Geotechnical Evaluation Report

Hammond Avenue Improvements
Belknap Avenue to 29th Street
Superior, Wisconsin

Prepared for

Short Elliott Hendrickson, Inc.

Professional Certification:
I hereby certify that this plan, specification, or report was prepared by me or under my direct supervision and that I am a duly licensed Professional Engineer under the laws of the State of Wisconsin.

Joseph C. Butler, PE
Senior Engineer
License Number: E-43286-6
February 18, 2022

BRAUN INTERTEC
The Science You Build On.

Project B2110337

Braun Intertec Corporation

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February 18, 2022 Project B2110337

Matthew Bolf, PE
Short Elliott Hendrickson, Inc.
418 W Superior Street, Suite 200
Duluth, MN 55802

Re: Geotechnical Evaluation
Hammond Avenue Improvements
Belknap Avenue to 29th Street
Superior, Wisconsin

Dear Mr. Bolf:

We are pleased to present this Geotechnical Evaluation Report for the Hammond Avenue Improvements project in Superior, Wisconsin.

Thank you for making Braun Intertec your geotechnical consultant for this project. If you have questions about this report, or if there are other services that we can provide in support of our work to date, please contact Kyle Warmuth (kwarmuth@braunintertec.com) at 218.624.4967.

Sincerely,

BRAUN INTERTEC CORPORATION

Kyle P. Warmuth, EIT
Staff Engineer

Joseph C. Butler, PE
Business Unit Manager, Senior Engineer

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Descriptive Terminology of Soil
Pavement Design (AASHTO 1993 Method)

A. Introduction

A.1. Project Description

This Geotechnical Evaluation Report addresses the proposed design and construction of proposed pavement and utility upgrades for Hammond Avenue and the associated residential streets adjacent to Hammond Avenue in Superior, Wisconsin. Hammond Avenue is expected to have a larger traffic volume than the associated streets.

For this report, we have assumed that new pavement will have a bituminous section, however, we understand that a concrete pavement section recommendations has been requested. As a basis of our evaluation, we assume the existing ground surface elevations are within 2 feet of the proposed finish grades.

A.2. Site Conditions and History

The existing alignment is currently a bituminous surface roadway with an urban section along Hammond Avenue. It is apparent that the original pavement section in portions of Hammond Avenue consisted of concrete. Bituminous was placed over the concrete between the curbs.

A.3. Purpose

The purpose of our pavement evaluation will be to determine thicknesses of the in-place pavement materials. The purpose of our geotechnical evaluation will be to characterize subsurface geologic conditions at selected exploration locations, evaluate their impact on the project, and provide geotechnical recommendations for the design and construction of street reconstruction.

A.4. Background Information and Reference Documents

We reviewed the following information:

- Wisconsin Geologic Map, “Soils of Wisconsin”, prepared by F. D. Hole, M.T Beatty, C.J. Milfred, G.B. Lee, and A.J Klingelhoets, dated 1968.

- Discussions with Jarrod Starren and Matt Bolf with SEH Inc. on the scope of the project.

- Aerial photos from Google Earth Pro©.

We have described our understanding of the proposed construction and site to the extent others reported it to us. Depending on the extent of available information, we may have made assumptions based on our experience with similar projects. If we have not correctly recorded or interpreted the project details, the project team should notify us. New or changed information could require additional evaluation, analyses and/or recommendations.

A.5. Scope of Services

We performed our scope of services for the project in accordance with our Proposal QTB144605 to SEH, Inc., dated October 18, 2021. The following list describes the geotechnical tasks completed in accordance with our authorized scope of services.

- Reviewing the background information and reference documents previously cited.

- Staking and clearing the exploration location of underground utilities. We staked the new exploration locations. We acquired the surface elevations and locations with GPS technology using the State of Minnesota's permanent GPS base station network. The Soil Boring Location Sketch included in the Appendix shows the approximate locations of the borings.

- Performing fourteen standard penetration test (SPT) borings, denoted as ST-1 to ST-14, to nominal depths of approximately 10 feet below grade across the site.

- Performing laboratory testing on select samples to aid in soil classification and engineering analysis.

- Perform engineering analysis including pavement and utilities.

- Preparing this report containing a boring location sketch, logs of soil borings, a summary of the soils encountered, results of laboratory tests, and recommendations for pavement subgrade preparation and the design of pavements, and utilities.

Our scope of services did not include environmental services or testing and our geotechnical personnel performing this evaluation are not trained to provide environmental services or testing. We can provide environmental services or testing at your request.

B. Results

B.1. Geologic Overview

We based the geologic origins used in this report on the soil types, in-situ and laboratory testing, and available common knowledge of the geological history of the site. Because of the complex depositional history, geologic origins can be difficult to ascertain. We did not perform a detailed investigation of the geologic history for the site.

B.2. Boring Results

Table 1 provides a summary of the soil boring results, in the general order we encountered the strata. Please refer to the Log of Boring sheets in the Appendix for additional details. The Descriptive Terminology sheets in the Appendix include definitions of abbreviations used in Table 1.

Table 1. Subsurface Profile Summary*

Strata	Soil Type - ASTM Classification	Range of Penetration Resistances	Commentary and Details
Pavement section			▪ Overall thickness ranges from 2 1/2 to 18 inches. ▪ Bituminous thickness 2 to 7 1/2 inches. ▪ Concrete thickness 4 to 7 inches. ▪ Apparent aggregate base is 6 to 9 inches.
Fill	SM, CL	4 to 9 BPF	▪ Moisture condition generally moist. ▪ Thicknesses at boring locations varied from 4 to 6 1/2 feet. ▪ Variable amounts of gravel ▪ Occasional layers of organic soils
Lacustrine Deposits	CH	5 to 10 BPF	▪ Variable amounts of gravel ▪ Moisture condition generally moist.

*Abbreviations defined in the attached Descriptive Terminology sheets.

For simplicity in this report, we define existing fill to mean existing, uncontrolled or undocumented fill.

B.3. Groundwater

We did not observe groundwater while advancing our borings. Therefore, it appears that groundwater is below the depths explored. However, groundwater may take days or longer to reach equilibrium in the boreholes and we immediately backfilled the boreholes, in accordance with our scope of work. If the project team identifies a need for more accurate determination of groundwater depth, we can install piezometers.

Project planning should anticipate seasonal and annual fluctuations of groundwater.

C. Recommendations

C.1. Design and Construction Discussion

C.1.a. Introduction

The City of Superior is facilitating the reconstruction the existing Hammond Avenue and the associated utilities within the street. The reconstruction will include the removal and replacement of existing pavements and the addition and/or replacement of watermain and storm sewer is planned.

C.1.a.1. Traffic Loads

Based on WisDOT Traffic Data Website and information given by SEH, Inc., the Average Daily Traffic (ADT) for Hammond Avenue was 4,500 in 2019. The historic traffic data on the WisDOT website indicates the ADT of Hammond Avenue is decreasing over time. For the purpose of traffic forecasting, we conservatively have utilized a 0.5 percent growth rate in our ESAL calculations.

Based on this data in the WisPAVE Design, we have assumed that section will be subjected to no more than 180,000 equivalent 18-kip single axle loads (ESALs) over an assumed design life of 20 years for bituminous pavements and no more than 240,000 ESALs over an assumed design life of 20 years for concrete pavements

C.1.b. Frost Protection and Drainage

The silt- and clay- rich soils present at anticipated pavement subgrade elevations are frost susceptible and are weak when wet. We recommend drainage be provided for the pavement aggregate base layer.

Removing water from the pavement subgrade will decrease strength loss during wet weather and during spring thaw.

C.1.c. Existing Fill

The boring indicates the relatively density of the fill soils was variable. To create a more uniform pavement subgrade, we recommend the pavement subgrade be compacted with a large vibratory compactor. The compactor should have a drum diameter of at least 4 feet and should complete a minimum of 3 passes, in each direction.

C.1.d. Construction Disturbance

The contractor should note the on-site, silty soils are highly susceptible to disturbance, due to repeated construction traffic. Disturbance of these soils may cause areas that were previously prepared, or that were suitable for pavement or structure support, to become unstable and require moisture conditioning and compaction. Subcutting and replacing the disturbed material with crushed, coarse gravel, free of fines is also an alternative. The contractor should use means and methods to limit disturbance of the soils.

C.1.e. Change In Information

We have attempted to describe our understanding of the proposed construction to the extent it was reported to us by others. Depending on the extent of available information, assumptions may have been made based on our experience with similar projects. If we have not correctly recorded or interpreted the project details, we should be notified. New or changed information could require additional evaluation, analyses and/or recommendations.

C.2. Earthwork Recommendations

C.2.a. Excavations and Subgrade Preparations

We recommend the following steps for pavement and exterior slab subgrade preparation, understanding the site will have a grade change of 1 foot or less. Note that project planning may need to require additional subcuts to limit frost heave.

1. Strip unsuitable soils consisting of topsoil, existing structures, and pavements from the area, within 3 feet of the surface of the proposed pavement grade.

2. Have a geotechnical representative observe the excavated subgrade to evaluate if additional subgrade improvements are necessary.

3. Slope subgrade soils to areas of sand or drain tile to allow the removal of accumulating water.

4. Scarify, moisture condition and surface compact the subgrade with at least 3 passes of a large roller with a minimum drum diameter of 3 ½ feet.

5. Proofroll the exterior slab subgrade as described in Section C.4.

To improve long-term pavement performance, we recommend incorporating 12 inches of granular engineered fill in paved areas, in addition to the recommendations above, as a sand subbase. Section C.4 provides recommended pavement design sections with and without the sand subbase. Note, we recommend sloping subgrade soils to promote drainage and removal of accumulated water.

C.2.b. Excavation Dewatering

We recommend dewatering to be performed such that any utilities or backfill materials are placed in a "dry" state. Sumps and pumps should be sufficient for removing groundwater or any surface water that has accumulated in excavations.

C.2.c. Excavated Slopes

Based on the borings, we anticipate on-site soils in excavations will consist of fat clay and fill material. These soils are typically considered Type B Soil under OSHA (Occupational Safety and Health Administration) guidelines. OSHA guidelines indicate unsupported excavations in Type B soils should have a gradient no steeper than 1H:1V. Slopes constructed in this manner may still exhibit surface sloughing. OSHA requires an engineer to evaluate slopes or excavations over 20 feet in depth.

An OSHA-approved qualified person should review the soil classification in the field. Excavations must comply with the requirements of OSHA 29 CFR, Part 1926, Subpart P, "Excavations and Trenches." This document states excavation safety is the responsibility of the contractor. The project specifications should reference these OSHA requirements.

C.3. Engineered Fill Materials and Compaction

The on-site existing fill can be considered for re-use as backfill and additional required fill provided debris (if encountered) is first removed. The glacial soils can also be considered for reuse as backfill and additional required fill.

Table 2 below contains our recommendations for fill materials, minimum compaction level, and moisture content for compacted fills.

Table 2. Pavement Materials and Compaction

Locations To Be Used	Fill Source and Soil Descriptions	Gradation	Relative Compaction, percent (ASTM D698 – Standard Proctor)	Moisture Content Variance from Optimum, percentage points
Dense Graded Base	Imported aggregate	WisDOT Standard Spec 305 Dense Graded Base	100	-3 to +1 for aggregate base
Granular Subbase	Imported sand and gravel	WisDOT Standard Spec 209 Grade 1 or Grade 2	100	-6 to +3 for granular subbase
Pavements subgrade and embankment grading	On-site glacial soils	100% passing 3-inch sieve < 2% OC PI < 15%	▪ 100 in upper 3 feet ▪ 95 below upper 3 feet	▪ -6 to +3 for GW, GP, SW, SP, SP-SM ▪ -1 to +3 for SC, SM, GM, GC

We recommend spreading engineered fill in loose lifts of approximately 12 inches thick. We recommend compacting engineered fill in accordance with the criteria presented below in Table 3.

Table 3. Compaction Recommendations Summary

Reference	Relative Compaction, percent (AASHTO T-99 – Standard Proctor)	Moisture Content Variance from Optimum, percentage points	
		< 12% Passing #200 Sieve (typically SP, SP-SM)	> 12% Passing #200 Sieve (typically SC, SM, GM, GC)
Within 3 feet of pavement subgrade	100	-6 to +3	-3 to +3
More than 3 feet below pavement subgrade	95	-6 to +3	-3 to +3
Below landscaped surfaces	90	±5	±5

The project documents should not allow the contractor to use frozen material as engineered fill or to place engineered fill on frozen material. Frost should not penetrate under foundations during construction.

We recommend performing density tests in engineered fill to evaluate if the contractors are effectively compacting the soil and meeting project requirements.

C.4. Pavements

C.4.a. Subgrade Proof-Roll

Prior to placing sub-base material, we recommend proof-rolling pavement subgrades to determine if the subgrade materials are loose, soft or weak, and in need of further stabilization, compaction or subexcavation and recompaction or replacement. A second proof-roll should be performed after the aggregate base material is in place, and prior to placing bituminous pavement.

C.4.b. Design Sections

We recommend a fat clay subgrade be assumed for this project. Based on this subgrade (DGI-value of 14 from the WisPAVE program) and aforementioned traffic loads, the WisPave Pavement Design method indicates a structural number of 3.10 is required for bituminous pavement for the areas with truck traffic and 5.2 inches for a concrete section.

Based on discussions with SEH, Inc. personnel, we understand the project team plans to utilize the following pavement section: 5 inches of bituminous pavement over 10 inches of aggregate base material and a 12-inch sand material subbase layer in traffic areas with truck traffic. After discussions with SEH, we understand that the city would like to explore the minimum require pavement section as well.

We also understand that a concrete pavement section recommendations has been requested.

Based upon the loads and an estimated DGI value of 14, we recommend Hammond Avenue pavement section designs as shown in Tables 4, 5, and 6 below.

Table 4. Proposed Hammond Avenue Bituminous Pavement Section

Pavement Material	Section	Structural Number
Bituminous (in.)	5	2.2
Aggregate Base (in.)	10	1
Subbase (in.)	12	0.24
Total Structural Number		**3.44**
Subgrade Preparation	Surface compact, then proofroll subgrade prior to placement of aggregate base to locate any soft areas	

Using the WisPave Pavement Design method the above payment section has a structure number of 3.44 which exceeds the required 3.10 structure number required.

Table 5. Minimum Hammond Avenue Bituminous Pavement Sections

Pavement Material	Section (Structural Number)	Section (Structural Number)
Bituminous (in.)	5 (2.2)	4 (1.76)
Aggregate Base (in.)	8 (0.8)	12 (1.2)
Subbase (in.)	12 (0.24)	12 (0.24)
Total Structural Number	**3.24**	**3.2**
Subgrade Preparation	Surface compact, then proofroll subgrade prior to placement of aggregate base to locate any soft areas	

Using the WisPave Pavement Design method the above payment sections has structure numbers of 3.24 and 3.2, which exceeds the required 3.10. structure number required.

Table 6. Hammond Avenue Concrete Pavement Section

Pavement Material	Section
Concrete (in.)	6
Aggregate Base (in.)	6
Subbase (in.)	12
Subgrade Preparation	Surface compact, then proofroll subgrade prior to placement of aggregate base to locate any soft areas

C.4.c. Performance

We based the above pavement designs on a 20-year performance life. This is the amount of time before we anticipate the pavement will require reconstruction. This performance life assumes routine maintenance, such as seal coating and crack sealing. The actual pavement life will vary depending on variations in weather, traffic conditions and maintenance.

C.4.d. Frost Protection and Subgrade Drainage

Clay and silty sand will underlie the pavements. We consider these soils to be highly frost susceptible. Soils of this type can retain moisture and heave upon freezing. In general, this characteristic is not an issue unless these soils become saturated, due to surface runoff or infiltration, or are excessively wet in situ. Once frozen, unfavorable amounts of general and isolated heaving of the soils and the surface structures supported on them could develop. This type of heaving could affect design drainage patterns and the performance of pavements.

To address most of the heave related issues, we recommend setting general site grades and grades for exterior surface features to direct surface drainage away from paved areas. Such grading will limit the potential for saturation of the subgrade and subsequent heaving. General grades should also have enough “slope” to tolerate potential larger areas of heave, which may not fully settle after thawing.

We also recommend installing perforated drainpipes throughout pavement areas at low points, around catch basins, and behind curb in landscaped areas. We also recommend installing drainpipes along pavement and exterior slab edges where exterior grades promote drainage toward those edge areas. The contractor should place drainpipes in small trenches, extended at least 8 inches below the granular subbase layer, or below the aggregate base material where no subbase is present.

C.4.e. Pavement Maintenance

Regardless of what is done to the pavement area subgrades, it will be critical the end-user develop a detailed maintenance program to seal and/or fill any cracks and joints that may develop during the useful life of the various surface features. Concrete and bituminous will experience episodes of normal thermo-expansion and thermo-contraction during its useful life. During this time, cracks may develop and joints may open up, which will expose the subgrade and allow any water flowing overland to enter the subgrade and either saturate the subgrade soils or to become perched atop it. This occurrence increases the potential for heave due to freezing conditions in the general vicinity of the crack or joint. This type of heave has the potential to become excessive if not addressed as part of a maintenance program. Special attention should be paid to areas where dissimilar materials abut one another, where construction joints occur and where shrinkage cracks develop.

C.5. Utilities

C.5.a. Subgrade Stabilization

Earthwork activities associated with utility installations should adhere to the recommendations in Section C.3 and utility pipes should be bedded on a cushion of sand.

We anticipate the soils at typical invert elevations will be suitable for utility support. However, if construction encounters unfavorable conditions such as soft clay, or perched water at invert grades, the unsuitable soils may require some additional subcutting and replacement with sand or crushed rock to prepare a proper subgrade for pipe support. Project design and construction should not place utilities within the 1H:1V oversizing of foundations.

C.5.b. Corrosion Potential

Based on our experience, the soils encountered by the borings are moderately corrosive to metallic conduits, but only marginally corrosive to concrete. We recommend specifying non-corrosive materials or providing corrosion protection, unless project planning chooses to perform additional tests to demonstrate the soils are not corrosive.

D. Construction Quality Control

D.1.a. Excavation Observations

We recommend having a geotechnical engineer observe all excavations related to utility subgrade preparation and pavement construction. The purpose of the observations is to evaluate the competence of the geologic materials exposed in the excavations.

D.1.b. Materials Testing

We recommend density tests be taken in excavation backfill and below pavements following the AASHTO T-99 method for standard proctor.

We recommend Rice tests on bituminous mixes to evaluate strength and air voids, and density tests to evaluate compaction. We recommend that bituminous pavement follows the Hot Mix Asphalt Pavement section 460 in the WisDOT 2022 Standard Specifications.

We also recommend slump, air content and strength tests of Portland cement concrete.

D.1.c. Cold Weather Precautions

If site grading and construction is anticipated during cold weather, all snow and ice should be removed from cut and fill areas prior to additional grading. No fill should be placed on frozen subgrades. No frozen soils should be used as fill.

Concrete delivered to the site should meet the temperature requirements of ASTM C 94. Concrete should not be placed on frozen subgrades. Concrete should be protected from freezing until the necessary strength is attained. Frost should not be permitted to penetrate below concrete.

E. Procedures

E.1. Penetration Test Borings

We drilled the penetration test borings with a float tire-mounted core and auger drill equipped with hollow-stem auger. We performed the borings in general accordance with ASTM D6151 taking penetration test samples at 2 1/2- or 5-foot intervals in general accordance to ASTM D1586. The boring logs show the actual sample intervals and corresponding depths.

E.2. Exploration Logs

E.2.a. Log of Boring Sheets

The Appendix includes Log of Boring sheets for our penetration test borings. The logs identify and describe the penetrated geologic materials, and present the results of penetration resistance and other in-situ tests performed. The logs also present the results of groundwater measurements.

We inferred strata boundaries from changes in the penetration test samples and the auger cuttings. Because we did not perform continuous sampling, the strata boundary depths are only approximate. The boundary depths likely vary away from the boring locations, and the boundaries themselves may occur as gradual rather than abrupt transitions.

E.2.b. Geologic Origins

We assigned geologic origins to the materials shown on the logs and referenced within this report, based on: (1) a review of the background information and reference documents cited above, (2) visual classification of the various geologic material samples retrieved during the course of our subsurface exploration, (3) penetration resistance and other in-situ testing performed for the project, and (4) available common knowledge of the geologic processes and environments that have impacted the site and surrounding area in the past.

E.3. Material Classification and Testing

E.3.a. Visual and Manual Classification

We visually and manually classified the geologic materials encountered based on ASTM D2488. When we performed laboratory classification tests, we used the results to classify the geologic materials in

accordance with ASTM D2487. The Appendix includes a chart explaining the classification system we used.

E.4. Groundwater Measurements

The drillers checked for groundwater while advancing the penetration test borings, and again after auger withdrawal. We then filled the boreholes, as noted on the boring logs.

F. Qualifications

F.1. Variations in Subsurface Conditions

F.1.a. Material Strata

We developed our evaluation, analyses and recommendations from a limited amount of site and subsurface information. It is not standard engineering practice to retrieve material samples from exploration locations continuously with depth. Therefore, we must infer strata boundaries and thicknesses to some extent. Strata boundaries may also be gradual transitions, and project planning should expect the strata to vary in depth, elevation and thickness, away from the exploration locations.

Variations in subsurface conditions present between exploration locations may not be revealed until performing additional exploration work, or starting construction. If future activity for this project reveals any such variations, you should notify us so that we may reevaluate our recommendations. Such variations could increase construction costs, and we recommend including a contingency to accommodate them.

F.1.b. Groundwater Levels

We made groundwater measurements under the conditions reported herein and shown on the exploration logs, and interpreted in the text of this report. Note that the observation periods were relatively short, and project planning can expect groundwater levels to fluctuate in response to rainfall, flooding, irrigation, seasonal freezing and thawing, surface drainage modifications and other seasonal and annual factors.

F.2. Continuity of Professional Responsibility

F.2.a. Plan Review

We based this report on a limited amount of information, and we made a number of assumptions to help us develop our recommendations. We should be retained to review the geotechnical aspects of the designs and specifications. This review will allow us to evaluate whether we anticipated the design correctly, if any design changes affect the validity of our recommendations, and if the design and specifications correctly interpret and implement our recommendations.

F.2.b. Construction Observations and Testing

We recommend retaining us to perform the required observations and testing during construction as part of the ongoing geotechnical evaluation. This will allow us to correlate the subsurface conditions exposed during construction with those encountered by the borings and provide professional continuity from the design phase to the construction phase. If we do not perform observations and testing during construction, it becomes the responsibility of others to validate the assumption made during the preparation of this report and to accept the construction-related geotechnical engineer-of-record responsibilities.

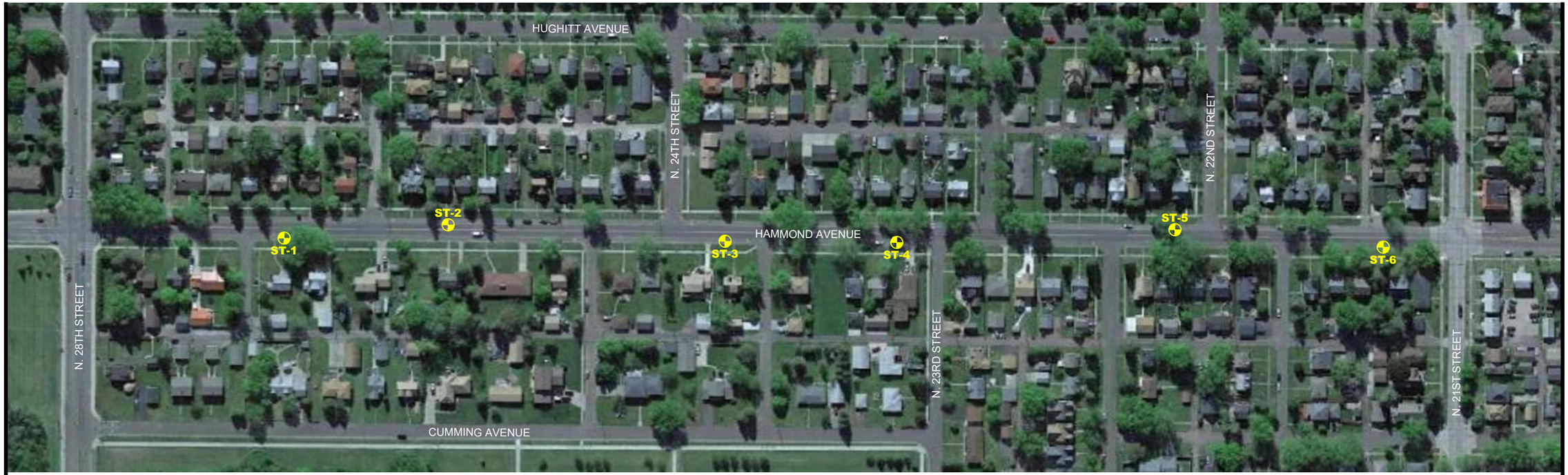
F.3. Use of Report

This report is for the exclusive use of the addressed parties. Without written approval, we assume no responsibility to other parties regarding this report. Our evaluation, analyses and recommendations may not be appropriate for other parties or projects.

F.4. Standard of Care

In performing its services, Braun Intertec used that degree of care and skill ordinarily exercised under similar circumstances by reputable members of its profession currently practicing in the same locality. No warranty, express or implied, is made.

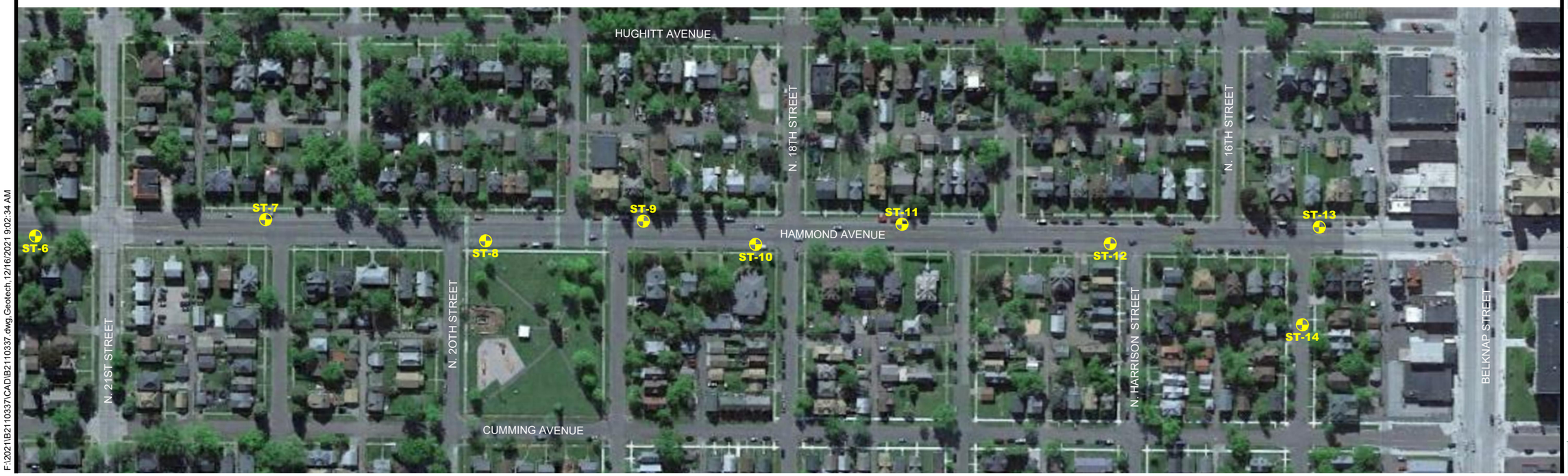
Appendix



DENOTES APPROXIMATE LOCATION OF STANDARD PENETRATION TEST BORING

100' 0 200'

SCALE: 1"= 200'



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Drawing Information

Project No:	B2110377
Drawing No:	B2110337
Drawn By:	JAG
Date Drawn:	12/15/21
Checked By:	KW
Last Modified:	12/16/21

Project Information

Hammond Avenue Improvements

28th Street to Belknap Street

Superior, Wisconsin

Soil Boring Location Sketch

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LOG OF BORING

See Descriptive Terminology sheet for explanation of abbreviations

Project Number B2110337
Geotechnical Evaluation
Hammond Avenue Improvements
Belknap Avenue to 29th Street
Superior, Wisconsin

BORING: **ST-1**

LOCATION: See attached sketch

NORTHING: 300538 EASTING: 148517

DRILLER: M. Heinzen | LOGGED BY: D. Morrison | START DATE: 11/30/21 | END DATE: 11/30/21

SURFACE ELEVATION: 652.3 ft | RIG: 7505 | METHOD: 3 1/4" HSA | SURFACING: Bituminous | WEATHER:

Elev./ Depth ft	Water Level	Description of Materials (Soil-ASTM D2488 or 2487; Rock-USACE EM 1110-1-2908)	Sample	Blows (N-Value) Recovery	q_p tsf	MC %	Tests or Remarks
651.6		BITUMINOUS, 8 inches					
0.7 650.3		FILL: SILTY SAND (SM), fine to medium-grained, with Gravel, dark brown, moist					
2.0 648.3		FILL: FAT CLAY (CH), trace Sand, brown, moist		2-2-2 (4) 4"			
4.0		FAT CLAY (CH), reddish brown, moist, medium to stiff (LACUSTRINE)		3-4-4 (8) 7"			
		5		3-4-5 (9) 14"			
		10		3-4-4 (8) 16"			
641.3							
11.0		END OF BORING Boring immediately backfilled with bentonite grout					Water not observed while drilling.
		15					
		20					
		25					
		30					

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LOG OF BORING

See Descriptive Terminology sheet for explanation of abbreviations

Project Number B2110337
Geotechnical Evaluation
Hammond Avenue Improvements
Belknap Avenue to 29th Street
Superior, Wisconsin

BORING: **ST-2**

LOCATION: See attached sketch

NORTHING: 300852 EASTING: 148492

DRILLER: M. Heinzen | LOGGED BY: D. Morrison | START DATE: 11/29/21 | END DATE: 11/29/21

SURFACE ELEVATION: 651.4 ft | RIG: 7505 | METHOD: 3 1/4" HSA | SURFACING: Bituminous | WEATHER:

Elev./ Depth ft	Water Level	Description of Materials (Soil-ASTM D2488 or 2487; Rock-USACE EM 1110-1-2908)	Sample	Blows (N-Value) Recovery	q_p tsf	MC %	Tests or Remarks
650.9 0.5		BITUMINOUS, 6 inches					
		CONCRETE, 5 1/2 inches					
650.4 1.0		APPARENT AGGREGATE BASE, 6 inches					
649.9 1.5		FILL: FAT CLAY (CH), trace Gravel, brown, moist		3-3-4 (7) 5"			
647.4 4.0		FILL: FAT CLAY (CH), brown, moist	5	2-3-3 (6) 10"			
644.9 6.5		FAT CLAY (CH), reddish brown, moist, medium (LACUSTRINE)		2-3-3 (6) 13"			
			10	3-4-4 (8) 14"			
640.4 11.0		END OF BORING Boring immediately backfilled with bentonite grout					Water not observed while drilling.
			15				
			20				
			25				
			30				

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LOG OF BORING

See Descriptive Terminology sheet for explanation of abbreviations

Project Number B2110337
Geotechnical Evaluation
Hammond Avenue Improvements
Belknap Avenue to 29th Street
Superior, Wisconsin

BORING: **ST-3**

LOCATION: See attached sketch

NORTHING: 301382 EASTING: 148523

DRILLER: M. Heinzen | LOGGED BY: D. Morrison | START DATE: 12/01/21 | END DATE: 12/01/21

SURFACE ELEVATION: 648.8 ft | RIG: 7505 | METHOD: 3 1/4" HSA | SURFACING: Bituminous | WEATHER:

Elev./ Depth ft	Water Level	Description of Materials (Soil-ASTM D2488 or 2487; Rock-USACE EM 1110-1-2908)	Sample	Blows (N-Value) Recovery	q_p tsf	MC %	Tests or Remarks
648.6		BITUMINOUS, 2 1/2 inches					
0.2		FILL: SILTY SAND (SM), with Gravel, dark brown, moist		4-4-5 (9) 0"			No recovery
644.8							
4.0		FILL: FAT CLAY (CH), trace Sand, brown, moist	5	2-3-5 (8) 5"			
642.3							
6.5		FAT CLAY (CH), reddish brown, moist, stiff (LACUSTRINE)		4-5-5 (10) 13"			
			10	4-4-5 (9) 15"			
637.8							
11.0		END OF BORING Boring immediately backfilled with bentonite grout					Water not observed while drilling.
			15				
			20				
			25				
			30				

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See Descriptive Terminology sheet for explanation of abbreviations

Project Number B2110337
Geotechnical Evaluation
Hammond Avenue Improvements
Belknap Avenue to 29th Street
Superior, Wisconsin

BORING: **ST-4**

LOCATION: See attached sketch

NORTHING: 301710 EASTING: 148525

DRILLER: M. Heinzen LOGGED BY: D. Morrison START DATE: 11/30/21 END DATE: 11/30/21

SURFACE ELEVATION: 646.9 ft RIG: 7505 METHOD: 3 1/4" HSA SURFACING: Bituminous WEATHER:

Elev./ Depth ft	Water Level	Description of Materials (Soil-ASTM D2488 or 2487; Rock-USACE EM 1110-1-2908)	Sample	Blows (N-Value) Recovery	q_p tsf	MC %	Tests or Remarks
646.4		BITUMINOUS, 6 inches					
0.5		CONCRETE, 7 inches					
645.8		FILL: SILTY SAND (SM), with Gravel, brown, moist		2-2-3 (5) 2"			
1.1		FILL: FAT CLAY (CH), trace Sand, brown, moist					
644.9							
2.0							
642.9		FAT CLAY (CH), reddish brown, moist, medium (LACUSTRINE)		2-3-4 (7) 4"			
4.0			5				
				3-3-4 (7) 15"			
			10	3-3-5 (8) 16"			
635.9							
11.0		END OF BORING					Water not observed while drilling.
		Boring immediately backfilled with bentonite grout	15				
			20				
			25				
			30				

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LOG OF BORING

See Descriptive Terminology sheet for explanation of abbreviations

Project Number B2110337
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Belknap Avenue to 29th Street
Superior, Wisconsin

BORING: **ST-5**

LOCATION: See attached sketch

NORTHING: 302242 EASTING: 148501

DRILLER: M. Heinzen LOGGED BY: D. Morrison START DATE: 11/29/21 END DATE: 11/29/21

SURFACE ELEVATION: 645.0 ft RIG: 7505 METHOD: 3 1/4" HSA SURFACING: Bituminous WEATHER:

Elev./ Depth ft	Water Level	Description of Materials (Soil-ASTM D2488 or 2487; Rock-USACE EM 1110-1-2908)	Sample	Blows (N-Value) Recovery	q_p tsf	MC %	Tests or Remarks
644.4		BITUMINOUS, 7 inches					
0.6		APPARENT AGGREGATE BASE, 8 inches					
643.8		FILL: FAT CLAY (CH), trace Gravel, brown, moist		2-3-4 (7) 0"			No recovery
1.3							
639.5			5	2-3-4 (7) 5"			
5.5		FAT CLAY (CH), reddish brown, moist, medium (LACUSTRINE)		3-3-5 (8) 14"			
634.0			10	3-3-5 (8) 14"			
11.0		END OF BORING Boring immediately backfilled with bentonite grout					Water not observed while drilling.
			15				
			20				
			25				
			30				

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See Descriptive Terminology sheet for explanation of abbreviations

Project Number B2110337
Geotechnical Evaluation
Hammond Avenue Improvements
Belknap Avenue to 29th Street
Superior, Wisconsin

BORING: **ST-6**

LOCATION: See attached sketch

NORTHING: 302640 EASTING: 148535

DRILLER: M. Heinzen | LOGGED BY: D. Morrison | START DATE: 11/30/21 | END DATE: 11/30/21

SURFACE ELEVATION: 645.5 ft | RIG: 7505 | METHOD: 3 1/4" HSA | SURFACING: Bituminous | WEATHER:

Elev./ Depth ft	Water Level	Description of Materials (Soil-ASTM D2488 or 2487; Rock-USACE EM 1110-1-2908)	Sample	Blows (N-Value) Recovery	q_p tsf	MC %	Tests or Remarks
644.9		BITUMINOUS, 7 inches					
0.6 643.5		FILL: SILTY SAND (SM), with Gravel, dark brown, moist					
2.0		FILL: FAT CLAY (CH), trace Sand, brown, moist		2-3-4 (7) 2"			
			5	3-4-3 (7) 0"			No recovery
639.0 6.5		FAT CLAY (CH), reddish brown, moist, medium (LACUSTRINE)		2-3-4 (7) 15"			
			10	3-3-4 (7) 16"			
634.5 11.0		END OF BORING Boring immediately backfilled with bentonite grout					Water not observed while drilling.
			15				
			20				
			25				
			30				

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LOG OF BORING

See Descriptive Terminology sheet for explanation of abbreviations

Project Number B2110337
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Superior, Wisconsin

BORING: **ST-7**

LOCATION: See attached sketch

NORTHING: 303084 EASTING: 148503

DRILLER: M. Heinzen LOGGED BY: D. Morrison START DATE: 11/29/21 END DATE: 11/29/21

SURFACE ELEVATION: 645.5 ft RIG: 7505 METHOD: 3 1/4" HSA SURFACING: Bituminous WEATHER:

Elev./ Depth ft	Water Level	Description of Materials (Soil-ASTM D2488 or 2487; Rock-USACE EM 1110-1-2908)	Sample	Blows (N-Value) Recovery	q_p tsf	MC %	Tests or Remarks
~~645.1~~		BITUMINOUS, 4 1/2 inches					
0.4		CONCRETE, 4 1/2 inches					
~~644.7~~		APPARENT AGGREGATE BASE, 9 inches					
0.8		FILL: FAT CLAY (CH), with organics, black, moist		2-3-4 (7) 0"			No recovery
644.0 1.5							
640.5				2-3-4 (7) 10"			
5.0		FAT CLAY (CH), reddish brown, moist, medium (LACUSTRINE)	5				
				3-3-5 (8) 14"			
			10	3-3-5 (8) 15"			
634.5							
11.0		END OF BORING					Water not observed while drilling.
		Boring immediately backfilled with bentonite grout	15				
			20				
			25				
			30				

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LOG OF BORING

See Descriptive Terminology sheet for explanation of abbreviations

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Belknap Avenue to 29th Street
Superior, Wisconsin

BORING: **ST-8**

LOCATION: See attached sketch

NORTHING: 303507 EASTING: 148544

DRILLER: M. Heinzen | LOGGED BY: D. Morrison | START DATE: 11/30/21 | END DATE: 11/30/21

SURFACE ELEVATION: 644.0 ft | RIG: 7505 | METHOD: 3 1/4" HSA | SURFACING: Bituminous | WEATHER:

Elev./ Depth ft	Water Level	Description of Materials (Soil-ASTM D2488 or 2487; Rock-USACE EM 1110-1-2908)	Sample	Blows (N-Value) Recovery	q_p tsf	MC %	Tests or Remarks
643.5		BITUMINOUS, 6 inches					
0.5		CONCRETE, 5 inches					
643.1		FILL: SILTY SAND (SM), with Gravel, brown, moist					
0.9		FILL: FAT CLAY (CH), trace Sand, brown, moist		3-3-4 (7) 0"			No recovery
642.0 2.0							
			5	2-3-4 (7) 4"			
637.5 6.5		FAT CLAY (CH), reddish brown, moist, soft to medium (LACUSTRINE)		2-2-3 (5) 10"			
			10	3-3-3 (6) 16"			
633.0 11.0		END OF BORING Boring immediately backfilled with bentonite grout					Water not observed while drilling.
			15				
			20				
			25				
			30				

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LOG OF BORING

See Descriptive Terminology sheet for explanation of abbreviations

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Belknap Avenue to 29th Street
Superior, Wisconsin

BORING: **ST-9**

LOCATION: See attached sketch

NORTHING: 303811 EASTING: 148506

DRILLER: M. Heinzen | LOGGED BY: D. Morrison | START DATE: 11/29/21 | END DATE: 11/29/21

SURFACE ELEVATION: 642.9 ft | RIG: 7505 | METHOD: 3 1/4" HSA | SURFACING: Bituminous | WEATHER:

Elev./ Depth ft	Water Level	Description of Materials (Soil-ASTM D2488 or 2487; Rock-USACE EM 1110-1-2908)	Sample	Blows (N-Value) Recovery	q_p tsf	MC %	Tests or Remarks
642.4		BITUMINOUS, 5 1/2 inches					
0.5		CONCRETE, 4 1/2 inches					
642.1		APPARENT AGGREGATE BASE, 8 inches					
0.8		FAT CLAY (CH), reddish brown, moist, medium (LACUSTRINE)		2-3-3 (6) 4"			
641.4							
1.5				2-4-4 (8) 6"			
5							
				2-3-4 (7) 11"			
				3-3-4 (7) 15"			
10							
631.9							
11.0		END OF BORING					Water not observed while drilling.
		Boring immediately backfilled with bentonite grout					
15							
20							
25							
30							

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LOG OF BORING

See Descriptive Terminology sheet for explanation of abbreviations

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Superior, Wisconsin

BORING: **ST-10**

LOCATION: See attached sketch

NORTHING: 304027 EASTING: 148551

DRILLER: M. Heinzen LOGGED BY: D. Morrison START DATE: 11/30/21 END DATE: 11/30/21

SURFACE ELEVATION: 641.9 ft RIG: 7505 METHOD: 3 1/4" HSA SURFACING: Bituminous WEATHER:

Elev./ Depth ft	Water Level	Description of Materials (Soil-ASTM D2488 or 2487; Rock-USACE EM 1110-1-2908)	Sample	Blows (N-Value) Recovery	q_p tsf	MC %	Tests or Remarks
641.5		BITUMINOUS, 5 inches					
0.4		CONCRETE, 4 inches					
641.2		FILL: FAT CLAY (CH), with Gravel, dark brown, moist		2-2-3 (5) 2"			
0.8		FILL: FAT CLAY (CH), brown, moist					
639.9							
2.0				2-2-3 (5) 6"			
			5				
635.4							
6.5		FAT CLAY (CH), reddish brown, moist, medium (LACUSTRINE)		3-3-5 (8) 14"			
			10	3-4-4 (8) 16"			
630.9							
11.0		END OF BORING					Water not observed while drilling.
		Boring immediately backfilled with bentonite grout					
			15				
			20				
			25				
			30				

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LOG OF BORING

See Descriptive Terminology sheet for explanation of abbreviations

Project Number B2110337
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Belknap Avenue to 29th Street
Superior, Wisconsin

BORING: **ST-11**

LOCATION: See attached sketch

NORTHING: 304309 EASTING: 148512

DRILLER: M. Heinzen LOGGED BY: D. Morrison START DATE: 12/01/21 END DATE: 12/01/21

SURFACE ELEVATION: 641.3 ft RIG: 7505 METHOD: 3 1/4" HSA SURFACING: Bituminous WEATHER:

Elev./ Depth ft	Water Level	Description of Materials (Soil-ASTM D2488 or 2487; Rock-USACE EM 1110-1-2908)	Sample	Blows (N-Value) Recovery	q_p tsf	MC %	Tests or Remarks
640.7		BITUMINOUS, 7 1/2 inches					
0.6		CONCRETE, 4 1/2 inches					
640.1		FILL: SILTY SAND (SM), with Gravel, brown, moist		2-2-3 (5) 0"			No recovery
1.2							
639.3		FILL: FAT CLAY (CH), trace Sand, Gravel, brown, moist					
2.0							
			5	2-2-3 (5) 5"			
634.8							
6.5		FAT CLAY (CH), reddish brown, moist, medium (LACUSTRINE)		2-3-3 (6) 16"			
			10	2-3-3 (6) 16"			
630.3							
11.0		END OF BORING					Water not observed while drilling.
		Boring immediately backfilled with bentonite grout					
			15				
			20				
			25				
			30				

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LOG OF BORING

See Descriptive Terminology sheet for explanation of abbreviations

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Belknap Avenue to 29th Street
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BORING: **ST-12**

LOCATION: See attached sketch

NORTHING: 304710 EASTING: 148549

DRILLER: M. Heinzen LOGGED BY: D. Morrison START DATE: 11/30/21 END DATE: 11/30/21

SURFACE ELEVATION: 640.2 ft RIG: 7505 METHOD: 3 1/4" HSA SURFACING: Bituminous WEATHER:

Elev./ Depth ft	Water Level	Description of Materials (Soil-ASTM D2488 or 2487; Rock-USACE EM 1110-1-2908)	Sample	Blows (N-Value) Recovery	q_p tsf	MC %	Tests or Remarks
~~639.8~~		BITUMINOUS, 5 inches					
~~0.4~~		CONCRETE, 6 inches					
639.3		FILL: SILTY SAND (SM), with Gravel, dark brown, moist		3-2-3 (5) 6"			
0.9		FILL: FAT CLAY (CH), brown, moist					
638.2							
2.0				3-3-3 (6) 4"			
			5				
633.7							
6.5		FAT CLAY (CH), reddish brown, moist, stiff (LACUSTRINE)		2-4-6 (10) 16"			
			10	2-4-5 (9) 16"			
629.2							
11.0		END OF BORING					Water not observed while drilling.
		Boring immediately backfilled with bentonite grout					
			15				
			20				
			25				
			30				

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LOG OF BORING

See Descriptive Terminology sheet for explanation of abbreviations

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Belknap Avenue to 29th Street
Superior, Wisconsin

BORING: **ST-13**

LOCATION: See attached sketch

NORTHING: 305113 EASTING: 148517

DRILLER: M. Heinzen LOGGED BY: D. Morrison START DATE: 11/30/21 END DATE: 11/30/21

SURFACE ELEVATION: 639.0 ft RIG: 7505 METHOD: 3 1/4" HSA SURFACING: Bituminous WEATHER:

Elev./ Depth ft	Water Level	Description of Materials (Soil-ASTM D2488 or 2487; Rock-USACE EM 1110-1-2908)	Sample	Blows (N-Value) Recovery	q_p tsf	MC %	Tests or Remarks
638.5		BITUMINOUS, 6 inches					
0.5		CONCRETE, 7 inches					
637.9		FILL: SILTY SAND (SM), fine to medium-grained, with Gravel, dark brown, moist		3-2-3 (5) 2"			
1.1		FILL: FAT CLAY (CH), trace Sand, brown, moist					
637.0							
2.0				3-2-3 (5) 2"			
5							
632.5							
6.5		FAT CLAY (CH), reddish brown, moist, medium (LACUSTRINE)		2-3-5 (8) 14"			
10				2-3-4 (7) 15"			
628.0							
11.0		END OF BORING					Water not observed while drilling.
		Boring immediately backfilled with bentonite grout					
15							
20							
25							
30							

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See Descriptive Terminology sheet for explanation of abbreviations

Project Number B2110337
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BORING: **ST-14**

LOCATION: See attached sketch

NORTHING: 305080 EASTING: 148706

DRILLER: M. Heinzen | LOGGED BY: D. Morrison | START DATE: 11/30/21 | END DATE: 11/30/21

SURFACE ELEVATION: 636.7 ft | RIG: 7505 | METHOD: 3 1/4" HSA | SURFACING: Bituminous | WEATHER:

Elev./ Depth ft	Water Level	Description of Materials (Soil-ASTM D2488 or 2487; Rock-USACE EM 1110-1-2908)	Sample	Blows (N-Value) Recovery	q_p tsf	MC %	Tests or Remarks
636.6		BITUMINOUS, 2 inches					
0.2		CONCRETE, 6 inches					
636.1		FILL: SILTY SAND (SM), with Gravel, dark brown, moist		2-2-3 (5) 4"			
0.7		FILL: FAT CLAY (CH), with Sand, brown, moist					
634.7							
2.0				3-3-3 (6) 5"			
			5				
630.2							
6.5		FAT CLAY (CH), reddish brown, moist, stiff to medium (LACUSTRINE)		3-4-5 (9) 15"			
			10	3-4-4 (8) 16"			
625.7							
11.0		END OF BORING					Water not observed while drilling.
		Boring immediately backfilled with bentonite grout					
			15				
			20				
			25				
			30				

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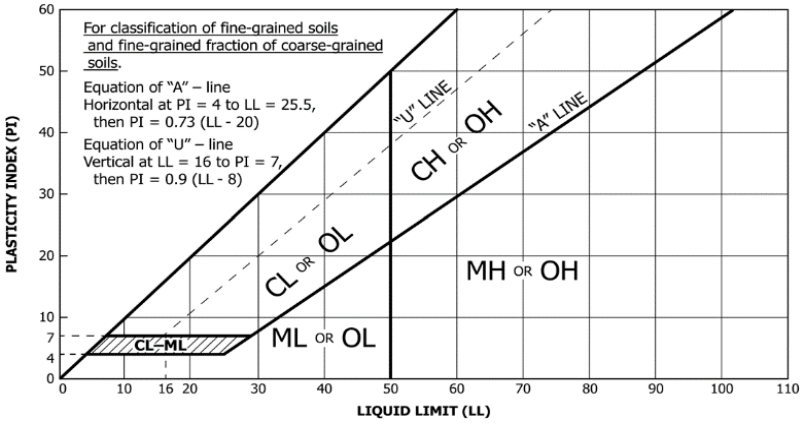
Descriptive Terminology of Soil

Based on Standards ASTM D2487/2488
(Unified Soil Classification System)

Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests[A]				Soil Classification	
				Group Symbol	Group Name[B]
Coarse-grained Soils (more than 50% retained on No. 200 sieve)	Gravels (More than 50% of coarse fraction retained on No. 4 sieve)	Clean Gravels (Less than 5% fines[C])	$C_u \geq 4$ and $1 \leq C_c \leq 3$[D]	GW	Well-graded gravel[E]
			$C_u < 4$ and/or ($C_c < 1$ or $C_c > 3$)[D]	GP	Poorly graded gravel[E]
		Gravels with Fines (More than 12% fines[C])	Fines classify as ML or MH	GM	Silty gravel[E F G]
			Fines Classify as CL or CH	GC	Clayey gravel[E F G]
	Sands (50% or more coarse fraction passes No. 4 sieve)	Clean Sands (Less than 5% fines[H])	$C_u \geq 6$ and $1 \leq C_c \leq 3$[D]	SW	Well-graded sand[I]
			$C_u < 6$ and/or ($C_c < 1$ or $C_c > 3$)[D]	SP	Poorly graded sand[I]
		Sands with Fines (More than 12% fines[H])	Fines classify as ML or MH	SM	Silty sand[F G I]
			Fines classify as CL or CH	SC	Clayey sand[F G I]
Fine-grained Soils (50% or more passes the No. 200 sieve)	Silts and Clays (Liquid limit less than 50)	Inorganic	PI > 7 and plots on or above "A" line[J]	CL	Lean clay[K L M]
			PI < 4 or plots below "A" line[J]	ML	Silt[K L M]
		Organic	Liquid Limit – oven dried / Liquid Limit – not dried <0.75	OL	Organic clay[K L M N] / Organic silt[K L M O]
	Silts and Clays (Liquid limit 50 or more)	Inorganic	PI plots on or above "A" line	CH	Fat clay[K L M]
			PI plots below "A" line	MH	Elastic silt[K L M]
		Organic	Liquid Limit – oven dried / Liquid Limit – not dried <0.75	OH	Organic clay[K L M P] / Organic silt[K L M Q]
Highly Organic Soils		Primarily organic matter, dark in color, and organic odor		PT	Peat

A. Based on the material passing the 3-inch (75-mm) sieve.
B. If field sample contained cobbles or boulders, or both, add "with cobbles or boulders, or both" to group name.
C. Gravels with 5 to 12% fines require dual symbols:
   GW-GM well-graded gravel with silt
   GW-GC well-graded gravel with clay
   GP-GM poorly graded gravel with silt
   GP-GC poorly graded gravel with clay
D. $C_u = D_{60} / D_{10}$ $C_c = (D_{30})^2 / (D_{10} \times D_{60})$
E. If soil contains ≥ 15% sand, add "with sand" to group name.
F. If fines classify as CL-ML, use dual symbol GC-GM or SC-SM.
G. If fines are organic, add "with organic fines" to group name.
H. Sands with 5 to 12% fines require dual symbols:
   SW-SM well-graded sand with silt
   SW-SC well-graded sand with clay
   SP-SM poorly graded sand with silt
   SP-SC poorly graded sand with clay
I. If soil contains ≥ 15% gravel, add "with gravel" to group name.
J. If Atterberg limits plot in hatched area, soil is CL-ML, silty clay.
K. If soil contains 15 to < 30% plus No. 200, add "with sand" or "with gravel", whichever is predominant.
L. If soil contains ≥ 30% plus No. 200, predominantly sand, add "sandy" to group name.
M. If soil contains ≥ 30% plus No. 200 predominantly gravel, add "gravelly" to group name.
N. PI ≥ 4 and plots on or above "A" line.
O. PI < 4 or plots below "A" line.
P. PI plots on or above "A" line.
Q. PI plots below "A" line.



Laboratory Tests

DD	Dry density, pcf	**q_p**	Pocket penetrometer strength, tsf
WD	Wet density, pcf	**q_U**	Unconfined compression test, tsf
P200	% Passing #200 sieve	**LL**	Liquid limit
MC	Moisture content, %	**PL**	Plastic limit
OC	Organic content, %	**PI**	Plasticity index

Particle Size Identification

Boulders..... over 12"
Cobbles..... 3" to 12"
Gravel
  Coarse..... 3/4" to 3" (19.00 mm to 75.00 mm)
  Fine..... No. 4 to 3/4" (4.75 mm to 19.00 mm)
Sand
  Coarse..... No. 10 to No. 4 (2.00 mm to 4.75 mm)
  Medium..... No. 40 to No. 10 (0.425 mm to 2.00 mm)
  Fine..... No. 200 to No. 40 (0.075 mm to 0.425 mm)
Silt..... No. 200 (0.075 mm) to .005 mm
Clay..... < .005 mm

Relative Proportions[L, M]

trace..... 0 to 5%
little..... 6 to 14%
with..... ≥ 15%

Inclusion Thicknesses

lens..... 0 to 1/8"
seam..... 1/8" to 1"
layer..... over 1"

Apparent Relative Density of Cohesionless Soils

Very loose ..... 0 to 4 BPF
Loose ..... 5 to 10 BPF
Medium dense..... 11 to 30 BPF
Dense..... 31 to 50 BPF
Very dense..... over 50 BPF

Consistency of Cohesive Soils	Blows Per Foot	Approximate Unconfined Compressive Strength
Very soft	0 to 1 BPF	< 0.25 tsf
Soft	2 to 4 BPF	0.25 to 0.5 tsf
Medium	5 to 8 BPF	0.5 to 1 tsf
Stiff	9 to 15 BPF	1 to 2 tsf
Very Stiff	16 to 30 BPF	2 to 4 tsf
Hard	over 30 BPF	> 4 tsf

Moisture Content:

Dry: Absence of moisture, dusty, dry to the touch.
Moist: Damp but no visible water.
Wet: Visible free water, usually soil is below water table.

Drilling Notes:

Blows/N-value: Blows indicate the driving resistance recorded for each 6-inch interval. The reported N-value is the blows per foot recorded by summing the second and third interval in accordance with the Standard Penetration Test, ASTM D1586.

Partial Penetration: If the sampler could not be driven through a full 6-inch interval, the number of blows for that partial penetration is shown as #/x" (i.e. 50/2"). The N-value is reported as "REF" indicating refusal.

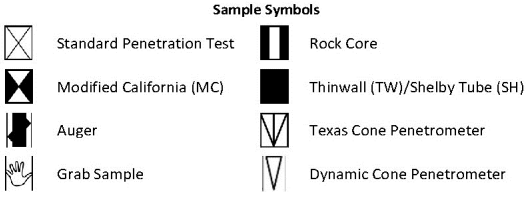
Recovery: Indicates the inches of sample recovered from the sampled interval. For a standard penetration test, full recovery is 18", and is 24" for a thinwall/shelby tube sample.

WOH: Indicates the sampler penetrated soil under weight of hammer and rods alone; driving not required.

WOR: Indicates the sampler penetrated soil under weight of rods alone; hammer weight and driving not required.

Water Level: Indicates the water level measured by the drillers either while drilling (▽), at the end of drilling (▼), or at some time after drilling (▼).

Sample Symbols



5/2021

Pavement Design General Information

Project ID:	2022-02-04	Designer's Name:	Kyle Warmuth
Design Name:	Hammond Avenue Reconstruction	Design Date:	02/04/2022
Roadway Name:	Hammond Avenue	Type:	Local
Project Termini:	--	Status:	Draft
Highway Name:	--	Design Source:	WisPave
Comments:			

Region	County
NW	Douglas

Soil Parameters

Design Group Index (DGI):	14
Subgrade Improvement:	No
Subgrade Soil Support Value (SSV):	4.0
Subgrade Modulus of Subgrade Reaction (K):	125

Traffic Parameters

Construction Year:	2023	Design Year:	2043
Construction Year AADT:	4800	Design Year AADT:	5280
Directional Factor (DF):	0.50	Lane Distribution Factor (LDF):	1.00

Truck Classification	% of AADT
2D	1.0
3SU	0.3
2S-1,-2	0.2
3S-2	0.3
2-S1-2	0.0
Total % Truck Traffic	**1.8**

Concrete Pavement Design

Truck Type	% of AADT	DLT	# of Trucks	ESAL Load Factor	ESALs
2D	1.0	2,520	25	0.3	8
3SU	0.3	2,520	8	1.2	9
2S-1,-2	0.2	2,520	5	0.6	3
3S-2	0.3	2,520	8	1.6	12
2-S1-2	0.0	2,520	0	2.1	0

Design Lane Daily ESALs: 32

Design Lane Total Life ESALs: 231,789 Rounded to: 240,000

Soil Parameters

Subgrade Improvement Flag Selected: No

K: 125

Design Calculation

Calculated Pavement Thickness 5.2

Pavement Thickness (ALT# 1): 7.0

Pavement Thickness (ALT# 2): 0.0

HMA Pavement Design

Truck Type	% of AADT	DLT	# of Trucks	ESAL Load Factor	ESALs
2D	1.0	2520	25	0.3	8
3SU	0.3	2520	8	0.8	6
2S-1,-2	0.2	2520	5	0.5	3
3S-2	0.3	2520	8	0.9	7
2-S1-2	0.0	2520	0	2.0	0

Design Lane Daily ESALs: 24

Design Lane Total Life ESALs: 175,200 Rounded to: 180,000

Soil Parameters

DGI: 14

Subgrade Improvement Flag Selected: No

SSV: 4.0

Design Calculation

Calculated Required SN: 3.10

HMA ALT#1 Layer Thickness Design

Layers	Existing Pavement	Uppermost Base Agg.	Other	Material Type	Unit Type	Layer Coefficient	Thickness in.	Structural Number
1	N	N	N	2 MT 58-34 S	-----	0.44	5.00	2.2
2	N	N	N	Base Aggregate Dense 1 1/4-inch	-----	0.1	10.00	1
3	N	N	N	Backfill Granular	-----	0.03	12.00	0.36

Note: You can add only 10 layers (including 'Other' layers)

No.of Layers: 3 No.of Other Layers: 0 Total SN: 3.56

Required SN: 3.1

Caution: Total SN differs from the required SN by 10% or more. This is just an alert; user may proceed.