

**Design Phase Geotechnical Evaluation:**

Proposed Ramsey Tiger Street Infrastructure Repair  
Tiger Street  
Ramsey, Minnesota

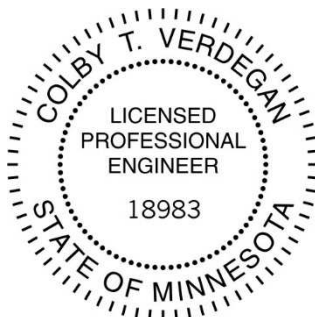
**Prepared for:**

City of Ramsey  
c/o: Joe Feriancek

December 11, 2020  
17623.20.MNS

**Certification:**

I hereby certify that this report was prepared by me or under my direct supervision, and that I am a duly licensed engineer under the laws of the State of Minnesota.



A handwritten signature in black ink that reads 'Colby T. Verdegan'.

Colby T. Verdegan, PE  
Geotechnical Engineer  
Registration Number 18983  
Date: December 11, 2020

# Chosen Valley Testing, Inc.

Geotechnical Engineering and Testing, 141 37<sup>th</sup> Ave. N., St. Cloud, Minnesota 56303 (320) 774-3500 fax (320) 393-3309

City of Ramsey  
c/o: Joe Feriancek  
7550 Sunwood Drive NW  
Ramsey, MN 55303  
mweidner@ic.ramsey.mn.us

December 11, 2020

**Re: Design Phase Geotechnical Evaluation  
Proposed Tiger Street Infrastructure Improvements  
Tiger Street  
Ramsey, Minnesota  
CVT Number: 17623.20.MNS**

Dear Mr. Feriancek,

As authorized, we have completed the geotechnical evaluation for the proposed infrastructure improvements of Tiger Street in Ramsey, Minnesota. The attached report provides details of our findings and recommendations for the proposed project. Photographs of the pavement cores taken at each location are also attached. CVT appreciates the opportunity to provide geotechnical services on this project. If you have any questions about our report, please feel free to contact us at (320) 774-3500.

Sincerely,  
**Chosen Valley Testing, Inc.**



Hannah Fischer  
Graduate Engineer



Colby T. Verdegan, PE  
President/Chief Engineer

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**BORING LOCATION SKETCH**  
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**LEGEND TO SOIL DESCRIPTION**

**Design Phase Geotechnical Report**  
**Proposed Tiger Street Infrastructure Improvements**  
**Tiger Street**  
**Ramsey, Minnesota**

CVT Project Number: 17623.20.MNS

Date: December 11, 2020

## **A. Introduction**

**The intent of this report is to present our findings and describe the means used to collect the data. The data was collected for a specific purpose and may not be suitable for other purposes. We should be consulted before attempting to use the data for other uses. A complete and thorough review of the entire document, including its assumptions and its appendices, should be undertaken immediately upon receipt.**

### **A.1. Purpose**

This geotechnical report was prepared to assist planning for proposed infrastructure improvements of Tiger Street in Ramsey, Minnesota. Our services were authorized by Mr. Joe Feriancek from The City of Ramsey.

### **A.2. Scope**

To obtain data for analysis, a total of 10 penetration test borings were performed. The borings were drilled to depths of about 10 feet. Our engineering scope consisted of providing this report of our findings and including geotechnical recommendations for construction and design of potential utility replacements and paved areas.

### **A.3. Boring Locations and Elevations**

The preferred boring locations were indicated to Chosen Valley Testing (CVT) on a site plan provided by the city. All the borings were relocated to the west side of the street due to the proximity of utilities. The Boring Location Sketch in the Appendix shows the approximate locations as drilled on aerial imagery using Google Earth software. Ground surface elevations were estimated using MnTOPO software from the Minnesota DNR and are indicated on the Log of Boring sheets in the Appendix. The elevations should be considered approximate.

### **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 indicate the soils in the area are dominated by terrace deposited sands. Bedrock is commonly more than 50 feet below the surface and is not a consideration for this project.

## **B. Subsurface Data**

**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 to 5-foot intervals. The core of soil obtained was classified and logged by our drilling personnel at the site and a representative portion was then sealed and delivered to our laboratory for further review.

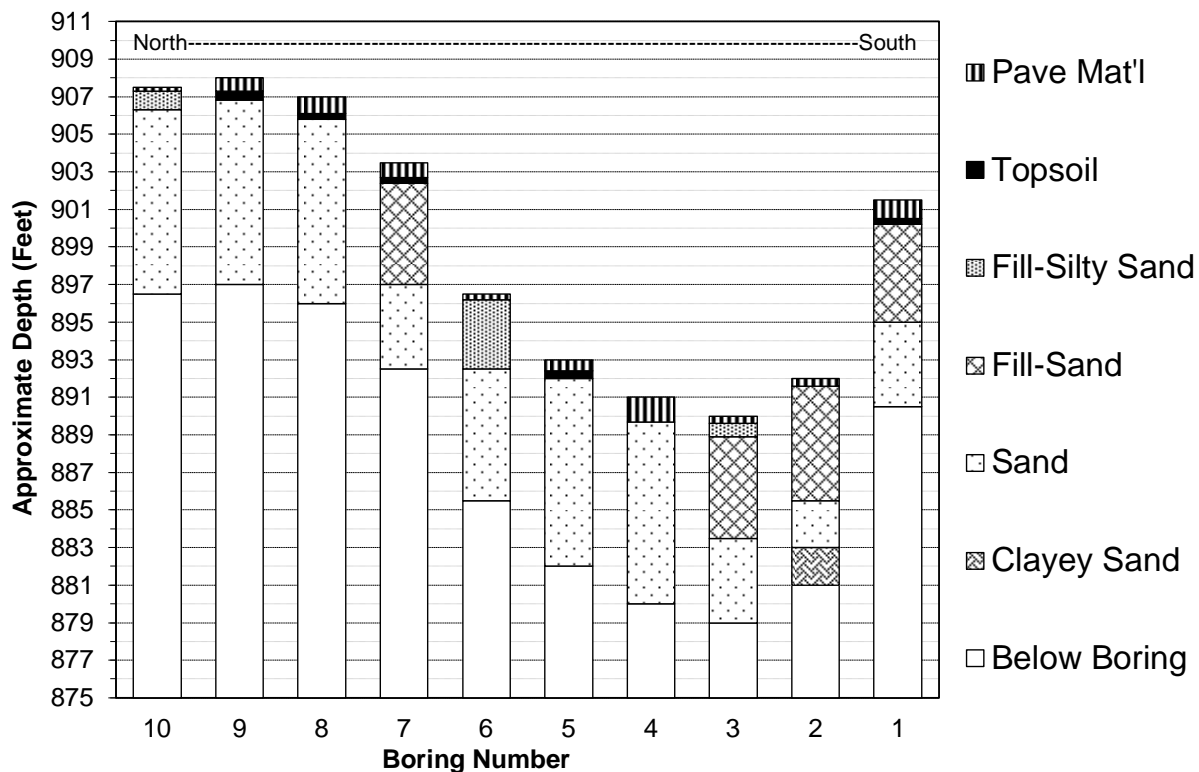
**B.1. Strata**

At the surface, the pavement borings encountered about 1 ½ to 5 inches of asphalt over 0 to 8 inches of aggregate base or recycled aggregate. Several borings encountered about ½ foot or less of buried topsoil below the pavement materials.

Below the surface materials, most of the borings encountered fill to possible fill to depths of 1 to 6 ½ feet. The fill consisted primarily of rather clean sands to silty sands.

Below the surface materials and fill, most of the borings were dominated by clean sands natural sands (poorly graded sand and poorly graded sand with silt). Boring B-02 encountered a layer of clayey sand at the 10-foot termination depth.

For the reader's convenience, we have summarized the soil boring data in the following cross-section. The reader is referred to the boring logs in the Appendix for more detailed information.



## **B.2. Penetration Test Results**

**Penetration Test Results:** The number of blows needed for the hammer to advance the penetration test sampler is an indicator of soil characteristics. The results tend to be more meaningful for natural mineral soils, than for fill soils. In fill soils, density tests are more meaningful.

Penetration resistance values ("N" Value) of 11 to 29 blows per foot (BPF) were recorded in the fill and possible materials.

The natural sands on site returned values of 4 to 20 BPF, indicating they were very loose to medium dense. The clayey sand returned an N value of 4 BPF, indicating it was rather soft.

A key to 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 drilling, the drillers may note the presence of moisture on the sampler, in the cuttings, or in the borehole itself. These findings are reported on the Logs of Boring. Because water levels vary with weather, time of year, and other factors, the presence or lack of water during exploration is subject to interpretation and is not always conclusive.**

Water was not observed in any of the borings. Groundwater levels at the site are expected to fluctuate seasonally similar to levels in the nearby lake, 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 complete reconstruction of pavements and the installation of watermain, storm sewer and sanitary sewer along Tiger Street. CVT assumes the pipes will be installed at depths between 5 and 10 feet using open cut excavations or direction drilling.

We have assumed final grades will be at or close to the existing grades. The new pavement is expected to consist of asphalt over aggregate base.

## **D. Utility Recommendations**

### **D.1. Groundwater/De-watering**

As mentioned earlier, water was not observed in the borings. If water is encountered during the excavation, well-points or dewatering wells will likely be required.

## **D.2. Trench Sidewalls**

The contractor will be required to slope or shore the excavations as needed to meet OSHA requirements for safety. Most of the soils would be expected to classify as Type C soils as defined by OSHA. Trench boxes or other stabilization methods may be necessary if excavations encroach near existing utilities or structures.

## **D.3. Trench Bottom Stability**

Depending upon location and depth, the utilities are expected to bear primarily on clean sands. These materials are considered generally suitable for support of pipes. If soft and unstable conditions are encountered, we recommend placing bedding of coarse sand or gravel at the base of the trenches to provide a more stable bottom for crews laying the pipes.

In order to reduce the potential for point loads on the pipes, we recommend removing any cobbles or boulders to a depth of at least 6 to 8 inches from around pipes and replacing those materials with clean sand or gravel that can more readily conform to the pipes.

## **D.4. Fill Placement and Compaction**

Soils placed as backfill below paved areas should ideally be compacted to 100% of their maximum standard Proctor density (ASTM D 698) in the upper 3 feet, and to at least 95% below. In green areas, 90% compaction is normally adequate.

The onsite soils are considered generally suitable for use as backfill above utilities, provided they can be adequately compacted. To reduce potential for differential frost action, fill placed in upper part of the trenches should ideally be placed in layers that align reasonably similar to the soil stratification on the trench side walls. In this case, all the soils appear to be reasonably uniform and layering does not appear to be necessary.

# **E. Pavement Recommendations**

## **E.1. Stripping and Grading**

We recommend removing the existing asphalt, aggregate base, and any organics soils from within 3 feet of the proposed pavement section subgrade before placing any new pavement material sections. It may be possible to reclaim and reuse the existing asphalt and aggregate for use as part of the new pavement's aggregate base, provided it meets MnDOT specifications. That being said, the existing paving materials appeared to be quite varied – with little or no apparent aggregate base in most areas and asphalt materials that were thin or layered with recycled materials.

After the removals, utility construction, and grading, the near-surface soils are expected to primarily consist of clean sands and silty sands. We recommend scarifying and compacting all near-surface soils in order to even out any localized discontinuities in the subgrade materials and to provide a more gradational transition between differing materials. This action is intended to limit differential frost heave and provide more uniform pavement support.

Subgrades should be test rolled using a tandem axle truck. Any soft areas detected should be scarified, dried, and recompacted. If time constraints prohibit drying, soil corrections, extra aggregate base, breaker run, sand subbase, and/or geotextiles may be necessary for stabilization.

### **E.2. Preliminary Pavement Design**

As mentioned earlier, subgrade soils are expected to consist primarily of clean sands and silty sands. The effective Hveem-stabilometer R-values for dominant sands and silty sands would be expected to range from 30 to 70, and associated Soil Factors from 50 to 75.

As noted before, the existing pavements could possibly be milled and then reused as base material provided the reclaimed material meets Mn/DOT Specification 3138 for Class 5 Aggregate Base.

## **F. Construction Testing and Documentation**

### **F.1. Excavation**

A variety of equipment is expected to be capable of performing earthwork and grading. An excavator or backhoe with a smooth-lipped bucket is recommended for completing any excavations. This is intended to limit disturbance to the supporting soils being left in place, while also producing a smooth working surface.

### **F.2. Compaction**

Fill should be placed in lifts adjusted to the compactor being used and the material being compacted. We recommend limiting lifts to no more than 1 foot, assuming large, self-propelled or tow-behind compactors are used. Thinner lifts should be used for lighter compaction equipment.

### **F.3. Cold Weather**

If the earthwork occurs during freezing temperatures, good winter construction practices should be used. No frozen fill should be used nor should structural filling take place on frozen ground.

### **F.4. Construction Phase Testing and Documentation**

The bottom of all excavations, grading, and roadway subgrade should be evaluated and documented by geotechnical personnel after the unsuitable materials are removed and before placement of any fill or pavement. Samples of any fill materials and/or alternative gradations of materials proposed for use should be submitted for approval before use. The County may wish to have, or may be obligated to have tests performed regarding the other various paving components. Specification of such requirements is normally the responsibility of the City and their design consultant.

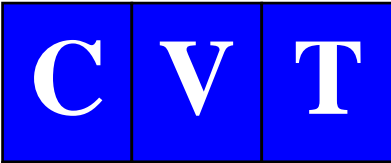
## **G. Level of Care**

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 # 1-10**



Chosen Valley Testing, Inc.

Legend

- Boring Locations

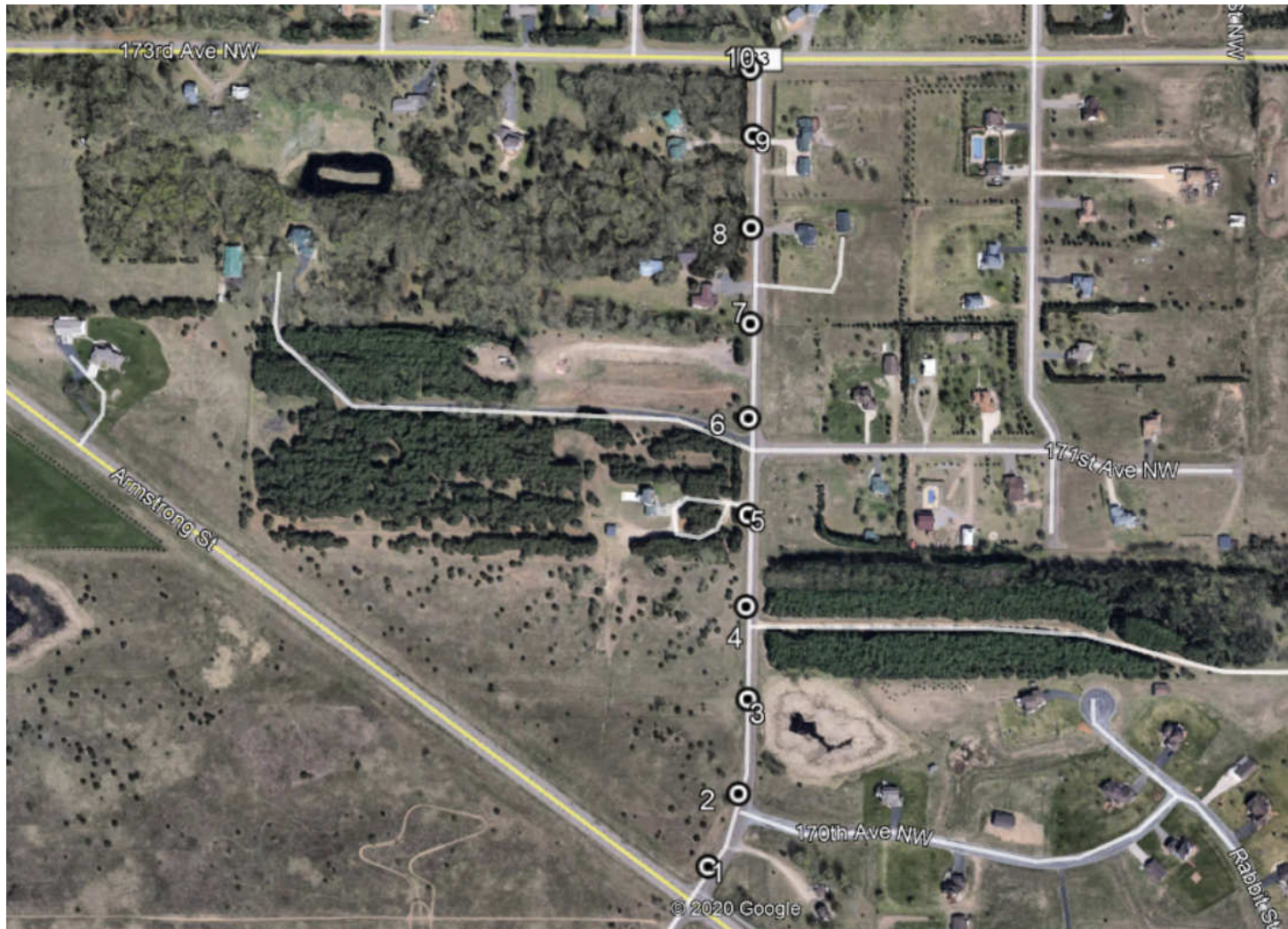
# Boring Location Sketch

Ramsey Tiger Street Infrastructure Improvement

Tiger Street

Ramsey, Minnesota

17623.20.MNS



# LOG OF BORING

CHOSEN VALLEY TESTING



PROJECT: 17623.20.MNS Design Phase Geotechnical Evaluation Proposed Infrastructure Improvements Tiger Street Ramsey, Minnesota	BORING: <b>B-01</b>	
	LOCATION: See attached sketch	
	DATE: 11/23/2020	SCALE: 1" = 2'

Elev.	Depth	USCS Symbol	Description of Materials (ASTM D 2487/2488)	BPF	WL	Tests and Notes
	0.0					
	0.3		<b>4" BITUMINOUS</b>			
		SP	<b>8" SAND and GRAVEL</b> , brown. (Fill)			
	1.0					
	1.3	SM	<b>SILTY SAND</b> , black, moist. (Fill)			
		SP	<b>POORLY GRADED SAND</b> , mostly fine to medium grained, trace gravel, brown, moist, medium dense. (Possible Fill)			
				19		
	4.0	SP SM	<b>POORLY GRADED SAND with SILT</b> , mostly fine to medium grained, trace gravel, greyish brown, moist, dense. (Possible Fill)			
				39		
	6.5	SP	<b>POORLY GRADED SAND</b> , mostly fine grained, trace gravel, brown, moist, medium dense. (Terrace Deposit)			
				20		
				13		
	11.0		End of boring. Water not encountered during drilling. Boring sealed upon completion.			

CVT STANDARD 17623.20.MNS (RAMSEY TIGER STREET).GPJ LOG-A.GNND06.GDT 12/7/20

# LOG OF BORING

CHOSEN VALLEY TESTING



PROJECT: 17623.20.MNS Design Phase Geotechnical Evaluation Proposed Infrastructure Improvements Tiger Street Ramsey, Minnesota	BORING: <b>B-02</b>	
	LOCATION: See attached sketch	
	DATE: 11/23/2020	SCALE: 1" = 2'

Elev.	Depth 0.0	USCS Symbol	Description of Materials (ASTM D 2487/2488)	BPF	WL	Tests and Notes
	0.4		<b>5" BITUMINOUS</b>			
		SP SM	<b>POORLY GRADED SAND with SILT</b> , mostly fine grained, brown with dark brown mixing, moist. (Fill)			
				14		
				11		
	6.5	SP	<b>POORLY GRADED SAND</b> , mostly fine to medium grained, brown, moist, loose. (Terrace Deposit)			
				6		
	9.0	SC	<b>CLAYEY SAND</b> with seams of Lean Clay and Silt, very fine grained, brown to grey, very wet, very loose. (Alluvium)			
				4		
	11.0		End of boring. Water not encountered during drilling. Boring sealed upon completion.			

CVT STANDARD 17623.20.MNS (RAMSEY TIGER STREET).GPJ LOG-A.GN06.GDT 12/7/20

# LOG OF BORING

CHOSEN VALLEY TESTING



PROJECT: 17623.20.MNS Design Phase Geotechnical Evaluation Proposed Infrastructure Improvements Tiger Street Ramsey, Minnesota	BORING: <b>B-03</b>	
	LOCATION: See attached sketch	
	DATE: 11/23/2020	SCALE: 1" = 2'

Elev.	Depth	USCS Symbol	Description of Materials (ASTM D 2487/2488)	BPF	WL	Tests and Notes
	0.0					
	0.3		<b>4" BITUMINOUS</b>			
	0.4	SM	<b>1" RECYCLED BITUMINOUS</b>			
	1.1		<b>SILTY SAND</b> , fine grained, black. (Fill)			
		SP SM	<b>POORLY GRADED SAND with SILT</b> , mostly fine grained, brown to dark brown, moist. (Fill)			
				13		
				17		
	6.5					
		SP SM	<b>POORLY GRADED SAND with SILT</b> , mostly fine to medium grained, trace gravel, grey, moist, loose.  (Terrace Deposit)			
				9		
	9.0					
		SP	<b>POORLY GRADED SAND</b> , mostly fine to medium grained, greyish brown, moist, loose.  (Terrace Deposit)			
				10		
	11.0					
			End of boring. Water not encountered during drilling. Boring sealed upon completion.			

CVT STANDARD 17623.20.MNS (RAMSEY TIGER STREET).GPJ LOG-A.GN06.GDT 12/7/20

# LOG OF BORING

CHOSEN VALLEY TESTING



PROJECT: 17623.20.MNS Design Phase Geotechnical Evaluation Proposed Infrastructure Improvements Tiger Street Ramsey, Minnesota	BORING: <b>B-04</b>	
	LOCATION: See attached sketch	
	DATE: 11/23/2020	SCALE: 1" = 2'

Elev.	Depth 0.0	USCS Symbol	Description of Materials (ASTM D 2487/2488)	BPF	WL	Tests and Notes
	0.3		<b>4" BITUMINOUS</b>			
		SP SM	<b>POORLY GRADED SAND with SILT</b> , trace gravel, brown. (Fill)			
	1.3	SP	<b>POORLY GRADED SAND</b> , mostly fine grained, trace gravel, brown, moist, very loose to loose. (Terrace Deposit)			
				8		
				10		
			Mostly fine to medium grained below 7 feet.	4		
				4		
	11.0		End of boring. Water not encountered during drilling. Boring sealed upon completion.			

CVT STANDARD 17623.20.MNS (RAMSEY TIGER STREET).GPJ LOG-A GNN06.GDT 12/7/20

# LOG OF BORING

CHOSEN VALLEY TESTING



PROJECT: 17623.20.MNS Design Phase Geotechnical Evaluation Proposed Infrastructure Improvements Tiger Street Ramsey, Minnesota	BORING: <b>B-05</b>	
	LOCATION: See attached sketch	
	DATE: 11/23/2020	SCALE: 1" = 2'

Elev.	Depth	USCS Symbol	Description of Materials (ASTM D 2487/2488)	BPF	WL	Tests and Notes
	0.0					
	0.1		<b>1.5" BITUMINOUS</b>			
	0.4		<b>3" RECYCLED BITUMINOUS</b>			
	0.6	SP	<b>POORLY GRADED SAND with SILT</b> , trace gravel, brown. (Fill)			
	1.0	SM				
		SP	<b>SILTY SAND</b> , black. (Possible Fill / Topsoil)			
			<b>POORLY GRADED SAND</b> , mostly fine to medim grained, trace gravel, brown, moist, loose. (Terrace Deposit)	5		
				6		
				6		
				6		
	11.0		End of boring. Water not encountered during drilling. Boring sealed upon completion.			

CVT STANDARD 17623.20.MNS (RAMSEY TIGER STREET).GPJ LOG-A.GNNO6.GDT 12/7/20

# LOG OF BORING

CHOSEN VALLEY TESTING



PROJECT: 17623.20.MNS Design Phase Geotechnical Evaluation Proposed Infrastructure Improvements Tiger Street Ramsey, Minnesota	BORING: <b>B-06</b>	
	LOCATION: See attached sketch	
	DATE: 11/23/2020	SCALE: 1" = 2'

Elev.	Depth	USCS Symbol	Description of Materials (ASTM D 2487/2488)	BPF	WL	Tests and Notes
	0.0					
	0.1		<b>1.5" BITUMINOUS</b>			
	0.3	SM	<b>3" RECYCLED BITUMINOUS</b> <b>SILTY SAND</b> , mostly fine grained, dark brown with black mixing, moist. (Fill)			
	4.0	SP SM	<b>POORLY GRADED SAND with SILT</b> , mostly fine to medium grained, trace gravel, brown, moist, very loose. (Terrace Deposit)	12		
	6.5	SP	<b>POORLY GRADED SAND</b> , mostly fine to medium grained, trace gravel, brown, moist, very loose to loose. (Terrace Deposit)	4		
	11.0		End of boring. Water not encountered during drilling. Boring sealed upon completion.	6		

CVT STANDARD 17623.20.MNS (RAMSEY TIGER STREET).GPJ LOG-A.GN06.GDT 12/7/20

# LOG OF BORING

CHOSEN VALLEY TESTING



PROJECT: 17623.20.MNS Design Phase Geotechnical Evaluation Proposed Infrastructure Improvements Tiger Street Ramsey, Minnesota	BORING: <b>B-07</b>	
	LOCATION: See attached sketch	
	DATE: 11/23/2020	SCALE: 1" = 2'

Elev.	Depth	USCS Symbol	Description of Materials (ASTM D 2487/2488)	BPF	WL	Tests and Notes
	0.0					
	0.3		<b>4" BITUMINOUS</b>			
			<b>1.5" RECYCLED BITUMINOUS</b>			
	0.4	SP	<b>POORLY GRADED SAND with SILT</b> , brown. (Fill)			
	0.8	SM				
	1.1	SM				
		SP	<b>SILTY SAND</b> , black. (Fill)			
			<b>POORLY GRADED SAND</b> , mostly fine to medium grained, trace gravel, brown, moist, medium dense.  (Possible Fill)			
			Trace Silty Sand inclusions around 5 feet			
	6.5	SP	<b>POORLY GRADED SAND</b> , mostly fine to medium grained, trace gravel, brown, moist, loose. (Terrace Deposit)			
	11.0		End of boring. Water not encountered during drilling. Boring sealed upon completion.			

CVT STANDARD 17623.20.MNS (RAMSEY TIGER STREET).GPJ LOG-A.GN06.GDT 12/7/20

# LOG OF BORING

CHOSEN VALLEY TESTING



PROJECT: 17623.20.MNS Design Phase Geotechnical Evaluation Proposed Infrastructure Improvements Tiger Street Ramsey, Minnesota	BORING: <b>B-08</b>	
	LOCATION: See attached sketch	
	DATE: 11/23/2020	SCALE: 1" = 2'

Elev.	Depth	USCS Symbol	Description of Materials (ASTM D 2487/2488)	BPF	WL	Tests and Notes
	0.0					
	0.3		<b>4" BITUMINOUS</b>			
	0.4	SM	<b>1" RECYCLED BITUMINOUS</b>			
	0.9	SM	<b>SILTY SAND</b> , dark brown, moist. (Fill)			
	1.2	SP	<b>SILTY SAND</b> , mostly fine grained, black, moist. (Possible Fill / Topsoil)			
			<b>POORLY GRADED SAND</b> , mostly fine grained, brown, moist, loose to medium dense. (Terrace Deposit)			
				10		
				11		
			Mostly fine to medium grained and trace gravel below 7.5 feet	5		
				7		
	11.0		End of boring. Water not encountered during drilling. Boring sealed upon completion.			

CVT STANDARD 17623.20.MNS (RAMSEY TIGER STREET).GPJ LOG-A GNN06.GDT 12/7/20

# LOG OF BORING

CHOSEN VALLEY TESTING



PROJECT: 17623.20.MNS Design Phase Geotechnical Evaluation Proposed Infrastructure Improvements Tiger Street Ramsey, Minnesota	BORING: <b>B-09</b>	
	LOCATION: See attached sketch	
	DATE: 11/23/2020	SCALE: 1" = 2'

Elev.	Depth	USCS Symbol	Description of Materials (ASTM D 2487/2488)	BPF	WL	Tests and Notes
	0.0					
	0.2		<b>3" BITUMINOUS</b>			
			<b>2" RECYCLED BITUMINOUS</b>			
	0.4	SM	<b>SILTY SAND</b> , mostly fine grained, trace gravel, dark brown, moist.			
	0.7	SM				
	1.2	SP	(Fill) <b>SILTY SAND</b> , mostly fine grained, black, moist. (Possible Fill / Topsoil)			
			<b>POORLY GRADED SAND</b> , mostly fine to medium grained, trace gravel, brown, moist, loose to medium dense. (Terrace Deposit)			
				7		
				11		
			Light brown below 7 feet			
				12		
				12		
	11.0		End of boring. Water not encountered during drilling. Boring sealed upon completion.			

CVT STANDARD 17623.20.MNS (RAMSEY TIGER STREET).GPJ LOG-A GNN06.GDT 12/7/20

# LOG OF BORING

CHOSEN VALLEY TESTING



PROJECT: 17623.20.MNS Design Phase Geotechnical Evaluation Proposed Infrastructure Improvements Tiger Street Ramsey, Minnesota	BORING: <b>B-10</b>	
	LOCATION: See attached sketch	
	DATE: 11/23/2020	SCALE: 1" = 2'

Elev.	Depth	USCS Symbol	Description of Materials (ASTM D 2487/2488)	BPF	WL	Tests and Notes
	0.0					
	0.2	SM	<b>1.5" BITUMINOUS SILTY SAND</b> , dark brown, moist. (Fill)			
	1.2	SP	<b>POORLY GRADED SAND</b> , mostly fine grained, trace gravel, brown, moist, loose to medium dense. (Terrace Deposit)			
				9		
				11		
			Mostly fine to medium grained below 7 feet	8		
				9		
	11.0		End of boring. Water not encountered during drilling. Boring sealed upon completion.			

CVT STANDARD 17623.20.MNS (RAMSEY TIGER STREET).GPJ LOG-A GNN06.GDT 12/7/20

# 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	
		GRAVELS WITH FINES >12% FINES	FINES CLASSIFY AS ML OR CL	GM	SILTY GRAVEL	
		CLEAN SANDS <5% FINES	Cu>6 AND 1<Cc<3	SW	WELL-GRADED SAND	
		SANDS AND FINES >12% FINES	FINES CLASSIFY AS CL OR CH	SC	CLAYEY SAND	
	SANDS  >50% OF COARSE FRACTION PASSES ON NO. 4. SIEVE	CLEAN SANDS <5% FINES	Cu>6 AND 1>Cc>3	SP	POORLY-GRADED SAND	
		SANDS AND FINES >12% FINES	FINES CLASSIFY AS ML OR CL	SM	SILTY SAND	
		SANDS AND FINES >12% FINES	FINES CLASSIFY AS CL OR CH	SC	CLAYEY SAND	
		SANDS AND FINES >12% FINES	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	
		INORGANIC	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	
		INORGANIC	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

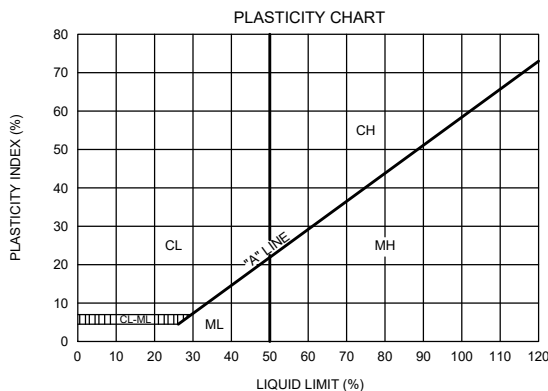
### SAMPLE TYPES

- 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



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	1.0 - 2.0
VERY DENSE	OVER 50	RATHER STIFF	9 - 12	1.0 - 2.0
		STIFF	13 - 16	2.0 - 4.0
		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).

CVT-16987.20.MNR (DODGE CENTER AIRPORT WATERMAIN EXTENSION).GPJ 8/4/20

## Chosen Valley Testing

Job No. 16987.20.MNR

## LEGEND TO SOIL DESCRIPTIONS



City of Ramsey Tiger Street Infrastructure Improvements

Boring B-02



City of Ramsey Tiger Street Infrastructure Improvements

Boring B-03



City of Ramsey Tiger Street Infrastructure Improvements

Boring B-04



City of Ramsey Tiger Street Infrastructure Improvements

Boring B-05



City of Ramsey Tiger Street Infrastructure Improvements

Boring B-06



City of Ramsey Tiger Street Infrastructure Improvements

Boring B-07



City of Ramsey Tiger Street Infrastructure Improvements

Boring B-08



City of Ramsey Tiger Street Infrastructure Improvements

Boring B-09



City of Ramsey Tiger Street Infrastructure Improvements

Boring B-10

