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Chosen Valley Testing

Design Phase Geotechnical Evaluation:

Proposed Trail Bridge
Gandy Dancer Trail
Town of Summit, Douglas County, Wisconsin

Prepared for:

Mr. Troy Peterson, PE
Cedar Corporation

April 30, 2021
17813.21.WIL

Certification:

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

Devin M. Ehler, PE
Geotechnical Engineer
Registration Number 44630
Date: April 30, 2021

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Chosen Valley Testing, Inc.

Geotechnical Engineering and Testing • 1019 Second Avenue SW • Onalaska, WI 54650 • Telephone (608) 782-5505• Fax (608) 785-2818

Mr. Troy Peterson, PE
Cedar Corporation
604 Wilson Avenue
Menomonie, WI 54751
troy.peterson@cedarcorp.com

April 30, 2021

Re: Design Phase Geotechnical Evaluation
Proposed Trail Bridge
Gandy Dancer Trail
Town of Summit, Douglas County, Wisconsin
CVT Project Number: 18037.21.WIL

Dear Mr. Peterson,

As authorized, we have completed the geotechnical evaluation for the proposed Gandy Dancer Trail bridge in Town of Summit, Douglas County, Wisconsin. This letter briefly summarizes the findings in the attached report.

Summary of Boring Results

At the surface, the borings encountered about 2 feet of aggregate over fill materials to depths of approximately 62 ½ to 72 ½ feet. Samples taken within the fill materials primarily consisted of relatively clean sands and silty sand, along with trace amounts of metal and wood debris at various depths.

Beneath the fill materials, glacial sand, silty sand, and clayey sand were met to depths of about 85 to 87½. Weathered sandstone followed to termination depths around 90 feet below the surface.

Water was observed in the borings around 67 to 78 feet below the surface during our exploration. The depths correspond near elevations 946 ½ to 957 feet. Groundwater levels at the site are expected to fluctuate seasonally, similar to water levels in the creek, as well as with local weather patterns.

Summary of Analysis and Recommendations

Desired pile resistances are expected to be achieved for 10x42 H-piles in the glacial sands around 65 to 80 feet below the top of the existing trail and for closed-ended 10 ¾-inch CIP pile in the glacial sands or weathered sandstone around 70 to 90 feet below the top of the existing trail. However, setup capacities could take a longer for H-piles to attain full static capacities due to their shape. Therefore, CIP piles are recommended for piles planned to end bear in soils. Alternatively, typical nominal (ultimate) resistances of 180 tons as stated by the WisDOT would be achievable for 10x42 H-pile end bearing in weathered sandstone which was encountered around 90 feet in the borings.

Driven piles should be equipped with tip protection since very dense soils and weathered sandstone are expected to be encountered with depth. As a result of the soils on site being dominantly granular and with preliminary plans to lower grades at the bridge, potential downdrag loads are expected to be negligible.

Remarks

CVT appreciates the opportunity to provide geotechnical services on this project. The attached report provides further details of our analysis. If you have any questions about our report, please feel free to contact us at (608) 782-5505 or (507) 281-0968.

Sincerely,
Chosen Valley Testing, Inc.

Devin M. Ehler, PE
Geotechnical Engineer

TABLE OF CONTENTS

Design Phase Geotechnical Evaluation
Proposed Trail Bridge
Gandy Dancer Trail
Town of Summit, Douglas County, Wisconsin

CVT Project Number: 17813.21.WIL
Date: April 30, 2021

A. Introduction

The intent of this report is to present our results to the client in the same logical sequence that led us to arrive at the opinions and recommendations expressed. Since our services must often be completed before the design, assumptions are sometimes needed to prepare a proper evaluation and to analyze the data. A complete and thorough review of this entire document, including the assumptions and the appendices, should be undertaken immediately upon receipt.

A.1. Purpose

This geotechnical evaluation was prepared to assist the design of the proposed Gandy Dancer Trail bridge in Town of Summit, Douglas County, Wisconsin. Our services were authorized by Mr. Troy Peterson, PE of Cedar Corporation.

A.2. Scope

To obtain data for analysis, we were authorized to perform 4 penetration test borings. The borings were drilled to depths of approximately 90 feet. Our engineering scope consisted of providing geotechnical recommendations for support of the proposed trail bridge.

A.3. Boring Location and Elevation

The boring locations were selected by Chosen Valley Testing based on a Wisconsin DNR conceptual elevation view plan, provided by Cedar Corporation. The approximate location of the borings as drilled are indicated on the Boring Location Sketch in the Appendix.

Ground surface elevations were estimated at the borings using a laser level. The control point above the center of the existing culvert was used as a benchmark and is understood to be near elevation 1023.988 feet.

A.4. Geologic Background

A geotechnical report is based on subsurface data collected for the specific structure or problem. Available geologic data from the region can help interpretation of the data and is briefly summarized in this section.

Geologic maps and nearby well logs indicate that the uppermost soils in the area are primarily fill materials and alluvial (water-deposited) clays and silts over glacial deposited clays and sands. Bedrock is commonly on the order of 50 to 100 feet below the surface with the uppermost formation consisting of sandstone.

B. Subsurface Data

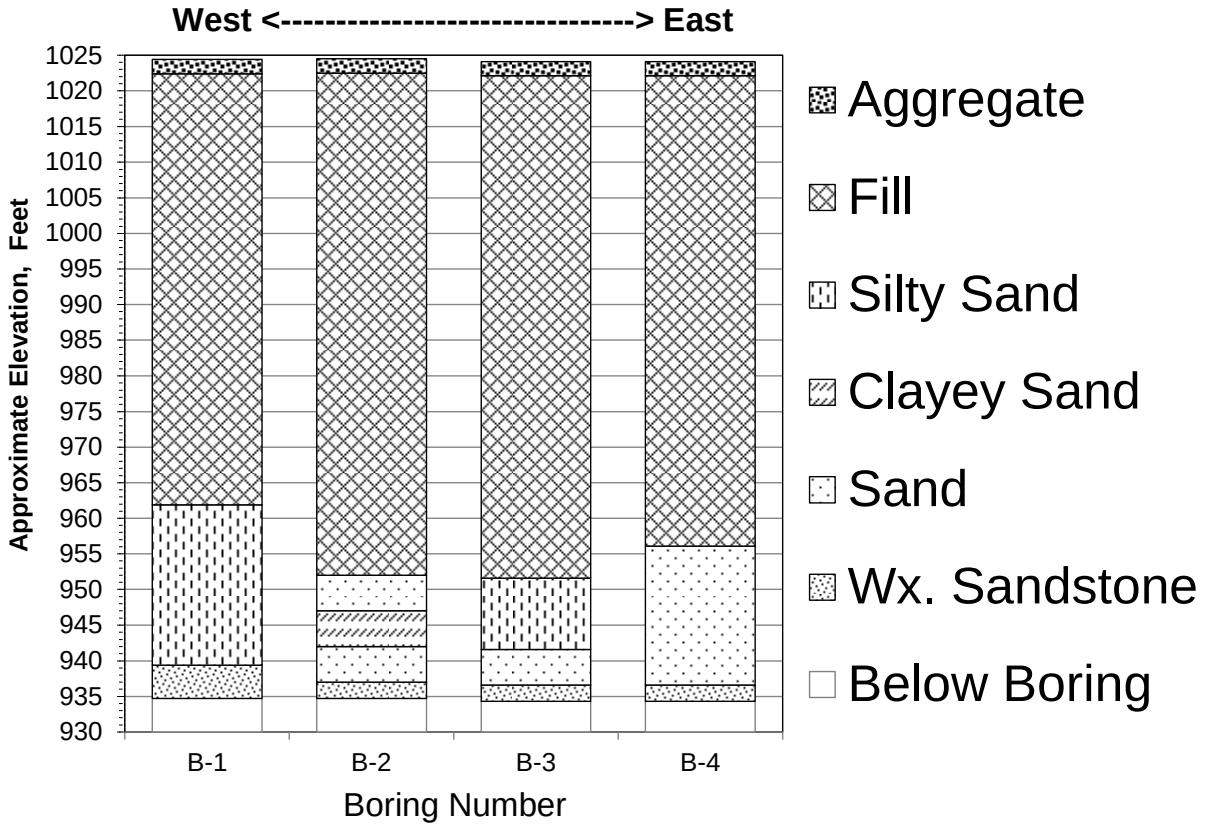
Methods: The borings were performed using penetration test procedures (Method of Test D1586 of the American Society for Testing and Materials). This procedure allows for the extraction of intact soil specimen from deep in the ground. With this method, a hollow-stem auger is drilled to the desired sampling depth. A 2-inch OD sampling tube is then screwed onto the end of a sampling rod, inserted through the hole in the auger's tip, and then driven into the soil with a 140-pound hammer dropped repeatedly from a height of 30 inches above the sampling rod. The sampler is driven 18 inches into the soil, unless the material is too hard. The samples are generally taken at 2½, 5, and 10-foot intervals. The core of soil obtained is classified and logged by the driller and a representative portion is then sealed and delivered to the soils engineer for review.

B.1. Stratification

At the surface, the borings encountered about 2 feet of aggregate over fill materials to depths of approximately 62 ½ to 72 ½ feet. Samples taken within the fill materials primarily consisted of relatively clean sands and silty sand, along with trace amounts of metal and wood debris at various depths.

Beneath the fill materials, glacial sand, silty sand, and clayey sand were met to depths of about 85 to 87½. Weathered sandstone followed to termination depths around 90 feet below the surface.

The boring data has been summarized in the following cross-section. For more detailed information, please refer to the individual Log of Boring sheets in the Appendix.



B.2. Penetration Test Results

The number of blows needed for the hammer to advance the penetration test sampler is an indicator of soil characteristics. The number of blows to advance the sampler 1 foot is called the penetration resistance or "N"-value. The results tend to be more meaningful for natural mineral soils, than for fill soils. In fill soils, compaction tests are more meaningful.

Penetration resistance values (N-values) of 1 to 15 BPF (Blows per Foot) were recorded in the fill materials, indicating they were very loose to medium dense, but mostly they were very loose to loose.

The glacial sand returned values of 6 BPF to 50 hammer blows for 4 inches of sampler advancement, indicating it was loose to very dense, but was mainly medium dense to very dense. Resistance values ranging from 32 BPF to 50 hammer blows for 2 inches of sampler advancement were recorded in the glacial silty sand and clayey sand, indicating they were dense to very dense. The weathered sandstone returned penetration tests of 50 hammer blows for 2 to 4 inches of sampler advancement, indicating it was very dense.

A key to the descriptors used to qualify the relative density of soil (such as *soft, stiff, loose,* and *dense*) can be found on the Legend to Soil Description in the Appendix.

B.3. Groundwater Data

During the drilling operation, the drillers may note the presence of moisture on the sampling instrument, in the cuttings, or within the borehole. These observations are recorded on the boring logs. The water level may vary with weather, time of year and other factors and the presence or absence of water during the drilling is subject to interpretation and is not always conclusive.

Water was observed in the borings around 67 to 78 feet below the surface during our exploration. The depths correspond near elevations 946 ½ to 957 feet. Groundwater levels at the site are expected to fluctuate seasonally, similar to water levels in the creek, as well as with local weather patterns.

C. Project Design Data

Each structure has a different loading configuration and intensity, different grades, and different structural and performance tolerances. Therefore, the geotechnical exploration will be construed differently from one structure to another. If the initial structure should change design, we should be engaged to review these conditions with respect to the prevailing soil conditions. Without the opportunity to review any such changes, the recommendations may no longer be valid or appropriate.

The project consists of replacing the existing culvert with a new trail bridge along the Gandy Dancer Trail crossing over the Little Balsam Creek in the Town of Summit, Douglas County, Wisconsin. Preliminary plans are for the trail bridge to be a 170-foot long, single-span or three-span structure constructed along a similar alignment to the existing trail and about 27 feet below existing trail surface grades. Piling is expected to be used for support and is assumed to be designed for resistances of about 40 to 60 tons per pile.

D. Analysis

Desired pile resistances are expected to be achieved for 10x42 H-piles in the glacial sands around 65 to 80 feet below the top of the existing trail and for closed-ended 10 ¾-inch CIP pile in the glacial sands or weathered sandstone around 70 to 90 feet below the top of the existing trail. However, setup capacities could take a longer for H-piles to attain full static capacities due to their shape. Therefore, CIP piles are recommended for piles planned to end bear in soils. Alternatively, typical nominal (ultimate) resistances of 180 tons as stated by the WisDOT would be achievable for 10x42 H-pile end bearing in weathered sandstone which was encountered around 90 feet in the borings.

Driven piles should be equipped with tip protection since very dense soils and weathered sandstone are expected to be encountered with depth. As a result of the soils on site being dominantly granular and with preliminary plans to lower grades at the bridge, potential downdrag loads are expected to be negligible.

E. Piling Recommendations

E.1. Pile Depths and Capacities

A static pile capacity analysis was performed using the Ensoft, Inc. Engineering Software APILE and the boring data. An analysis was performed on 10x42 H-piles and closed-ended 10 ¾-inch CIP pile at the abutments and potential piers. The pile tip area used in the analysis for 10x42 H-piles was 0.679 ft.^{2} and the pile circumference was 3.296 ft. For 10 ¾-inch CIP piles, the pile tip area used in the analysis was 0.63 ft.^{2} and the pile circumference was 2.814 ft. Foundations at the abutments are assumed to bear about 37 feet below existing grades at the top of the trail and about 47 feet below existing grades at the top of the trail at the potential piers.

The results of our analysis are provided in the following tables below and on the next two pages. The capacities should be multiplied by the appropriate pile surface areas. The skin friction and end bearing capacities shown are the nominal (ultimate) values and should be reduced by a resistance factor (Φstat) of 0.45 for static analysis and a resistance factor (Φdyn) of 0.5 for analysis in the field during pile driving using the modified Gates dynamic formula, as recommended by WisDOT.

10x42 H-pile

Boring	Soil Type	Elevation	Friction Angle	Cohesion	Unit Weight	Skin Friction Capacity	End Bearing Capacity
		(feet)	(degrees)	(psf)	(pcf)	(psf)	(psf)
B-1	Fill	1022.5-962	27	--	120	1,350	1,500
	Silty Sand, SM	962-946.5	34.5	--	125	3,400	8,000
	Silty Sand, SM	946.5-939.5	31.5	--	125	3,200	3,000
	Weathered Sandstone	939.5-934.5	43	--	130	5,000	600,000

10x42 H-pile (continued)

Boring	Soil Type	Elevation	Friction Angle	Cohesion	Unit Weight	Skin Friction Capacity	End Bearing Capacity
		(feet)	(degrees)	(psf)	(pcf)	(psf)	(psf)
B-2	Fill	1022.5-956.5	27	--	120	1,600	1,500
	Fill	956.5-952	28	--	120	2,000	1,900
	P-G Sand, SP	952-947	31.5	--	120	2,600	4,500
	Clayey Sand, SC	947-942	34.5	--	125	3,400	9,500
	P-G Sand w/ Silt, SP-SM	942-937	30.5	--	120	3,000	17,500
	Weathered Sandstone	937-934.5	43	--	130	5,000	600,000

Boring	Soil Type	Elevation	Friction Angle	Cohesion	Unit Weight	Skin Friction Capacity	End Bearing Capacity
		(feet)	(degrees)	(psf)	(pcf)	(psf)	(psf)
B-3	Fill	1022-957	28	--	120	1,700	1,500
	Fill	957-951.5	27	--	120	1,900	1,500
	Silty Sand, SM	951.5-941.5	37.5	--	125	4,300	30,000
	P-G Sand w/ Silt, SP-SM	941.5-936.5	38.5	--	120	5,000	36,000
	Weathered Sandstone	936.5-934	43	--	130	5,000	600,000

Boring	Soil Type	Elevation	Friction Angle	Cohesion	Unit Weight	Skin Friction Capacity	End Bearing Capacity
		(feet)	(degrees)	(psf)	(pcf)	(psf)	(psf)
B-4	Fill	1022-956	27	--	120	1,500	1,500
	P-G Sand w/ Silt, SP-SM	956-946	27	--	120	1,900	1,500
	P-G Sand w/ Silt, SP-SM	946-936.5	31.5	--	120	2,900	3,500
	Weathered Sandstone	936.5-934	43	--	130	5,000	600,000

10 ¾-inch CIP pile

Boring	Soil Type	Elevation	Friction Angle	Cohesion	Unit Weight	Skin Friction Capacity	End Bearing Capacity
		(feet)	(degrees)	(psf)	(pcf)	(psf)	(psf)
B-1	Fill	1022.5-962	27	--	120	1,050	12,000
	Silty Sand, SM	962-946.5	34.5	--	125	2,650	63,000
	Silty Sand, SM	946.5-939.5	31.5	--	125	2,450	26,000
	Weathered Sandstone	939.5-934.5	43	--	130	4,000	600,000

Boring	Soil Type	Elevation	Friction Angle	Cohesion	Unit Weight	Skin Friction Capacity	End Bearing Capacity
		(feet)	(degrees)	(psf)	(pcf)	(psf)	(psf)
B-2	Fill	1022.5-956.5	27	--	120	1,200	12,000
	Fill	956.5-952	28	--	120	1,500	12,000
	P-G Sand, SP	952-947	31.5	--	120	1,950	26,000
	Clayey Sand, SC	947-942	34.5	--	125	2,600	90,000
	P-G Sand w/ Silt, SP-SM	942-937	30.5	--	120	2,400	17,500
	Weathered Sandstone	937-934.5	43	--	130	4,000	600,000

Boring	Soil Type	Elevation	Friction Angle	Cohesion	Unit Weight	Skin Friction Capacity	End Bearing Capacity
		(feet)	(degrees)	(psf)	(pcf)	(psf)	(psf)
B-3	Fill	1022-957	28	--	120	1,300	12,000
	Fill	957-951.5	27	--	120	1,400	12,000
	Silty Sand, SM	951.5-941.5	37.5	--	125	3,450	200,000
	P-G Sand w/ Silt, SP-SM	941.5-936.5	38.5	--	120	4,000	300,000
	Weathered Sandstone	936.5-934	43	--	130	4,000	600,000

10 ¾-inch CIP pile (continued)

Boring	Soil Type	Elevation	Friction Angle	Cohesion	Unit Weight	Skin Friction Capacity	End Bearing Capacity
		(feet)	(degrees)	(psf)	(pcf)	(psf)	(psf)
B-4	Fill	1022-956	27	--	120	1,100	12,000
	P-G Sand w/ Silt, SP-SM	956-946	27	--	120	1,450	12,000
	P-G Sand w/ Silt, SP-SM	946-936.5	31.5	--	120	2,250	30,000
	Weathered Sandstone	936.5-934	43	--	130	4,000	600,000

E.2. Pile Installation

The borings encountered very dense soils and weathered sandstone with depth. Therefore, protective tips are recommended for piling in an effort to prevent damage during driving. Pile capacities should be evaluated in the field using a dynamic pile analyzer, ENR pile driving criteria, or other approved procedures.

E.3. Drivability Analysis and Recommendations

A drivability analysis was performed using GRLWEAP Version 2010-6 software on 10x42 H-pile and on 10 ¾-inch CIP pile with a ¼-inch thick shell. Our analysis was based on the boring data and the software's default manufacturer's information for the hammer parameters and cushion information. The piles noted above should be drivable to the boring depths without overstressing the pile section using Delmag D-12 or Delmag D-15 Hammers. Other hammers may be suitable for pile driving at this site but were limited to these hammer types for our analysis. We recommend a pile drivability analysis be performed prior to final pile and driving hammer selection to determine the pile-hammer compatibility.

E.4. Abutment Filling

We recommend using clean granular material having less than 10% particles passing a number 200 sieve, as fill around the abutment. The subgrade away from the bridge may consist of materials other than clean sands. To limit the potential for differential frost heave, we suggest providing a transition between these materials and the abutment backfill. In that event, the depth of the sand layer should be tapered from 5 feet at the abutment to 0 feet at a distance of 50 feet or more from the abutment (10H:1V ratio).

The backfill should be compacted to a minimum of 95% of its maximum dry density as determined by the American Society for Testing and Materials (ASTM) Method of Test D 698 (standard Proctor).

F. Pavement Recommendations

F.1. Dominant Area Soils

The NRCS soil survey of the area indicated that loam from the Sedgwick-Munuscong complex, 0 to 6 percent slopes and sand from the Rubicon-Sayner complex, 0 to 6 percent slopes are the dominant soil types mapped away from the creek banks. The loam will likely be more frost-susceptible than the recommended clean sand fill at the abutments.

F.2. Pavement Recommendations

The following tabulation presents recommended support values for the various subgrade materials encountered, indicated, or recommended:

Soil Type	AASHTO Classification	Frost Index	Design Group Index	K-Value	Soil Support Factor	Est. California Bearing Ratio
Loam / Silty Sand	A-4/A-6	F-3	15	125	3.8	3 or less
Sand	A-3	F-2	6	250	5.0	10 to 25

G. Level of Care

The services provided for this project have been conducted in a manner consistent with that level of care and skill ordinarily exercised by members of the profession currently practicing in this area, under similar budget and time constraints. This is our professional responsibility. No other warranty, expressed or implied, is made.

Appendix

Boring Location Sketch

Log of Boring # 1-4

Legend to Soil Description

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Chosen Valley Testing, Inc.

Legend

- Boring Locations
- Benchmark

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Boring Location Sketch

Proposed Trail Bridge
Gandy Dancer Trail
Town of Summit, Douglas County, Wisconsin
17813.21.WIL

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LOG OF BORING

CHOSEN VALLEY TESTING CVT

PROJECT: 17813.21.WIL Design Phase Geotechnical Evaluation Proposed Trail Bridge Gandy Dancer Trail Town of Summit, Douglas Co., Wisconsin	BORING: **B-1** LOCATION: See attached sketch. DATE: 1/25/2021 SCALE: 1" = 6'

Elev.	Depth	USCS Symbol	Description of Materials (ASTM D 2487/2488)	BPF	WL	Tests and Notes
1024.4	0.0		**24" AGGREGATE**			Benchmark: Control point above center of culvert, understood elevation = 1023.988 feet.
1022.4	2.0	SP	**FILL**, Poorly Graded Sand, fine-to-medium grained, brown, moist.	5		
				5		
			Trace metal debris around 7 feet.	7		
			Below 10 feet, Silty Sand, fine-to-medium grained, trace Gravel, brown, moist.	2		
				1		
				5		
			With wood debris around 20 feet.	4		
			Below 25 feet, Poorly Graded Sand with Silt, fine-to-medium grained, trace Gravel, brown, moist.	3		
				4		
				3		
				2		
				4		

CVT STANDARD 17813.21.WIL (GANDY DANCER TRAIL BRIDGE).GPJ LOG A GNNN06.GDT 4/28/21

(continued)

LOG OF BORING

CHOSEN VALLEY TESTING CVT

PROJECT: 17813.21.WIL Design Phase Geotechnical Evaluation Proposed Trail Bridge Gandy Dancer Trail Town of Summit, Douglas Co., Wisconsin	BORING: **B-1 (cont.)** LOCATION: See attached sketch. DATE: 1/25/2021 SCALE: 1" = 6'

Elev.	Depth	USCS Symbol	Description of Materials (ASTM D 2487/2488)	BPF	WL	Tests and Notes
		SP *(continued)*		4		
				5		
				6		
961.9	62.5	SM	**SILTY SAND**, fine-to-medium grained, trace Gravel, brown, moist to 78 feet then water bearing below, dense to very dense. (Glacial Till)	56		
				*		* 20 / 35 / 50 = 4"
				*		* 18 / 27 / 50 = 2"
					▽	
			Fine-grained around 80 feet.	32		
939.4	85.0			*		* 37 / 50 = 3"
		GP	**WEATHERED SANDSTONE**, cemented sandstone Sandy Gravel recovered in sampler, fine-to-medium grained, tan to pink, wet, very dense.			
934.7	89.7			*		* 50 = 2" (set)
			End of boring. Water observed around 78 feet during drilling. Boring was sealed upon completion.			

CVT STANDARD 17813.21.WIL (GANDY DANCER TRAIL BRIDGE).GPJ LOG A GNNN06.GDT 4/28/21

LOG OF BORING

CHOSEN VALLEY TESTING CVT

PROJECT: 17813.21.WIL Design Phase Geotechnical Evaluation Proposed Trail Bridge Gandy Dancer Trail Town of Summit, Douglas Co., Wisconsin	BORING: **B-2** LOCATION: See attached sketch. DATE: 1/26/2021 SCALE: 1" = 6'

Elev.	Depth	USCS Symbol	Description of Materials (ASTM D 2487/2488)	BPF	WL	Tests and Notes
1024.5	0.0		**24" AGGREGATE**			Benchmark: Control point above center of culvert, understood elevation = 1023.988 feet.
1022.5	2.0	SP SM	**FILL**, Silty Sand, fine-to-medium grained, trace Gravel, brown, moist.	8		
			Below 20 feet, Poorly Graded Sand with Silt, fine-to-medium grained, trace Gravel, brown, moist.	5		
			Below 30 feet, Silty Sand, fine-to-medium grained, trace Gravel, brown, moist.	4		
			Below 40 feet, Poorly Graded Sand, fine-to-medium grained, trace Gravel, brown, moist.	3		

CVT STANDARD 17813.21.WIL (GANDY DANCER TRAIL BRIDGE).GPJ LOG A GNNN06.GDT 4/28/21

LOG OF BORING

CHOSEN VALLEY TESTING CVT

PROJECT: 17813.21.WIL Design Phase Geotechnical Evaluation Proposed Trail Bridge Gandy Dancer Trail Town of Summit, Douglas Co., Wisconsin	BORING: **B-2 (cont.)** LOCATION: See attached sketch. DATE: 1/26/2021 SCALE: 1" = 6'

Elev.	Depth	USCS Symbol	Description of Materials (ASTM D 2487/2488)	BPF	WL	Tests and Notes
		SP SM	*(continued)*	4		
				4		
			Water bearing below 68 feet.		▽	
			Trace organic fibers around 70 feet.	9		
952.0	72.5	SP	**POORLY-GRADED SAND**, fine-to-medium grained, brown, water bearing, dense. (Glacial Outwash)	30		
947.0	77.5	SC	**CLAYEY SAND**, fine grained, trace Gravel, brown, wet, very dense. (Glacial Till)	*		* 18 / 32 / 50 = 3"
942.0	82.5	SP SM	**POORLY GRADED SAND with SILT**, fine-to-medium grained, trace Gravel, brown, water bearing, medium dense. (Glacial Outwash)	26		
937.0	87.5	GP	**WEATHERED SANDSTONE**, cemented sandstone Sandy Gravel recovered in sampler, fine-to-medium grained, tan, wet, very dense.	*		* 50 = 3" (set)
934.7	89.8		End of boring. Water observed around 68 feet during drilling. Boring was sealed upon completion.			

CVT STANDARD 17813.21.WIL (GANDY DANCER TRAIL BRIDGE).GPJ LOG A GNNN06.GDT 4/28/21

LOG OF BORING

CHOSEN VALLEY TESTING CVT

PROJECT: 17813.21.WIL Design Phase Geotechnical Evaluation Proposed Trail Bridge Gandy Dancer Trail Town of Summit, Douglas Co., Wisconsin	BORING: **B-3** LOCATION: See attached sketch. DATE: 1/26/2021 SCALE: 1" = 6'

Elev.	Depth	USCS Symbol	Description of Materials (ASTM D 2487/2488)	BPF	WL	Tests and Notes
1024.1	0.0		**24" AGGREGATE**			Benchmark: Control point above center of culvert, understood elevation = 1023.988 feet.
1022.1	2.0	SP SM	**FILL**, Poorly Graded Sand with Silt, fine-to-medium grained, trace Gravel, dark brown, moist.			
			Brown below 10 feet.	15		
			Below 20 feet, Silty Sand, fine-to-medium grained, trace Gravel, brown, moist.	7		
			Below 30 feet, Poorly Graded Sand with Silt, fine-to-medium grained, trace Gravel, brown, moist.	3		
				5		

CVT STANDARD 17813.21.WIL (GANDY DANCER TRAIL BRIDGE).GPJ LOG A GNNN06.GDT 4/28/21

(continued)

LOG OF BORING

CHOSEN VALLEY TESTING CVT

PROJECT: 17813.21.WIL Design Phase Geotechnical Evaluation Proposed Trail Bridge Gandy Dancer Trail Town of Summit, Douglas Co., Wisconsin	BORING: **B-3 (cont.)** LOCATION: See attached sketch. DATE: 1/26/2021 SCALE: 1" = 6'

Elev.	Depth	USCS Symbol	Description of Materials (ASTM D 2487/2488)	BPF	WL	Tests and Notes
		SP SM *(continued)*		7		
				6		
			Trace metal debris around 60 feet.	6		
				13	▽	
				7		
951.6	72.5	SM	**SILTY SAND**, fine-to-medium grained, trace Gravel, brown, very dense. (Glacial Till)	71		
				*		* 20 / 37 / 50 = 3"
941.6	82.5	SP SM	**POORLY GRADED SAND with SILT**, fine-to-medium grained, trace Gravel, brown, water bearing, very dense. (Glacial Outwash)	*		* 33 / 50 = 4"
936.6	87.5	GP	**WEATHERED SANDSTONE**, cemented sandstone Sandy Gravel recovered in sampler, fine-to-medium grained, tan to pink, wet, very dense.	*		* 50 = 3" (set)
934.3	89.8		End of boring. Water observed around 67 feet during drilling. Boring was sealed upon completion.			

CVT STANDARD 17813.21.WIL (GANDY DANCER TRAIL BRIDGE).GPJ LOG A GNNN06.GDT 4/28/21

LOG OF BORING

CHOSEN VALLEY TESTING CVT

PROJECT: 17813.21.WIL Design Phase Geotechnical Evaluation Proposed Trail Bridge Gandy Dancer Trail Town of Summit, Douglas Co., Wisconsin	BORING: **B-4** LOCATION: See attached sketch. DATE: 1/26/2021 SCALE: 1" = 6'

Elev.	Depth	USCS Symbol	Description of Materials (ASTM D 2487/2488)	BPF	WL	Tests and Notes
1024.1	0.0		**24" AGGREGATE**			Benchmark: Control point above center of culvert, understood elevation = 1023.988 feet.
1022.1	2.0	SP SM	**FILL**, Poorly Graded Sand with Silt, fine-to-medium grained, trace Gravel, brown, moist.	9 4 3 4		

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LOG OF BORING

CHOSEN VALLEY TESTING CVT

PROJECT: 17813.21.WIL Design Phase Geotechnical Evaluation Proposed Trail Bridge Gandy Dancer Trail Town of Summit, Douglas Co., Wisconsin	BORING: **B-4 (cont.)** LOCATION: See attached sketch. DATE: 1/26/2021 SCALE: 1" = 6'

Elev.	Depth	USCS Symbol	Description of Materials (ASTM D 2487/2488)	BPF	WL	Tests and Notes
		SP SM	*(continued)*			
			Below 50 feet, Silty Sand, fine-to-medium grained, trace Gravel, brown, moist.	2		
				5		
			Below 60 feet, Poorly Graded Sand with Silt, fine-to-medium grained, trace Gravel, brown, moist.	4		
				6		
956.1	68.0	SP SM	**POORLY GRADED SAND with SILT**, fine-to-medium grained, trace gravel, brown, water bearing, loose to dense. (Glacial Outwash)	6	▽	
				9		
				18		
				47		
936.6	87.5	SP SM	**WEATHERED SANDSTONE**, uncemented Poorly Graded Sand with Silt recovered in sampler, fine-to-medium grained, brown to tan, wet, very dense.	*		* 50 = 4" (set)
934.3	89.8		End of boring. Water observed around 68 feet during drilling. Boring was sealed upon completion.			

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UNIFIED SOIL CLASSIFICATION (ASTM D-2487/2488)

MATERIAL TYPES	CRITERIA FOR ASSIGNING SOIL GROUP NAMES			GROUP SYMBOL	SOIL GROUP NAMES & LEGEND
COARSE-GRAINED SOILS >50% RETAINED ON NO. 200 SIEVE	GRAVELS >50% OF COARSE FRACTION RETAINED ON NO 4. SIEVE	CLEAN GRAVELS <5% FINES	Cu>4 AND 1<Cc<3	GW	WELL-GRADED GRAVEL
			Cu>4 AND 1>Cc>3	GP	POORLY-GRADED GRAVEL
		GRAVELS WITH FINES >12% FINES	FINES CLASSIFY AS ML OR CL	GM	SILTY GRAVEL
			FINES CLASSIFY AS CL OR CH	GC	CLAYEY GRAVEL
	SANDS >50% OF COARSE FRACTION PASSES ON NO 4. SIEVE	CLEAN SANDS <5% FINES	Cu>6 AND 1<Cc<3	SW	WELL-GRADED SAND
			Cu>6 AND 1>Cc>3	SP	POORLY-GRADED SAND
		SANDS AND FINES >12% FINES	FINES CLASSIFY AS ML OR CL	SM	SILTY SAND
			FINES CLASSIFY AS CL OR CH	SC	CLAYEY SAND
FINE-GRAINED SOILS >50% PASSES NO. 200 SIEVE	SILTS AND CLAYS LIQUID LIMIT<50	INORGANIC	PI>7 AND PLOTS>"A" LINE	CL	LEAN CLAY
			PI>4 AND PLOTS<"A" LINE	ML	SILT
		ORGANIC	LL (oven dried)/LL (not dried)<0.75	OL	ORGANIC CLAY OR SILT
	SILTS AND CLAYS LIQUID LIMIT>50	INORGANIC	PI PLOTS >"A" LINE	CH	FAT CLAY
			PI PLOTS <"A" LINE	MH	ELASTIC SILT
		ORGANIC	LL (oven dried)/LL (not dried)<0.75	OH	ORGANIC CLAY OR SILT
HIGHLY ORGANIC SOILS		PRIMARILY ORGANIC MATTER, DARK IN COLOR, AND ORGANIC ODOR		PT	PEAT

Relative Proportions of Sand and Gravel

TERM	PERCENT
Trace	< 15
With	15 - 29
Modifier	> 30

Relative Proportions of Fines

TERM	PERCENT
Trace	< 5
With	5 - 12
Modifier	> 12

Grain Size Terminology

TERM	SIZE
Boulder	> 12 in.
Cobble	3 in. - 12 in.
Gravel	#4 sieve to 3 in.
Sand	#200 sieve to #4 sieve
Silt or Clay	Passing #200 sieve

SAMPLE TYPES

Hollow Stem

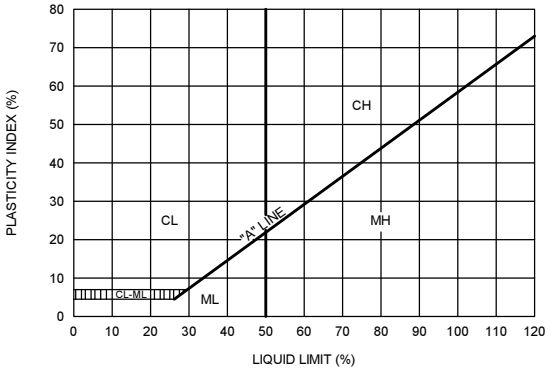
Standard Penetration Test

TEST SYMBOLS

MC	-	MOISTURE CONTENT	LL	-	LIQUID LIMIT
OC	-	ORGANIC CONTENT	PI	-	PLASTISITY INDEX
CN	-	CONSOLIDATION	SW	-	SWELL TEST
DD	-	DRY DENSITY	UU		Unconsolidated Undrained triaxial
PP	-	POCKET PENETROMETER			
RV	-	R-VALUE			
SA	-	SIEVE ANALYSIS			
P200	-	% PASSING #200 SIEVE			

- WATER LEVEL (WITH TIME OF) MEASUREMENT

PLASTICITY CHART



PENETRATION RESISTANCE
(RECORDED AS BLOWS / 0.5 FT)

SAND & GRAVEL		SILT & CLAY		
RELATIVE DENSITY	BLOWS/FOOT*	CONSISTENCY	BLOWS/FOOT*	COMPRESSIVE STRENGTH (TSF)
VERY LOOSE	0 - 4	VERY SOFT	0 - 1	0 - 0.25
LOOSE	4 - 10	SOFT	2 - 3	0.25 - 0.50
MEDIUM DENSE	10 - 30	RATHER SOFT	4 - 5	0.50 - 1.0
DENSE	30 - 50	MEDIUM	6 - 8	
VERY DENSE	OVER 50	RATHER STIFF	9 - 12	1.0 - 2.0
		STIFF	13 - 16	
		VERY STIFF	17 - 30	2.0 - 4.0
		HARD	OVER 30	OVER 4.0

* NUMBER OF BLOWS OF 140 LB HAMMER FALLING 30 INCHES TO DRIVE A 2 INCH O.D. (1-3/8 INCH I.D.) SPLIT-BARREL SAMPLER THE LAST 12 INCHES OF AN 18-INCH DRIVE (ASTM-1586 STANDARD PENETRATION TEST).

Chosen Valley Testing

Job No. 17813.21.WIL

LEGEND TO SOIL DESCRIPTIONS

CVT

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