FREEMAN COMPANIES

LAND DEVELOPMENT | ENGINEERING DESIGN | CONSTRUCTION SERVICES

Geotechnical Engineering Report
Replacement of Bridge 023008 – West Road over Cherry Brook
Canton, Connecticut

September 17, 2021
(Revised from March 16, 2021)

Freeman Project No.: 2020-0401

Prepared for:

WSP USA Inc.
500 Winding Brook Drive
Glastonbury, Connecticut 06033

Prepared by:

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36 John Street
Hartford, CT 06106

Christopher J. Tonzi, P.E.
Senior Geotechnical Engineer

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1.0 INTRODUCTION

1.1 Summary

This report presents our evaluation of the subsurface conditions and geotechnical engineering recommendations for replacement of Bridge 023008, West Road over Cherry Brook, located in Canton, Connecticut. This evaluation is based on recent subsurface explorations and laboratory test data.

Subsurface conditions generally consist of fill overlying sand overlying bedrock. We recommend that the proposed abutments and wingwalls be supported on spread footing foundations bearing directly on the decomposed bedrock.

However, if anticipated construction costs are too high for dewatering and support-of-excavation that will be required to place bottoms of footings below scour depths, then micropiles should be considered.

1.2 Scope of Work

Freeman Companies, LLC performed the following tasks:

- Coordinated drilling of test borings at the site;
- Provided technical monitoring of the test borings, described soil and rock materials encountered, and prepared test boring logs;
- Arranged for a testing laboratory to conduct laboratory soil and rock tests; and
- Evaluated the subsurface conditions and prepared this report containing geotechnical design recommendations and construction considerations.

1.3 Authorization

The work was completed in accordance with our Professional Services Subcontract dated October 14, 2020.

1.4 Project Vertical Datum

Elevations in this report were taken from the topographic plan provided to Freeman Cos. and are referenced to NAVD-88.

2.0 SITE AND PROJECT DESCRIPTION

2.1 Site Description

Bridge 023008 carrying West Road over Cherry Brook is located approximately ½ mile north of its intersection with Meadow Road in Canton, Connecticut, as shown on Figure 1, Site Location Map. It is a 17-foot long single steel arch bridge with an 18-foot wide roadway, originally constructed in 1965.

The existing bridge is shown in plan and profile on Figures 2 and 3, Subsurface Exploration Location Plan and Subsurface Profile.

2.2 Project Description

The proposed bridge will be a 22-foot long simple span structure with a 22-foot wide roadway on top. We understand that shallow spread footings, bearing on naturally-deposited materials and placed below scour depth is the preferred foundation type.

3.0 EXPLORATIONS

3.1 Subsurface Explorations

Three test borings (designated S-1, S-2 and S-2A) were completed by New England Boring Contractors, Inc., of Glastonbury, Connecticut on December 7, 2020. During the advancement of test boring S-2, the lead section of casing broke, so the borehole was abandoned and relocated 2 ft west as boring S-2A. Test borings were drilled by advancing hollow stem augers to depths of about 10 feet, then telescoping 4-inch diameter flush-joint casing to depths of about 15 feet. The boreholes were then advanced open hole (into weathered bedrock) using a roller bit to depths of 20 to 30 feet.

Standard Penetration Tests were conducted and soil samples were recovered at maximum 5-foot intervals. Borings were terminated within bedrock following retrieval of bedrock cores using an NX-size core barrel. Taped exploration locations are shown on Figure 2, Subsurface Exploration Location Plan. A Freeman Companies geologist observed the drilling, described the soil samples, and prepared the test boring logs included in Appendix A.

3.2 Laboratory Testing

Grain size analyses (ASTM D6913) were performed on four representative soil samples from test borings and one upstream sediment grab sample to aid in determining engineering properties. Two unconfined compression tests were performed on representative bedrock core samples.

Laboratory testing was conducted by Geotesting Express, Inc., of Acton, Massachusetts. Results of laboratory testing are provided in Appendix B.

4.0 SUBSURFACE CONDITIONS

4.1 Subsurface Conditions

Subsurface conditions encountered in the explorations consisted of Fill overlying Sand (alluvium) overlying Bedrock A layer of Decomposed Bedrock overlying more intact bedrock was also encountered. Subsurface materials encountered are shown graphically on Figure 3, and data are summarized on Table I.

Generalized subsurface conditions were as follows:

THICKNESS (FT)	GENERALIZED DESCRIPTION
4 to 4.5	Fill – Generally brown, coarse to fine SAND and coarse to fine GRAVEL, trace to little silt. SPT N-Values ranged from 35 to more than 60 blows per foot (bpf, dense to very dense), with refusals.
10.5 to 11.5	Sand (Alluvium)– Generally gray/brown coarse to fine SAND and to little coarse to fine GRAVEL, trace to little silt. A layer of sandy SILT was encountered at about 11 feet below grade in Boring S-2A. SPT N-Values ranged from 22 to 28 bpf (medium dense), with refusals. Inferred cobbles were encountered in the sand at test boring S-2.
5 to 14.5	Decomposed Bedrock – Reddish Brown sandstone that could be roller-bitted through with moderate effort. One SPT value of 77 was measured. Several SPT refusals were noted.

Bedrock - Bedrock encountered was moderately strong, moderately weathered, moderately to extremely fractured, red brown, fine-grained SANDSTONE. Primary joints are low angle, planar, open and weathered. Several vertical joints were noted. Rock Quality Designation (RQD) ranged from 0 to 70 (very poor to fair quality rock).

Results of two laboratory unconfined compression strength tests conducted on bedrock core samples recovered from the borings were 23,166 and 9,761 pounds per square inch.

Groundwater – Although groundwater was not measured in the boreholes during drilling, water levels are expected to be heavily influenced by and about the same elevation as surface water levels in Cherry Brook, but will vary with season, precipitation, temperature, construction activity in the area and other factors.

5.0 GEOTECHNICAL ENGINEERING RECOMMENDATIONS

We recommend that the new bridge structure (abutments, wingwalls and/or pre-cast box units) be supported on spread footing foundations bearing directly on the decomposed bedrock stratum.

Recommendations for both spread footings and micropiles are provided below.

5.1 General

- Seismic Design: Soils are not susceptible to liquefaction. Seismic design is not required for simple-span bridges (AASHTO Article 4.7.4.2). Soil conditions at the site are defined as AASHTO Site Class C.
- Backfill Material: Place Pervious Structure Backfill (CTDOT Form 818 M.02.05) behind the abutments and abutment wingwalls above a line defined by a 1V:1.5H slope extending up from the heel of the footing to grade.
- Weep Holes: 4-inch-dia. weep holes at max 10 foot spacing, installed according to CTDOT specifications.
- Lateral Earth Pressures: Figure 4 - At-Rest Earth Pressures, to be used in design of a 3-sided box culvert or abutment and wingwall retaining walls that are fixed at their tops. Figure 5 – Active Earth pressures are appropriate for design if wingwalls are free to rotate at their tops.

5.2 Spread Footing Design Criteria

- Subgrade Preparation: Design abutment and wingwall foundations to bear directly on a 12-inch-thick layer of crushed stone (Form 818 M.01.01, No. 6) placed over the decomposed bedrock. The crushed stone layer is recommended to provide uniform bearing and to create a dry, stable working platform.
- Bearing Resistance:
  Service Limit State (Nominal): 8,000 pounds per square foot (psf); apply Resistance Factor of 1.0 (AASHTO 10.5.5.1) to get the factored bearing resistance;
  Strength Limit State (Nominal): 20,000 psf; apply Resistance Factor of 0.55 (AASHTO Table 11.5.7-1) to get the factored bearing resistance.
- Settlement at Recommended Bearing Pressure: Estimated total settlement less than 1 inch; differential less than ¾- inch.
- **Coefficient of Friction (tan δ) A**long Bottom: 0.55 (AASHTO Table C3.11.5.3-1); Resistance factor 1.0 (AASHTO Table 11.5.7-1).

5.3 Micropile Design

- Micropile Design: Design micropiles as Type A with the following elements:
  - 9-5/8 inch O.D., 0.472-inch thick wall permanent casing that extends to bedrock. Casing should not be relied upon for uplift resistance.
  - A minimum 8.5-inch diameter bonded zone socketed into bedrock. The top of the rock socket should be within sound rock below the decomposed bedrock. Evaluation of the required length of the rock socket should be designed by the Contractor per CTDOT procedures for micropile design.
  - A No. 18 central rebar core that extends the full length of the micropile from the pile head to the bottom of the rock socket.
  - A grout strength of 5,000 pounds per square inch (psi).
- Bearing Resistance:
  - Service Limit State (Nominal): 100 kips; apply Resistance Factor of 1.0 (AASHTO 10.5.5.1) to get the factored bearing resistance;
  - Strength Limit State (Nominal): 200 kips; apply Resistance Factor of 0.7 (AASHTO Table 10.5.5.2.5-1) to get the factored bearing resistance.
- Ultimate Axial Compression: We recommend an ultimate axial capacity of 200 kips be provided to the Contractor for purposes of their micropile design and verification test.
- Spacing: Minimum 30 inches or 3 times the pile diameter, whichever is greater (AASHTO 10.9.1.2)
- Settlement: Maximum total settlement of micropiles is estimated at less than 1 inch. This settlement will occur as loads are applied.
- Load Tests: We recommend that load tests include a minimum of one verification test on a sacrificial pile, and proof tests on five percent of the production piles.
- Lateral Resistance: Lateral pile load analyses will be conducted, if required.
- Drilling: Use casing through soil. Anticipate difficult drilling conditions (i.e., cobbles, boulders, hard rock).

6.0 CONSTRUCTION CONSIDERATIONS

6.1 Excavation

Conventional heavy excavation equipment should be suitable for excavation in existing soil materials. Excavation should conform to OSHA excavation regulations contained in 29 CFR Part 1926, latest edition. Bedrock excavation will likely be required, and the Contractor should assume controlled blasting will be required.

6.2 Bearing Surface Preparation

Place crushed stone (Form 818 M.01.01, No. 6) directly over the natural subgrade surface. Compact the crushed stone layer with at least six passes of a large vibratory plate compactor capable of exerting a minimum dynamic force of 2,000 lbs.

6.3 Cofferdam and Dewatering

We expect that excavations for shallow foundations and/or pile caps are likely to penetrate below groundwater, depending on the water level in the brook during construction. Construction should be performed in-the-dry, and cofferdam and dewatering will be required. The footings will bear on decomposed bedrock, so steel sheeting will not likely be feasible. We anticipate that a drilled system such as soldier piles and lagging with the soldier piles drilled into the bedrock will be feasible. The system would need a means to make the lagging water-tight. Other means may also be feasible.

Dewatering from sumps located in the bottom of excavations appears feasible. Surface water should be diverted away from excavations.

6.4 Micropile Installation

Micropiles should be drilled with a permanent casing. Micropile pile drilling equipment must be capable of drilling through the overburden, which is anticipated to contain variable sized cobbles and boulders, and also capable of penetrating through fractured and intact bedrock. Therefore, it should be assumed that drilling activities may be difficult and time consuming if boulders are encountered. Drilling techniques should limit loss of ground. The bonded zone should be entirely with bedrock below any decomposed bedrock.

6.5 Temporary Earth Retaining Systems

Temporary earth retaining systems (TERS) will likely be required in some areas to accommodate the proposed staged excavation. Steel sheeting may be feasible depending on the depth of the excavation and depth to bedrock. Soldier piles and lagging also appears feasible. Soldier piles may need to be drilled into the bedrock. Micropiles and lagging, and other TERS systems may also be considered.

6.6 Preconstruction Survey and Monitoring

Vibrations from demolition, pile installation, cofferdam installation, and bedrock excavation are not expected to affect the structural integrity of nearby structures. However, vibration and noise will likely be noticeable inside nearby buildings. A preconstruction survey of structures within 250 feet should be conducted in advance of construction, and vibration monitoring should be conducted. There appear to be several existing structures within this distance.

6.6 Reuse of Existing Soils

The existing soils to be excavated will consist of existing Fill, sand and decomposed bedrock. These soils are not expected to be readily suitable for reuse as Pervious Structure Backfill or Granular Fill. Excavated soils may be suitable for reuse as embankment fill. However, siltier soils may be difficult to properly compact when wet, and may need to be dried to achieve compaction. Drying the soils can be difficult and at times impractical, particularly during periods of cold and wet weather.

7.0 FUTURE SERVICES AND LIMITATIONS

7.1 Future Services

We recommend that Freeman Companies be engaged during construction to observe:

- Verify that soil conditions exposed in excavations are in general conformance with design assumptions, and that the geotechnical aspects of construction are consistent with the project specifications.
- Review contractor submittals related to micropiles and observe installation in accordance with Form 818.
- Observe preparation of bearing surfaces.

7.2 Limitations

This report was prepared for the exclusive use of WSP and the project design team. The recommendations provided herein are based on the project information provided at the time of this report and may require modification if there are any changes in the nature, design, or location of the bridge.

The recommendations in this report are based in part on the data obtained from the subsurface explorations. The nature and extent of variations between explorations may not become evident until construction. If variations from the anticipated conditions are encountered, it may be necessary to revise the recommendations in this report.

Our professional services for this project have been performed in accordance with generally accepted engineering practices; no warranty, express or implied, is made.

Bridge 023008
West Road over Cherry Brook
Canton, Connecticut

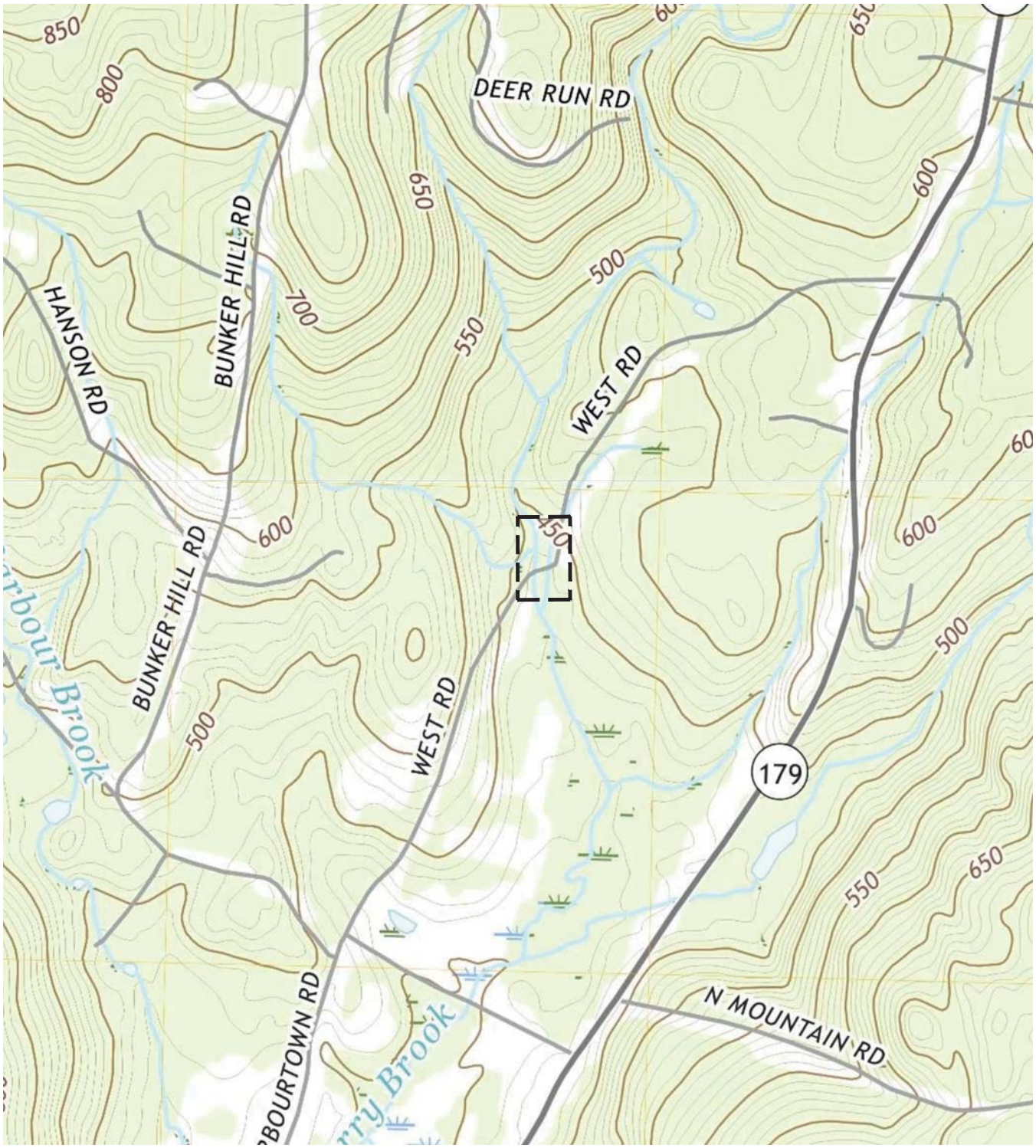
Table 1
Subsurface Data

Boring No.	Ground Surface El.[1]	Depth (ft.)	Thickness (ft.)				Groundwater[2]		Bedrock	
			Asphalt	Fill	Sand	Decomposed Bedrock	Depth (ft.)	Elevation	Depth (ft.)	Elevation
S-1	444	40.0 (C)	0.3	3.7	11.5	14.5	NM	---	30.0	414
S-2	444	11.0 (E)	0.3	4.2	---	NE	NM	---	NE	NE
S-2A	444	29.5 (C)	0.3	4.2	10.5	5.0	NM	---	20.0	424

Notes:

1. Ground surface elevations were estimated from topographic plans.
2. Groundwater levels were not measured due to the introduction of water to the drill stem.
3. "NE" - Stratum Not Encountered; "C" - Bedrock cored; "R" - Refusal encountered; "E" Equipment failure
4. Refer to the text of the report for additional information.

FIGURES



USGS QUADRANGLE MAPS
COLLINSVILLE & NEW HARTFORD, CONNECTICUT
DATE 2018

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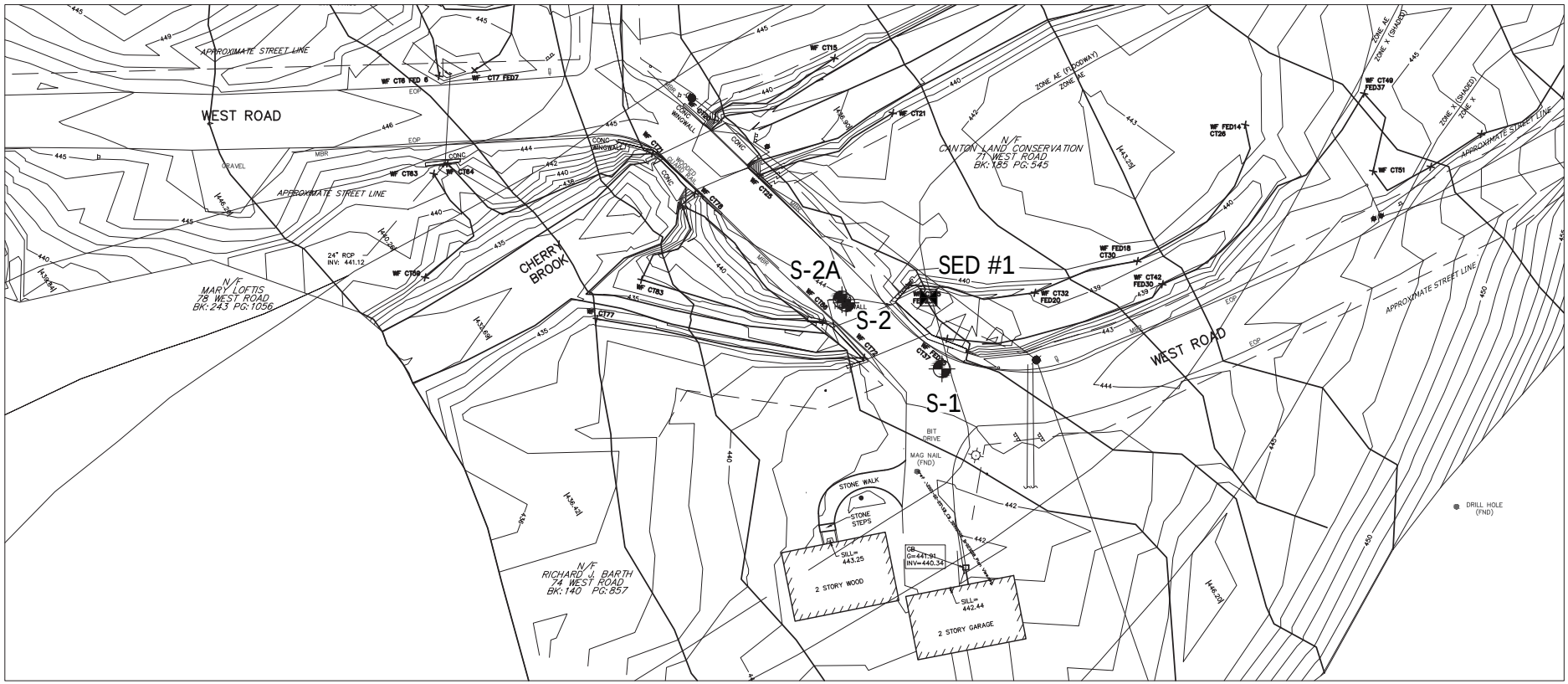
SITE LOCATION MAP

REPLACEMENT OF BRIDGE No. 023008
WEST ROAD OVER CHERRY BROOK
CANTON, CONNECTICUT

DRAFTED:	N.J.
CHECKED:	N.W.
APPROVED:	N.W.
SCALED:	1"=1000'
PROJECT NO.:	2020-0401
DATE:	12/30/2020

SHEET NO.

FIGURE 1



LEGEND:

- S-1 — TEST BORINGS
- SED #1 — SEDIMENT SAMPLES

NOTES:

1. BASE PLAN PROVIDED BY WSP
2. EXPLORATION LOCATIONS WERE TAPED FROM EXISTING FEATURES AND ARE APPROXIMATE
3. REFER TO THE TEXT AND APPENDICES FOR ADDITIONAL INFORMATION

GRAPHIC SCALE

40 20 0 40

SCALE IN FEET

SUBSURFACE EXPLORATION LOCATION PLAN

REPLACEMENT OF BRIDGE No. 023008, WEST ROAD OVER CHERRY BROOK CANTON, CONNECTICUT

FREEMAN COMPANIES

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No.	Date	Description

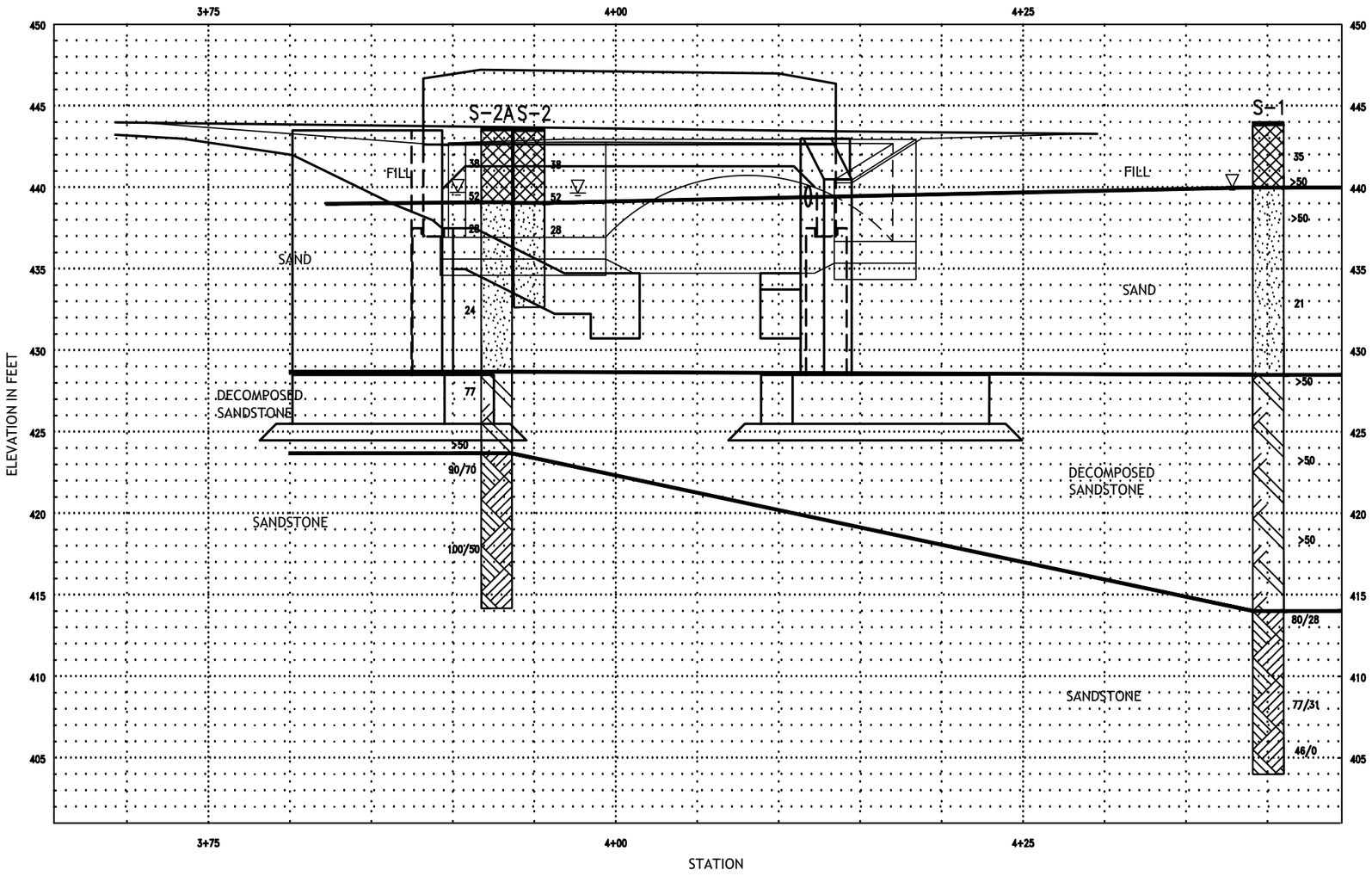
REVISIONS

DRAWN:	N.J.
CHECKED:	C.T.
APPROVED:	N.W.
SCALE:	1' = 40'
PROJECT NO.:	2020-0401
DATE:	2/25/2021

SHEET NO.

FIGURE 2

SOUTH ELEVATION



STATION

LEGEND
21 SPT N-VALUE
100/40 RECOVERY% / RQD%

NOTE:
THE INTERPRETED STRATA BOUNDARIES INDICATED ARE KNOWN ONLY AT THE BORING LOCATIONS AND WILL VARY BETWEEN LOCATIONS

SUBSURFACE EXPLORATION PROFILE

REPLACEMENT OF BRIDGE No. 023008,
WEST ROAD OVER CHERRY BROOK
CANTON, CONNECTICUT

FREEMAN COMPANIES
LAND DEVELOPMENT : ENGINEERING DESIGN : CONSTRUCTION SERVICES
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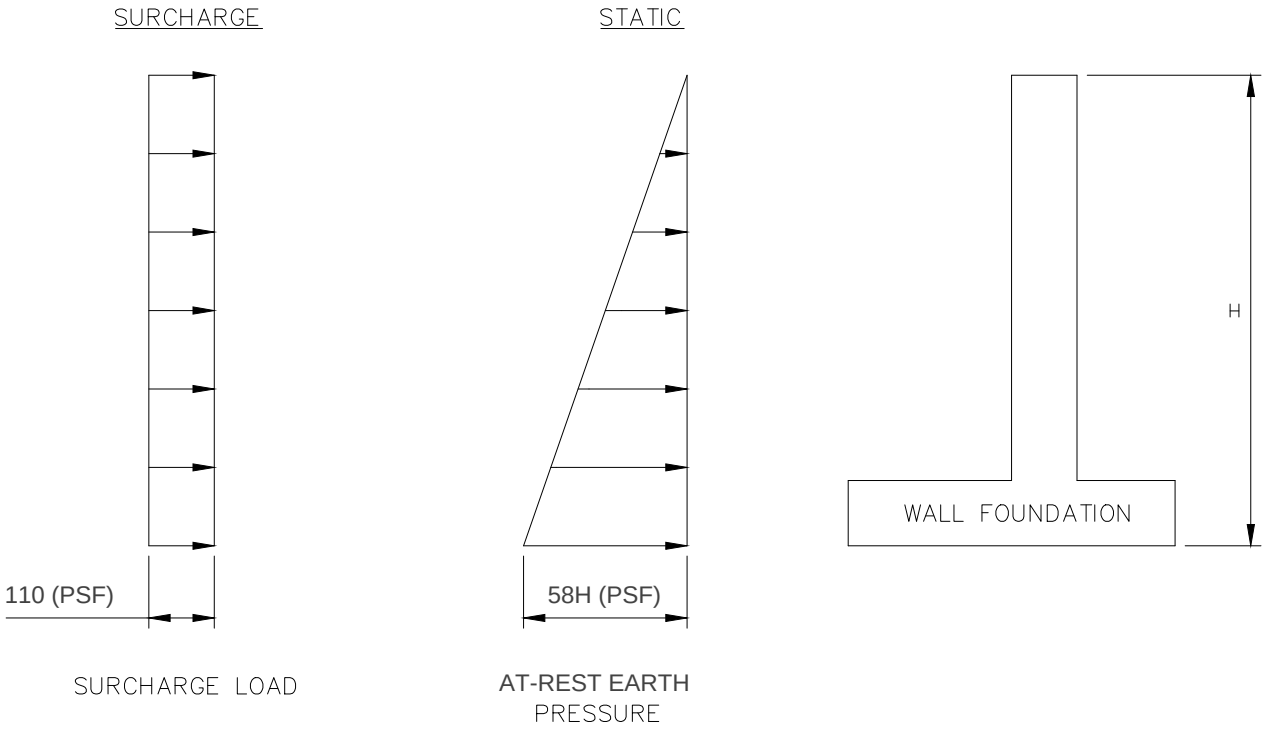
No. Date Description
REVISIONS

DRAWN:	N.J.
CHECKED:	C.T.
APPROVED:	N.W.
SCALE:	1' = 8'
PROJECT NO.:	2020-0401
DATE:	2/26/2021

SHEET NO.

FIGURE 3



NOTES:

1. APPLIES TO WALLS THAT ARE FIXED AT THE TOP AND ASSUMES AT-REST EARTH PRESSURES.
2. H IS MEASURED IN FEET
3. THE WALL SHOULD BE DRAINED BY PERVIOUS STRUCTURE BACKFILL (FORM 818 M.02.05) WITH A UNIT WEIGHT OF 125 PCF AND WEEPHOLES THROUGH THE WALL. THEREFORE, HYDROSTATIC PRESSURE IS NOT INCLUDED.
4. THESE PRESSURE DISTRIBUTIONS ASSUME HORIZONTAL BACKFILL BEHIND THE WALL.
5. SLIDING:
   COEFFICIENT OF FRICTION BETWEEN FOOTING AND BASE= 0.55 (AASHTO TABLE 3.11.5.3–1) RESISTANCE FACTOR= 1.0 (AASHTO TABLE 11.5.7–1).
6. IGNORE PASSIVE RESISTANCE IN FRONT OF FOOTING.
7. SEISMIC LATERAL EARTH PRESSURES ARE NOT REQUIRED FOR SINGLE SPAN BRIDGES (AASHTO 4.7.4.2).

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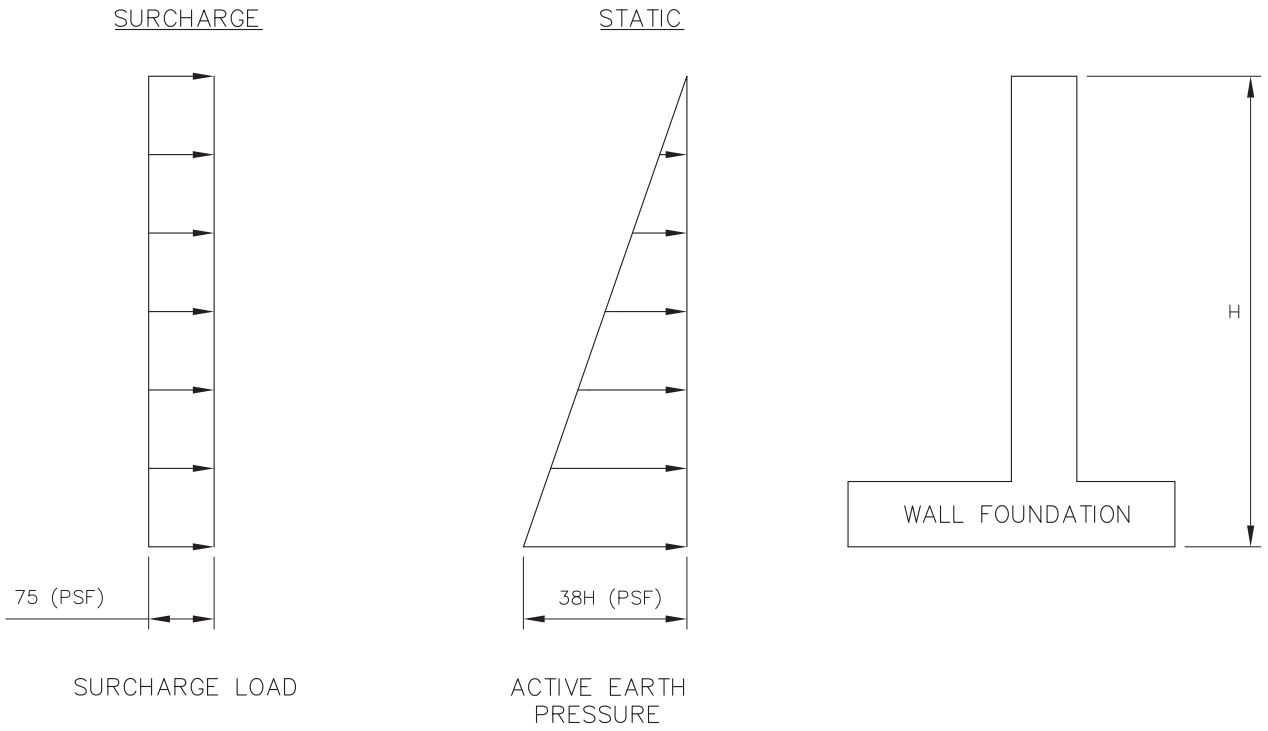
LATERAL EARTH PRESSURES
AT-REST EARTH PRESSURES

BRIDGE 023008 -
WEST ROAD OVER CHERRY BROOK
CANTON, CONNECTICUT

DRAFTED:	T.T.
CHECKED:	N.W.
APPROVED:	N.W.
SCALED:	N.T.S.
PROJECT NO.:	2020-0401
DATE:	08/18/2020

FIG.

FIGURE 4



NOTES:

1. APPLIES TO WALLS THAT CAN DEFLECT AT THE TOP AND ASSUMES ACTIVE EARTH PRESSURES.
2. H IS MEASURED IN FEET
3. THE WALL SHOULD BE DRAINED BY PERVIOUS STRUCTURE BACKFILL (FORM 818 M.02.05) WITH A UNIT WEIGHT OF 125 PCF AND WEEPHOLES THROUGH THE WALL. THEREFORE, HYDROSTATIC PRESSURE IS NOT INCLUDED.
4. THESE PRESSURE DISTRIBUTIONS ASSUME HORIZONTAL BACKFILL BEHIND THE WALL.
5. SLIDING:
   COEFFICIENT OF FRICTION BETWEEN FOOTING AND BASE= 0.55 (AASHTO TABLE 3.11.5.3–1) RESISTANCE FACTOR= 1.0 (AASHTO TABLE 11.5.7–1).
6. IGNORE PASSIVE RESISTANCE IN FRONT OF FOOTING.
7. SEISMIC LATERAL EARTH PRESSURES ARE NOT REQUIRED FOR SINGLE SPAN BRIDGES (AASHTO 4.7.4.2).

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LATERAL EARTH PRESSURES
ACTIVE EARTH PRESSURES

BRIDGE 023008
WEST ROAD OVER CHERRY BROOK
CANTON, CONNECTICUT

DRAFTED:	T.T.
CHECKED:	C.T.
APPROVED:	N.W.
SCALED:	N.T.S.
PROJECT NO.:	2020–0401
DATE:	03/15/2021

FIG.

FIGURE 5

APPENDIX A

TEST BORING LOGS

Driller:	R. Posa	**Connecticut DOT Boring Report Format**		Hole No.:	S-1
Inspector:	G. Jacobson	Town:	Canton	Stat./Offset:	4+40.0/-2.6 (L)
Engineer:	Nathan Whetten	Project No.:	2020-0401	Northing:	
Start Date:	12-7-20	Route No.:	West Rd	Easting:	
Finish Date:	12-7-20	Bridge No.:	023008	Surface Elevation:	444
Project Description:	Replacement of Bridge 023008 over Cherry Brook				
Casing Size/Type:	4" HW	Sampler Type/Size:	SS 1-3/8	Core Barrel Type:	NX
Hammer Wt.:	300lb Fall: 24in.	Hammer Wt.:	140lb Fall: 30in.		
Groundwater Observations:	4 ATD				

Depth (ft)	SAMPLES: Sample Type/No.	SAMPLES: Blows on Sampler per 6 inches	SAMPLES: Pen. (in.)	SAMPLES: Rec. (in.)	SAMPLES: RQD %	Generalized Strata Description	Material Description and Notes	Elevation (ft)
0						Pavement Structure	Pavement Structure - Asphalt Pavement	
	S-1	18 18 17 19	24	14		Fill	Brown c-f SAND, some c-f GRAVEL, little silt	
	S-2	9 8 50/3"	15	10			Brown c-f SAND, some c-f GRAVEL, little silt	440
5	S-3	30 50/1"	7	3		Sand	Gray-brown c-f SAND, little c-f gravel, little silt	
								435
10	S-4	14 11 10 19	24	8			Gray-brown c-f SAND and c-f GRAVEL, little silt	
								430
15	S-5	60 50/4"	10	8		Decomposed Sandstone	Gray-brown c-f SAND, little c-f gravel, little silt; red sandstone chips in tip of split-spoon	
								425
20	S-6	50/3"	3	3			Red f SAND and SILT (Decomposed Sandstone)	
								420
25								

Sample Type: S = Split Spoon C = Core UP = Undisturbed Piston V = Vane Shear Test

Proportions Used: Trace = 1 - 10%, Little = 10 - 20%, Some = 20 - 35%, And = 35 - 50%

Total Penetration in Earth: 30ft Rock: 10ft No. of Soil Samples: 7 No. of Core Runs: 3	NOTES: Augers to 10 ft; drove 4" casing to 15 ft; roller bit open hole to 30 ft. Roller bitted moderately hard from 15.5 to 30 ft Core barrel repeatedly blocked by soft soil-like layers from 38 to 40 ft.	Sheet 1 of 2 SM-001-M REV. 1/02

Driller:	R. Posa	**Connecticut DOT Boring Report Format**		Hole No.:	S-1
Inspector:	G. Jacobson	Town:	Canton	Stat./Offset:	4+40.0/-2.6 (L)
Engineer:	Nathan Whetten	Project No.:	2020-0401	Northing:	
Start Date:	12-7-20	Route No.:	West Rd	Easting:	
Finish Date:	12-7-20	Bridge No.:	023008	Surface Elevation:	444
Project Description:	Replacement of Bridge 023008 over Cherry Brook				
Casing Size/Type:	4" HW	Sampler Type/Size:	SS 1-3/8	Core Barrel Type:	NX
Hammer Wt.:	300lb Fall: 24in.	Hammer Wt.:	140lb Fall: 30in.		
Groundwater Observations:	4 ATD				

Depth (ft)	SAMPLES: Sample Type/No.	SAMPLES: Blows on Sampler per 6 inches	SAMPLES: Pen. (in.)	SAMPLES: Rec. (in.)	SAMPLES: RQD %	Generalized Strata Description	Material Description and Notes	Elevation (ft)
25	S-7	100/5"	5	5		Decomposed Sandstone *(con't)*	Red f SAND and SILT (Decomposed Sandstone)	
								415
30						Sandstone		
	C-1		60	48	28		Mod strong, mod weath, aphanitic, red, SANDSTONE. Granite seam at 32 ft, bedding indistinct, primary joints 1-20 in spaced, shallow dip, open, weathered. Secondary cracks and joints vertical, tight, mod. weathered. Core Rate (min/ft): 2,2,2,3,3	410
35	C-2		36	28	31		Mod. strong, mod. weathered, aphanitic, red, SANDSTONE; med grained at 38 ft. Bedding indistinct, primary joints 2-8 in spaced, shallow dipping, open, weath. Secondary cracks and joints vertical, tight, mod. weath. CoreRate(min/ft): 3,3,3	
	C-3		24	11	0		Soft weathered aphanitic red SANDSTONE. Primary joints are 1 to 2 in. spaced, with probably soil layers (not recovered). Core Rate (min/ft): 3,3	405
40							END OF BORING 40ft	
								400
45								
								395
50								

Sample Type: S = Split Spoon C = Core UP = Undisturbed Piston V = Vane Shear Test

Proportions Used: Trace = 1 - 10%, Little = 10 - 20%, Some = 20 - 35%, And = 35 - 50%

Total Penetration in Earth: 30ft Rock: 10ft No. of Soil Samples: 7 No. of Core Runs: 3	NOTES: Augers to 10 ft; drove 4" casing to 15 ft; roller bit open hole to 30 ft. Roller bitted moderately hard from 15.5 to 30 ft Core barrel repeatedly blocked by soft soil-like layers from 38 to 40 ft.	Sheet 2 of 2 SM-001-M REV. 1/02

Driller:	A. McKernon	**Connecticut DOT Boring Report Format**		Hole No.:	S-2
Inspector:	G. Jacobson	Town:	Canton	Stat./Offset:	3+94.7/-1.5 (L)
Engineer:	Nathan Whetten	Project No.:	2020-0401	Northing:	
Start Date:	12-7-20	Route No.:	West Rd	Easting:	
Finish Date:	12-7-20	Bridge No.:	023008	Surface Elevation:	444
Project Description:	Replacement of Bridge 023008 over Cherry Brook				
Casing Size/Type:	4" HW	Sampler Type/Size:	SS 1-3/8	Core Barrel Type:	NX
Hammer Wt.:	300lb Fall: 24in.	Hammer Wt.:	140lb Fall: 30in.		
Groundwater Observations:	4 ATD				

Depth (ft)	SAMPLES: Sample Type/No.	SAMPLES: Blows on Sampler per 6 inches	SAMPLES: Pen. (in.)	SAMPLES: Rec. (in.)	SAMPLES: RQD %	Generalized Strata Description	Material Description and Notes	Elevation (ft)
0						Pavement Structure	Pavement Structure - Asphalt Pavement	
	S-1	16 18 20 14	24	14		Fill	Brown c-f GRAVEL and c-f SAND, trace silt	
	S-2	20 28 24 16	24	3			Brown c-f SAND and c-f GRAVEL, little silt	440
5	S-3	4 7 21 36	24	8		Sand	Brown to dark brown fine SAND and SILT, trace roots	
								435
10							No recovery below 6 ft. Roller bitted several cobbles from 6 to 11 ft	
							END OF BORING 11ft	
								430
15								
								425
20								
								420
25								

Sample Type: S = Split Spoon C = Core UP = Undisturbed Piston V = Vane Shear Test

Proportions Used: Trace = 1 - 10%, Little = 10 - 20%, Some = 20 - 35%, And = 35 - 50%

Total Penetration in Earth: 11ft Rock: 0ft	NOTES: Augers to 10 ft; drove 4" casing to 11 ft; broke off bottom 5 ft of casing; abandon hole; move 2 ft west to S-2A	Sheet 1 of 1
No. of Soil Samples: 4 No. of Core Runs: 0		SM-001-M REV. 1/02

Driller:	A. McKernon	**Connecticut DOT Boring Report Format**		Hole No.:	S-2A
Inspector:	G. Jacobson	Town:	Canton	Stat./Offset:	3+92.7/-1.5 (L)
Engineer:	Nathan Whetten	Project No.:	2020-0401	Northing:	
Start Date:	12-7-20	Route No.:	West Rd	Easting:	
Finish Date:	12-7-20	Bridge No.:	023008	Surface Elevation:	444
Project Description:	Replacement of Bridge 023008 over Cherry Brook				
Casing Size/Type:	4" HW	Sampler Type/Size:	SS 1-3/8	Core Barrel Type:	NX
Hammer Wt.:	300lb Fall: 24in.	Hammer Wt.:	140lb Fall: 30in.		
Groundwater Observations:	4 ATD				

Depth (ft)	Sample Type/No.	Blows on Sampler per 6 inches	Pen. (in.)	Rec. (in.)	RQD %	Generalized Strata Description	Material Description and Notes	Elevation (ft)
0						Pavement Structure	Pavement Structure - Asphalt Pavement	
	S-1	16 18 20 14	24	14		Fill	Brown c-f SAND and c-f GRAVEL, little silt	
	S-2	20 28 24 16	24	3			Brown c-f SAND and c-f GRAVEL, little silt	440
5						Sand		
	S-3	4 7 21 36	24	8			Brown to dark brown fine SAND and SILT, trace roots	
								435
10								
	S-4	18 12 12 16	24	14			10 - 11 ft: Brown c-f SAND, some c-f gravel, little silt; 11 - 12 ft: Red brown SILT and fine SAND.	
								430
15						Decomposed Sandstone		
	S-5	46 30 47 47	24	12			Red brown fine SAND and SILT	
								425
20	S-6	30/0"	0	0		Sandstone		
	C-1		60	54	70		Mod strong, mod weath, fine grained, red brown, SANDSTONE. Bedding indistinct, primary joints 3-16 in spaced, shallow dip, open, weathered. Secondary joints vertical, tight, slightly weathered. Core Rate (min/ft): 1, 1, 1, 1, 1.25	
								420
25								

Sample Type: S = Split Spoon C = Core UP = Undisturbed Piston V = Vane Shear Test

Proportions Used: Trace = 1 - 10%, Little = 10 - 20%, Some = 20 - 35%, And = 35 - 50%

Total Penetration in Earth: 20ft Rock: 10ft No. of Soil Samples: 2 No. of Core Runs: 2	NOTES: Moved over from S-2 (abandoned); started sampling at 10 ft; drove 4" casing to 15 ft; roller bit open hole to 30 ft. Roller bitted easily from 10 to 15 ft; roller bitted moderately hard 15 to 20 ft.	Sheet 1 of 2 SM-001-M REV. 1/02

Driller:	A. McKernon	**Connecticut DOT Boring Report Format**		Hole No.:	S-2A
Inspector:	G. Jacobson	Town:	Canton	Stat./Offset:	3+92.7/-1.5 (L)
Engineer:	Nathan Whetten	Project No.:	2020-0401	Northing:	
Start Date:	12-7-20	Route No.:	West Rd	Easting:	
Finish Date:	12-7-20	Bridge No.:	023008	Surface Elevation:	444
Project Description:	Replacement of Bridge 023008 over Cherry Brook				
Casing Size/Type:	4" HW	Sampler Type/Size:	SS 1-3/8	Core Barrel Type:	NX
Hammer Wt.:	300lb Fall: 24in.	Hammer Wt.:	140lb Fall: 30in.		
Groundwater Observations:	4 ATD				

Depth (ft)	SAMPLES: Sample Type/No.	SAMPLES: Blows on Sampler per 6 inches	SAMPLES: Pen. (in.)	SAMPLES: Rec. (in.)	SAMPLES: RQD %	Generalized Strata Description	Material Description and Notes	Elevation (ft)
25	C-2		54	54	50	Sandstone *(con't)*	Mod strong, mod weath, aphanitic, red, SANDSTONE soft below 28 ft, bedding indistinct, primary joints 1-3 in spaced, shallow dip, open, weathered. Core Rate (min/ft): 1.25, 1.25, 1.25, 1.25, 1.25	415
30							END OF BORING 29.5ft	410
35								405
40								400
45								395
50								

Sample Type: S = Split Spoon C = Core UP = Undisturbed Piston V = Vane Shear Test

Proportions Used: Trace = 1 - 10%, Little = 10 - 20%, Some = 20 - 35%, And = 35 - 50%

Total Penetration in Earth: 20ft Rock: 10ft No. of Soil Samples: 2 No. of Core Runs: 2	NOTES: Moved over from S-2 (abandoned); started sampling at 10 ft; drove 4" casing to 15 ft; roller bit open hole to 30 ft. Roller bitted easily from 10 to 15 ft; roller bitted moderately hard 15 to 20 ft.	Sheet 2 of 2 SM-001-M REV. 1/02

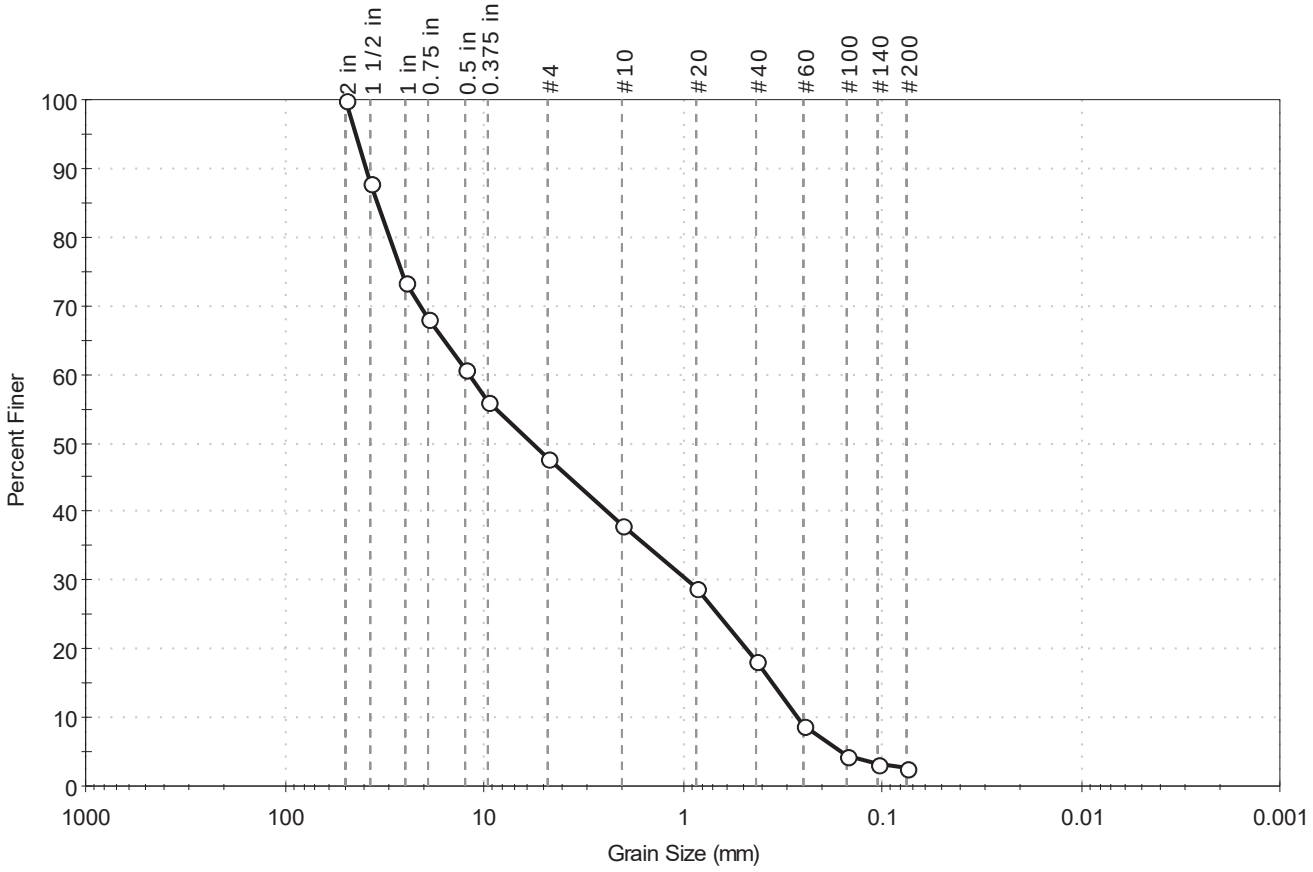
APPENDIX B

RESULTS OF LABORATORY TESTING

GeoTesting EXPRESS

Client:	Freeman Companies, LLC				
Project:	West Rd over Cherry Brook				
Location:	Canton, CT			Project No:	GTX-312901
Boring ID:	---	Sample Type:	bag	Tested By:	ckg
Sample ID:	Grab-1	Test Date:	12/22/20	Checked By:	bfs
Depth :	U/S	Test Id:	605799		
Test Comment:	---				
Visual Description:	Moist, dark olive brown gravel with sand				
Sample Comment:	---				

Particle Size Analysis - ASTM D6913



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	52.1	45.2	2.7

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
2 in	50.00	100		
1 1/2 in	37.50	88		
1 in	25.00	73		
0.75 in	19.00	68		
0.5 in	12.50	61		
0.375 in	9.50	56		
#4	4.75	48		
#10	2.00	38		
#20	0.85	29		
#40	0.42	18		
#60	0.25	9		
#100	0.15	4		
#140	0.11	3		
#200	0.075	2.7		

Coefficients

D_{85} = 34.6597 mm	D_{30} = 0.9477 mm
D_{60} = 11.9582 mm	D_{15} = 0.3527 mm
D_{50} = 5.6742 mm	D_{10} = 0.2658 mm
C_u = 44.989	C_c = 0.283

Classification

ASTM — Poorly graded GRAVEL with Sand (GP)

AASHTO — Stone Fragments, Gravel and Sand (A-1-a (1))

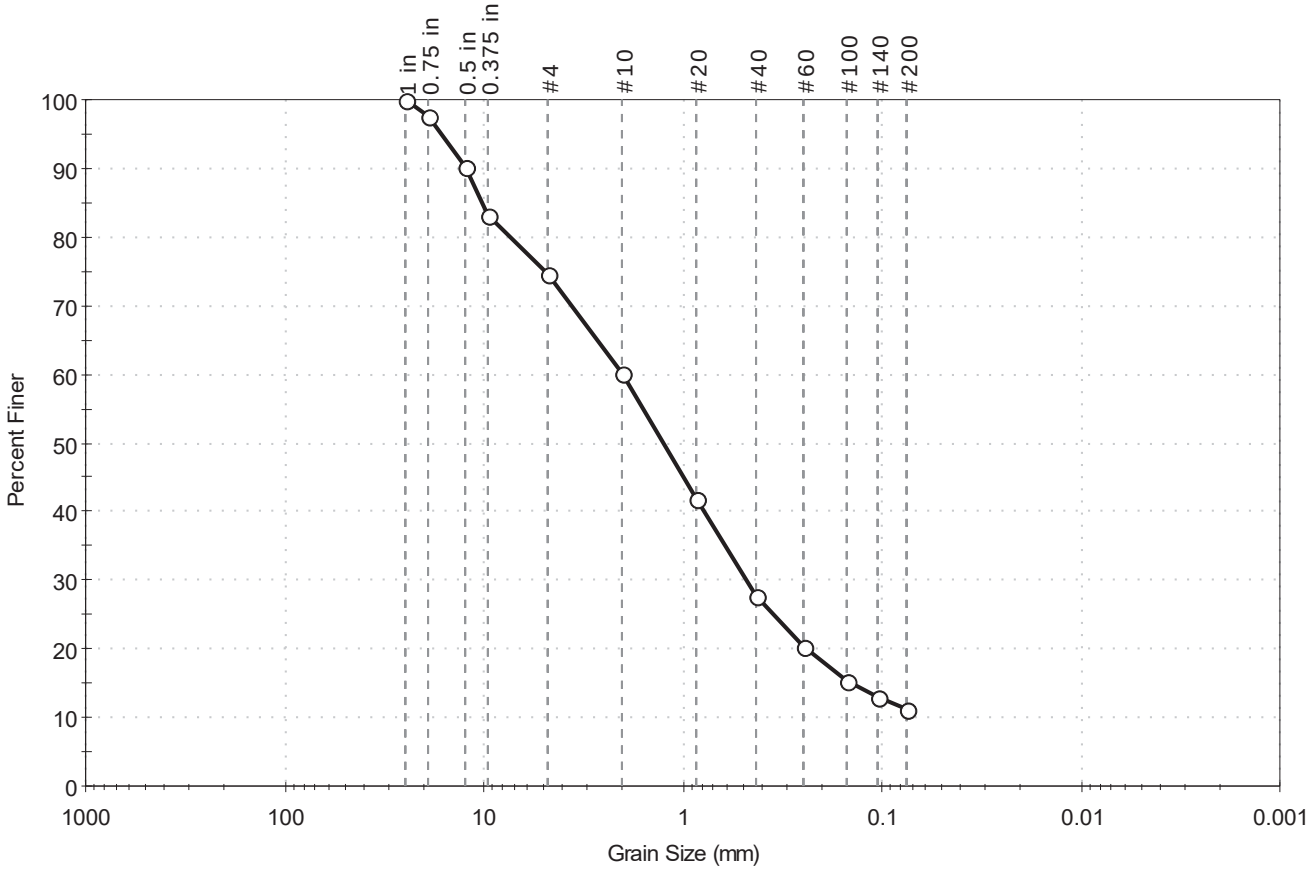
Sample / Test Description

Sand/Gravel Particle Shape : ANGULAR

Sand/Gravel Hardness : HARD

Client:	Freeman Companies, LLC				
Project:	West Rd over Cherry Brook				
Location:	Canton, CT			Project No:	GTX-312901
Boring ID:	S-1	Sample Type:	bag	Tested By:	ckg
Sample ID:	S-1	Test Date:	12/21/20	Checked By:	bfs
Depth :	1-3	Test Id:	605795		
Test Comment:	---				
Visual Description:	Moist, brown sand with silt and gravel				
Sample Comment:	---				

Particle Size Analysis - ASTM D6913



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	25.3	63.5	11.2

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
1 in	25.00	100		
0.75 in	19.00	98		
0.5 in	12.50	90		
0.375 in	9.50	83		
#4	4.75	75		
#10	2.00	60		
#20	0.85	42		
#40	0.42	28		
#60	0.25	20		
#100	0.15	15		
#140	0.11	13		
#200	0.075	11		

Coefficients

D_{85} = 10.1860 mm	D_{30} = 0.4722 mm
D_{60} = 1.9834 mm	D_{15} = 0.1430 mm
D_{50} = 1.2391 mm	D_{10} = N/A
C_u = N/A	C_c = N/A

Classification

ASTM N/A

AASHTO Stone Fragments, Gravel and Sand (A-1-b (0))

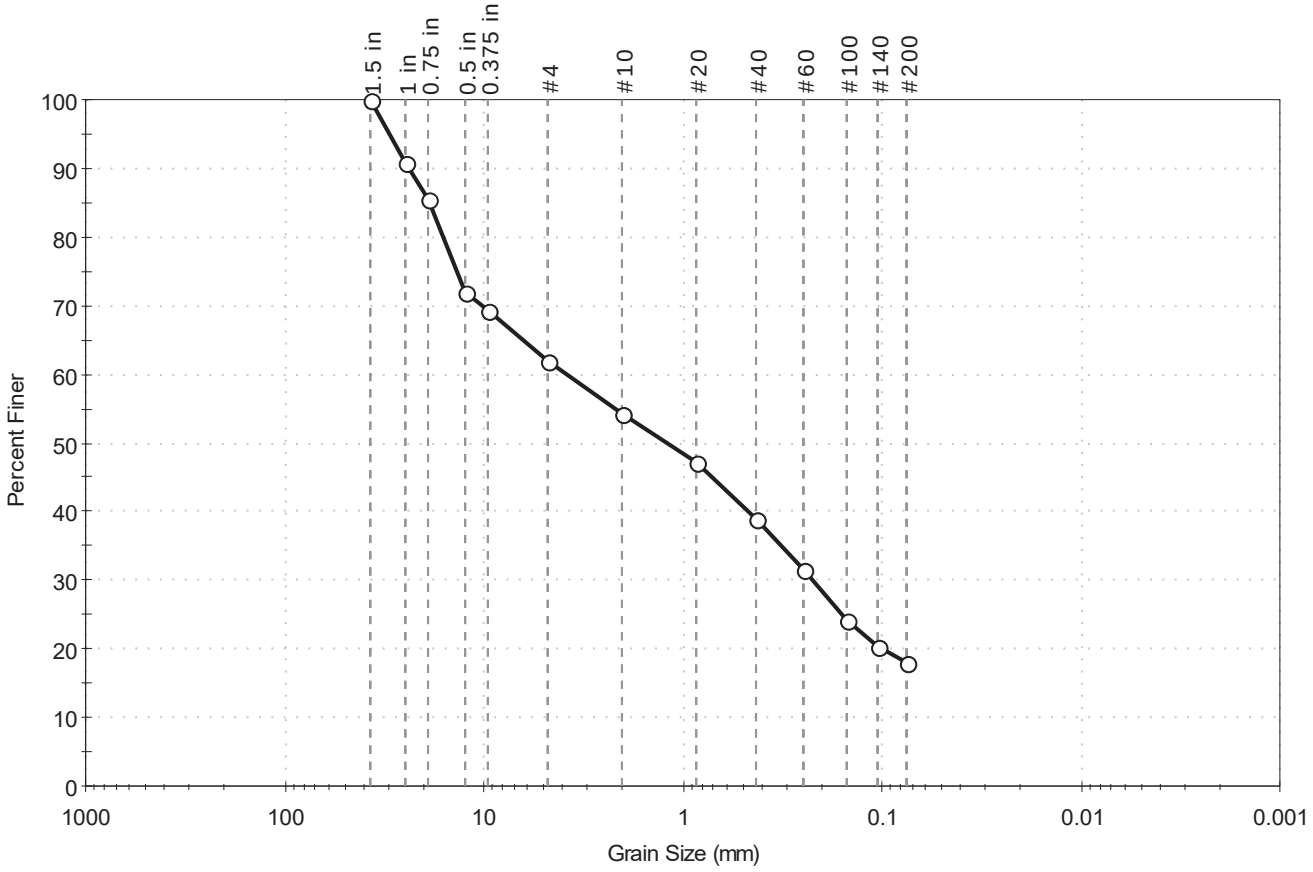
Sample / Test Description

Sand/Gravel Particle Shape : ANGULAR

Sand/Gravel Hardness : HARD

Client:	Freeman Companies, LLC				
Project:	West Rd over Cherry Brook				
Location:	Canton, CT			Project No:	GTX-312901
Boring ID:	S-1	Sample Type:	bag	Tested By:	ckg
Sample ID:	S-4	Test Date:	12/21/20	Checked By:	bfs
Depth :	10-12	Test Id:	605796		
Test Comment:	---				
Visual Description:	Moist, dark grayish brown clayey sand with gravel				
Sample Comment:	---				

Particle Size Analysis - ASTM D6913



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	38.1	44.0	17.9

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
1.5 in	37.50	100		
1 in	25.00	91		
0.75 in	19.00	85		
0.5 in	12.50	72		
0.375 in	9.50	69		
#4	4.75	62		
#10	2.00	54		
#20	0.85	47		
#40	0.42	39		
#60	0.25	32		
#100	0.15	24		
#140	0.11	20		
#200	0.075	18		

Coefficients

D_{85} = 18.7162 mm	D_{30} = 0.2252 mm
D_{60} = 3.8035 mm	D_{15} = N/A
D_{50} = 1.1885 mm	D_{10} = N/A
C_u = N/A	C_c = N/A

Classification

ASTM N/A

AASHTO Stone Fragments, Gravel and Sand (A-1-b (0))

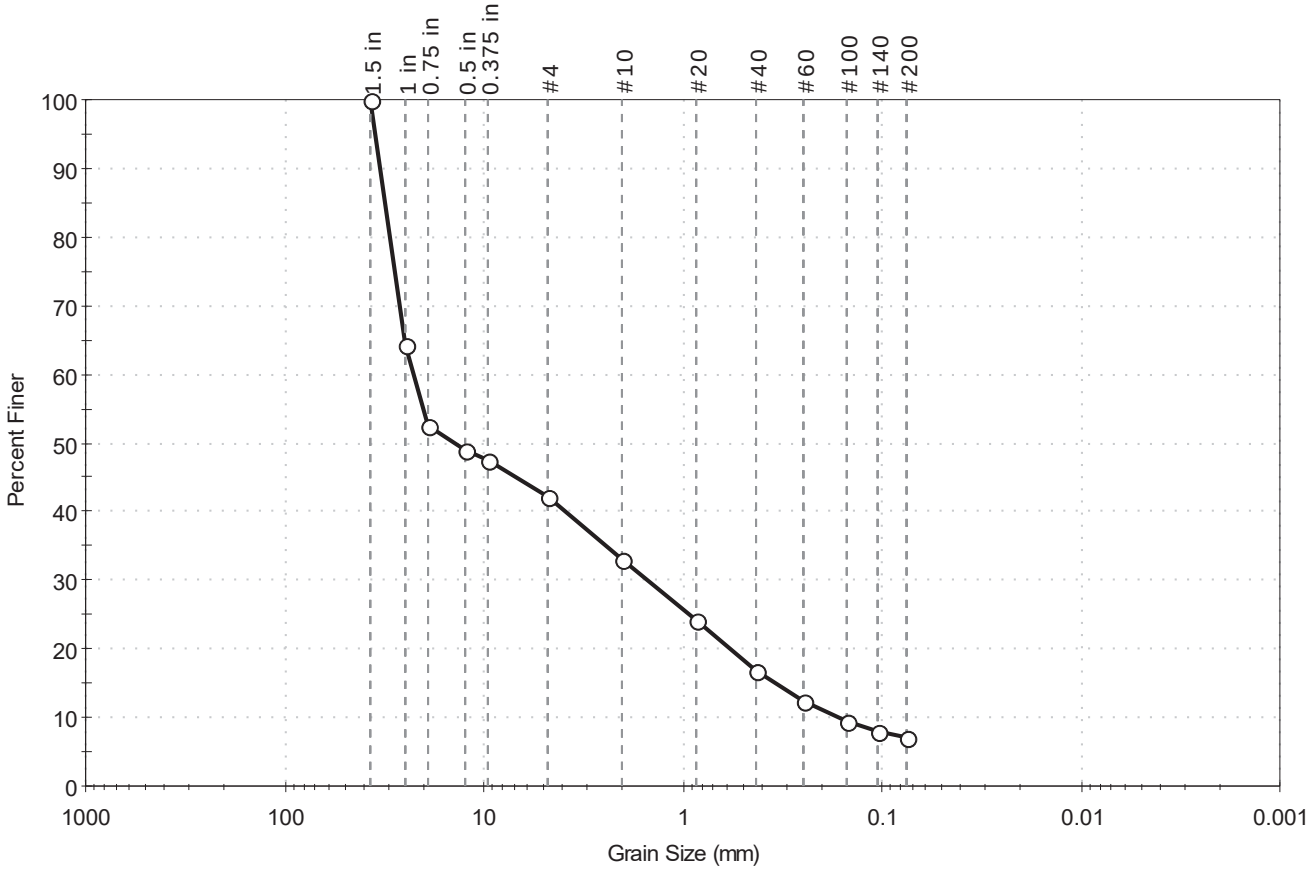
Sample / Test Description

Sand/Gravel Particle Shape : ANGULAR

Sand/Gravel Hardness : HARD

Client:	Freeman Companies, LLC				
Project:	West Rd over Cherry Brook				
Location:	Canton, CT			Project No:	GTX-312901
Boring ID:	S-2	Sample Type:	bag	Tested By:	ckg
Sample ID:	S-1	Test Date:	12/21/20	Checked By:	bfs
Depth :	1-3	Test Id:	605797		
Test Comment:	---				
Visual Description:	Moist, brown gravel with silt and sand				
Sample Comment:	---				

Particle Size Analysis - ASTM D6913



% Cobble	% Gravel	% Sand	% Silt & Clay Size
—	57.9	35.1	7.0

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
1.5 in	37.50	100		
1 in	25.00	64		
0.75 in	19.00	52		
0.5 in	12.50	49		
0.375 in	9.50	47		
#4	4.75	42		
#10	2.00	33		
#20	0.85	24		
#40	0.42	17		
#60	0.25	12		
#100	0.15	9		
#140	0.11	8		
#200	0.075	7.0		

Coefficients

D_{85} = 31.6184 mm D_{30} = 1.4869 mm

D_{60} = 22.6048 mm D_{15} = 0.3422 mm

D_{50} = 14.1227 mm D_{10} = 0.1637 mm

C_u = 138.087 C_c = 0.597

Classification

ASTM N/A

AASHTO Stone Fragments, Gravel and Sand (A-1-a (1))

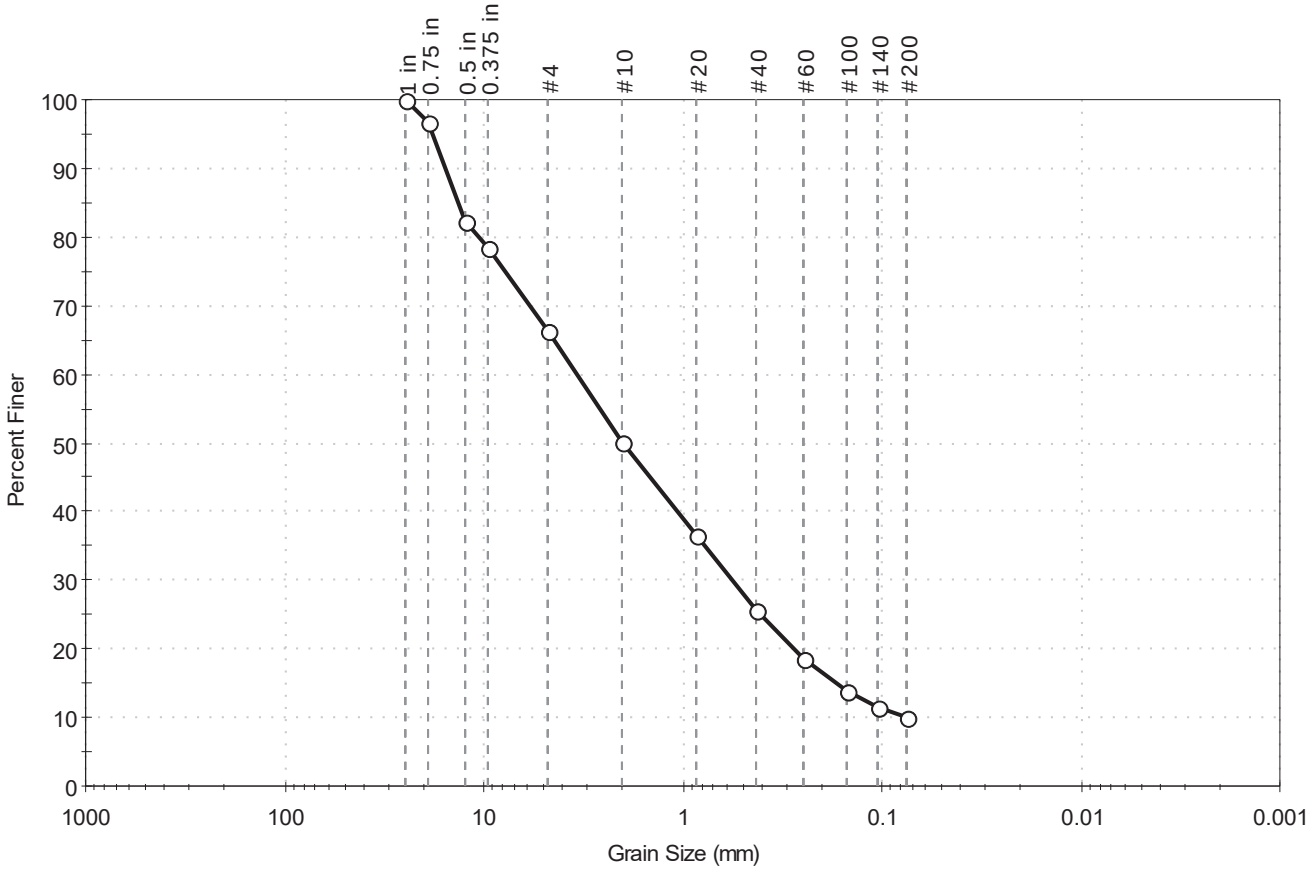
Sample / Test Description

Sand/Gravel Particle Shape : ANGULAR

Sand/Gravel Hardness : HARD

Client:	Freeman Companies, LLC				
Project:	West Rd over Cherry Brook				
Location:	Canton, CT			Project No:	GTX-312901
Boring ID:	S-2	Sample Type:	bag	Tested By:	ckg
Sample ID:	S-4	Test Date:	12/21/20	Checked By:	bfs
Depth :	10-12	Test Id:	605798		
Test Comment:	---				
Visual Description:	Moist, brown sand with silt and gravel				
Sample Comment:	---				

Particle Size Analysis - ASTM D6913



% Cobble	% Gravel	% Sand	% Silt & Clay Size
--	33.7	56.3	10.0

Sieve Name	Sieve Size, mm	Percent Finer	Spec. Percent	Complies
1 in	25.00	100		
0.75 in	19.00	97		
0.5 in	12.50	82		
0.375 in	9.50	79		
#4	4.75	66		
#10	2.00	50		
#20	0.85	37		
#40	0.42	26		
#60	0.25	19		
#100	0.15	14		
#140	0.11	11		
#200	0.075	10.0		

Coefficients

D_{85} = 13.5391 mm	D_{30} = 0.5605 mm
D_{60} = 3.3888 mm	D_{15} = 0.1706 mm
D_{50} = 1.9786 mm	D_{10} = 0.0758 mm
C_u = 44.707	C_c = 1.223

Classification

ASTM N/A

AASHTO Stone Fragments, Gravel and Sand (A-1-b (1))

Sample / Test Description

Sand/Gravel Particle Shape : ANGULAR

Sand/Gravel Hardness : HARD

Client:	Freeman Companies, LLC				
Project:	West Rd over Cherry Brook				
Location:	Canton, CT			Project No:	GTX-312901
Boring ID:	---	Sample Type:	---	Tested By:	tlm
Sample ID:	---	Test Date:	12/28/20	Checked By:	smd
Depth :	---	Test Id:	605801		

Bulk Density and Compressive Strength of Rock Core Specimens by ASTM D7012 Method C

Boring ID	Sample Number	Depth	Bulk Density, pcf	Compressive strength, psi	Failure Type	Meets ASTM D4543	Note(s)
S-1	C-2	35.53-35.91 ft	161	23166	1	No	2,*
S-2	C-1	20.09-20.49 ft	152	9761	1	Yes	---

Notes: Density determined on core samples by measuring dimensions and weight and then calculating.

All specimens tested at the approximate as-received moisture content and at standard laboratory temperature.

The axial load was applied continuously at a stress rate that produced failure in a test time between 2 and 15 minutes.

Failure Type: 1 = Intact Material Failure; 2 = Discontinuity Failure; 3 = Intact Material and Discontinuity Failure (See attached photographs)

1: Best effort end preparation. See Tolerance report for details.
2: The as-received core did not meet the ASTM side straightness tolerance due to irregularities in the sample as cored.
3: Specimen L/D < 2.
4: The as-received core did not meet the ASTM minimum diameter tolerance of 1.875 inches.
5: Specimen diameter is less than 10 times maximum particle size.
6: Specimen diameter is less than 6 times maximum particle size.

*Because the indicated tested specimens did not meet the ASTM D4543 standard tolerances, the results reported here may differ from those for a test specimen within tolerances.

Client:	Freeman Companies, LLC	Test Date:	12/28/2020
Project Name:	West Rd over Cherry Brook	Tested By:	cmh
Project Location:	Canton, CT	Checked By:	smd
GTX #:	312901		
Boring ID:	S-1		
Sample ID:	C-2		
Depth:	35.53-35.91 ft		
Visual Description:	See photographs		

UNIT WEIGHT DETERMINATION AND DIMENSIONAL AND SHAPE TOLERANCES OF ROCK CORE SPECIMENS BY ASTM D4543

BULK DENSITY

	1	2	Average
Specimen Length, in:	4.32	4.32	4.32
Specimen Diameter, in:	1.97	1.97	1.97
Specimen Mass, g:	558.75		
Bulk Density, lb/ft^3	161	**Minimum Diameter Tolerence Met?**	YES
Length to Diameter Ratio:	2.2	**Length to Diameter Ratio Tolerance Met?**	YES

DEVIATION FROM STRAIGHTNESS (Procedure S1)

Maximum gap between side of core and reference surface plate:
Is the maximum gap ≤ 0.02 in.? NO

Maximum difference must be < 0.020 in.
Straightness Tolerance Met? NO

END FLATNESS AND PARALLELISM (Procedure FP1)

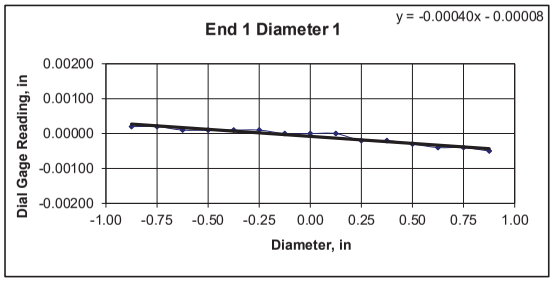
END 1	-0.875	-0.750	-0.625	-0.500	-0.375	-0.250	-0.125	0.000	0.125	0.250	0.375	0.500	0.625	0.750	0.875
Diameter 1, in	0.00020	0.00020	0.00010	0.00010	0.00010	0.00000	0.00000	0.00000	0.00000	-0.00020	-0.00020	-0.00030	-0.00040	-0.00040	-0.00050
Diameter 2, in (rotated 90°)	-0.00010	-0.00010	-0.00010	-0.00010	0.00010	0.00010	0.00010	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000

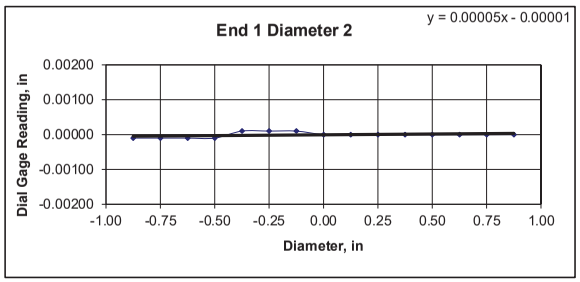
Difference between max and min readings, in:
0° = 0.00070 90° = 0.00020

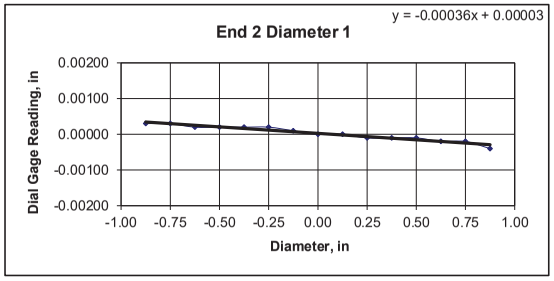
END 2	-0.875	-0.750	-0.625	-0.500	-0.375	-0.250	-0.125	0.000	0.125	0.250	0.375	0.500	0.625	0.750	0.875
Diameter 1, in	0.00030	0.00030	0.00020	0.00020	0.00020	0.00020	0.00010	0.00000	0.00000	-0.00010	-0.00010	-0.00010	-0.00020	-0.00020	-0.00040
Diameter 2, in (rotated 90°)	-0.00010	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	-0.00010	-0.00010

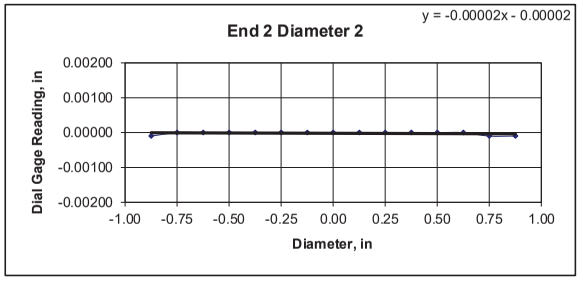
Difference between max and min readings, in:
0° = 0.0007 90° = 0.0001

Maximum difference must be < 0.0020 in. Difference = ± 0.00035
Flatness Tolerance Met? YES









DIAMETER 1

End 1:
Slope of Best Fit Line 0.00040
Angle of Best Fit Line: 0.02308

End 2:
Slope of Best Fit Line 0.00036
Angle of Best Fit Line: 0.02079

Maximum Angular Difference: 0.00229

Parallelism Tolerance Met? YES
Spherically Seated

DIAMETER 2

End 1:
Slope of Best Fit Line 0.00005
Angle of Best Fit Line: 0.00262

End 2:
Slope of Best Fit Line 0.00002
Angle of Best Fit Line: 0.00098

Maximum Angular Difference: 0.00164

Parallelism Tolerance Met? YES
Spherically Seated

PERPENDICULARITY (Procedure P1) (Calculated from End Flatness and Parallelism measurements above)

END 1	Difference, Maximum and Minimum (in.)	Diameter (in.)	Slope	Angle°	Perpendicularity Tolerance Met?
Diameter 1, in	0.00070	1.970	0.00036	0.020	YES
Diameter 2, in (rotated 90°)	0.00020	1.970	0.00010	0.006	YES
END 2					
Diameter 1, in	0.00070	1.970	0.00036	0.020	YES
Diameter 2, in (rotated 90°)	0.00010	1.970	0.00005	0.003	YES

Maximum angle of departure must be ≤ 0.25°
Perpendicularity Tolerance Met? YES

Client:	Freeman Companies, LLC
Project Name:	West Rd over Cherry Brook
Project Location:	Canton, CT
GTX #:	312901
Test Date:	12/28/2020
Tested By:	cmh
Checked By:	smd
Boring ID:	S-1
Sample ID:	C-2
Depth, ft:	35.53-35.91

After cutting and grinding

After break

Client:	Freeman Companies, LLC	Test Date:	12/28/2020
Project Name:	West Rd over Cherry Brook	Tested By:	cmh
Project Location:	Canton, CT	Checked By:	smd
GTX #:	312901		
Boring ID:	S-2		
Sample ID:	C-1		
Depth:	20.09-20.49 ft		
Visual Description:	See photographs		

UNIT WEIGHT DETERMINATION AND DIMENSIONAL AND SHAPE TOLERANCES OF ROCK CORE SPECIMENS BY ASTM D4543

BULK DENSITY

	1	2	Average
Specimen Length, in:	4.45	4.45	4.45
Specimen Diameter, in:	1.98	1.98	1.98
Specimen Mass, g:	547.25		
Bulk Density, lb/ft^3	152	**Minimum Diameter Tolerence Met?**	YES
Length to Diameter Ratio:	2.2	**Length to Diameter Ratio Tolerance Met?**	YES

DEVIATION FROM STRAIGHTNESS (Procedure S1)

Maximum gap between side of core and reference surface plate:
Is the maximum gap ≤ 0.02 in.? YES

Maximum difference must be < 0.020 in.
Straightness Tolerance Met? YES

END FLATNESS AND PARALLELISM (Procedure FP1)

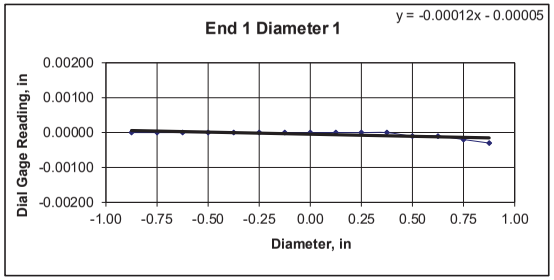
END 1	-0.875	-0.750	-0.625	-0.500	-0.375	-0.250	-0.125	0.000	0.125	0.250	0.375	0.500	0.625	0.750	0.875
Diameter 1, in	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	-0.00010	-0.00010	-0.00020	-0.00030
Diameter 2, in (rotated 90°)	-0.00030	-0.00030	-0.00020	-0.00010	-0.00010	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000

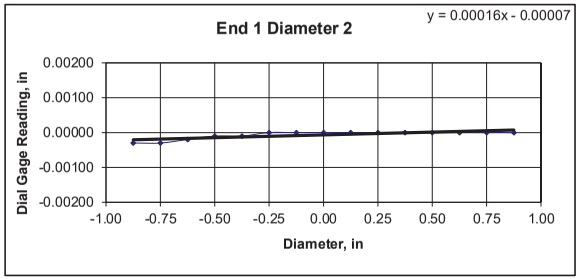
Difference between max and min readings, in:
0° = 0.00030 90° = 0.00030

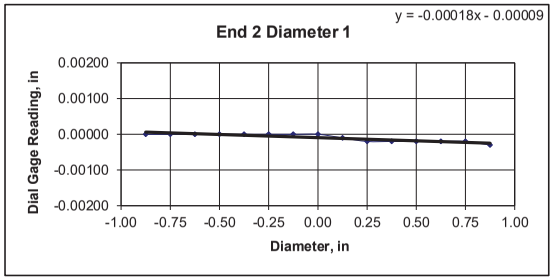
END 2	-0.875	-0.750	-0.625	-0.500	-0.375	-0.250	-0.125	0.000	0.125	0.250	0.375	0.500	0.625	0.750	0.875
Diameter 1, in	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	-0.00010	-0.00020	-0.00020	-0.00020	-0.00020	-0.00020	-0.00030
Diameter 2, in (rotated 90°)	-0.00010	-0.00010	-0.00010	-0.00010	-0.00010	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00010	0.00020

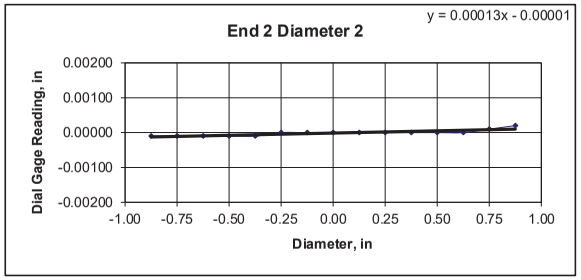
Difference between max and min readings, in:
0° = 0.0003 90° = 0.0003

Maximum difference must be < 0.0020 in. Difference = ± 0.00015
Flatness Tolerance Met? YES









DIAMETER 1

End 1:
Slope of Best Fit Line 0.00012
Angle of Best Fit Line: 0.00688

End 2:
Slope of Best Fit Line 0.00018
Angle of Best Fit Line: 0.01015

Maximum Angular Difference: 0.00327

Parallelism Tolerance Met? YES
Spherically Seated

DIAMETER 2

End 1:
Slope of Best Fit Line 0.00016
Angle of Best Fit Line: 0.00917

End 2:
Slope of Best Fit Line 0.00013
Angle of Best Fit Line: 0.00737

Maximum Angular Difference: 0.00180

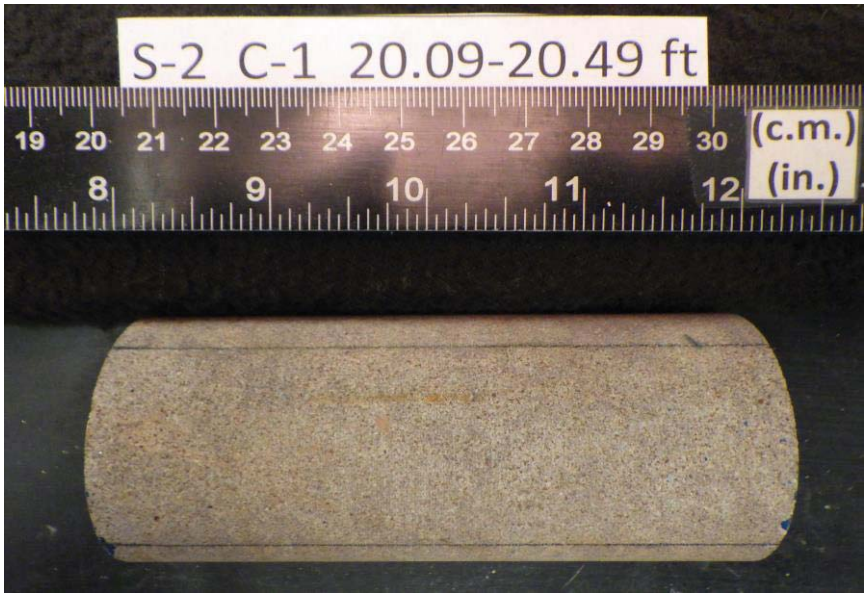
Parallelism Tolerance Met? YES
Spherically Seated

PERPENDICULARITY (Procedure P1) (Calculated from End Flatness and Parallelism measurements above)

END 1	Difference, Maximum and Minimum (in.)	Diameter (in.)	Slope	Angle°	Perpendicularity Tolerance Met?
Diameter 1, in	0.00030	1.980	0.00015	0.009	YES
Diameter 2, in (rotated 90°)	0.00030	1.980	0.00015	0.009	YES
END 2					
Diameter 1, in	0.00030	1.980	0.00015	0.009	YES
Diameter 2, in (rotated 90°)	0.00030	1.980	0.00015	0.009	YES

Maximum angle of departure must be ≤ 0.25°
Perpendicularity Tolerance Met? YES

Client:	Freeman Companies, LLC
Project Name:	West Rd over Cherry Brook
Project Location:	Canton, CT
GTX #:	312901
Test Date:	12/28/2020
Tested By:	cmh
Checked By:	smd
Boring ID:	S-2
Sample ID:	C-1
Depth, ft:	20.09-20.49



After cutting and grinding

After break