GEOTECHNICAL EVALUATION REPORT

VINCENT STREET SLOPE - GEO
CHAGRIN FALLS, OHIO

SME Project Number: 087249.00
JANUARY 17, 2022

SME
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January 17, 2022

Mr. Tim Lannon, PE
CT Consultants, Inc.
Sterling Court
Mentor, Ohio 44060

Via Email:

RE: Geotechnical Evaluation Report
Vincent Street Slope – GEO
Chagrin Falls, Ohio
SME Project No. 087249.00

Dear Mr. Lannon:

We have completed the geotechnical evaluation for the Vincent Street Slope in Chagrin Falls, Ohio. The attached report presents the results of our field and laboratory testing, stability analysis, interpretation of the data, and our recommendations.

We appreciate the opportunity to work with you on this project. If you have questions, please call.

Sincerely,

SME

Brendan Lieske

Brendan P. Lieske, PE
Senior Project Engineer

1. INTRODUCTION

This report presents the results of our geotechnical evaluation for the Vincent Street Slope in Chagrin Falls, Ohio. We performed this evaluation in general accordance with our proposal P02973.20, dated February 26, 2021.

Our scope included a total of three soil borings drilled to rock, designated B1 through B3, with rock core being obtained at B2. We also drilled with hand equipment at three locations on the slope, designated HA1 through HA3, to determine the depth to rock and characterize the overburden soils. B1 and B2 were drilled in the pavement in the area of the current landslide. The stability analysis and recommendations presented in this report are based on data from these borings and the hand auger borings on the slope. B3 was drilled further east, at the intersection of Vincent and American Streets to evaluate subsurface conditions in that area. Slopes at the east end of Vincent Street are somewhat flatter and are not currently failing.

In preparing this report, SME referenced the “Vincent Street Sanitary Sewer Replacement” drawings provided to us by CT Consultants, dated March 2001.

1.1 SITE CONDITIONS AND PROJECT DESCRIPTION

The project site is located on Vincent Street approximately 150 feet east of Bell Street. Vincent Street is a two-lane, asphalt paved road with storm and sanitary sewers along the centerline and a water line along the edge of the road in the area of the current slope failure. A landslide is occurring along about 100 feet of the road with the head scarp along the edge of road but not currently intruding into the pavement. Guardrail along the edge of the road that helps prevent vehicles from going off road and down the steep slope is moving down slope with the landslide.

Total slope height is about 45 feet in the landslide area. The slope is wooded and appeared to be covered with random fill. From other nearby projects, shale bedrock was expected to be encountered at relatively shallow depths.

2. EVALUATION PROCEDURES

We completed three Standard Penetration Test (SPT) borings on August 30 and 31, 2021. The borings were drilled to depths ranging from 13.9 to 16.5 feet. SPT split-barrel samples were obtained at about 2.5-foot intervals in the upper 10 feet, followed by 5-foot intervals. At B2, we cored rock an additional 10 feet, to a termination depth of 26 feet. During drilling, we checked for groundwater and measured its depth, where encountered. The borings were backfilled with auger cuttings and the pavement was patched with asphalt cold path. To evaluate conditions on the slope and to determine the depth to rock, we used hand auger equipment to auger to rock at three locations. We returned to the site in late December and drilled an additional set of hand auger borings on the slope near the locations of the first set to better define the subsurface profile on the slope.

SME determined the number, depths, and locations of the borings. CT Consultants surveyed the boring and original hand auger locations. SME surveyed the second set of hand auger boring and also surveyed multiple points along the slope to provide the data we needed to develop the model used in our slope stability analysis. Boring locations and the slope stability profile are shown on Figures 1 and 2.

FIGURE 1: Boring Location Plan

FIGURE 2: Boring locations in the area of the landslide

Samples were taken to our laboratory, where they were visually classified in general accordance with ASTM D-2488. Laboratory testing included moisture contents and hand penetrometer tests on selected cohesive samples. Mechanical sieve, hydrometer, and Atterberg limits tests were performed on representative soil samples and a uniaxial compression test was completed on a representative segment of the rock core. The core was photographed and measured for percent recovery and RQD.

Boring logs were prepared with soil descriptions for the SPT borings. Descriptions of the soils encountered in the hand auger borings are presented in the tabular form. The boring logs, table with the hand auger soil descriptions, rock core photo, and laboratory test results are included with the attachments. Explanations of symbols and terms used on the boring logs are provided on the Boring Log Terminology sheet are also included.

3. SUBSURFACE CONDITIONS

We encountered 12 inches of asphalt at the surface of B1 and B2 and 4 inches at B3. Fill was encountered to depths ranging from 3.5 to 9 feet at B1 through B3. The fill at HA1 through HA3 ranged from depths of 4.5 to 6 feet. The fill consists of brown and gray lean clay with varying amounts of sand, gravel, shale fragments, and organics.

Below the fill at B1 through B3, we encountered brown and gray very stiff lean clay with sand and gravel. At HA1 through HA3, we encountered gray shale below the fill. Below the clay layer at B1 through B3, we encountered brown and gray, weathered, very weak shale at approximately 12 feet below the existing ground surface (near elevation 955 feet at B1 and B2, and near elevation 966 at B3). Rock core recovery at B2, was just 63%. The drillers reported that the core loss was at the top of the core and was not due to voids in the rock but was more likely soft, fractured rock interbedded with thin residual clay seams. Core that was recovered classified as gray strong shale. From this data, we interpret the depth to the strong shale to be approximately 20 feet below the existing ground surface (near elevation 946.5 feet).

The soil profile described above is a generalized description of the conditions encountered. The stratification depths indicate a zone of transition from one soil/rock type to another and do not show the exact depths of change. Soil/rock conditions may vary between or away from the boring locations.

Groundwater was encountered during drilling at B2 at a depth of 15 feet (approximate elevation 951 feet), within the weathered shale. Groundwater was not encountered in the other borings. For our slope stability profile, we assume that groundwater flows through and along the surface of the fractured shale toward the river. Groundwater levels should be expected to fluctuate during the year, based on variations in precipitation, evaporation, run-off, and other factors. Groundwater conditions encountered at the borings represent conditions at the time the readings were taken. Groundwater levels at other times may vary from those conditions noted on the boring logs.

4. ANALYSIS AND RECOMMENDATIONS

4.1 SLOPE STABILITY ANALYSIS

We used the survey information from CT Consultants to develop the surface profile used in our slope stability analysis. We used soils information from our borings and laboratory tests to assign strength parameters to the various soil strata. Rock properties were determined based on the rock mass rating (RMR) which we interpreted from the laboratory data and condition of the rock core. Material properties used in our slope stability analysis are listed in Table 1 and are shown on the computer printouts included with the attachments. Strength parameters were checked by back calculating based on the existing failure. Since the slope has undergone significant movement, the friction angle in the clay soils will have decreased and may have reached the residual friction angle, which we have used in this analysis.

Table 1. Stability analysis soil properties.

Soil Description	Unit Weight (lbs/ft^3)	Cohesion (psf)	Friction Angle (deg.)
Fill	125	50	28
Lean Clay	135	0	Residual 22
Weathered Shale	140	1,000	20
Shale	150	1,500	30

Our evaluation indicates that failure is occurring in the fill and lean clay soil along the soil-shale interface. We have identified this as a weak (low shear strength) layer within this subsurface profile. Cases we studied in our slope stability analyses included existing conditions with varying soil/rock parameters. We also varied the bounds of our analyses to evaluate stability of the full height of the slope and to isolate the upper portion of the slope. Soil layers are shaded with different colors in the computer printouts for identification. Engineering parameters assigned to each layer are listed in the legends on the plots. Each analysis included thousands of trial surfaces. The residual shear strength of the lean clay soil layer is used in the analyses, since we believe this to be representative of the existing conditions.

Plots showing results of two of our slope stability analyses are included in the Appendix. This includes an analysis of the upper slope and an analysis of the full height of the slope. For existing conditions several slip surfaces with factors of safety close to unity (FS = 1.0) are shown in the results. The upper slope analysis shows slip surfaces with factors of safety near 1.0 extending into the westbound lane of Vincent Street. The full height of slope analysis shows slip surfaces with factors of safety near 1.0 or slightly less for the current failures along the face of the slope. A FS of at least 1.3 is generally considered acceptable where there are no structures on or near the slope.

Based on these analyses, we conclude that a retaining wall is needed near the top of the slope to protect the roadway and utility infrastructure. Without a wall, the slope failure will continue and is likely to intrude into the pavement, potentially making the traffic lane nearest the slope inaccessible and unsafe to traffic. An additional safety concern is the loss of guardrail. Utility infrastructure along this section of Vincent Street may also become compromised if the slope remains unsupported.

Assuming the retaining wall is constructed near the top of the slope, expect the slope downhill of the wall to continue to slide based on its FS near 1.0.

4.2 RETAINING WALL RECOMMENDATIONS AND DESIGN PARAMETERS

Based on the results of our slope stability analysis and depth of the failure plane, options for protecting the road include soldier pile and lagging, and secant, tangent, or plug pile walls. Each of these options would retain the soil on the upslope side of the wall as the slope below the wall continues to slide toward the river.

A soldier pile and lagging wall would likely consist of a structural W or HP section set in a drilled shaft filled with concrete. The soldier piles, embedded in rock with drilled shafts, would likely be spaced at 6 to 8 feet on center and lagging would be set to the top of rock. Tangent, secant, and plug pile walls are all variations of continuous drilled pier walls. Reinforcement could consist of a W and HP structural section or deformed bar reinforcement. With plug pile walls, every second pier is typically reinforced.

The drilled shafts for the options listed above should be drilled into bedrock with an embedment length of at least three times the diameter of the drilled shaft (3D where D = diameter of shaft) with no less than 8 feet below the top of shale. Assuming the wall will be positioned about 5 feet from the edge of pavement, we anticipate the top of shale at approximately elevation 954.5 feet.

Retaining wall design parameters are shown in Table 2. The wall should be designed based on the active equivalent fluid densities for each soil/rock layer. Surcharges, if any, would result in a uniform lateral loading on the wall equal to 0.36 times the vertical surcharge, with the resultant acting at mid-height.

Passive earth pressure can be considered below the top of rock (assumed at elevation 954.5 feet).

Table 2: Retaining Wall Design Parameters

Soil/Rock Layer Description	Elevation Range (feet)	Passive Earth Pressure (psf)	Friction Angle, phi (degrees)	Cohesion (psf)	Unit Weight (pcf)	Active Equivalent Fluid Density (pcf)
Fill	966 to 957	0	28	0	125	45
CL	957 to 954.5	0	22	0	135	60
Weathered Very Weak Shale	954.5 to 946.5	3,000 + 250 x H*	20	1,000	140	70
Strong Shale	946.5 to tip elevation	5,000 + 400 x H*	30	1,500	150	50

*H = depth below top of shale (assumed at elevation 954.5).

4.3 BACKFILL FOR RETAINING WALLS

The retaining wall should be backfilled with clean, free draining, compacted, crushed aggregate meeting an ODOT #8 or #57 gradation. Do not use slag products or shale. The free draining fill should be wrapped in a non-woven geosynthetic fabric to prevent fine grained material from being transported into the pore space of the drainage fill. The free-draining fill should be capped with 1 foot of compacted lean clay.

The zone of free draining fill should, at a minimum, begin at the base of the wall or grade beam and extend upward and outward at a 2V:1H slope. Positive gravity drainage should be provided at the bottom of the free draining fill. The drainage backfill should be placed in lifts and consolidated until no further densification is noted. Compaction equipment should be sized so the wall is not damaged during construction.

4.4 CONSTRUCTION CONSIDERATIONS

The contractor must take precautions to protect the adjacent structures during construction. Care must be exercised during excavating and compacting operations so that vibrations do not cause damage of nearby structures during wall construction.

4.5 RECOMMENDED NEXT STEPS

We recommend that the City of Chagrin Falls initiate a design evaluation phase to develop the wall design. This should include determining the following:

- The type and location of the wall.
- The required embedment depth of foundation elements.
- The structural design of the wall.
- SME should be retained to review the conceptual and final wall design to provide feedback and comments, as needed.

5. SIGNATURES

Prepared by:

Brendan P. Lieske, PE
Senior Project Engineer

Reviewed by:

Alan J. Esser, PE, D.GE
Chief Consultant

APPENDIX A

BORING LOG TERMINOLOGY
BORING LOGS
LABORATORY RESULTS
SLOPE STABILITY ANALYSIS

SME

BORING LOG TERMINOLOGY

UNIFIED SOIL CLASSIFICATION AND SYMBOL CHART

COARSE-GRAINED SOIL (more than 50% of material is larger than No. 200 sieve size.)		
	Clean Gravel (Less than 5% fines)	
GRAVEL More than 50% of coarse fraction larger than No. 4 sieve size	GW	Well-graded gravel; gravel-sand mixtures, little or no fines
	GP	Poorly-graded gravel; gravel-sand mixtures, little or no fines
	Gravel with fines (More than 12% fines)	
	GM	Silty gravel; gravel-sand-silt mixtures
	GC	Clayey gravel; gravel-sand-clay mixtures
	Clean Sand (Less than 5% fines)	
SAND 50% or more of coarse fraction smaller than No. 4 sieve size	SW	Well-graded sand; sand-gravel mixtures, little or no fines
	SP	Poorly graded sand; sand-gravel mixtures, little or no fines
	Sand with fines (More than 12% fines)	
	SM	Silty sand; sand-silt-gravel mixtures
	SC	Clayey sand; sand–clay-gravel mixtures
FINE-GRAINED SOIL (50% or more of material is smaller than No. 200 sieve size)		
SILT AND CLAY Liquid limit less than 50%	ML	Inorganic silt; sandy silt or gravelly silt with slight plasticity
	CL	Inorganic clay of low plasticity; lean clay, sandy clay, gravelly clay
	OL	Organic silt and organic clay of low plasticity
SILT AND CLAY Liquid limit 50% or greater	MH	Inorganic silt of high plasticity, elastic silt
	CH	Inorganic clay of high plasticity, fat clay
	OH	Organic silt and organic clay of high plasticity
HIGHLY ORGANIC SOIL	PT	Peat and other highly organic soil

OTHER MATERIAL SYMBOLS

Topsoil, Void, Sandstone, Asphalt Concrete, Glacial Till, Siltstone, Aggregate Base, Coal, Limestone, Portland Cement Concrete, Shale, Fill

LABORATORY CLASSIFICATION CRITERIA

GW	$C_U = \frac{D_{60}}{D_{10}}$ greater than 4; $C_C = \frac{D_{30}^{\,2}}{D_{10} \times D_{60}}$ between 1 and 3	
GP	Not meeting all gradation requirements for GW	
GM	Atterberg limits below "A" line or PI less than 4	Above "A" line with PI between 4 and 7 are borderline cases requiring use of dual symbols
GC	Atterberg limits above "A" line with PI greater than 7	
SW	$C_U = \frac{D_{60}}{D_{10}}$ greater than 6; $C_C = \frac{D_{30}^{\,2}}{D_{10} \times D_{60}}$ between 1 and 3	
SP	Not meeting all gradation requirements for SW	
SM	Atterberg limits below "A" line or PI less than 4	Above "A" line with PI between 4 and 7 are borderline cases requiring use of dual symbols
SC	Atterberg limits above "A" line with PI greater than 7	

Determine percentages of sand and gravel from grain-size curve. Depending on percentage of fines (fraction smaller than No. 200 sieve size), coarse-grained soils are classified as follows:

Less than 5 percent……………………………..GW, GP, SW, SP
More than 12 percent…………………………..GM, GC, SM, SC
5 to 12 percent……………..……..Cases requiring dual symbols

- SP-SM or SW-SM (SAND with Silt or SAND with Silt and Gravel)
- SP-SC or SW-SC (SAND with Clay or SAND with Clay and Gravel)
- GP-GM or GW-GM (GRAVEL with Silt or GRAVEL with Silt and Sand)
- GP-GC or GW-GC (GRAVEL with Clay or GRAVEL with Clay and Sand)

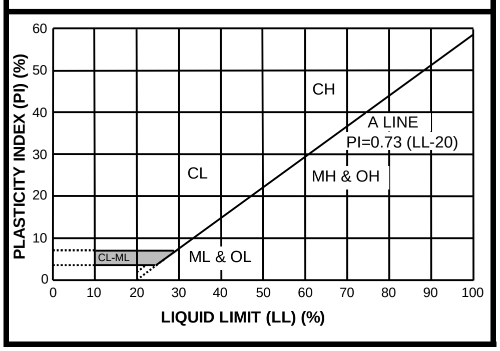
If the fines are CL-ML:

- SC-SM (SILTY CLAYEY SAND or SILTY CLAYEY SAND with Gravel)
- SM-SC (CLAYEY SILTY SAND or CLAYEY SILTY SAND with Gravel)
- GC-GM (SILTY CLAYEY GRAVEL or SILTY CLAYEY GRAVEL with Sand)

PARTICLE SIZES

Boulders	-	Greater than 12 inches
Cobbles	-	3 inches to 12 inches
Gravel- Coarse	-	3/4 inches to 3 inches
Fine	-	No. 4 to 3/4 inches
Sand- Coarse	-	No. 10 to No. 4
Medium	-	No. 40 to No. 10
Fine	-	No. 200 to No. 40
Silt and Clay	-	Less than (0.074 mm)

PLASTICITY CHART



VISUAL MANUAL PROCEDURE

When laboratory tests are not performed to confirm the classification of soils exhibiting borderline classifications, the two possible classifications would be separated with a slash, as follows:

For soils where it is difficult to distinguish if it is a coarse or fine-grained soil:

- SC/CL (CLAYEY SAND to Sandy LEAN CLAY)
- SM/ML (SILTY SAND to SANDY SILT)
- GC/CL (CLAYEY GRAVEL to Gravelly LEAN CLAY)
- GM/ML (SILTY GRAVEL to Gravelly SILT)

For soils where it is difficult to distinguish if it is sand or gravel, poorly or well-graded sand or gravel; silt or clay; or plastic or non-plastic silt or clay:

- SP/GP or SW/GW (SAND with Gravel to GRAVEL with Sand)
- SC/GC (CLAYEY SAND with Gravel to CLAYEY GRAVEL with Sand)
- SM/GM (SILTY SAND with Gravel to SILTY GRAVEL with Sand)
- SW/SP (SAND or SAND with Gravel)
- GP/GW (GRAVEL or GRAVEL with Sand)
- SC/SM (CLAYEY to SILTY SAND)
- GM/GC (SILTY to CLAYEY GRAVEL)
- CL/ML (SILTY CLAY)
- ML/CL (CLAYEY SILT)
- CH/MH (FAT CLAY to ELASTIC SILT)
- CL/CH (LEAN to FAT CLAY)
- MH/ML (ELASTIC SILT to SILT)

DRILLING AND SAMPLING ABBREVIATIONS

2ST	–	Shelby Tube – 2" O.D.
3ST	–	Shelby Tube – 3" O.D.
AS	–	Auger Sample
GS	–	Grab Sample
LS	–	Liner Sample
NR	–	No Recovery
PM	–	Pressuremeter
RC	–	Rock Core diamond bit. NX size, except where noted
SB	–	Split Barrel Sample 1-3/8" I.D., 2" O.D., except where noted
VS	–	Vane Shear
WS	–	Wash Sample

OTHER ABBREVIATIONS

WOH	–	Weight of Hammer
WOR	–	Weight of Rods
SP	–	Soil Probe
PID	–	Photo Ionization Device
FID	–	Flame Ionization Device

DEPOSITIONAL FEATURES

Parting	–	as much as 1/16 inch thick
Seam	–	1/16 inch to 1/2 inch thick
Layer	–	1/2 inch to 12 inches thick
Stratum	–	greater than 12 inches thick
Pocket	–	deposit of limited lateral extent
Lens	–	lenticular deposit
Hardpan/Till	–	an unstratified, consolidated or cemented mixture of clay, silt, sand and/or gravel, the size/shape of the constituents vary widely
Lacustrine	–	soil deposited by lake water
Mottled	–	soil irregularly marked with spots of different colors that vary in number and size
Varved	–	alternating partings or seams of silt and/or clay
Occasional	–	one or less per foot of thickness
Frequent	–	more than one per foot of thickness
Interbedded	–	strata of soil or beds of rock lying between or alternating with other strata of a different nature

DESCRIPTION OF RELATIVE QUANTITIES

The visual-manual procedure uses the following terms to describe the relative quantities of notable foreign materials, gravel, sand or fines:

Trace	–	particles are present but estimated to be less than 5%
Few	–	5 to 10%
Little	–	15 to 25%
Some	–	30 to 45%
Mostly	–	50 to 100%

CLASSIFICATION TERMINOLOGY AND CORRELATIONS

Cohesionless Soils

Relative Density	N_{60} (N-Value) (Blows per foot)
Very Loose	0 to 4
Loose	5 to 10
Medium Dense	11 to 30
Dense	31 to 50
Very Dense	51 to 80
Extremely Dense	Over 81

Cohesive Soils

Consistency	N_{60} (N-Value) (Blows per foot)	Undrained Shear Strength (kips/ft^2)
Very Soft	<2	0.25 or less
Soft	2 - 4	> 0.25 to 0.50
Medium	5 - 8	> 0.50 to 1.0
Stiff	9 - 15	> 1.0 to 2.0
Very Stiff	16 - 30	> 2.0 to 4.0
Hard	> 30	> 4.0 or greater

Standard Penetration 'N-Value' = Blows per foot of a 140-pound hammer falling 30 inches on a 2-inch O.D. split barrel sampler, except where noted. N60 values as reported on boring logs represent raw N-values corrected for hammer efficiency only.

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BORING B1

BORING DEPTH: 16.5 FEET

SME

PROJECT NAME: Vincent Street Slope - GEO
PROJECT NUMBER: 087249.00
CLIENT: CT Consultants Inc
PROJECT LOCATION: Chagrin Falls, OH
DATE STARTED: 8/31/21
COMPLETED: 8/31/21
BORING METHOD: 4" Solid Stem Auger
DRILLER: JH & WI
RIG NO.: 293 (CME 55)
LOGGED BY: APP
CHECKED BY: AJE

LATITUDE: 41.43246
LONGITUDE: -81.38859
ELEVATION: 966.7 FT

HAMMER EFFICIENCY: 83%
DATE: 7/30/2020
N_{60} -- ○

DRY DENSITY (pcf) -- ■ (90, 100, 110, 120)
MOISTURE & ATTERBERG LIMITS (%): PL, MC, LL (10, 20, 30, 40)
SHEAR STRENGTH (KSF) (1, 2, 3, 4): ▽ HAND PENE., TORVANE SHEAR, UNC. COMP., VANE SHEAR (PK), VANE SHEAR (REM), TRIAXIAL (UU)

DEPTH (FEET)	PROFILE DESCRIPTION	ELEVATION (FEET)
0 – 1.0	12 inches of ASPHALT	965.7
1.0 – 3.5	Possible FILL- Sandy LEAN CLAY with Shale Fragments- Brown and Gray (CL/SC)	963.2
3.5 – 8.0	Sandy LEAN CLAY- Brown and Gray- Very Stiff (CL)	958.7
8.0 – 12.0	LEAN CLAY- Brown- Very Stiff (CL)	954.7
12.0 – 16.5	SHALE- Brown and Gray- Very Weak	950.2
16.5	END OF BORING AT 16.5 FEET.	

SAMPLE TYPE/NO.	RECOVERY LENGTH (INCHES)	SPT BLOWS PER SIX INCHES	N_{60}	MC (%)	PL	LL	HAND PENE. (KSF)	REMARKS
SB1	8	20 10 10	28	10			4.5+	
SB2	18	7 8 8	22	18				
SB3	18	5 4 5	12	20				
SB4	18	12 8 8	22	22	24	39		
SB5	18	12 28 40	94	10	24	40		
SB6		50/0"	69+					Refusal

GROUNDWATER & BACKFILL INFORMATION

GROUNDWATER WAS NOT ENCOUNTERED

BACKFILL METHOD: Auger Cuttings & Cold Patch

NOTES:
1. The indicated stratification lines are approximate. The in-situ transitions between materials may be gradual.
2. The colors depicted on the symbolic profile are solely for visualization purposes and do not necessarily represent the in-situ colors encountered.

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BORING B2

BORING DEPTH: 26 FEET

SME

PROJECT NAME: Vincent Street Slope - GEO
PROJECT NUMBER: 087249.00
CLIENT: CT Consultants Inc
PROJECT LOCATION: Chagrin Falls, OH
DATE STARTED: 8/30/21
COMPLETED: 8/30/21
BORING METHOD: 4" Solid Stem Auger
DRILLER: JH & RM
RIG NO.: 293 (CME 55)
LOGGED BY: APP
CHECKED BY: AJE

LATITUDE: 41.43254
LONGITUDE: -81.38847
ELEVATION: 966.4 FT

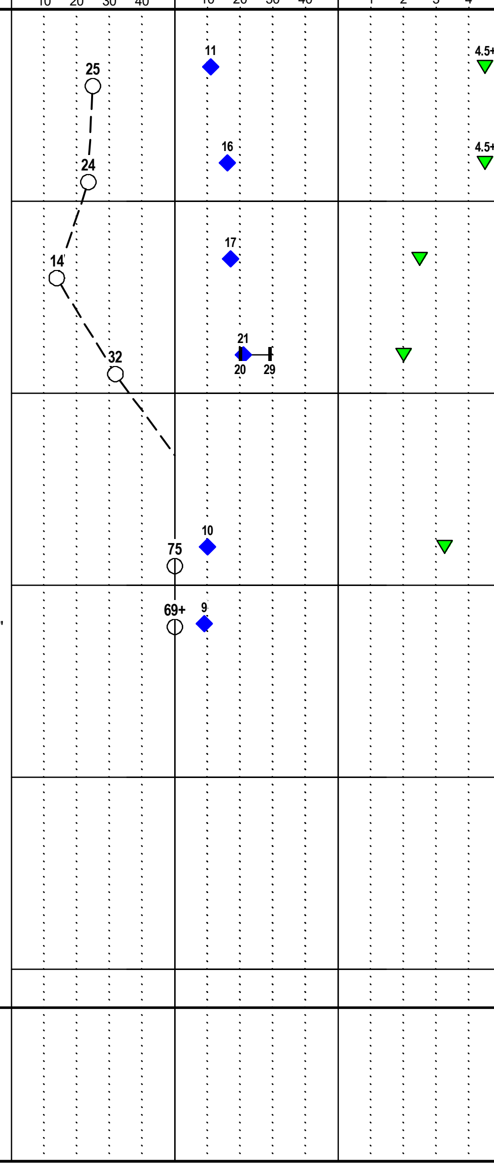
HAMMER EFFICIENCY: 83%
DATE: 7/30/2020
N_{60} -- ○

DRY DENSITY (pcf) -- ■ (90, 100, 110, 120)
MOISTURE & ATTERBERG LIMITS (%) PL, MC, LL (10, 20, 30, 40)

SHEAR STRENGTH (KSF) (1, 2, 3, 4): ▽ HAND PENE. / TORVANE SHEAR / UNC. COMP. / VANE SHEAR (PK) / VANE SHEAR (REM) / TRIAXIAL (UU)

ELEVATION (FEET)	DEPTH (FEET)	PROFILE DESCRIPTION	SAMPLE TYPE/NO. INTERVAL	RECOVERY LENGTH (INCHES)	SPT BLOWS PER SIX INCHES	N_{60}	MC (%)	SHEAR STRENGTH (KSF)	REMARKS
965.4	1.0	12 inches of ASPHALT							
957.4	9.0	FILL- Sandy Clay with Shale- Trace Gravel- Trace Organics- Brown (CL)	SB1	10	12 9 9	25	11	4.5+	
			SB2	18	7 8 9	24	16	4.5+	
			SB3	18	4 5 5	14	17		
955.4	11.0	Sandy LEAN CLAY with Gravel Decomposed Root- Brown- Very Stiff (CL)	SB4	18	5 10 13	32	21 (PL 20, LL 29)		Glass and Organics
950.2	16.2	Weathered SHALE- Brown and Gray- Very Weak	SB5	18	18 24 30	75	10		
			SB6		50/2"	69+	9		Auger Refusal
940.4	26.0	SHALE- Gray- Unweathered to Slightly Weathered- Strong- Fractured	RC1	75					RC1 (16.2' - 26') REC= 63%, RQD= 39%; Compression test on specimen from 22.5 to 23 feet, 8.8 ksi.

END OF BORING AT 26.0 FEET.



GROUNDWATER & BACKFILL INFORMATION

	DEPTH (FT)	ELEV (FT)
▽ DURING BORING:	15.0	951.4

BACKFILL METHOD: Auger Cuttings & Concrete Cap

NOTES:
1. The indicated stratification lines are approximate. The in-situ transitions between materials may be gradual.
2. The colors depicted on the symbolic profile are solely for visualization purposes and do not necessarily represent the in-situ colors encountered.
3. No groundwater measurements were taken after the introduction of water in the coring process.

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SME

BORING B3

BORING DEPTH: 13.92 FEET

PROJECT NAME: Vincent Street Slope - GEO
PROJECT NUMBER: 087249.00
CLIENT: CT Consultants Inc
PROJECT LOCATION: Chagrin Falls, OH
DATE STARTED: 8/31/21
COMPLETED: 8/31/21
BORING METHOD: 4" Solid Stem Auger
DRILLER: JH & WI
RIG NO.: 293 (CME 55)
LOGGED BY: APP
CHECKED BY: AJE

LATITUDE: 41.61598
LONGITUDE: -81.35485
ELEVATION: 977.8 FT

HAMMER EFFICIENCY: 83%
DATE: 7/30/2020
N_{60} -- ○

DRY DENSITY (pcf) -- ■
MOISTURE & ATTERBERG LIMITS (%): PL, MC, LL
SHEAR STRENGTH (KSF): ▼ HAND PENE., TORVANE SHEAR, UNC. COMP., VANE SHEAR (PK), VANE SHEAR (REM), TRIAXIAL (UU)

DEPTH (FEET)	PROFILE DESCRIPTION	ELEVATION (FEET)
0.3	4 inches of ASPHALT	977.5
2.0	FILL- Asphalt and Cinders- Black- Loose	975.8
5.5	FILL- Lean Clay with Rock Fragments, Gravel and Sand- Brown- Medium Stiff (CL)	972.3
7.5	LEAN CLAY- Brown- Very Stiff (CL)	970.3
12.0	LEAN CLAY- Brown and Gray- Hard (CL)	965.8
13.9	SHALE- Brown and Gray- Very Weak	963.9
	END OF BORING AT 13.9 FEET.	

SAMPLE TYPE/NO. INTERVAL	RECOVERY LENGTH (INCHES)	SPT BLOWS PER SIX INCHES	N_{60}	MOISTURE (%)	SHEAR STRENGTH (KSF)	REMARKS
SB1	6	6 3 3	8	9		
SB2	10	2 2 3	7	14	▼	
SB3	18	3 6 8	19	19	▼	
SB4		7 7 9	22	18	4.5+ ▼	
SB5		50/4"	69+	9		

GROUNDWATER & BACKFILL INFORMATION

GROUNDWATER WAS NOT ENCOUNTERED

BACKFILL METHOD: Auger Cuttings & Cold Patch

NOTES: 1. The indicated stratification lines are approximate. The in-situ transitions between materials may be gradual.
2. The colors depicted on the symbolic profile are solely for visualization purposes and do not necessarily represent the in-situ colors encountered.

Project Name	Vincent Street Slope - GEO
Project No.	087249.00
Location	Chagrin Falls, Ohio
Date	12/9/2021

Hand Auger Data

HA1 - Upper Slope - Elevation 955 ft (+/-) - Coordinates 41.432553°, -81.388573°		
Top Depth (ft)	Bottom Depth (ft)	Description
0	1.5	Sandy Topsoil with Roots - Black
1.5	4	Fill - LEAN CLAY with Sand and Trace Gravel - Brown and Gray (CL)
4	6	Fill - LEAN CLAY with Sand - Brown and Gray (CL)
		***Shale encountered at approximately 6-feet below surface - 949 ft**

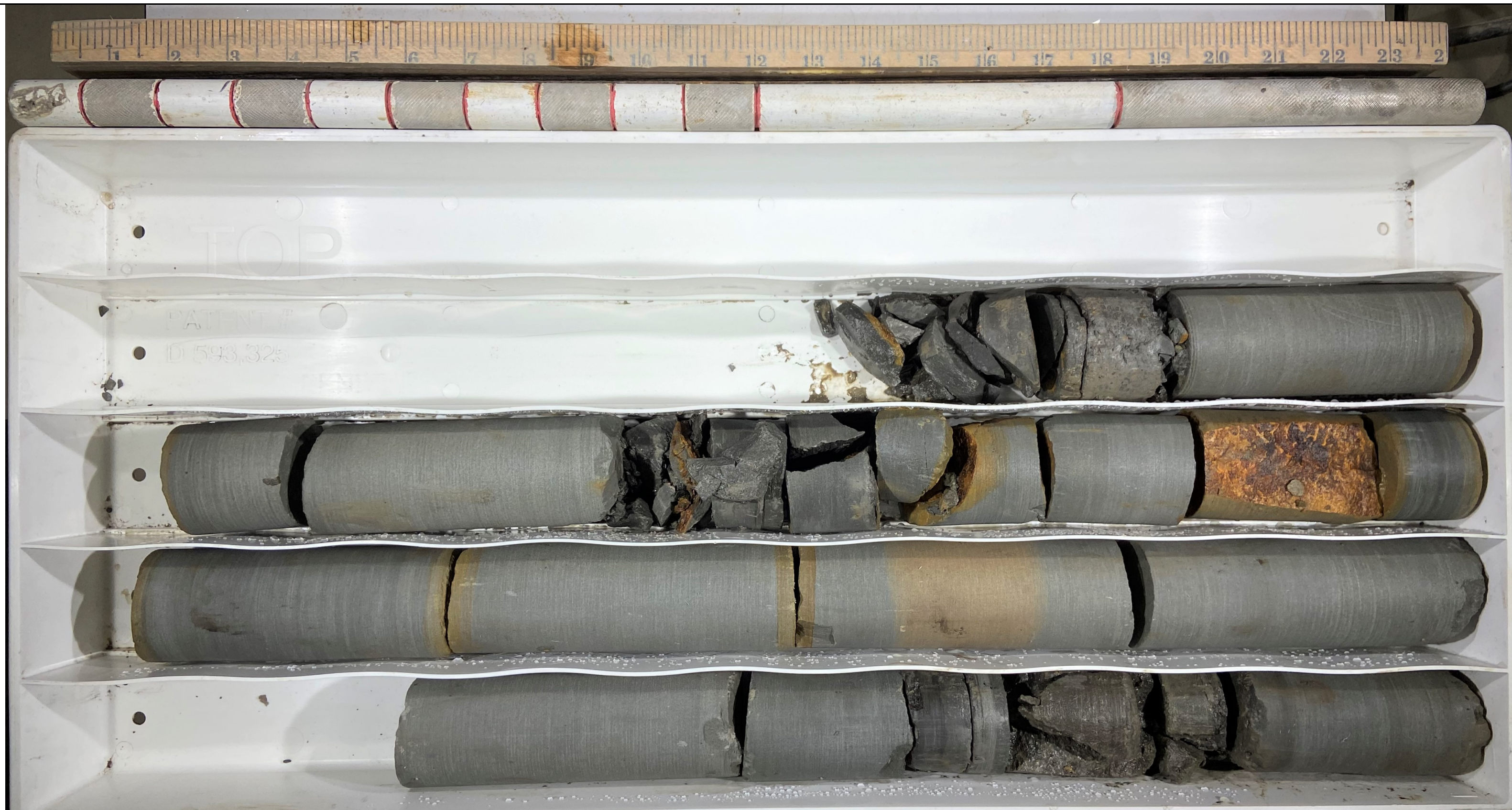
HA2 - Middle of Slope - Elevation 935 ft (+/-) - Coordinates 41.432587°, -81.388646°		
Top Depth (ft)	Bottom Depth (ft)	Description
0	0.5	Sandy Topsoil with Roots - Black
0.5	1.25	Fill - LEAN CLAY with Sand - Brown (CL)
1.25	4.5	Fill - LEAN CLAY with Sand and Gravel - Brown and Gray (CL)
		***Shale encountered at approximately 4.5-feet below surface - 930.5 ft**

HA3 - Bottom of Slope - Elevation 926 ft (+/-) - Coordinates 41.432618°, -81.388706°		
Top Depth (ft)	Bottom Depth (ft)	Description
0.5	2.5	Fill- LEAN CLAY with Sand, Gravel, Trace Organics - Brown and Gray (CL)
2.5	4	Fill- LEAN CLAY with Trace Sand - Brown and Gray (CL) (Borehole filled with water)
4	5	Fill- LEAN CLAY - Gray (CL)
		***Shale encountered at approximately 5-feet below surface - 921 ft**

Vincent Street Slope
Chagrin Falls, Ohio

SME Project No.: 087249.00
Core Date: August 30, 2021

B2						



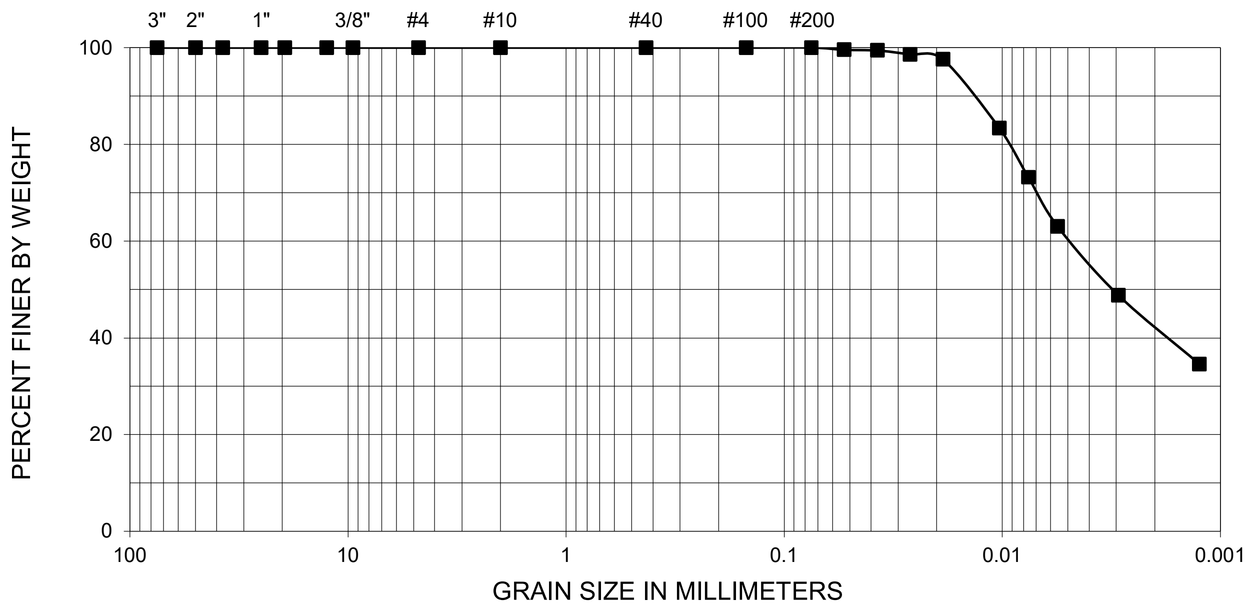
Run#:	**Depth**		**Recovery**		**RQD**	
1	16’	26’	75”/120”	63%	47”/120”	39%

Note: Except for the first two sections, gaps were left at the left end to avoid extra breaks needed to fit core into the core box. Core loss was at the top of the core run in what is believed to have been thinly interbedded very weak, highly weathered, and more intact rock, and is not due to voids in the rock.

SME
9375 CHILLICOTHE ROAD, KIRTLAND, OH 44094
PHONE: 440-256-6500 FAX: 440-256-6507

PARTICLE SIZE ANALYSIS WITH HYDROMETER ASTM D422

PROJECT INFORMATION		SAMPLE INFORMATION		
Project:	Vincent Street Slope	***ASTM Description***	lean clay (milled shale)	CL
Location:	Chagrin Falls, OH			
Project #:	087249.00	***OHIO Modified AASHTO***	Silty clay	A-6b (10)
Test Date:	September 27, 2021			
Sample #:	SB5	***Sample Location***	B-1; 13.5' - 15'	



SIEVE ANALYSIS

Sieve #	Sieve size, mm	Percent Passing
3"	75	100.0
2"	50	100.0
1-1/2"	37.5	100.0
1"	25	100.0
3/4"	19	100.0
3/8"	9.5	100.0
#4	4.75	100.0
#10	2	100.0
#40	0.43	100.0
#100	0.15	100.0
#200	0.074	100.0
#270	0.053	99.6

HYDROMETER ANALYSIS

Particle Size	Percent Passing
0.074 mm	100.0
0.053 mm	99.6
0.005 mm	60.8
0.0013 mm	34.6

ATTERBERG LIMITS

LIQUID LIMIT	40
PLASTIC LIMIT	24
PLASTICITY INDEX	16

PARTICLE DISTRIBUTION

D_{10}	NA	mm
D_{30}	NA	mm
D_{60}	0.005	mm
C_c	NA	
C_u	NA	

DISPERSION

Device	ASTM D422, Type A
Agent	Sodium Hexametaphosphate
Time in Agent	16 Hours

SAND AND GRAVEL DESCRIPTION

SHAPE	Angular
HARDNESS	Hard and durable

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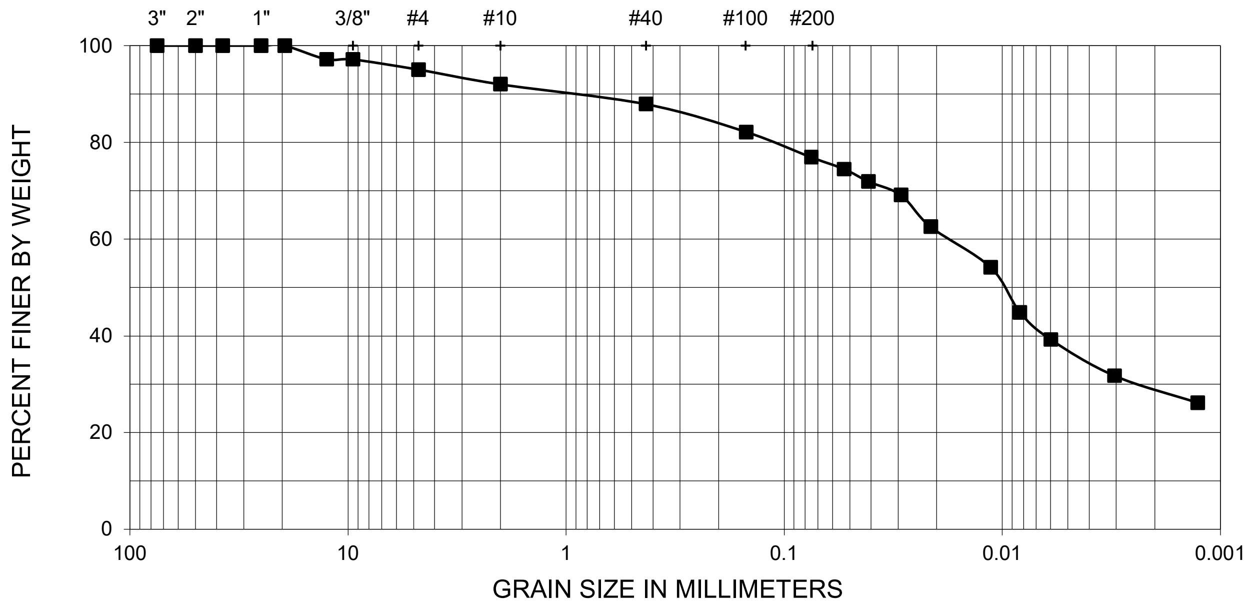
PARTICLE SIZE ANALYSIS WITH HYDROMETER ASTM D422

PROJECT INFORMATION		SAMPLE INFORMATION		
Project:	Vincent Street Slope	***ASTM Description***	lean clay with sand	CL
Location:	Chagrin Falls, OH			
Project #:	087249.00	***OHIO Modified AASHTO***	Sandy silt	A-4a (8)
Test Date:	September 27, 2021			
Sample #:	SB4	***Sample Location***	B-2; 8.5' - 10'	



SIEVE ANALYSIS

Sieve #	Sieve size, mm	Percent Passing
3"	75	100.0
2"	50	100.0
1-1/2"	37.5	100.0
1"	25	100.0
3/4"	19	100.0
3/8"	9.5	97.2
#4	4.75	95.0
#10	2	92.0
#40	0.43	87.9
#100	0.15	82.1
#200	0.074	76.9
#270	0.053	74.5

HYDROMETER ANALYSIS

Particle Size	Percent Passing
0.074 mm	76.9
0.053 mm	74.5
0.005 mm	37.1
0.0013 mm	26.1

ATTERBERG LIMITS

LIQUID LIMIT	29
PLASTIC LIMIT	20
PLASTICITY INDEX	9

PARTICLE DISTRIBUTION

D_{10}	NA	mm
D_{30}	0.002	mm
D_{60}	0.018	mm
C_c	NA	
C_u	NA	

DISPERSION

Device	ASTM D422, Type A
Agent	Sodium Hexametaphosphate
Time in Agent	16 Hours

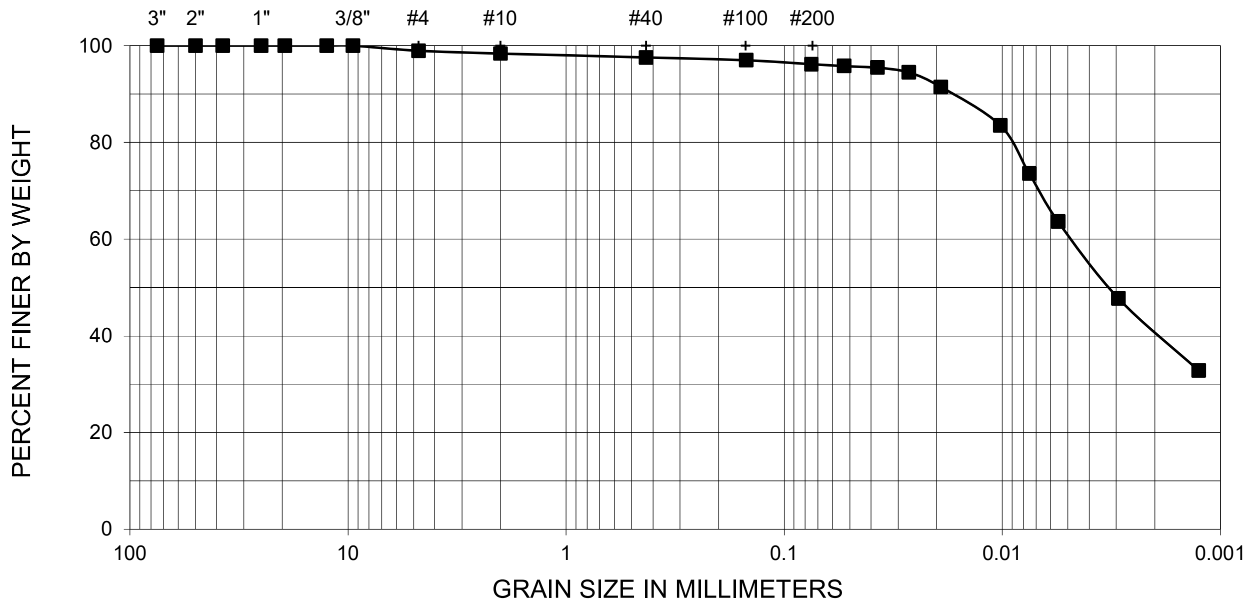
SAND AND GRAVEL DESCRIPTION

SHAPE	Angular
HARDNESS	Hard and durable

9375 CHILLICOTHE ROAD, KIRTLAND, OH 44094
PHONE: 440-256-6500 FAX: 440-256-6507

PARTICLE SIZE ANALYSIS WITH HYDROMETER ASTM D422

PROJECT INFORMATION		SAMPLE INFORMATION		
Project:	Vincent Street Slope	***ASTM Description***	lean clay	CL
Location:	Chagrin Falls, OH			
Project #:	087249.00	***OHIO Modified AASHTO***	Silt and clay	A-6a (10)
Test Date:	September 27, 2021			
Sample #:	SB4	***Sample Location***	B-1; 8.5' - 10'	



SIEVE ANALYSIS

Sieve #	Sieve size, mm	Percent Passing
3"	75	100.0
2"	50	100.0
1-1/2"	37.5	100.0
1"	25	100.0
3/4"	19	100.0
3/8"	9.5	100.0
#4	4.75	98.9
#10	2	98.4
#40	0.43	97.6
#100	0.15	97.0
#200	0.074	96.2
#270	0.053	95.8

DISPERSION

Device	ASTM D422, Type A
Agent	Sodium Hexametaphosphate
Time in Agent	16 Hours

HYDROMETER ANALYSIS

Particle Size	Percent Passing
0.074 mm	96.2
0.053 mm	95.8
0.005 mm	60.8
0.0013 mm	32.8

ATTERBERG LIMITS

LIQUID LIMIT	39
PLASTIC LIMIT	24
PLASTICITY INDEX	15

PARTICLE DISTRIBUTION

D_{10}	NA	mm
D_{30}	NA	mm
D_{60}	0.005	mm
C_c	NA	
C_u	NA	

SAND AND GRAVEL DESCRIPTION

SHAPE	Angular
HARDNESS	Hard and durable

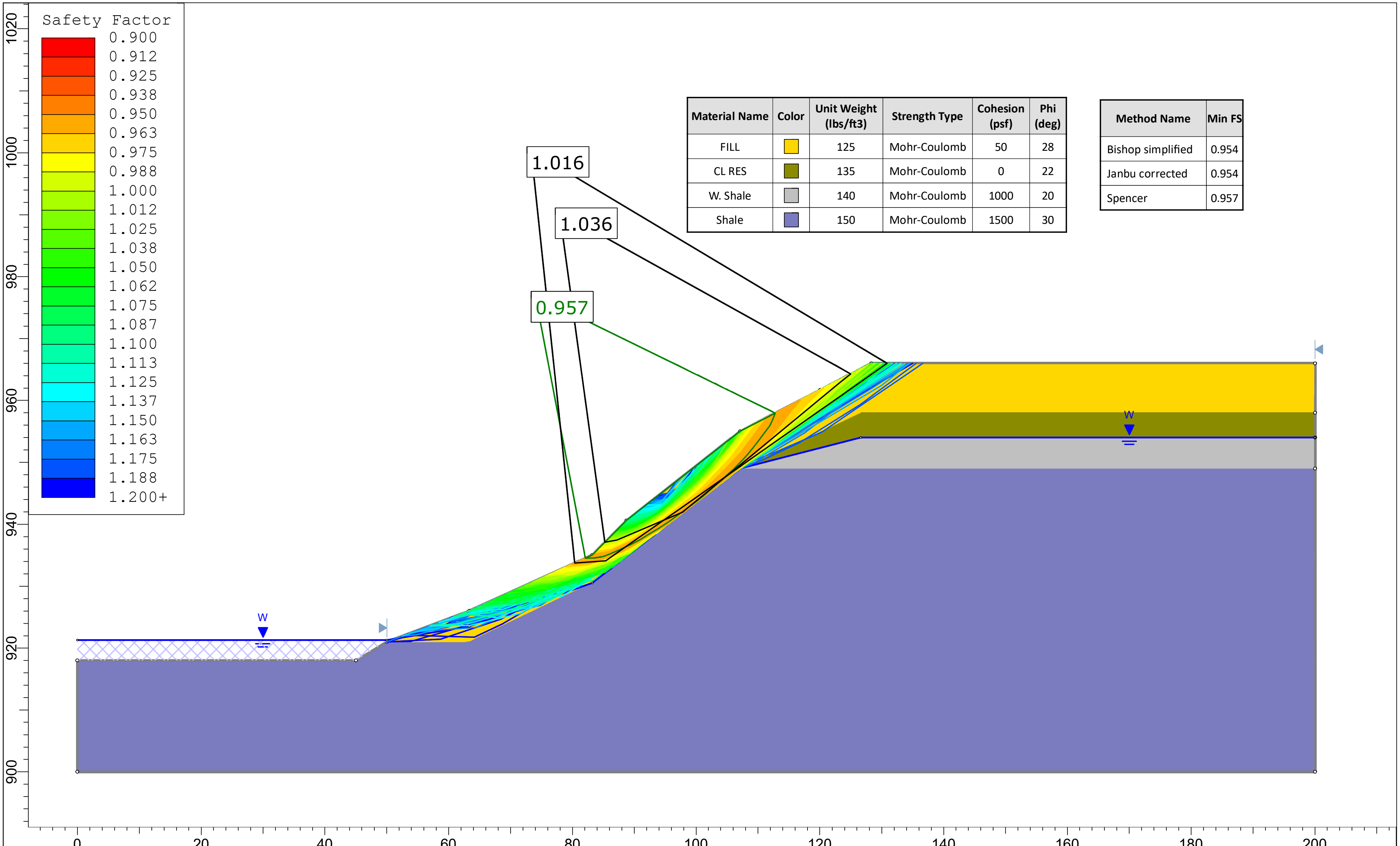
SME
9375 CHILLICOTHE ROAD, KIRTLAND, OH 44094
PHONE: 440-256-6500 FAX: 440-256-6507

Compressive Strength of Intact Rock Core Specimens
ASTM D7012

PROJECT	Vincent Street Slope - GEO
LOCATION	Chagrin Falls, OH
DATE	September 24, 2021
PROJECT #	087249.00
CLIENT	CT Consultants Inc.

SAMPLE	**1**	**2**	**3**	**4**
				
SAMPLE LOCATION	22.5' - 23'			
DATE TESTED	September 24, 2021			
ORIGINAL LENGTH, in	---			
CAPPED LENGTH, in	4.57			
DIAMETER, in	1.98			
AREA, sq. in.	3.08			
LOAD AT FAILURE, lbs.	27,070			
GROSS UNIT STRESS, psi	**8,786**			
LENGTH/DIAMETER RATIO	2.3			
MOISTURE CONDITION WHEN TESTED	MOIST			

REMARKS:
Samples tested do not meet the requirements for sample preparation per ASTM D4543



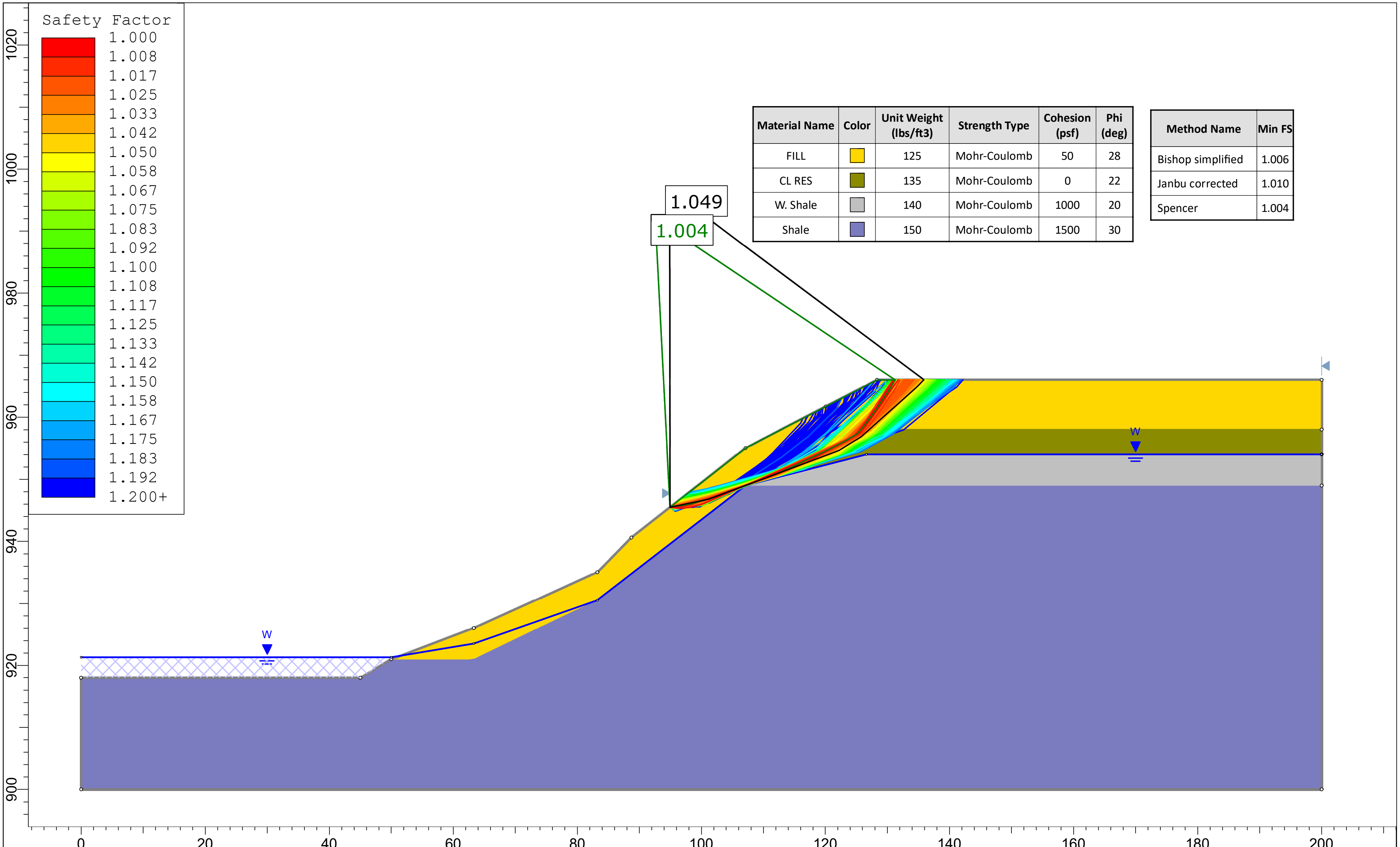
Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)
FILL		125	Mohr-Coulomb	50	28
CL RES		135	Mohr-Coulomb	0	22
W. Shale		140	Mohr-Coulomb	1000	20
Shale		150	Mohr-Coulomb	1500	30

Method Name	Min FS
Bishop simplified	0.954
Janbu corrected	0.954
Spencer	0.957

SME

SLIDEINTERPRET 8.032

Project	087249.00 Vincent Street Slope - GEO		
Analysis Description	Full Height Slope - Non-Circular Slope Stability Analysis		
Drawn By	BPL	*Company*	SME
Date:	1/13/2022	*File Name*	087249.00 Vincent Street Slope.slmd



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)
FILL		125	Mohr-Coulomb	50	28
CL RES		135	Mohr-Coulomb	0	22
W. Shale		140	Mohr-Coulomb	1000	20
Shale		150	Mohr-Coulomb	1500	30

Method Name	Min FS
Bishop simplified	1.006
Janbu corrected	1.010
Spencer	1.004

SME

SLIDEINTERPRET 8.032

Project	087249.00 Vincent Street Slope - GEO		
Analysis Description	Upper Slope - Non-Circular Slope Stability Analysis		
Drawn By	BPL	*Company*	SME
Date:	1/13/2022	*File Name*	087249.00 Vincent Street Slope.slmd

APPENDIX B

IMPORTANT INFORMATION ABOUT THIS GEOTECHNICAL ENGINEERING REPORT

GENERAL COMMENTS

Important Information about This

Geotechnical-Engineering Report

Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes.

While you cannot eliminate all such risks, you can manage them. The following information is provided to help.

The Geoprofessional Business Association (GBA) has prepared this advisory to help you – assumedly a client representative – interpret and apply this geotechnical-engineering report as effectively as possible. In that way, clients can benefit from a lowered exposure to the subsurface problems that, for decades, have been a principal cause of construction delays, cost overruns, claims, and disputes. If you have questions or want more information about any of the issues discussed below, contact your GBA-member geotechnical engineer. Active involvement in the Geoprofessional Business Association exposes geotechnical engineers to a wide array of risk-confrontation techniques that can be of genuine benefit for everyone involved with a construction project.

Geotechnical-Engineering Services Are Performed for Specific Purposes, Persons, and Projects

Geotechnical engineers structure their services to meet the specific needs of their clients. A geotechnical-engineering study conducted for a given civil engineer will not likely meet the needs of a civil-works constructor or even a different civil engineer. Because each geotechnical-engineering study is unique, each geotechnical-engineering report is unique, prepared *solely* for the client. *Those who rely on a geotechnical-engineering report prepared for a different client can be seriously misled.* No one except authorized client representatives should rely on this geotechnical-engineering report without first conferring with the geotechnical engineer who prepared it. *And no one – not even you – should apply this report for any purpose or project except the one originally contemplated.*

Read this Report in Full

Costly problems have occurred because those relying on a geotechnical-engineering report did not read it *in its entirety*. Do not rely on an executive summary. Do not read selected elements only. *Read this report in full.*

You Need to Inform Your Geotechnical Engineer about Change

Your geotechnical engineer considered unique, project-specific factors when designing the study behind this report and developing the confirmation-dependent recommendations the report conveys. A few typical factors include:

- the client's goals, objectives, budget, schedule, and risk-management preferences;
- the general nature of the structure involved, its size, configuration, and performance criteria;
- the structure's location and orientation on the site; and
- other planned or existing site improvements, such as retaining walls, access roads, parking lots, and underground utilities.

Typical changes that could erode the reliability of this report include those that affect:

- the site's size or shape;
- the function of the proposed structure, as when it's changed from a parking garage to an office building, or from a light-industrial plant to a refrigerated warehouse;
- the elevation, configuration, location, orientation, or weight of the proposed structure;
- the composition of the design team; or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project changes – even minor ones – and request an assessment of their impact. *The geotechnical engineer who prepared this report cannot accept responsibility or liability for problems that arise because the geotechnical engineer was not informed about developments the engineer otherwise would have considered.*

This Report May Not Be Reliable

Do not rely on this report if your geotechnical engineer prepared it:

- for a different client;
- for a different project;
- for a different site (that may or may not include all or a portion of the original site); or
- before important events occurred at the site or adjacent to it; e.g., man-made events like construction or environmental remediation, or natural events like floods, droughts, earthquakes, or groundwater fluctuations.

Note, too, that it could be unwise to rely on a geotechnical-engineering report whose reliability may have been affected by the passage of time, because of factors like changed subsurface conditions; new or modified codes, standards, or regulations; or new techniques or tools. *If your geotechnical engineer has not indicated an "apply-by" date on the report, ask what it should be*, and, in general, *if you are the least bit uncertain* about the continued reliability of this report, contact your geotechnical engineer before applying it. A minor amount of additional testing or analysis – if any is required at all – could prevent major problems.

Most of the "Findings" Related in This Report Are Professional Opinions

Before construction begins, geotechnical engineers explore a site's subsurface through various sampling and testing procedures. *Geotechnical engineers can observe actual subsurface conditions only at those specific locations where sampling and testing were performed.* The data derived from that sampling and testing were reviewed by your geotechnical engineer, who then applied professional judgment to form opinions about subsurface conditions throughout the site. Actual sitewide-subsurface conditions may differ – maybe significantly – from those indicated in this report. Confront that risk by retaining your geotechnical engineer to serve on the design team from project start to project finish, so the individual can provide informed guidance quickly, whenever needed.

This Report's Recommendations Are Confirmation-Dependent

The recommendations included in this report – including any options or alternatives – are confirmation-dependent. In other words, *they are not final*, because the geotechnical engineer who developed them relied heavily on judgment and opinion to do so. Your geotechnical engineer can finalize the recommendations *only after observing actual subsurface conditions* revealed during construction. If through observation your geotechnical engineer confirms that the conditions assumed to exist actually do exist, the recommendations can be relied upon, assuming no other changes have occurred. *The geotechnical engineer who prepared this report cannot assume responsibility or liability for confirmation-dependent recommendations if you fail to retain that engineer to perform construction observation.*

This Report Could Be Misinterpreted

Other design professionals' misinterpretation of geotechnical-engineering reports has resulted in costly problems. Confront that risk by having your geotechnical engineer serve as a full-time member of the design team, to:

- confer with other design-team members,
- help develop specifications,
- review pertinent elements of other design professionals' plans and specifications, and
- be on hand quickly whenever geotechnical-engineering guidance is needed.

You should also confront the risk of constructors misinterpreting this report. Do so by retaining your geotechnical engineer to participate in prebid and preconstruction conferences and to perform construction observation.

Give Constructors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can shift unanticipated-subsurface-conditions liability to constructors by limiting the information they provide for bid preparation. To help prevent the costly, contentious problems this practice has caused, include the complete geotechnical-engineering report, along with any attachments or appendices, with your contract documents, *but be certain to note conspicuously that you've included the material for informational purposes only*. To avoid misunderstanding, you may also want to note that "informational purposes" means constructors have no right to rely on the interpretations, opinions, conclusions, or recommendations in the report, but they may rely on the factual data relative to the specific times, locations, and depths/elevations referenced. Be certain that constructors know they may learn about specific project requirements, including options selected from the report, *only* from the design drawings and specifications. Remind constructors that they may perform their own studies if they want to, and *be sure to allow enough time* to permit them to do so. Only then might you be in a position to give constructors the information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions. Conducting prebid and preconstruction conferences can also be valuable in this respect.

Read Responsibility Provisions Closely

Some client representatives, design professionals, and constructors do not realize that geotechnical engineering is far less exact than other engineering disciplines. That lack of understanding has nurtured unrealistic expectations that have resulted in disappointments, delays, cost overruns, claims, and disputes. To confront that risk, geotechnical engineers commonly include explanatory provisions in their reports. Sometimes labeled "limitations," many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely*. Ask questions. Your geotechnical engineer should respond fully and frankly.

Geoenvironmental Concerns Are Not Covered

The personnel, equipment, and techniques used to perform an environmental study – e.g., a "phase-one" or "phase-two" environmental site assessment – differ significantly from those used to perform a geotechnical-engineering study. For that reason, a geotechnical-engineering report does not usually relate any environmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated subsurface environmental problems have led to project failures*. If you have not yet obtained your own environmental information, ask your geotechnical consultant for risk-management guidance. As a general rule, *do not rely on an environmental report prepared for a different client, site, or project, or that is more than six months old.*

Obtain Professional Assistance to Deal with Moisture Infiltration and Mold

While your geotechnical engineer may have addressed groundwater, water infiltration, or similar issues in this report, none of the engineer's services were designed, conducted, or intended to prevent uncontrolled migration of moisture – including water vapor – from the soil through building slabs and walls and into the building interior, where it can cause mold growth and material-performance deficiencies. Accordingly, ***proper implementation of the geotechnical engineer's recommendations will not of itself be sufficient to prevent moisture infiltration.*** Confront the risk of moisture infiltration by including building-envelope or mold specialists on the design team. ***Geotechnical engineers are not building-envelope or mold specialists.***

GEOPROFESSIONAL
BUSINESS
ASSOCIATION

Telephone: 301/565-2733
e-mail: info@geoprofessional.org www.geoprofessional.org

GENERAL COMMENTS

BASIS OF GEOTECHNICAL REPORT

This report has been prepared in accordance with generally accepted geotechnical engineering practices to assist in the design and/or evaluation of this project. If the project plans, design criteria, and other project information referenced in this report and utilized by SME to prepare our recommendations are changed, the conclusions and recommendations contained in this report are not considered valid unless the changes are reviewed, and the conclusions and recommendations of this report are modified or approved in writing by our office.

The discussions and recommendations submitted in this report are based on the available project information, described in this report, and the geotechnical data obtained from the field exploration at the locations indicated in the report. Variations in the soil and groundwater conditions commonly occur between or away from sampling locations. The nature and extent of the variations may not become evident until the time of construction. If significant variations are observed during construction, SME should be contacted to reevaluate the recommendations of this report. SME should be retained to continue our services through construction to observe and evaluate the actual subsurface conditions relative to the recommendations made in this report.

In the process of obtaining and testing samples and preparing this report, procedures are followed that represent reasonable and accepted practice in the field of soil and foundation engineering. Specifically, field logs are prepared during the field exploration that describe field occurrences, sampling locations, and other information. Samples obtained in the field are frequently subjected to additional testing and reclassification in the laboratory and differences may exist between the field logs and the report logs. The engineer preparing the report reviews the field logs, laboratory classifications, and test data and then prepares the report logs. Our recommendations are based on the contents of the report logs and the information contained therein.

REVIEW OF DESIGN DETAILS, PLANS, AND SPECIFICATIONS

SME should be retained to review the design details, project plans, and specifications to verify those documents are consistent with the recommendations contained in this report.

REVIEW OF REPORT INFORMATION WITH PROJECT TEAM

Implementation of our recommendations may affect the design, construction, and performance of the proposed improvements, along with the potential inherent risks involved with the proposed construction. The client and key members of the design team, including SME, should discuss the issues covered in this report so that the issues are understood and applied in a manner consistent with the owner's budget, tolerance of risk, and expectations for performance and maintenance.

FIELD VERIFICATION OF GEOTECHNICAL CONDITIONS

SME should be retained to verify the recommendations of this report are properly implemented during construction. This may avoid misinterpretation of our recommendations by other parties and will allow us to review and modify our recommendations if variations in the site subsurface conditions are encountered.

PROJECT INFORMATION FOR CONTRACTOR

This report and any future addenda or other reports regarding this site should be made available to prospective contractors prior to submitting their proposals for their information only and to supply them with facts relative to the subsurface evaluation and laboratory test results. If the selected contractor encounters subsurface conditions during construction, which differ from those presented in this report, the contractor should promptly describe the nature and extent of the differing conditions in writing and SME should be notified so that we can verify those conditions. The construction contract should include provisions for dealing with differing conditions and contingency funds should be reserved for potential problems during earthwork and foundation construction. We would be pleased to assist you in developing the contract provisions based on our experience.

The contractor should be prepared to handle environmental conditions encountered at this site, which may affect the excavation, removal, or disposal of soil; dewatering of excavations; and health and safety of workers. Any Environmental Assessment reports prepared for this site should be made available for review by bidders and the successful contractor.

THIRD PARTY RELIANCE/REUSE OF THIS REPORT

This report has been prepared solely for the use of our Client for the project specifically described in this report. This report cannot be relied upon by other parties not involved in the project, unless specifically allowed by SME in writing. SME also is not responsible for the interpretation by other parties of the geotechnical data and the recommendations provided herein.