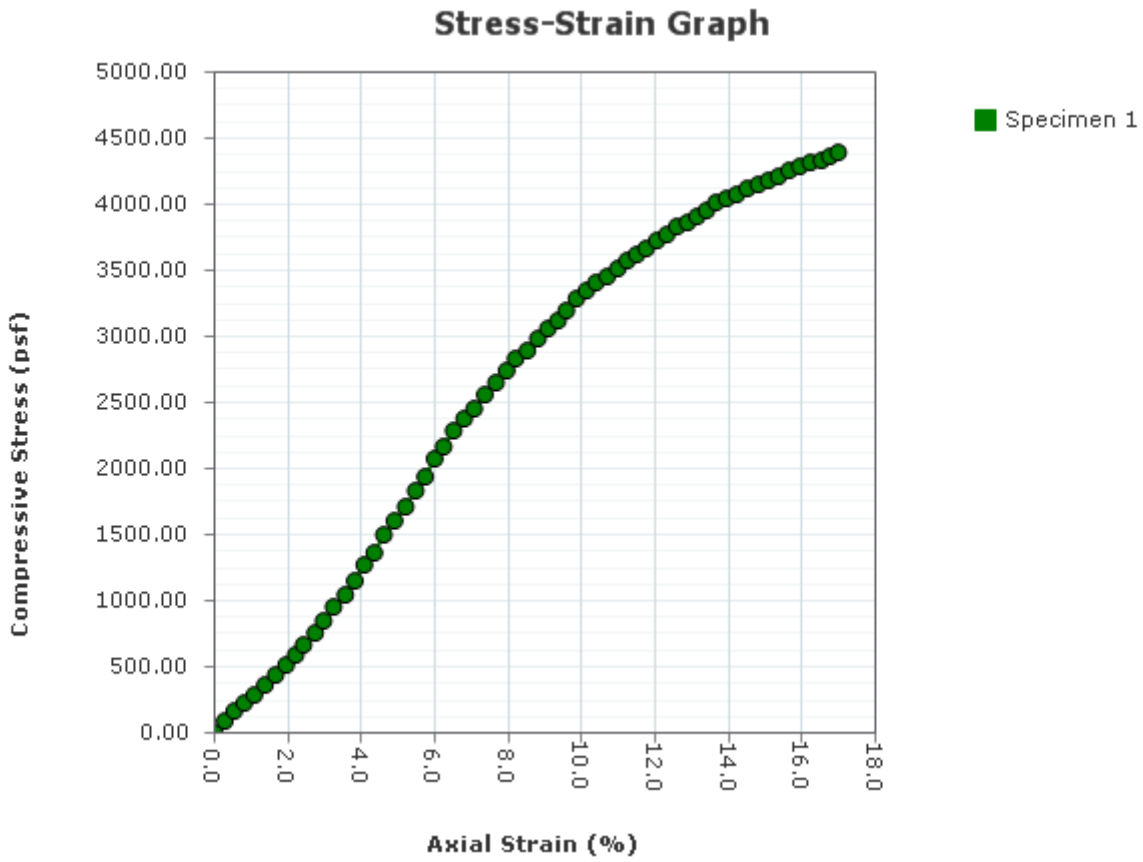
Unconfined



Project:	FAI 94 (Edens Expwy) at Devon Avenue
Project Number:	2023-1279-01G
Received Date:	9/20/2023
Sampling Date:	9/20/2023
Sample Number:	22
Sample Depth:	73.5-75.0 ft
Boring Number:	B-4
Location:	
Client Name:	Baxter and Woodman
Remarks:	

Unconfined Compression Test

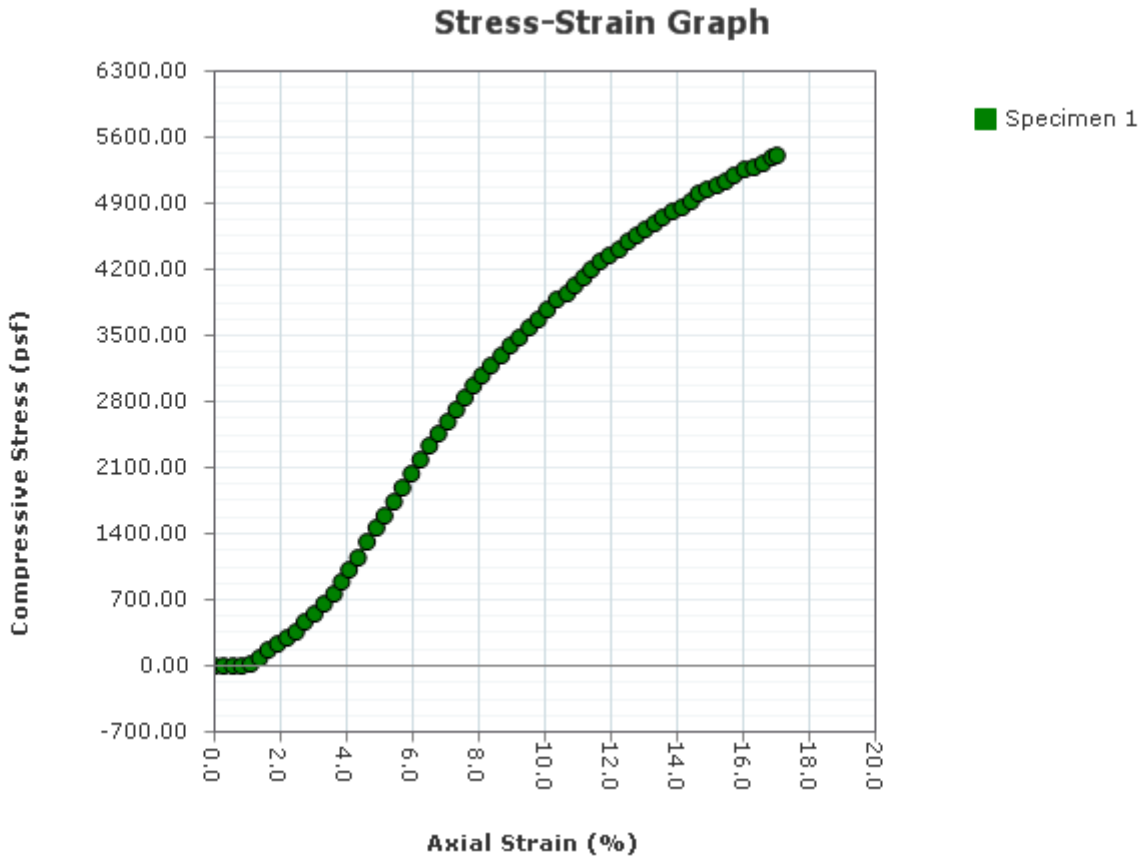
Unconfined



Project:	FAI 94 (Edens Expwy) at Devon Avenue
Project Number:	2023-1279-01G
Received Date:	9/22/2023
Sampling Date:	9/22/2023
Sample Number:	16
Sample Depth:	43.5-45.0 ft
Boring Number:	B-5
Location:	
Client Name:	Baxter and Woodman
Remarks:	

Unconfined Compression Test

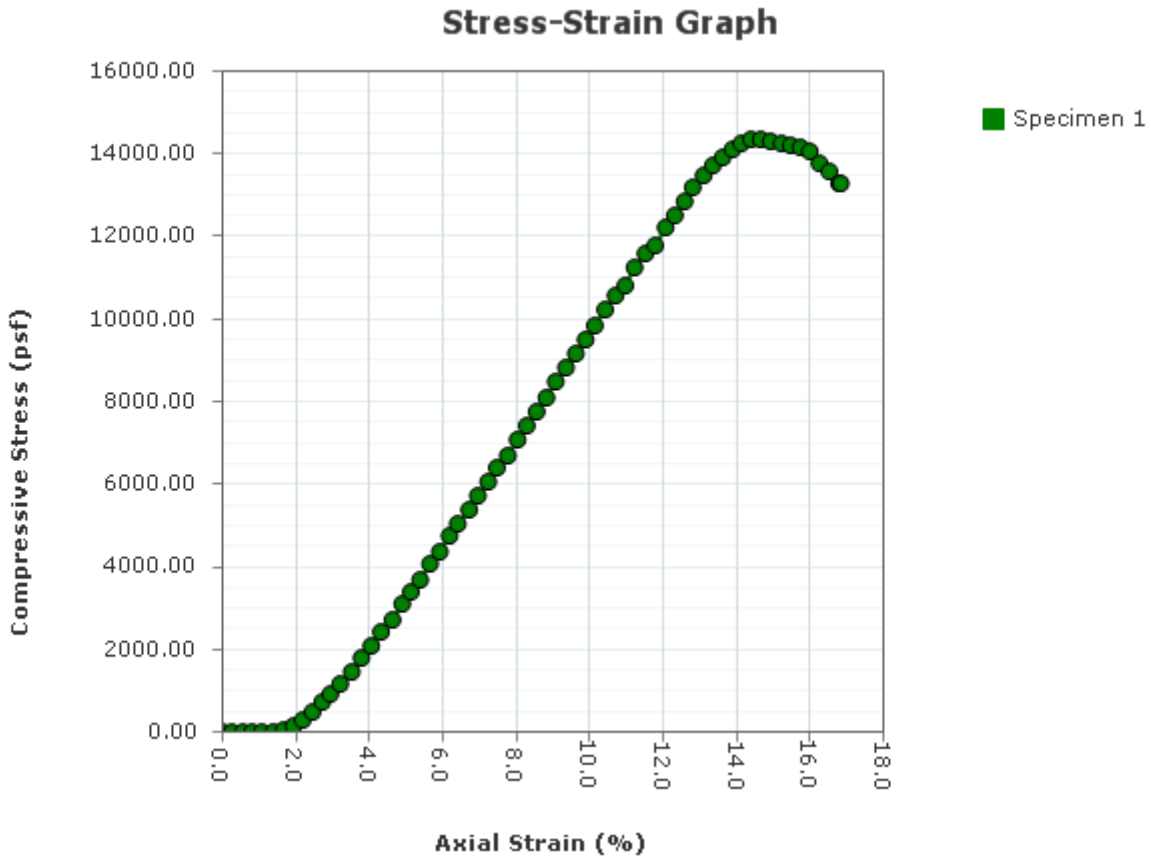
Unconfined



Project:	FAI 94 (Edens Expwy) at Devon Avenue
Project Number:	2023-1279-01G
Received Date:	9/20/2023
Sampling Date:	9/20/2023
Sample Number:	19
Sample Depth:	63.5-65.0 ft
Boring Number:	B-5
Location:	
Client Name:	Baxter and Woodman
Remarks:	

Unconfined Compression Test

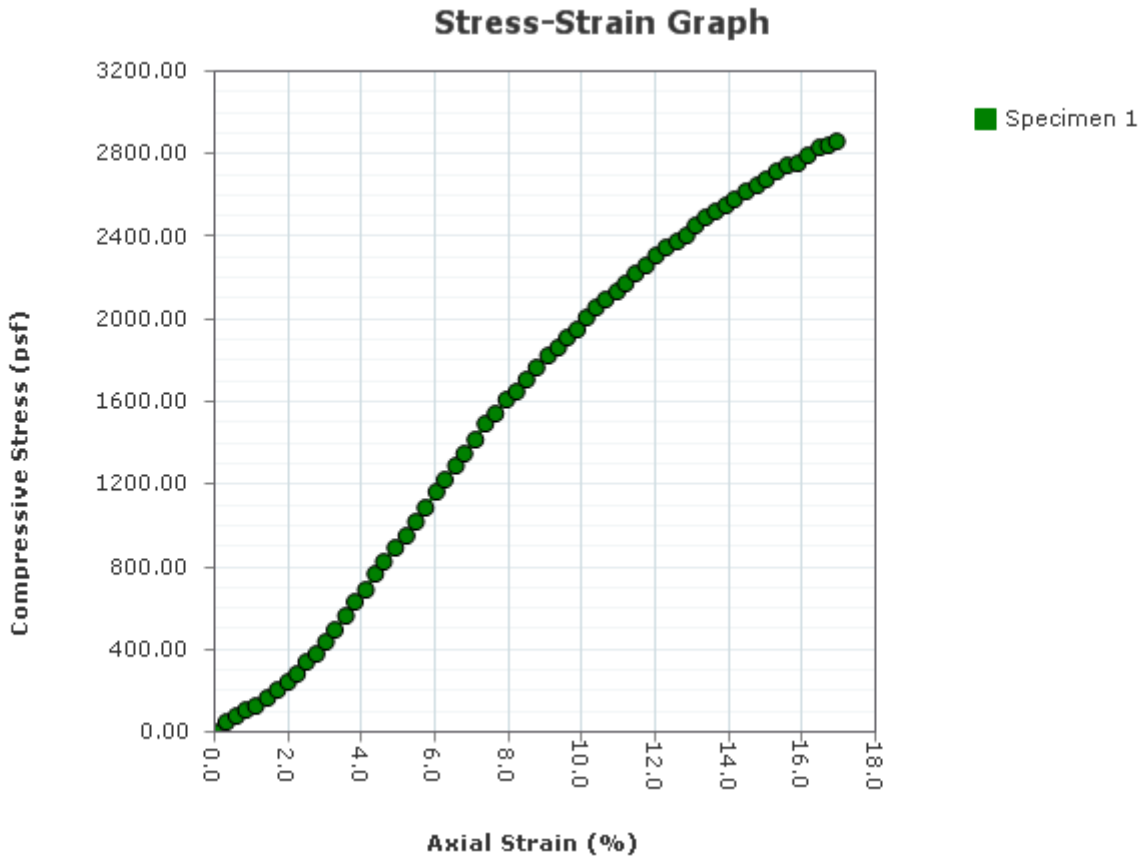
Unconfined



Project:	FAI 94 (Edens Expwy) at Devon Avenue
Project Number:	2023-1279-01G
Received Date:	9/20/2023
Sampling Date:	9/20/2023
Sample Number:	21
Sample Depth:	73.5-75.0 ft
Boring Number:	B-5
Location:	
Client Name:	Baxter and Woodman
Remarks:	

Unconfined Compression Test

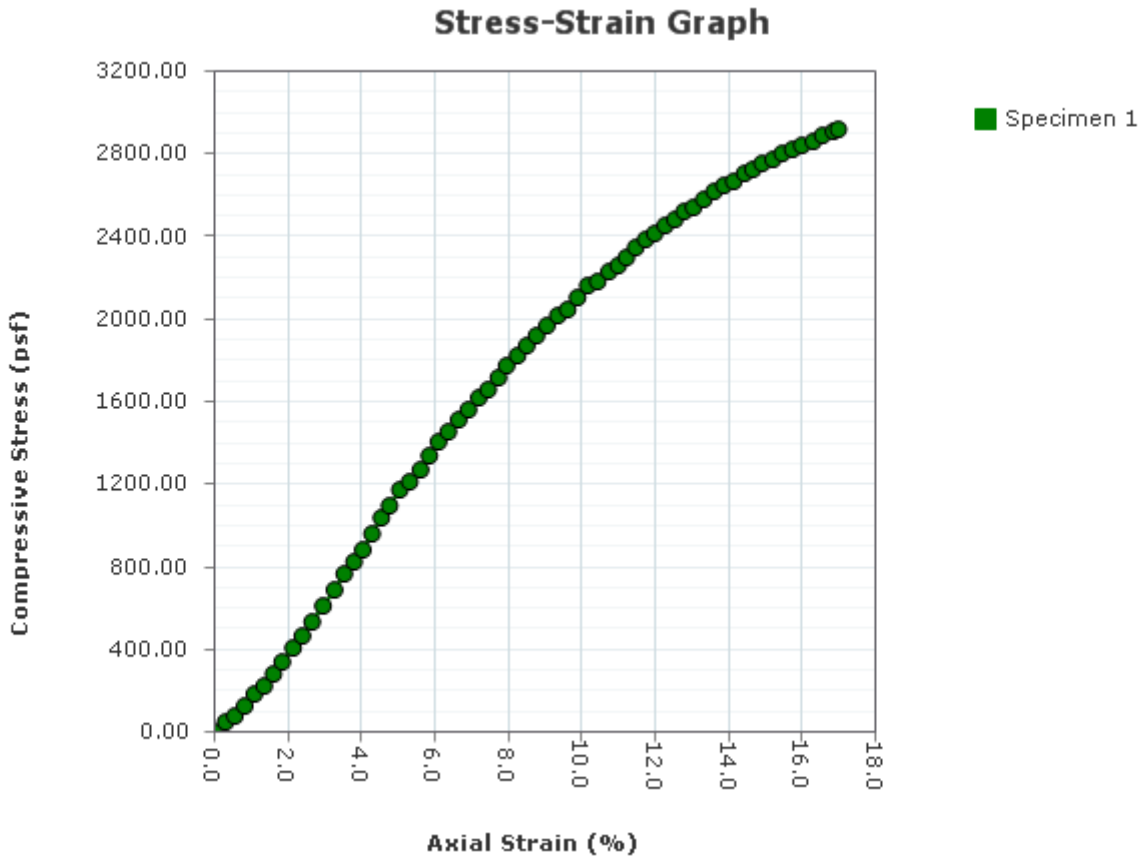
Unconfined



Project:	FAI 94 (Edens Expwy) at Devon Avenue
Project Number:	2023-1279-01G
Received Date:	9/25/2023
Sampling Date:	9/25/2023
Sample Number:	15
Sample Depth:	43.5-45.0 ft
Boring Number:	B-7
Location:	
Client Name:	Baxter and Woodman
Remarks:	

Unconfined Compression Test

Unconfined



Project:	FAI 94 (Edens Expwy) at Devon Avenue
Project Number:	2023-1279-01G
Received Date:	9/25/2023
Sampling Date:	9/25/2023
Sample Number:	20
Sample Depth:	68.5-70.0 ft
Boring Number:	B-7
Location:	
Client Name:	Baxter and Woodman
Remarks:	

IDOT STATIC METHOD OF ESTIMATING PILE LENGTH

I.D.O.T. BBS FOUNDATIONS AND GEOTECHNICAL UNIT — Modified 10/18/2011

SUBSTRUCTURE========== Center pier
REFERENCE BORING ========== B-13
LRFD or ASD or SEISMIC ========== LRFD
PILE CUTOFF ELEV. ========== 601.76 ft
GROUND SURFACE ELEV. AGAINST PILE DURING DRI 603.76 ft
GEOTECHNICAL LOSS TYPE (None, Scour, Liquef., DD) None
BOTTOM ELEV. OF SCOUR, LIQUEF., or DD ========= 0.00 ft
TOP ELEV. OF LIQUEF. (so layers above apply DD) ==== 0.00 ft

TOTAL FACTORED SUBSTRUCTURE LOAD ========= 6000 kips
TOTAL LENGTH OF SUBSTRUCTURE (along skew)==== 140.00 ft
NUMBER OF ROWS OF PILES PER SUBSTRUCTURE = 1
Approx. Factored Loading Applied per pile at 8 ft. Cts ===== 342.86 KIPS
Approx. Factored Loading Applied per pile at 3 ft. Cts ===== 128.57 KIPS

MAX. REQUIRED BEARING & RESISTANCE for Selected Pile, Soil Profile, & Losses

Maximum Nominal Req'd Bearing of Pile	Maximum Nominal Req.d Bearing of Boring	Maximum Factored Resistance Available in Boring	Maximum Pile Driveable Length in Boring
454 KIPS	**375** KIPS	**206** KIPS	*** Below Boring

PILE TYPE AND SIZE ========== Steel HP 10 X 57
Plugged Pile Perimeter========== 3.365 FT. Unplugged Pile Perimeter========== 4.883 FT.
Plugged Pile End Bearing Area========== 0.708 SQFT. Unplugged Pile End Bearing Area===== 0.117 SQFT.

Delete Qu and Treat as Hard Till.

BOT. OF LAYER ELEV. (FT.)	LAYER THICK. (FT.)	UNCONF. COMPR. STRENGTH (TSF.)	S.P.T. N VALUE (BLOWS)	GRANULAR OR ROCK LAYER DESCRIPTION	NOMINAL PLUGGED SIDE RESIST. (KIPS)	NOMINAL PLUGGED END BRG. RESIST. (KIPS)	NOMINAL PLUGGED TOTAL RESIST. (KIPS)	NOMINAL UNPLUG'D SIDE RESIST. (KIPS)	NOMINAL UNPLUG'D END BRG. RESIST. (KIPS)	NOMINAL UNPLUG'D TOTAL RESIST. (KIPS)	NOMINAL REQ'D BEARING (KIPS)	FACTORED GEOTECH. LOSS FROM SCOUR or DD (KIPS)	FACTORED GEOTECH. LOSS LOAD FROM DD (KIPS)	FACTORED RESISTANCE AVAILABLE (KIPS)	ESTIMATED PILE LENGTH (FT.)
601.76	2.00		50	Sandy Gravel	15.7		63.3	22.8		***30.7***	31	0	0	17	0
599.26	2.50		50	Sandy Gravel	19.6	47.6	66.3	28.5	7.9	***56.4***	56	0	0	31	3
596.76	2.50	3.12	13		13.2	30.9	77.6	19.2	5.1	***75.3***	75	0	0	41	5
594.26	2.50	2.92	12		12.6	29.0	94.8	18.3	4.8	***94.4***	94	0	0	52	8
591.76	2.50	3.38	11		14.0	33.5	***108.8***	20.4	5.5	114.8	109	0	0	60	10
589.26	2.50	3.38	9		14.0	33.5	***108.4***	20.4	5.5	132.8	108	0	0	60	13
586.76	2.50	1.92	9		9.5	19.0	***108.8***	13.8	3.1	145.1	109	0	0	60	15
584.26	2.50	1.00	15		6.0	9.9	***123.9***	8.7	1.6	155.3	124	0	0	68	18
581.76	2.50	1.92	11		9.5	19.0	***134.4***	13.8	3.1	169.3	134	0	0	74	20
579.26	2.50	2.02	14		9.9	20.0	***153.2***	14.3	3.3	185.1	153	0	0	84	23
576.76	2.50	2.92	17		12.6	29.0	***177.8***	18.3	4.8	205.4	178	0	0	98	25
574.26	2.50	4.13	25		16.3	41.0	***201.2***	23.7	6.8	230.2	201	0	0	111	28
569.26	5.00	4.84	24		35.0	48.0	***212.2***	50.8	7.9	277.0	212	0	0	117	33
564.26	5.00	2.42	16		22.2	24.0	***252.3***	32.2	4.0	312.2	252	0	0	139	38
559.26	5.00	4.23	19		33.3	41.9	***270.6***	48.3	6.9	358.0	271	0	0	149	43
554.26	5.00	2.72	20		24.0	27.0	***296.6***	34.9	4.4	393.2	297	0	0	163	48
549.26	5.00	2.92	9		25.2	29.0	***350.9***	36.6	4.8	434.7	351	0	0	193	53
544.26	5.00	5.85	51	Hard Till	11.0	58.0	***370.1***	16.0	9.6	452.0	370	0	0	204	58
539.26	5.00		50	Hard Till	10.7	66.1	***393.7***	15.5	10.9	469.7	394	0	0	217	63
534.26	5.00	7.97	50	Hard Till	10.7	79.0	***375.0***	15.5	13.0	480.4	375	0	0	206	68
532.76	1.50	5.00	27			49.6			8.2						

Pile Design Table for Center pier utilizing Boring #B-13

Nominal Required Bearing (Kips)	Factored Resistance Available (Kips)	Estimated Pile Length (Ft.)
Metal Shell 12"Φ w/.179" walls		
211	116	5
234	129	8
254	140	10
Metal Shell 12"Φ w/.25" walls		
211	116	5
234	129	8
254	140	10
262	144	13
268	148	15
285	157	18
300	165	20
322	177	23
351	193	25
Metal Shell 14"Φ w/.25" walls		
231	127	3
251	138	5
278	153	8
302	166	10
309	170	13
315	173	15
336	185	18
353	194	20
380	209	23
Metal Shell 14"Φ w/.312" walls		
231	127	3
251	138	5
278	153	8
302	166	10
309	170	13
315	173	15
336	185	18
353	194	20
380	209	23
416	229	25
452	249	28
484	266	33
Steel HP 8 X 36		
233	128	48
272	149	53
286	157	58
Steel HP 10 X 42		
208	114	33
247	136	38
265	146	43
290	160	48

Nominal Required Bearing (Kips)	Factored Resistance Available (Kips)	Estimated Pile Length (Ft.)
Steel HP 10 X 57		
212	117	33
252	139	38
271	149	43
297	163	48
351	193	53
370	204	58
375	206	68
Steel HP 12 X 53		
218	120	25
247	136	28
255	140	33
306	168	38
325	179	43
356	196	48
Steel HP 12 X 63		
221	121	25
250	137	28
258	142	33
309	170	38
328	180	43
359	198	48
430	237	53
455	250	58
457	251	68
Steel HP 12 X 74		
224	123	25
254	140	28
261	144	33
314	173	38
332	183	43
364	200	48
437	240	53
462	254	58
463	255	68
Steel HP 12 X 84		
228	125	25
258	142	28
265	146	33
319	175	38
337	185	43
369	203	48
443	244	53
469	258	58
470	259	68

Nominal Required Bearing (Kips)	Factored Resistance Available (Kips)	Estimated Pile Length (Ft.)
Steel HP 14 X 73		
230	126	23
271	149	25
308	169	28
310	170	33
376	207	38
393	216	43
430	237	48
522	287	53
Steel HP 14 X 89		
233	128	23
275	151	25
312	171	28
313	172	33
380	209	38
398	219	43
435	240	48
529	291	53
558	307	68
Steel HP 14 X 102		
204	112	20
236	130	23
278	153	25
316	174	28
317	174	33
385	212	38
402	221	43
441	242	48
536	295	53
565	311	68
Steel HP 14 X 117		
206	114	20
239	132	23
282	155	25
320	176	28
321	177	33
390	215	38
407	224	43
446	245	48
543	298	53
572	315	68

IDOT STATIC METHOD OF ESTIMATING PILE LENGTH

I.D.O.T. BBS FOUNDATIONS AND GEOTECHNICAL UNIT — Modified 10/18/2011

SUBSTRUCTURE========== EAST ABUTMENT
REFERENCE BORING ========== BB-2
LRFD or ASD or SEISMIC ========== LRFD
PILE CUTOFF ELEV. ========== 617.31 ft
GROUND SURFACE ELEV. AGAINST PILE DURING DRI 619.31 ft
GEOTECHNICAL LOSS TYPE (None, Scour, Liquef., DD) None
BOTTOM ELEV. OF SCOUR, LIQUEF., or DD ========= 0.00 ft
TOP ELEV. OF LIQUEF. (so layers above apply DD) ==== 0.00 ft

TOTAL FACTORED SUBSTRUCTURE LOAD ========= 6000 kips
TOTAL LENGTH OF SUBSTRUCTURE (along skew)==== 140.00 ft
NUMBER OF ROWS OF PILES PER SUBSTRUCTURE = 1
Approx. Factored Loading Applied per pile at 8 ft. Cts ======: 342.86 KIPS
Approx. Factored Loading Applied per pile at 3 ft. Cts ======: 128.57 KIPS

PILE TYPE AND SIZE ========== Steel HP 12 X 63
Plugged Pile Perimeter========== 4.000 FT. Unplugged Pile Perimeter========== 5.883 FT.
Plugged Pile End Bearing Area========== 1.000 SQFT. Unplugged Pile End Bearing Area======: 0.128 SQFT.

MAX. REQUIRED BEARING & RESISTANCE for Selected Pile, Soil Profile, & Losses

Maximum Nominal Req'd Bearing of Pile	Maximum Nominal Req.d Bearing of Boring	Maximum Factored Resistance Available in Boring	Maximum Pile Driveable Length in Boring
497 KIPS	**378** KIPS	**208** KIPS	**68** FT.

Delete Qu if rock or add N value if Granular or Delete Description if Cohesive.

BOT. OF LAYER ELEV. (FT.)	LAYER THICK. (FT.)	UNCONF. COMPR. STRENGTH (TSF.)	S.P.T. N VALUE (BLOWS)	GRANULAR OR ROCK LAYER DESCRIPTION	NOMINAL PLUGGED SIDE RESIST. (KIPS)	NOMINAL PLUGGED END BRG. RESIST. (KIPS)	NOMINAL PLUGGED TOTAL RESIST. (KIPS)	NOMINAL UNPLUG'D SIDE RESIST. (KIPS)	NOMINAL UNPLUG'D END BRG. RESIST. (KIPS)	NOMINAL UNPLUG'D TOTAL RESIST. (KIPS)	NOMINAL REQ'D BEARING (KIPS)	FACTORED GEOTECH. LOSS FROM SCOUR or DD (KIPS)	FACTORED GEOTECH. LOSS LOAD FROM DD (KIPS)	FACTORED RESISTANCE AVAILABLE (KIPS)	ESTIMATED PILE LENGTH (FT.)
617.31	2.00	0.61	6		3.7		37.6	5.4		***9.8***	10	0	0	5	0
614.81	2.50	2.42	6		13.2	33.9	31.0	19.4	4.3	***26.6***	27	0	0	15	3
612.31	2.50	1.01	4		7.2	14.1	117.4	10.5	1.8	***47.3***	47	0	0	26	5
609.81	2.50		50	Very Fine Silty Sand	9.3	93.4	***47.3***	13.6	11.9	50.8	47	0	0	26	8
607.31	2.50	1.00	5		7.1	14.0	***57.9***	10.5	1.8	61.7	58	0	0	32	10
604.81	2.50	1.25	6		8.4	17.5	***70.0***	12.4	2.2	74.5	70	0	0	39	13
602.31	2.50	1.51	9		9.7	21.2	***83.0***	14.2	2.7	89.2	83	0	0	46	15
599.81	2.50	1.75	7		10.7	24.5	***105.9***	15.7	3.1	106.5	106	0	0	58	18
597.31	2.50	2.62	19		13.9	36.7	***117.0***	20.5	4.7	126.6	117	0	0	64	20
594.81	2.50	2.42	14		13.2	33.9	***128.8***	19.4	4.3	145.7	129	0	0	71	23
592.31	2.50	2.32	13		12.8	32.5	***140.8***	18.8	4.2	164.5	141	0	0	77	25
589.81	2.50		17		0.0	31.8	***119.6***	0.0	4.1	161.8	120	0	0	66	28
584.81	5.00	0.75	15		11.2	10.5	***137.8***	16.4	1.3	179.1	138	0	0	76	33
579.81	5.00	1.25	17		16.9	17.5	***182.3***	24.9	2.2	207.5	182	0	0	100	38
574.81	5.00	3.23	23		32.2	45.2	***234.4***	47.4	5.8	257.4	234	0	0	129	43
569.81	5.00	4.64	22		41.6	65.0	***230.7***	61.2	8.3	312.8	231	0	0	127	48
564.81	5.00	1.41	17		18.4	19.8	***278.8***	27.1	2.5	343.7	279	0	0	153	53
559.81	5.00	3.53	23		34.5	49.4	***347.2***	50.7	6.3	398.8	347	0	0	191	58
554.81	5.00	5.95	35		7.7	83.3	***329.5***	11.4	10.6	406.9	330	0	0	181	63
549.81	5.00	4.13	28		38.9	57.9	***378.3***	57.2	7.4	465.3	378	0	0	208	68
544.81	5.00	4.84	64		19.1	67.8	***497.7***	28.1	8.7	506.3	~~498~~	~~0~~	~~0~~	~~274~~	~~73~~
539.81	5.00	12.00	50		12.7	168.2	***510.5***	18.7	21.5	525.0	~~510~~	~~0~~	~~0~~	~~281~~	~~78~~
534.81	5.00	12.00	50			168.2			21.5						

Pile Design Table for EAST ABUTMENT utilizing Boring #BB-2

Nominal Required Bearing (Kips)	Factored Resistance Available (Kips)	Estimated Pile Length (Ft.)
Metal Shell 12"Φ w/.179" walls		
222	122	38
Metal Shell 12"Φ w/.25" walls		
222	122	38
274	150	43
297	163	48
338	186	53
Metal Shell 14"Φ w/.25" walls		
217	119	33
264	145	38
327	180	43
349	192	48
400	220	53
Metal Shell 14"Φ w/.312" walls		
217	119	33
264	145	38
327	180	43
349	192	48
400	220	53
478	263	58
492	271	63
Steel HP 8 X 36		
209	115	63
240	132	68
Steel HP 10 X 42		
223	123	53
263	145	63
302	166	68

Nominal Required Bearing (Kips)	Factored Resistance Available (Kips)	Estimated Pile Length (Ft.)
Steel HP 10 X 57		
228	125	53
269	148	63
309	170	68
396	218	73
407	224	78
Steel HP 12 X 53		
229	126	48
276	152	53
326	179	63
375	206	68
Steel HP 12 X 63		
231	127	48
279	153	53
330	181	63
378	208	68
Steel HP 12 X 74		
185	102	38
234	129	48
283	156	53
334	184	63
384	211	68
506	278	73
519	285	78
Steel HP 12 X 84		
188	103	38
237	130	48
287	158	53
339	187	63
389	214	68
515	283	73
528	290	78

Nominal Required Bearing (Kips)	Factored Resistance Available (Kips)	Estimated Pile Length (Ft.)
Steel HP 14 X 73		
223	123	38
275	151	48
338	186	53
399	219	63
458	252	68
Steel HP 14 X 89		
227	125	38
278	153	48
342	188	53
404	222	63
464	255	68
610	336	73
632	348	78
Steel HP 14 X 102		
230	126	38
282	155	48
346	191	53
409	225	63
470	259	68
617	339	73
639	351	78
Steel HP 14 X 117		
233	128	38
285	157	48
351	193	53
414	228	63
476	262	68
627	345	73
649	357	78
Precast 14"x 14"		
46	25	3
Timber Pile		
151	83	23

IDOT STATIC METHOD OF ESTIMATING PILE LENGTH

I.D.O.T. BBS FOUNDATIONS AND GEOTECHNICAL UNIT — Modified 10/18/2011

SUBSTRUCTURE========== East Abutment
REFERENCE BORING ========== BB-7
LRFD or ASD or SEISMIC ========== LRFD
PILE CUTOFF ELEV. ========== 618.50 ft
GROUND SURFACE ELEV. AGAINST PILE DURING DRI 620.50 ft
GEOTECHNICAL LOSS TYPE (None, Scour, Liquef., DD) None
BOTTOM ELEV. OF SCOUR, LIQUEF., or DD ========= 0.00 ft
TOP ELEV. OF LIQUEF. (so layers above apply DD) ==== 0.00 ft

TOTAL FACTORED SUBSTRUCTURE LOAD ========= 5000 kips
TOTAL LENGTH OF SUBSTRUCTURE (along skew)==== 140.00 ft
NUMBER OF ROWS OF PILES PER SUBSTRUCTURE = 1
Approx. Factored Loading Applied per pile at 8 ft. Cts ======: 285.71 KIPS
Approx. Factored Loading Applied per pile at 3 ft. Cts ======: 107.14 KIPS

PILE TYPE AND SIZE ========== Steel HP 12 X 63
Plugged Pile Perimeter========== 4.000 FT. Unplugged Pile Perimeter========== 5.883 FT.
Plugged Pile End Bearing Area========== 1.000 SQFT. Unplugged Pile End Bearing Area======: 0.128 SQFT.

MAX. REQUIRED BEARING & RESISTANCE for Selected Pile, Soil Profile, & Losses

Maximum Nominal Req'd Bearing of Pile	Maximum Nominal Req.d Bearing of Boring	Maximum Factored Resistance Available in Boring	Maximum Pile Driveable Length in Boring
497 KIPS	**450** KIPS	**247** KIPS	**68** FT.

Input Hard Till when Qu > 3.0 tsf and N > 30 and delete Qu.

BOT. OF LAYER ELEV. (FT.)	LAYER THICK. (FT.)	UNCONF. COMPR. STRENGTH (TSF.)	S.P.T. N VALUE (BLOWS)	GRANULAR OR ROCK LAYER DESCRIPTION	NOMINAL PLUGGED SIDE RESIST. (KIPS)	NOMINAL PLUGGED END BRG. RESIST. (KIPS)	NOMINAL PLUGGED TOTAL RESIST. (KIPS)	NOMINAL UNPLUG'D SIDE RESIST. (KIPS)	NOMINAL UNPLUG'D END BRG. RESIST. (KIPS)	NOMINAL UNPLUG'D TOTAL RESIST. (KIPS)	NOMINAL REQ'D BEARING (KIPS)	FACTORED GEOTECH. LOSS FROM SCOUR or DD (KIPS)	FACTORED GEOTECH. LOSS LOAD FROM DD (KIPS)	FACTORED RESISTANCE AVAILABLE (KIPS)	ESTIMATED PILE LENGTH (FT.)
618.50	2.00	1.50	4		7.7		26.1	11.3		***13.7***	14	0	0	8	0
616.00	2.50	1.31	7		8.7	18.4	39.0	12.9	2.3	***27.1***	27	0	0	15	3
613.50	2.50	1.61	7		10.1	22.6	61.8	14.9	2.9	***43.6***	44	0	0	24	5
611.00	2.50	2.52	15		13.5	35.3	78.2	19.9	4.5	***63.8***	64	0	0	35	8
608.50	2.50	2.72	9		14.3	38.1	***57.9***	21.0	4.9	80.4	58	0	0	32	10
606.00	2.50	0.25	WHO		2.0	3.5	91.4	3.0	0.4	***87.4***	87	0	0	48	13
603.50	2.50	2.50	ST		13.5	35.0	115.1	19.8	4.5	***108.5***	109	0	0	60	15
601.00	2.50	3.23	23		16.1	45.2	***126.9***	23.7	5.8	131.7	127	0	0	70	18
598.50	2.50	2.92	17		15.0	41.0	***140.6***	22.1	5.2	153.6	141	0	0	77	20
596.00	2.50	2.82	14		14.6	39.5	***141.1***	21.5	5.1	173.4	141	0	0	78	23
593.50	2.50	1.81	15		10.9	25.4	***149.2***	16.1	3.2	189.1	149	0	0	82	25
591.00	2.50	1.61	12		10.1	22.6	***172.0***	14.9	2.9	205.6	172	0	0	95	28
586.00	5.00	2.52	12		27.1	35.3	***223.1***	39.8	4.5	248.5	223	0	0	123	33
581.00	5.00	4.23	16.3		39.6	59.3	***262.7***	58.3	7.6	306.7	263	0	0	144	38
576.00	5.00	4.23	21		39.6	59.3	***306.6***	58.3	7.6	365.5	307	0	0	169	43
571.00	5.00	4.54	34		7.5	63.6	***295.7***	11.0	8.1	374.2	296	0	0	163	48
566.00	5.00	3.23	12		32.2	45.2	***360.4***	47.4	5.8	425.8	360	0	0	198	53
561.00	5.00	5.54	28		41.6	77.7	***387.9***	61.2	9.9	485.1	388	0	0	213	58
556.00	5.00	4.54	28		41.6	63.6	***415.3***	61.2	8.1	544.5	415	0	0	228	63
551.00	5.00	3.53	28		34.5	49.4	***449.7***	50.7	6.3	595.1	450	0	0	247	68
546.00	5.00	3.53	40	Hard Till	9.2	49.4	***502.9***	13.5	6.3	614.3	~~503~~	~~0~~	~~0~~	~~277~~	~~73~~
541.00	5.00		50	Hard Till	12.7	93.4	***515.7***	18.7	11.9	633.0	~~516~~	~~0~~	~~0~~	~~284~~	~~78~~
536.50	4.50		50	Hard Till		93.4			11.9						

Pile Design Table for East Abutment utilizing Boring #BB-7

Nominal Required Bearing (Kips)	Factored Resistance Available (Kips)	Estimated Pile Length (Ft.)
Metal Shell 12"Φ w/.179" walls		
190	104	28
238	131	33
Metal Shell 12"Φ w/.25" walls		
190	104	28
238	131	33
287	158	38
338	186	43
Metal Shell 14"Φ w/.25" walls		
187	103	23
200	110	25
226	124	28
285	156	33
341	188	38
402	221	43
Metal Shell 14"Φ w/.312" walls		
187	103	23
200	110	25
226	124	28
285	156	33
341	188	38
402	221	43
421	232	48
494	272	53
Steel HP 8 X 36		
189	104	48
226	124	53
247	136	58
269	148	63
Steel HP 10 X 42		
175	97	33
208	114	38
237	131	48
286	157	53
311	171	58

Nominal Required Bearing (Kips)	Factored Resistance Available (Kips)	Estimated Pile Length (Ft.)
Steel HP 10 X 57		
180	99	33
213	117	38
243	133	48
293	161	53
318	175	58
343	189	63
372	204	68
411	226	73
421	232	78
Steel HP 12 X 53		
170	94	28
221	121	33
260	143	38
293	161	48
357	196	53
384	211	58
411	226	63
Steel HP 12 X 63		
172	95	28
223	123	33
263	144	38
296	163	48
360	198	53
388	213	58
415	228	63
450	247	68
Steel HP 12 X 74		
175	96	28
227	125	33
267	147	38
300	165	48
366	201	53
394	216	58
421	232	63
456	251	68
510	281	73
523	288	78
Steel HP 12 X 84		
177	97	28
230	127	33
271	149	38
304	167	48
371	204	53
399	220	58
427	235	63
462	254	68
518	285	73
531	292	78

Nominal Required Bearing (Kips)	Factored Resistance Available (Kips)	Estimated Pile Length (Ft.)
Steel HP 14 X 73		
180	99	25
209	115	28
274	151	33
321	176	38
357	196	48
439	242	53
469	258	58
498	274	63
539	296	68
Steel HP 14 X 89		
182	100	25
212	117	28
278	153	33
325	179	38
361	199	48
445	245	53
475	261	58
504	277	63
545	300	68
618	340	73
633	348	78
Steel HP 14 X 102		
184	101	25
215	118	28
282	155	33
329	181	38
366	201	48
451	248	53
481	264	58
510	281	63
551	303	68
626	344	73
641	353	78
Steel HP 14 X 117		
187	103	25
218	120	28
286	157	33
334	184	38
370	204	48
457	251	53
487	268	58
516	284	63
558	307	68
634	349	73
649	357	78
Precast 14"x 14"		
176	97	15
201	110	18
227	125	20
238	131	23
255	140	25
Timber Pile		
148	81	23

IDOT STATIC METHOD OF ESTIMATING PILE LENGTH

I.D.O.T. BBS FOUNDATIONS AND GEOTECHNICAL UNIT — Modified 10/18/2011

SUBSTRUCTURE========== West Abutment
REFERENCE BORING ========== BB-4
LRFD or ASD or SEISMIC ========== LRFD
PILE CUTOFF ELEV. ========== 617.16 ft
GROUND SURFACE ELEV. AGAINST PILE DURING DRI 619.16 ft
GEOTECHNICAL LOSS TYPE (None, Scour, Liquef., DD) None
BOTTOM ELEV. OF SCOUR, LIQUEF., or DD ========= 0.00 ft
TOP ELEV. OF LIQUEF. (so layers above apply DD) ==== 0.00 ft

TOTAL FACTORED SUBSTRUCTURE LOAD ========= 6000 kips
TOTAL LENGTH OF SUBSTRUCTURE (along skew)==== 140.00 ft
NUMBER OF ROWS OF PILES PER SUBSTRUCTURE = 1
Approx. Factored Loading Applied per pile at 8 ft. Cts ======: 342.86 KIPS
Approx. Factored Loading Applied per pile at 3 ft. Cts ======: 128.57 KIPS

MAX. REQUIRED BEARING & RESISTANCE for Selected Pile, Soil Profile, & Losses

Maximum Nominal Req'd Bearing of Pile	Maximum Nominal Req.d Bearing of Boring	Maximum Factored Resistance Available in Boring	Maximum Pile Driveable Length in Boring
497 KIPS	**371** KIPS	**204** KIPS	**63** FT.

PILE TYPE AND SIZE ========== Steel HP 12 X 63
Plugged Pile Perimeter========== 4.000 FT. Unplugged Pile Perimeter========== 5.883 FT.
Plugged Pile End Bearing Area========== 1.000 SQFT. Unplugged Pile End Bearing Area======: 0.128 SQFT.

Delete Qu if rock or add N value if Granular or Delete Description if Cohesive.

BOT. OF LAYER ELEV. (FT.)	LAYER THICK. (FT.)	UNCONF. COMPR. STRENGTH (TSF.)	S.P.T. N VALUE (BLOWS)	GRANULAR OR ROCK LAYER DESCRIPTION	NOMINAL PLUGGED SIDE RESIST. (KIPS)	NOMINAL PLUGGED END BRG. RESIST. (KIPS)	NOMINAL PLUGGED TOTAL RESIST. (KIPS)	NOMINAL UNPLUG'D SIDE RESIST. (KIPS)	NOMINAL UNPLUG'D END BRG. RESIST. (KIPS)	NOMINAL UNPLUG'D TOTAL RESIST. (KIPS)	NOMINAL REQ'D BEARING (KIPS)	FACTORED GEOTECH. LOSS FROM SCOUR or DD (KIPS)	FACTORED GEOTECH. LOSS LOAD FROM DD (KIPS)	FACTORED RESISTANCE AVAILABLE (KIPS)	ESTIMATED PILE LENGTH (FT.)
617.16	2.00		7		0.0		6.7	0.0		***0.9***	1	0	0	0	0
614.66	2.50		6		0.0	6.7	3.5	0.0	0.9	***0.4***	0	0	0	0	3
612.16	2.50		2		0.0	3.5	20.6	0.0	0.4	***2.6***	3	0	0	1	5
609.66	2.50		11		0.0	20.6	5.6	0.0	2.6	***0.7***	1	0	0	0	8
607.16	2.50		3		0.0	5.6	7.5	0.0	0.7	***1.0***	1	0	0	1	10
604.66	2.50		4		0.0	7.5	33.9	0.0	1.0	***4.3***	4	0	0	2	13
602.16	2.50	2.42	10		13.2	33.9	68.2	19.4	4.3	***26.4***	26	0	0	15	15
599.66	2.50	3.93	12		18.7	55.1	82.7	27.5	7.0	***53.4***	53	0	0	29	18
597.16	2.50	3.63	13		17.6	50.8	83.4	25.9	6.5	***77.1***	77	0	0	42	20
594.66	2.50	2.42	13		13.2	33.9	***90.9***	19.4	4.3	95.8	91	0	0	50	23
592.16	2.50	2.02	13		11.7	28.3	***106.8***	17.2	3.6	113.5	107	0	0	59	25
589.66	2.50	2.32	13		12.8	32.5	***123.9***	18.8	4.2	132.9	124	0	0	68	28
584.66	5.00	2.62	17		27.8	36.7	***164.4***	40.9	4.7	175.4	164	0	0	90	33
579.66	5.00	3.53	21		34.5	49.4	***197.5***	50.7	6.3	225.9	197	0	0	109	38
574.66	5.00	3.43	20		33.7	48.1	***248.1***	49.6	6.1	277.7	248	0	0	136	43
569.66	5.00	4.64	20		41.6	65.0	***302.4***	61.2	8.3	340.5	302	0	0	166	48
564.66	5.00	5.54	21		41.6	77.6	***346.8***	61.2	9.9	402.0	347	0	0	191	53
559.66	5.00	5.74	25		41.6	80.5	***358.7***	61.2	10.3	459.4	359	0	0	197	58
554.66	5.00	3.63	27		35.2	50.8	***371.1***	51.8	6.5	508.2	371	0	0	204	63
549.66	5.00	2.00	29		23.3	28.0	***528.9***	34.2	3.6	559.6	~~529~~	~~0~~	~~0~~	~~291~~	~~68~~
544.66	5.00	11.60	57		15.7	162.6	***475.5***	23.1	20.8	573.9	475	0	0	262	73
539.66	5.00		50	Hard Till	12.7	93.4	***488.2***	18.7	11.9	592.6	488	0	0	269	78
534.66	5.00		50	Hard Till		93.4			11.9						

Pile Design Table for West Abutment utilizing Boring #BB-4

Nominal Required Bearing (Kips)	Factored Resistance Available (Kips)	Estimated Pile Length (Ft.)
Metal Shell 12"Φ w/.179" walls		
213	117	38
Metal Shell 12"Φ w/.25" walls		
213	117	38
265	146	43
324	178	48
Metal Shell 14"Φ w/.25" walls		
206	113	33
255	140	38
317	174	43
387	213	48
Metal Shell 14"Φ w/.312" walls		
206	113	33
255	140	38
317	174	43
387	213	48
449	247	53
484	266	58
Steel HP 8 X 36		
231	127	58
244	134	63
Steel HP 10 X 42		
195	107	43
238	131	48
274	151	53
289	159	58
302	166	63

Nominal Required Bearing (Kips)	Factored Resistance Available (Kips)	Estimated Pile Length (Ft.)
Steel HP 10 X 57		
200	110	43
244	134	48
281	155	53
295	162	58
308	170	63
388	213	73
398	219	78
Steel HP 12 X 53		
195	107	38
246	135	43
299	165	48
343	189	53
355	195	58
368	202	63
Steel HP 12 X 63		
197	109	38
248	136	43
302	166	48
347	191	53
359	197	58
371	204	63
Steel HP 12 X 74		
201	110	38
252	139	43
307	169	48
352	194	53
364	200	58
376	207	63
483	265	73
496	273	78
Steel HP 12 X 84		
204	112	38
256	141	43
312	172	48
358	197	53
369	203	58
381	210	63
490	269	73
503	277	78

Nominal Required Bearing (Kips)	Factored Resistance Available (Kips)	Estimated Pile Length (Ft.)
Steel HP 14 X 73		
203	112	33
242	133	38
305	168	43
371	204	48
424	233	53
432	238	58
442	243	63
Steel HP 14 X 89		
206	113	33
245	135	38
309	170	43
376	207	48
430	236	53
437	240	58
447	246	63
585	322	73
600	330	78
Steel HP 14 X 102		
209	115	33
248	137	38
313	172	43
381	210	48
435	239	53
443	243	58
452	249	63
593	326	73
608	335	78
Steel HP 14 X 117		
212	117	33
252	138	38
318	175	43
387	213	48
441	243	53
448	246	58
457	251	63
601	330	73
616	339	78
Precast 14"x 14"		
198	109	28
263	144	33
Timber Pile		
152	83	33

IDOT STATIC METHOD OF ESTIMATING PILE LENGTH

I.D.O.T. BBS FOUNDATIONS AND GEOTECHNICAL UNIT — Modified 10/18/2011

SUBSTRUCTURE========== West Abutment
REFERENCE BORING ========== BB-5
LRFD or ASD or SEISMIC ========== LRFD
PILE CUTOFF ELEV. ========== 617.86 ft
GROUND SURFACE ELEV. AGAINST PILE DURING DRI 619.86 ft
GEOTECHNICAL LOSS TYPE (None, Scour, Liquef., DD) None
BOTTOM ELEV. OF SCOUR, LIQUEF., or DD ========= 0.00 ft
TOP ELEV. OF LIQUEF. (so layers above apply DD) ==== 0.00 ft

TOTAL FACTORED SUBSTRUCTURE LOAD ========= 6000 kips
TOTAL LENGTH OF SUBSTRUCTURE (along skew)==== 140.00 ft
NUMBER OF ROWS OF PILES PER SUBSTRUCTURE = 1
Approx. Factored Loading Applied per pile at 8 ft. Cts ===== 342.86 KIPS
Approx. Factored Loading Applied per pile at 3 ft. Cts ===== 128.57 KIPS

MAX. REQUIRED BEARING & RESISTANCE for Selected Pile, Soil Profile, & Losses

Maximum Nominal Req'd Bearing of Pile	Maximum Nominal Req.d Bearing of Boring	Maximum Factored Resistance Available in Boring	Maximum Pile Driveable Length in Boring
497 KIPS	**477** KIPS	**263** KIPS	*** Below Boring

PILE TYPE AND SIZE ========== Steel HP 12 X 63
Plugged Pile Perimeter========== 4.000 FT. Unplugged Pile Perimeter========== 5.883 FT.
Plugged Pile End Bearing Area========== 1.000 SQFT. Unplugged Pile End Bearing Area===== 0.128 SQFT.

Delete Qu if rock or add N value if Granular or Delete Description if Cohesive.

BOT. OF LAYER ELEV. (FT.)	LAYER THICK. (FT.)	UNCONF. COMPR. STRENGTH (TSF.)	S.P.T. N VALUE (BLOWS)	GRANULAR OR ROCK LAYER DESCRIPTION	NOMINAL PLUGGED SIDE RESIST. (KIPS)	NOMINAL PLUGGED END BRG. RESIST. (KIPS)	NOMINAL PLUGGED TOTAL RESIST. (KIPS)	NOMINAL UNPLUG'D SIDE RESIST. (KIPS)	NOMINAL UNPLUG'D END BRG. RESIST. (KIPS)	NOMINAL UNPLUG'D TOTAL RESIST. (KIPS)	NOMINAL REQ'D BEARING (KIPS)	FACTORED GEOTECH. LOSS FROM SCOUR or DD (KIPS)	FACTORED GEOTECH. LOSS LOAD FROM DD (KIPS)	FACTORED RESISTANCE AVAILABLE (KIPS)	ESTIMATED PILE LENGTH (FT.)
617.86	2.00	1.51	6		7.7		24.5	11.4		***13.5***	14	0	0	7	0
615.36	2.50		15		0.0	16.8	49.8	0.0	2.1	***16.7***	17	0	0	9	3
612.86	2.50	3.00	15		15.3	42.0	116.5	22.5	5.4	***45.8***	46	0	0	25	5
610.36	2.50		50		0.0	93.4	54.8	0.0	11.9	***37.9***	38	0	0	21	8
607.86	2.50		17		0.0	31.8	37.0	0.0	4.1	***35.7***	36	0	0	20	10
605.36	2.50	1.00	12		7.1	14.0	105.0	10.5	1.8	***53.9***	54	0	0	30	13
602.86	2.50	5.34	18		20.8	74.8	100.3	30.6	9.6	***81.2***	81	0	0	45	15
600.36	2.50	3.53	20		17.2	49.4	***102.0***	25.3	6.3	104.6	102	0	0	56	18
597.86	2.50	2.42	17		13.2	33.9	***112.4***	19.4	4.3	123.6	112	0	0	62	20
595.36	2.50	2.22	13		12.4	31.1	***130.5***	18.3	4.0	142.6	130	0	0	72	23
592.86	2.50	2.62	15		13.9	36.7	***143.0***	20.5	4.7	162.9	143	0	0	79	25
590.36	2.50	2.52	12		13.5	35.3	***150.9***	19.9	4.5	182.1	151	0	0	83	28
585.36	5.00	2.12	14		24.1	29.7	***182.0***	35.5	3.8	218.5	182	0	0	100	33
580.36	5.00	2.62	16		27.8	36.7	***208.4***	40.9	4.7	259.2	208	0	0	115	38
575.36	5.00	2.52	34		27.1	35.3	***261.0***	39.8	4.5	302.3	261	0	0	144	43
570.36	5.00	4.33	31		6.7	60.7	***256.4***	9.9	7.8	310.7	256	0	0	141	48
565.36	5.00	3.53	20		34.5	49.4	***314.9***	50.7	6.3	364.5	315	0	0	173	53
560.36	5.00	5.24	25		41.6	73.4	***343.7***	61.2	9.4	424.0	344	0	0	189	58
555.36	5.00	4.33	29		40.4	60.7	***374.3***	59.4	7.8	482.1	374	0	0	206	63
550.36	5.00	3.64	25		35.3	51.0	***436.3***	51.9	6.5	537.4	436	0	0	240	68
545.36	5.00	5.54	50		12.7	77.7	***449.8***	18.7	9.9	556.2	450	0	0	247	73
540.36	5.00	5.60	50		12.7	78.5	***477.5***	18.7	10.0	576.8	477	0	0	263	78
535.36	5.00		50			93.4			11.9						

Pile Design Table for West Abutment utilizing Boring #BB-5

Nominal Required Bearing (Kips)	Factored Resistance Available (Kips)	Estimated Pile Length (Ft.)
Metal Shell 12"Φ w/.179" walls		
201	111	33
235	129	38
Metal Shell 12"Φ w/.25" walls		
201	111	33
235	129	38
283	156	43
303	167	48
Metal Shell 14"Φ w/.25" walls		
199	109	28
239	132	33
278	153	38
338	186	43
360	198	48
Metal Shell 14"Φ w/.312" walls		
199	109	28
239	132	33
278	153	38
338	186	43
360	198	48
429	236	53
478	263	58
Steel HP 8 X 36		
218	120	58
241	133	63
277	152	68
286	157	73
Steel HP 10 X 42		
204	112	48
249	137	53
275	151	58
301	166	63

Nominal Required Bearing (Kips)	Factored Resistance Available (Kips)	Estimated Pile Length (Ft.)
Steel HP 10 X 57		
209	115	48
255	140	53
281	155	58
308	169	63
357	196	68
368	202	73
389	214	78
Steel HP 12 X 53		
206	114	38
254	140	48
312	171	53
340	187	58
371	204	63
Steel HP 12 X 63		
208	115	38
256	141	48
315	173	53
344	189	58
374	206	63
436	240	68
450	247	73
477	263	78
Steel HP 12 X 74		
212	116	38
260	143	48
320	176	53
349	192	58
380	209	63
443	244	68
456	251	73
485	267	78
Steel HP 12 X 84		
215	118	38
264	145	48
325	179	53
354	195	58
385	212	63
449	247	68
463	255	73
492	271	78

Nominal Required Bearing (Kips)	Factored Resistance Available (Kips)	Estimated Pile Length (Ft.)
Steel HP 14 X 73		
221	122	33
252	139	38
311	171	48
385	212	53
416	229	58
450	248	63
528	291	68
545	299	73
Steel HP 14 X 89		
224	123	33
255	140	38
315	173	48
390	215	53
422	232	58
456	251	63
535	294	68
552	303	73
588	323	78
Steel HP 14 X 102		
227	125	33
259	142	38
319	176	48
395	217	53
427	235	58
461	254	63
542	298	68
559	307	73
595	327	78
Steel HP 14 X 117		
230	127	33
262	144	38
324	178	48
401	220	53
432	238	58
467	257	63
549	302	68
566	311	73
603	332	78
Timber Pile		
140	77	25

AASHTO Soil Classification System Guide

The AASHTO classification system was created in 1928 and is one of the first engineering classification systems. The system was developed for use in highway construction and rates soils for their suitability for support of roadway pavements. Soil material under the AASHTO system only includes soils which pass the 3-inch sieve.

Note that some specifications described in the following content may not be the same as the specifications followed by your agency. Always check with your State agency's standards and specifications when using these guidelines.

AASHTO Soil Classification System

AASHTO Soil Classification System (from AASHTO M 145 or ASTM D3282)

General Classification	**Granular Materials (35% or less passing the 0.075 mm sieve)**							**Silt-Clay Materials (>35% passing the 0.075 mm sieve)**			
Group Classification	A-1		A-3	A-2				A-4	A-5	A-6	A-7
	A-1-a	A-1-b		A-2-4	A-2-5	A-2-6	A-2-7				A-7-5 A-7-6
Sieve Analysis, % passing											
2.00 mm (No. 10)	50 max	...	...	...	...	...	...	...	...	...	...
0.425 (No. 40)	30 max	50 max	51 min	...	...	...	...	...	...	...	...
0.075 (No. 200)	15 max	25 max	10 max	35 max	35 max	35 max	35 max	36 min	36 min	36 min	36 min
Characteristics of fraction passing 0.425 mm (No. 40)											
Liquid Limit	...		...	40 max	41 min	40 max	41 min	40 max	41 min	40 max	41 min
Plasticity Index	6 max		N.P.	10 max	10 max	11 min	11 min	10 max	10 max	11 min	11 min[1]
Usual types of significant constituent materials	stone fragments, gravel and sand		fine sand	silty or clayey gravel and sand				silty soils		clayey soils	
General rating as a subgrade	excellent to good							fair to poor			

KEY TO TEST DATA

DRILLING & SAMPLING SYMBOLS:

SL = SS with Liner
SS = Split Spoon — 1⅜" 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

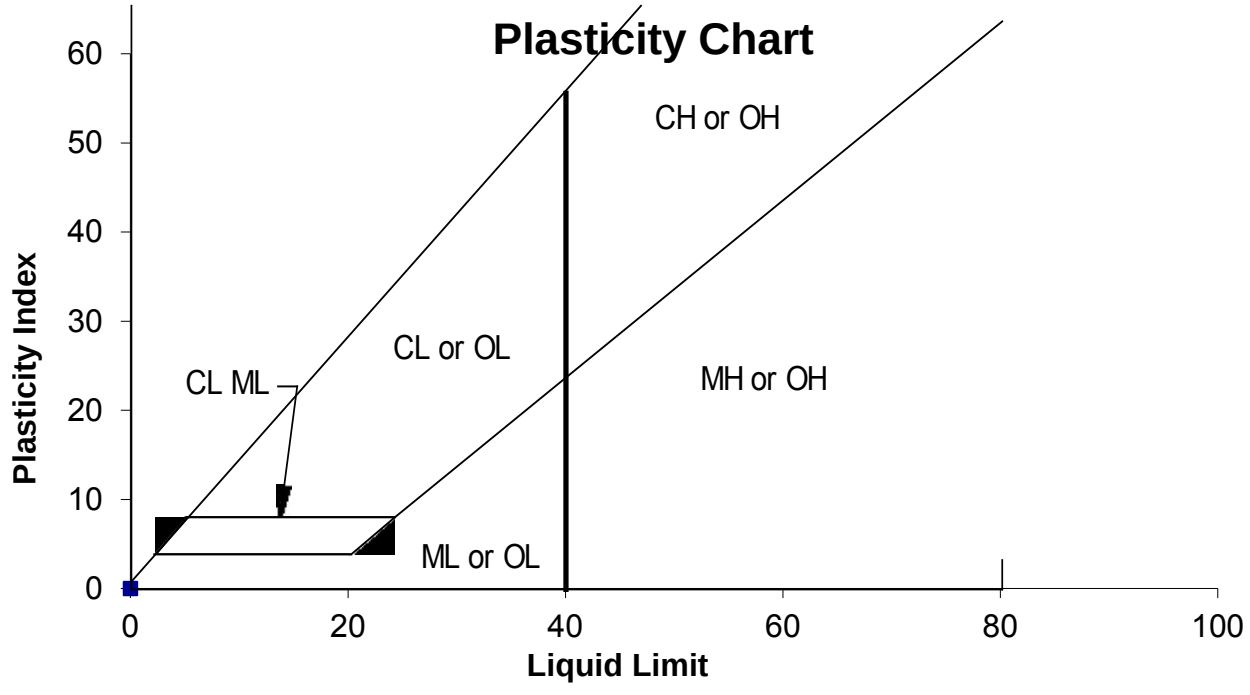
Unconfined Comp. Strength, Qu, tsf	Consistency
<0.25	Very Soft
0.25— 0.49	Soft
0.50 — 0.99	Medium (Firm)
1.00— 1.99	Stiff
2.00 — 3.99	Very Stiff
4.00 — 8.00	Hard
>8.00	Very Hard

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	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.