

# **APPENDIX 'G'**

# **GEOTECHNICAL REPORT**



Quality Engineering | Valued Relationships

Morrison Hershfield

## **2018 Local Streets Package (PW File #: 18-R-05)**

**Prepared for:**

Morrison Hershfield  
25 Scurfield Blvd, Unit 1  
Winnipeg, MB R3Y 1G4  
Attention: Ron Bruce

**Distribution:**

Ron Bruce, P.Eng.

**Project Number:**

0035 057 00

**Date:**

February 2, 2018  
Final Report



Quality Engineering | Valued Relationships

February 2, 2018

Our File No. 0035 057 00

Ron Bruce, P.Eng.  
Morrison Hershfield  
25 Scurfield Blvd, Unit 1  
Winnipeg, MB R3Y 1G4

**RE: Sub-Surface Investigation Report for  
2018 Local Streets Package (PW File #: 18-R-05)**

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TREK Geotechnical Inc. is pleased to submit our report for the sub-surface investigations for the 2018 Local Streets Package (PW File #: 18-R-05).

Please contact the undersigned if you have any questions. Thank you for the opportunity to serve you on this assignment.

Sincerely,

**TREK Geotechnical Inc.**

**Per:**

A handwritten signature in blue ink, appearing to read "N. Ferreira".

Nelson John Ferreira, Ph.D., P. Eng.  
Geotechnical Engineer, Principal  
Tel: 204.975.9433 ext. 103

cc: Angela Fidler-Kliewer C.Tech. (TREK Geotechnical)

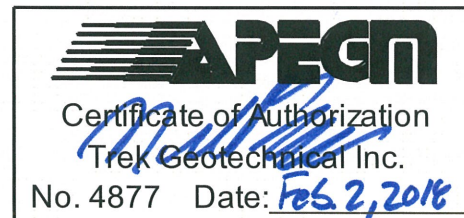
## Revision History

Revision No.	Author	Issue Date	Description
0	AFK	February 2, 2018	Final Report

## Authorization Signatures

Prepared By:

  
Angela Fidler-Kliwer C.Tech.



Reviewed By:

Nelson John Ferreira, Ph.D., P.Eng.  
Geotechnical Engineer



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## 1.0 Introduction

This report summarizes the results of the sub-surface investigation completed for the 2018 Local Streets Package 18-R-05 project. The streets included Tache Avenue, Oxford Street, and ~~Culross Bay~~. The information collected describes the pavement structure of the existing road as well as the soil stratigraphy beneath the pavement structure.

## 2.0 Sub-Surface Investigation and Laboratory Program

For each street test holes were drilled approximately every 50m of street length with specific locations shown on Figure 01 to Figure 02. The test holes were drilled in order to determine sub-surface conditions for the reconstruction of the road segment.

The sub-surface investigation was conducted between December 14, 2017 and December 22, 2017. The test holes were drilled to a depth of 3.0 m below road surface by Maple Leaf Drilling Ltd. using their B40 Mobile truck mounted drill rig equipped with 125 mm diameter solid stem augers. The pavement structure (asphalt or concrete) was cored by Harsimran Singh of TREK Geotechnical Inc. (TREK) using a portable coring press equipped with a hollow 150 mm diameter diamond core drill bit. The sub-surface conditions were observed during drilling and visually classified by Dawn Sellick of TREK. Other pertinent information such as groundwater and drilling conditions were also recorded during the drilling investigation. Disturbed (auger cuttings) samples retrieved during the sub-surface investigation were transported to TREK's material testing laboratory for further testing. Core samples were also retrieved and logged at TREK's material testing laboratory.

The laboratory testing program consisted of moisture content determination, Atterberg limits, and grain size analysis (mechanical sieve and hydrometer methods) on select samples between 0.5 and 1.0 m below pavement. Information gathered for each street is included in separate appendices (Appendices A and B). The information provided in the Appendices includes test hole logs, laboratory testing summary tables and results, and photos of the concrete cores.

Test hole locations noted on the test hole logs and shown on Figure 01 and Figure 02 are based on their location relative to the nearest address, and measured distances from the edge of pavement or other permanent features.

## 3.0 Closure

The information provided in this report is in accordance with current engineering principles and practices (Standard of Practice). The findings of this report were based on information provided (field investigation, laboratory testing, geometries). Soil conditions are natural deposits that can be highly variable across a site. If sub-surface conditions are different than the conditions previously encountered on-site or those presented here, we should be notified to adjust our findings if necessary.

All information provided in this report is subject to our standard terms and conditions for engineering services, a copy of which is provided to each of our clients with the original scope of work, or a mutually executed standard engineering services agreement. If these conditions are not attached, and you are not

already in possession of such terms and conditions, contact our office and you will be promptly provided with a copy.

This report has been prepared by TREK Geotechnical Inc. (the Consultant) for the exclusive use of Morrison Hershfield (the Client) and their agents for the work product presented in the report. Any findings or recommendations provided in this report are not to be used or relied upon by any third parties, except as agreed to in writing by the Client and Consultant prior to use.

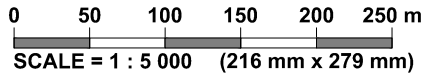
## Figures

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ANSI full bleed A (8.50 x 11.00 Inches)

FIG.002, 2018-01-29 Test Hole Plan(TACHE AVENUE).D, A, SL 0035 057 00.dwg, 2/2/2018 2:42:54 PM



**LEGEND:** TEST HOLE (TREK, 2018)

**NOTES:** 1. AERIAL IMAGE FROM CITY OF WINNIPEG 2016

**Figure 01**  
Test Hole Plan

**Appendix A**

**Tache Ave., between St. Mary's Ave. and Lyndale Drive.**

**Test Hole Logs, Summary Table, Lab  
Data and Photographs of Pavement  
Core Samples**

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## GENERAL NOTES

- Classifications are based on the United Soil Classification System and include consistency, moisture, and color. Field descriptions have been modified to reflect results of laboratory tests where deemed appropriate.
- Descriptions on these test hole logs apply only at the specific test hole locations and at the time the test holes were drilled. Variability of soil and groundwater conditions may exist between test hole locations.
- When the following classification terms are used in this report or test hole logs, the primary and secondary soil fractions may be visually estimated.

Major Divisions	USCS Classification	Symbols	Typical Names	Laboratory Classification Criteria		Particle Size				
<b>Coarse-Grained soils</b> (More than half the material is larger than No. 200 sieve size)	<b>Gravels</b> (More than half of coarse fraction is larger than 4.75 mm)	GW		Well-graded gravels, gravel-sand mixtures, little or no fines	$C_u = \frac{D_{60}}{D_{10}}$ greater than 4; $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ between 1 and 3  Not meeting all gradation requirements for GW	ASTM Sieve sizes #10 to #4 #40 to #10 #200 to #40 < #200				
		GP		Poorly-graded gravels, gravel-sand mixtures, little or no fines						
		GM		Silty gravels, gravel-sand-silt mixtures						
		GC		Clayey gravels, gravel-sand-silt mixtures						
	<b>Sands</b> (More than half of coarse fraction is smaller than 4.75 mm)	<b>Clean sands</b> (Little or no fines)	SW		Well-graded sands, gravelly sands, little or no fines	$C_u = \frac{D_{60}}{D_{10}}$ greater than 6; $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ between 1 and 3  Not meeting all gradation requirements for SW	mm 2.00 to 4.75 0.425 to 2.00 0.075 to 0.425 < 0.075			
			SP		Poorly-graded sands, gravelly sands, little or no fines					
		<b>Sands with fines</b> (Appreciable amount of fines)	SM		Silty sands, sand-silt mixtures			Atterberg limits below "A" line or P.I. less than 4  Above "A" line with P.I. between 4 and 7 are borderline cases requiring use of dual symbols		
			SC		Clayey sands, sand-clay mixtures				Atterberg limits above "A" line or P.I. greater than 7  Above "A" line with P.I. between 4 and 7 are borderline cases requiring use of dual symbols	
		<b>Fine-Grained soils</b> (More than half the material is smaller than No. 200 sieve size)	<b>Silts and Clays</b> (Liquid limit less than 50)	ML				Inorganic silts and very fine sands, rock floor, silty or clayey fine sands or clayey silts with slight plasticity	<b>Plasticity Chart</b> 	Particle Size ASTM Sieve Sizes mm > 300 75 to 300 19 to 75 4.75 to 19 > 12 in. 3 in. to 12 in. 3/4 in. to 3 in. #4 to 3/4 in.
				CL				Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays		
OL				Organic silts and organic silty clays of low plasticity						
<b>Silts and Clays</b> (Liquid limit greater than 50)	MH			Inorganic silts, micaceous or distomaceous fine sandy or silty soils, organic silts						
	CH			Inorganic clays of high plasticity, fat clays						
	OH			Organic clays of medium to high plasticity, organic silts						
<b>Highly Organic Soils</b>	Pt			Peat and other highly organic soils	Von Post Classification Limit  Strong colour or odour, and often fibrous texture	Material Boulders Cobbles Gravel Coarse Fine				

\* Borderline classifications used for soils possessing characteristics of two groups are designated by combinations of groups symbols. For example; GW-GC, well-graded gravel-sand mixture with clay binder.

## Other Symbol Types

	Asphalt		Bedrock (undifferentiated)		Cobbles
	Concrete		Limestone Bedrock		Boulders and Cobbles
	Fill		Cemented Shale		Silt Till
			Non-Cemented Shale		Clay Till

## LEGEND OF ABBREVIATIONS AND SYMBOLS

LL - Liquid Limit (%)	▽ Water Level at Time of Drilling
PL - Plastic Limit (%)	▼ Water Level at End of Drilling
PI - Plasticity Index (%)	▽ Water Level After Drilling as Indicated on Test Hole Logs
MC - Moisture Content (%)	
SPT - Standard Penetration Test	
RQD- Rock Quality Designation	
Qu - Unconfined Compression	
Su - Undrained Shear Strength	
VW - Vibrating Wire Piezometer	
SI - Slope Incliner	

## FRACTION OF SECONDARY SOIL CONSTITUENTS ARE BASED ON THE FOLLOWING TERMINOLOGY

TERM	EXAMPLES	PERCENTAGE
and	and CLAY	35 to 50 percent
"y" or "ey"	clayey, silty	20 to 35 percent
some	some silt	10 to 20 percent
trace	trace gravel	1 to 10 percent

## TERMS DESCRIBING CONSISTENCY OR COMPACTION CONDITION

The Standard Penetration Test blow count (N) of a non-cohesive soil can be related to compactness condition as follows:

<u>Descriptive Terms</u>	<u>SPT (N) (Blows/300 mm)</u>
Very loose	< 4
Loose	4 to 10
Compact	10 to 30
Dense	30 to 50
Very dense	> 50

The Standard Penetration Test blow count (N) of a cohesive soil can be related to its consistency as follows:

<u>Descriptive Terms</u>	<u>SPT (N) (Blows/300 mm)</u>
Very soft	< 2
Soft	2 to 4
Firm	4 to 8
Stiff	8 to 15
Very stiff	15 to 30
Hard	> 30

The undrained shear strength (Su) of a cohesive soil can be related to its consistency as follows:

<u>Descriptive Terms</u>	<u>Undrained Shear Strength (kPa)</u>
Very soft	< 12
Soft	12 to 25
Firm	25 to 50
Stiff	50 to 100
Very stiff	100 to 200
Hard	> 200



# Sub-Surface Log

Test Hole TH17-01

1 of 1

Client: Morrison Hershfield Project Number: 0035-057-00  
 Project Name: Local Streets 18-R-05 - Tache Ave Location: UTM N-5526118, E-634842  
 Contractor: Maple Leaf Drilling Ground Elevation: Top of Pavement  
 Method: 125mm Solid Stem Auger, B40 Mobile Truck Mount Date Drilled: 2017 December 14

Sample Type:  Grab (G)  Shelby Tube (T)  Split Spoon (SS)  Split Barrel (SB)  Core (C)

Particle Size Legend:  Fines  Clay  Silt  Sand  Gravel  Cobbles  Boulders

Depth (m)	Soil Symbol	MATERIAL DESCRIPTION	Sample Type	Sample Number	Bulk Unit Wt (kN/m <sup>3</sup> )		Particle Size (%)		Undrained Shear Strength (kPa)								
					16	17	18	19	20	21	0	50	100	150	200	250	
0.0 - 0.1		CONCRETE - 203 mm thick															
0.1 - 0.5		SAND (Fill) - gravelly, trace silt - light brown - frozen, moist and compact when thawed - well graded, sub-angular to angular gravel - no plasticity - "pit-run"	<input checked="" type="checkbox"/>	G01													
0.5 - 1.0		CLAY - silty, trace sand - dark grey - frozen to 0.8 m, moist and soft when thawed - high plasticity - stiff to very stiff between 0.9 m to 1.1 m	<input checked="" type="checkbox"/>	G02													
1.0 - 1.5		- firm to stiff below 1.1 m	<input checked="" type="checkbox"/>	G03													
1.5 - 2.0		- stiff below 1.5 m	<input checked="" type="checkbox"/>	G04													
2.0 - 2.5			<input checked="" type="checkbox"/>	G05													
2.5 - 3.0			<input checked="" type="checkbox"/>	G06													
3.0 - 3.5			<input checked="" type="checkbox"/>	G07													
3.5 - 4.0			<input checked="" type="checkbox"/>	G08													

END OF HOLE AT 3.0 m DEPTH IN CLAY

Notes:

- 1) No seepage or sloughing.
- 2) Test hole backfilled with auger cuttings, bentonite chips, sand and cold patch asphalt.
- 3) Test hole located at the East side of house #59, 1.8 m South of Westbound curb.

Logged By: Dawn Sellick Reviewed By: Nelson Ferreira Project Engineer: Nelson Ferreira

PTH 83 TH LOGS MIT FONT LOGS 2018-01-25 LOCAL STREETS 18-R-05 TACHE 0035-057-00 0 B NM GP J TREK GEOTECHNICAL GDT 18-2-1



# Sub-Surface Log

Test Hole TH17-02

1 of 1

Client: Morrison Hershfield Project Number: 0035-057-00  
 Project Name: Local Streets 18-R-05 - Tache Ave Location: UTM N-5526183, E-634849  
 Contractor: Maple Leaf Drilling Ground Elevation: Top of Pavement  
 Method: 125mm Solid Stem Auger, B40 Mobile Truck Mount Date Drilled: 2017 December 14

Sample Type:  Grab (G)  Shelby Tube (T)  Split Spoon (SS)  Split Barrel (SB)  Core (C)

Particle Size Legend:  Fines  Clay  Silt  Sand  Gravel  Cobbles  Boulders

Depth (m)	Soil Symbol	MATERIAL DESCRIPTION	Sample Type	Sample Number	Bulk Unit Wt (kN/m <sup>3</sup> )		Particle Size (%)		Undrained Shear Strength (kPa)								
					16	17	18	19	20	21	0	50	100	150	200	250	
0.0 - 0.1		ASPHALT - 127 mm thick															
0.1 - 0.4		SAND (Fill) - silty, gravelly, some clay, light brown, frozen, moist and compact when thawed, well graded, no to low plasticity, sub-angular to angular															
0.4 - 0.5		CLAY - silty, trace sand															
0.5 - 1.7		- grey - frozen to 1.1 m, moist and soft when thawed - high plasticity															
1.7 - 2.75		- stiff to very stiff below 1.7 m															
2.75 - 3.0		- firm to stiff below 2.75 m															
				G09													
				G10													
				G11													
				G12													
				G13													
				G14													
				G15													
				G16													
				G17													

END OF HOLE AT 3.0 m DEPTH IN CLAY

Notes:

- 1) No seepage or sloughing.
- 2) Test hole backfilled with auger cuttings, bentonite chips, sand and cold patch asphalt.
- 3) Test hole located at the East side of house #52, 1.1 m North of Eastbound curb.

Logged By: Dawn Sellick Reviewed By: Nelson Ferreira Project Engineer: Nelson Ferreira

PTH 83 TH LOGS MIT FONT LOGS 2018-01-25 LOCAL STREETS 18-R-05 TACHE 0035-057-00 0 B NM GP J TREK GEOTECHNICAL GDT 18-2-1



# Sub-Surface Log

Test Hole TH17-03

1 of 1

Client: Morrison Hershfield Project Number: 0035-057-00  
 Project Name: Local Streets 18-R-05 - Tache Ave Location: UTM N-5526270, E-634845  
 Contractor: Maple Leaf Drilling Ground Elevation: Top of Pavement  
 Method: 125mm Solid Stem Auger, B40 Mobile Truck Mount Date Drilled: 2017 December 14

Sample Type:  Grab (G)  Shelby Tube (T)  Split Spoon (SS)  Split Barrel (SB)  Core (C)

Particle Size Legend:  Fines  Clay  Silt  Sand  Gravel  Cobbles  Boulders

Depth (m)	Soil Symbol	MATERIAL DESCRIPTION	Sample Type	Sample Number	Bulk Unit Wt (kN/m <sup>3</sup> )		Particle Size (%)		Undrained Shear Strength (kPa)									
					16	17	18	19	20	21	0	50	100	150	200	250		
0.0 - 0.1		ASPHALT - 178 mm thick																
0.1 - 0.5		SAND (Fill) - silty, gravelly, some clay, - light brown - frozen, wet and compact when thawed - well graded, sub-angular to angular gravel - no to low plasticity	<input checked="" type="checkbox"/>	G18														
0.5 - 0.8		CLAY (Fill) - silty, some sand, grey, frozen to 0.8 m, moist and soft when thawed, high plasticity	<input checked="" type="checkbox"/>	G19														
0.8 - 1.0		CLAY - silty, trace sand - grey - moist, stiff - high plasticity - light brown below 1.0 m	<input checked="" type="checkbox"/>	G20														
1.0 - 1.5		CLAY - silty, trace sand - grey - moist, stiff - high plasticity - light brown below 1.0 m	<input checked="" type="checkbox"/>	G21														
1.5 - 1.8		SILT - clayey, trace sand - light brown - moist, soft - low to intermediate plasticity	<input checked="" type="checkbox"/>	G22														
1.8 - 2.0		CLAY - silty, trace sand - grey - moist, very stiff - high plasticity	<input checked="" type="checkbox"/>	G23														
2.0 - 2.5		CLAY - silty, trace sand - grey - moist, very stiff - high plasticity	<input checked="" type="checkbox"/>	G24														
2.5 - 3.0		CLAY - silty, trace sand - grey - moist, very stiff - high plasticity	<input checked="" type="checkbox"/>	G25														

END OF HOLE AT 3.2 m DEPTH IN CLAY

Notes:

- 1) No seepage or sloughing.
- 2) Test hole backfilled with auger cuttings, bentonite chips, sand and cold patch asphalt.
- 3) Test hole located at the East side of house #71, 1.0 m South of Westbound curb.

Logged By: Dawn Sellick Reviewed By: Nelson Ferreira Project Engineer: Nelson Ferreira

PTH 83 TH LOGS MIT FONT LOGS 2018-01-25 LOCAL STREETS 18-R-05 TACHE 0035-057-00 0 B NM GP J TREK GEOTECHNICAL GDT 18-2-1



# Sub-Surface Log

Test Hole TH17-04

1 of 1

Client: Morrison Hershfield Project Number: 0035-057-00  
 Project Name: Local Streets 18-R-05 - Tache Ave Location: UTM N-5526346, E-634851  
 Contractor: Maple Leaf Drilling Ground Elevation: Top of Pavement  
 Method: 125mm Solid Stem Auger, B40 Mobile Truck Mount Date Drilled: 2017 December 14

Sample Type:  Grab (G)  Shelby Tube (T)  Split Spoon (SS)  Split Barrel (SB)  Core (C)

Particle Size Legend:  Fines  Clay  Silt  Sand  Gravel  Cobbles  Boulders

Depth (m)	Soil Symbol	MATERIAL DESCRIPTION	Sample Type	Sample Number	Bulk Unit Wt (kN/m <sup>3</sup> )		Undrained Shear Strength (kPa)	
					16	17	18	19
0.0		ASPHALT - 152 mm thick						
0.0		CONCRETE - 102 mm thick						
0.0		SAND (Fill) - silty, gravelly, some clay, light brown, frozen, moist and compact when thawed, well graded, no to low plasticity, sub-angular to angular	<input checked="" type="checkbox"/>	G26				
0.0		CLAY (Fill) - silty, gravelly, trace sand, trace gravel (<10 mm diameter) - grey - frozen, moist and soft when thawed - low plasticity, hydrocarbon like odor	<input checked="" type="checkbox"/>	G27				△ +
0.5		CLAY - silty, trace sand - light grey - moist, soft - intermediate plasticity	<input checked="" type="checkbox"/>	G28				
0.5			<input checked="" type="checkbox"/>	G29				
0.5			<input checked="" type="checkbox"/>	G30				
1.0								
1.5		- grey, firm to stiff, high plasticity below 1.4 m						
1.5			<input checked="" type="checkbox"/>	G31				△ +
2.0								
2.0			<input checked="" type="checkbox"/>	G32				△ +
2.5								
2.5			<input checked="" type="checkbox"/>	G33				△ +
3.0		END OF HOLE AT 3.0 m DEPTH IN CLAY						

Notes:  
 1) No seepage or sloughing.  
 2) Test hole backfilled with auger cuttings, bentonite chips, sand and cold patch asphalt.  
 3) Test hole located at house #90, 1.1 m North of Eastbound curb.

PTH 83 TH LOGS MIT FONT LOGS 2018-01-25 LOCAL STREETS 18-R-05 TACHE 0035-057-00 0 B NM GP J TREK GEOTECHNICAL GDT 18-2-1





# Sub-Surface Log

Test Hole TH17-05

1 of 1

Client: Morrison Hershfield Project Number: 0035-057-00  
 Project Name: Local Streets 18-R-05 - Tache Ave Location: UTM N-5526404, E-634848  
 Contractor: Maple Leaf Drilling Ground Elevation: Top of Pavement  
 Method: 125mm Solid Stem Auger, B40 Mobile Truck Mount Date Drilled: 2017 December 14

Sample Type:  Grab (G)  Shelby Tube (T)  Split Spoon (SS)  Split Barrel (SB)  Core (C)

Particle Size Legend:  Fines  Clay  Silt  Sand  Gravel  Cobbles  Boulders

Depth (m)	Soil Symbol	MATERIAL DESCRIPTION	Sample Type	Sample Number	Bulk Unit Wt (kN/m <sup>3</sup> )		Particle Size (%)		Undrained Shear Strength (kPa)								
					16	17	18	19	20	21	0	50	100	150	200	250	
0.0		ASPHALT - 102 mm thick															
0.0		CONCRETE - 127 mm thick		G34													
0.0		CLAY (Fill)- silty, trace sand, trace gravel (<10 mm diameter) - grey - frozen, moist and soft when thawed - low plasticity		G35													
0.5				G36													
0.5		SILT - some clay, trace sand - light brown - moist, soft - low plasticity		G37													
1.0																	
1.0		CLAY - silty - light brown - moist, soft - intermediate plasticity		G38													
1.5		- grey, very stiff, high plasticity below 1.5 m		G39													
2.0				G40													
2.0				G41													
2.5		- firm below 2.5 m		G42													

END OF HOLE AT 2.9 m DEPTH IN CLAY

Notes:

- 1) No seepage or sloughing.
- 2) Test hole backfilled with auger cuttings, bentonite chips, sand and cold patch asphalt.
- 3) Test hole located between house #105 and 107, 1.4 m South of Westbound curb.

Logged By: Dawn Sellick Reviewed By: Nelson Ferreira Project Engineer: Nelson Ferreira

PTH 83 TH LOGS MIT FONT LOGS 2018-01-25 LOCAL STREETS 18-R-05 TACHE 0035-057-00 0 B NM GP J TREK GEOTECHNICAL\_GDT 18-2-1



# Sub-Surface Log

Test Hole TH17-06

1 of 1

Client: Morrison Hershfield Project Number: 0035-057-00  
 Project Name: Local Streets 18-R-05 - Tache Ave Location: UTM N-5526470, E-634852  
 Contractor: Maple Leaf Drilling Ground Elevation: Top of Pavement  
 Method: 125mm Solid Stem Auger, B40 Mobile Truck Mount Date Drilled: 2017 December 14

Sample Type:  Grab (G)  Shelby Tube (T)  Split Spoon (SS)  Split Barrel (SB)  Core (C)

Particle Size Legend:  Fines  Clay  Silt  Sand  Gravel  Cobbles  Boulders

Depth (m)	Soil Symbol	MATERIAL DESCRIPTION	Sample Type	Sample Number	Bulk Unit Wt (kN/m <sup>3</sup> )		Particle Size (%)		Undrained Shear Strength (kPa)								
					16	17	18	19	20	21	0	50	100	150	200	250	
0.00 - 0.05		ASPHALT - 64 mm thick															
0.05 - 0.10		CONCRETE - 191 mm thick															
0.10 - 0.45		SAND (Fill) - silty, gravelly, some clay, light brown, frozen, moist and compact when thawed, well graded, no to low plasticity, sub-angular to angular	G	G43													
0.45 - 0.60		CLAY (FILL) - silty, sandy, trace gravel, grey, moist, soft, low plasticity	G	G44													
0.60 - 1.00		CLAY - silty, trace sand - grey - moist, very stiff - high plasticity	G	G45													
1.00 - 1.50		SILT - trace to some clay - light brown - dry to moist, soft - low plasticity	G	G46													
1.50 - 2.00		CLAY - silty - grey - moist, stiff - high plasticity	G	G47													
2.00 - 2.50			G	G48													
2.50 - 2.90			G	G49													
2.90 - 3.00			G	G50													

END OF HOLE AT 2.9 m DEPTH IN CLAY

Notes:

- 1) No seepage or sloughing.
- 2) Test hole backfilled with auger cuttings, bentonite chips, sand and cold patch asphalt.
- 3) Test hole located at house #126, 1.2 m North of Eastbound curb.



# Sub-Surface Log

Test Hole TH17-07

1 of 1

Client: Morrison Hershfield Project Number: 0035-057-00  
 Project Name: Local Streets 18-R-05 - Tache Ave Location: UTM N-5526547, E-634850  
 Contractor: Maple Leaf Drilling Ground Elevation: Top of Pavement  
 Method: 125mm Solid Stem Auger, B40 Mobile Truck Mount Date Drilled: 2017 December 14

Sample Type:  Grab (G)  Shelby Tube (T)  Split Spoon (SS)  Split Barrel (SB)  Core (C)

Particle Size Legend:  Fines  Clay  Silt  Sand  Gravel  Cobbles  Boulders

Depth (m)	Soil Symbol	MATERIAL DESCRIPTION	Sample Type	Sample Number	Bulk Unit Wt (kN/m <sup>3</sup> )						Undrained Shear Strength (kPa)					
					16	17	18	19	20	21	Test Type					
					Particle Size (%)											
					0	20	40	60	80	100						
					PL _____ MC _____ LL _____ 0 20 40 60 80 100											
					0	20	40	60	80	100	0	50	100	150	200	250
		ASPHALT - 64 mm thick														
		CRUSHED CONCRETE - 51 mm thick														
		CONCRETE - 89 mm thick														
		SAND (Fill) - silty, gravelly, some clay, light brown, frozen, moist and compact when thawed, well graded, no to low plasticity, sub-angular to angular	G51													
		CLAY (FILL) - silty, sandy, trace gravel (<10 mm diameter), grey, moist, low plasticity	G52													
0.5		CLAY - silty, trace sand - grey - moist, soft - high plasticity	G53													
1.0		- very stiff, blocky between 0.9 m to 1.5 m	G54													
1.5		- stiff to very stiff below 1.5 m	G55													
2.0			G56													
2.5			G57													
3.0			G58													

END OF HOLE AT 3.0 m DEPTH IN CLAY

Notes:

- 1) No seepage or sloughing.
- 2) Test hole backfilled with auger cuttings, bentonite chips, sand and cold patch asphalt.
- 3) Test hole located between house #137 and #141, 1.5 m South of Westbound curb.

Logged By: Dawn Sellick Reviewed By: Nelson Ferreira Project Engineer: Nelson Ferreira

PTH 83 TH LOGS MIT FONT LOGS 2018-01-25 LOCAL STREETS 18-R-05 TACHE 0035-057-00 0 B NM GP J TREK GEOTECHNICAL GDT 18-2-1



# Sub-Surface Log

Test Hole TH17-08

1 of 1

Client: Morrison Hershfield Project Number: 0035-057-00  
 Project Name: Local Streets 18-R-05 - Tache Ave Location: UTM N-5526637, E-634857  
 Contractor: Maple Leaf Drilling Ground Elevation: Top of Pavement  
 Method: 125mm Solid Stem Auger, B40 Mobile Truck Mount Date Drilled: 2017 December 14

Sample Type:  Grab (G)  Shelby Tube (T)  Split Spoon (SS)  Split Barrel (SB)  Core (C)

Particle Size Legend:  Fines  Clay  Silt  Sand  Gravel  Cobbles  Boulders

Depth (m)	Soil Symbol	MATERIAL DESCRIPTION	Sample Type	Sample Number	Bulk Unit Wt (kN/m <sup>3</sup> )						Undrained Shear Strength (kPa)					
					16	17	18	19	20	21	Test Type					
					Particle Size (%)											
					0	20	40	60	80	100						
					0	20	40	60	80	100	0	50	100	150	200	250
0.00 - 0.05		ASPHALT - 152 mm thick														
0.05 - 0.10		CONCRETE - 254 mm thick														
0.10 - 0.50		SAND (Fill) - silty, gravelly, some clay, light brown, frozen, moist and compact when thawed, well graded, no to low plasticity, sub-angular to angular	<input checked="" type="checkbox"/>	G59												
0.50 - 1.00		CLAY (FILL) - silty, sandy, gravelly, - grey - frozen to 0.6 m, moist and soft when thawed - high plasticity	<input checked="" type="checkbox"/>	G60												
1.00 - 1.70		CLAY - silty, trace sand - grey - moist, stiff - high plasticity	<input checked="" type="checkbox"/>	G61												
1.70 - 2.00			<input checked="" type="checkbox"/>	G62												
2.00 - 2.50			<input checked="" type="checkbox"/>	G63												
2.50 - 3.00			<input checked="" type="checkbox"/>	G64												
3.00 - 3.30			<input checked="" type="checkbox"/>	G65												
3.30 - 3.60			<input checked="" type="checkbox"/>	G66												
3.60 - 3.90			<input checked="" type="checkbox"/>	G67												

END OF HOLE AT 3.0 m DEPTH IN CLAY

Notes:

- 1) No seepage or sloughing.
- 2) Test hole backfilled with auger cuttings, bentonite chips, sand and cold patch asphalt.
- 3) Test hole located 39.0 m South of St. Mary's Ave and Tache Ave intersection, 1.0 m North of Eastbound curb.

Logged By: Dawn Sellick Reviewed By: Nelson Ferreira Project Engineer: Nelson Ferreira

PTH 83 TH LOGS MIT FONT LOGS 2018-01-25 LOCAL STREETS 18-R-05 TACHE 0035-057-00 0 B NM GP J TREK GEOTECHNICAL GDT 18-2-1







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## Moisture Content Report ASTM D2216-10

**Project No.** 0035-057-00  
**Client** Morrison Hershfield  
**Project** Local Streets 18-R-05 Tache Ave.

**Sample Date** 14-Dec-17  
**Test Date** 2-Jan-18  
**Technician** DS

Test Pit	TH17-01	TH17-01	TH17-01	TH17-01	TH17-01	TH17-01
Depth (m)	0.3 - 0.5	0.6 - 0.8	0.9 - 1.1	1.1 - 1.2	1.4 - 1.5	1.7 - 1.8
Sample #	G01	G02	G03	G04	G05	G06
Tare ID	DW	E99	W96	N68	K20	F128
Mass of tare	356.9	8.5	8.5	8.5	8.5	8.5
Mass wet + tare	1083.7	403.4	319.4	308.2	320.8	302.9
Mass dry + tare	1035.3	297.1	244.8	255.2	265.2	228.6
Mass water	48.4	106.3	74.6	53.0	55.6	74.3
Mass dry soil	678.4	288.6	236.3	246.7	256.7	220.1
Moisture %	7.1%	36.8%	31.6%	21.5%	21.7%	33.8%

Test Pit	TH17-01	TH17-01	TH17-02	TH17-02	TH17-02	TH17-02
Depth (m)	2.0 - 2.1	2.7 - 2.9	0.3 - 0.5	0.5 - 0.6	0.8 - 0.9	0.9 - 1.1
Sample #	G07	G08	G09	G10	G11	G12
Tare ID	N08	H50	AB61	E48	E143	N83
Mass of tare	8.6	8.5	6.8	8.8	8.4	8.6
Mass wet + tare	317.1	303.6	408.7	411.8	402.9	319.1
Mass dry + tare	225.2	216.9	360.7	345.0	318.8	267.2
Mass water	91.9	86.7	48.0	66.8	84.1	51.9
Mass dry soil	216.6	208.4	353.9	336.2	310.4	258.6
Moisture %	42.4%	41.6%	13.6%	19.9%	27.1%	20.1%

Test Pit	TH17-02	TH17-02	TH17-02	TH17-02	TH17-03	TH17-03
Depth (m)	1.4 - 1.5	1.7 - 1.8	2.0 - 2.1	2.7 - 2.9	0.3 - 0.5	0.6 - 0.8
Sample #	G14	G15	G16	G17	G18	G19
Tare ID	E32	F110	AB86	E26	A27	E35
Mass of tare	8.6	8.2	6.7	8.5	8.5	8.5
Mass wet + tare	334.9	308.8	322.1	339.6	353.0	308.5
Mass dry + tare	279.3	233.7	237.3	246.2	307.9	243.5
Mass water	55.6	75.1	84.8	93.4	45.1	65.0
Mass dry soil	270.7	225.5	230.6	237.7	299.4	235.0
Moisture %	20.5%	33.3%	36.8%	39.3%	15.1%	27.7%



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## Moisture Content Report ASTM D2216-10

**Project No.** 0035-057-00  
**Client** Morrison Hershfield  
**Project** Local Streets 18-R-05 Tache Ave.

**Sample Date** 14-Dec-17  
**Test Date** 2-Jan-18  
**Technician** DS

Test Pit	TH17-03	TH17-03	TH17-03	TH17-03	TH17-03	TH17-03
Depth (m)	0.8 - 0.9	1.1 - 1.2	1.4 - 1.5	1.7 - 1.8	2.0 - 2.1	2.6 - 2.7
Sample #	G20	G21	G22	G23	G24	G25
Tare ID	Z13	Z26	K14	W15	N71	W71
Mass of tare	8.7	8.4	8.5	8.4	8.7	8.5
Mass wet + tare	401.2	306.9	302.4	306.9	300.4	340.3
Mass dry + tare	300.9	228.9	249.5	234.4	213.7	236.9
Mass water	100.3	78.0	52.9	72.5	86.7	103.4
Mass dry soil	292.2	220.5	241.0	226.0	205.0	228.4
Moisture %	34.3%	35.4%	22.0%	32.1%	42.3%	45.3%

Test Pit	TH17-04	TH17-04	TH17-04	TH17-04	TH17-04	TH17-04
Depth (m)	0.3 - 0.5	0.5 - 0.6	0.8 - 0.9	1.1 - 1.2	1.2 - 1.4	1.7 - 1.8
Sample #	G26	G27	G28	G29	G30	G31
Tare ID	H23	W86	A19	Z134	E89	H33
Mass of tare	8.5	8.6	8.6	8.5	8.8	8.6
Mass wet + tare	354.7	306.7	302.7	323.3	308.6	328.8
Mass dry + tare	307.6	231.2	248.7	266.7	247.0	232.3
Mass water	47.1	75.5	54.0	56.6	61.6	96.5
Mass dry soil	299.1	222.6	240.1	258.2	238.2	223.7
Moisture %	15.7%	33.9%	22.5%	21.9%	25.9%	43.1%

Test Pit	TH17-04	TH17-04	TH17-05	TH17-05	TH17-05	TH17-05
Depth (m)	2.3 - 2.4	2.7 - 2.9	0.1 - 0.2	0.2 - 0.3	0.5 - 0.6	0.8 - 0.9
Sample #	G32	G33	G34	G35	G36	G37
Tare ID	E19	N61	N41	N39	E135	F47
Mass of tare	8.4	8.6	8.4	8.3	8.4	8.4
Mass wet + tare	349.1	348.6	312.3	310.8	316.6	420.6
Mass dry + tare	257.8	236.4	246.7	250.9	264.3	356.5
Mass water	91.3	112.2	65.6	59.9	52.3	64.1
Mass dry soil	249.4	227.8	238.3	242.6	255.9	348.1
Moisture %	36.6%	49.3%	27.5%	24.7%	20.4%	18.4%





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**Moisture Content Report  
 ASTM D2216-10**

**Project No.** 0035-057-00  
**Client** Morrison Hershfield  
**Project** Local Streets 18-R-05 Tache Ave.

**Sample Date** 14-Dec-17  
**Test Date** 2-Jan-18  
**Technician** DS

<b>Test Pit</b>	TH17-05	TH17-05	TH17-05	TH17-05	TH17-05	TH17-06
<b>Depth (m)</b>	1.2 - 1.4	1.5 - 1.7	1.8 - 2.0	2.1 - 2.3	2.4 - 2.6	0.2 - 0.3
<b>Sample #</b>	G38	G39	G40	G41	G42	G43
<b>Tare ID</b>	Z31	K2	E106	AA09	E102	P04
<b>Mass of tare</b>	8.5	8.6	8.7	7.0	8.8	9.3
<b>Mass wet + tare</b>	323.3	301.9	345.2	312.0	337.7	307.9
<b>Mass dry + tare</b>	256.4	223.7	248.0	219.3	234.7	255.5
<b>Mass water</b>	66.9	78.2	97.2	92.7	103.0	52.4
<b>Mass dry soil</b>	247.9	215.1	239.3	212.3	225.9	246.2
<b>Moisture %</b>	27.0%	36.4%	40.6%	43.7%	45.6%	21.3%

<b>Test Pit</b>	TH17-06	TH17-06	TH17-06	TH17-06	TH17-06	TH17-06
<b>Depth (m)</b>	0.5 - 0.6	0.8 - 0.9	0.9 - 1.1	1.1 - 1.2	1.5 - 1.7	2.1 - 2.3
<b>Sample #</b>	G44	G45	G46	G47	G48	G49
<b>Tare ID</b>	W47	AB17	E42	F105	E88	Z02
<b>Mass of tare</b>	8.7	6.8	8.5	8.4	8.5	8.5
<b>Mass wet + tare</b>	314.4	323.1	321.6	327.4	328.1	314.3
<b>Mass dry + tare</b>	256.1	249.5	257.5	279.7	240.2	223.3
<b>Mass water</b>	58.3	73.6	64.1	47.7	87.9	91.0
<b>Mass dry soil</b>	247.4	242.7	249.0	271.3	231.7	214.8
<b>Moisture %</b>	23.6%	30.3%	25.7%	17.6%	37.9%	42.4%

<b>Test Pit</b>	TH17-06	TH17-07	TH17-07	TH17-07	TH17-07	TH17-07
<b>Depth (m)</b>	2.7 - 2.9	0.2 - 0.3	0.3 - 0.5	0.6 - 0.8	0.9 - 1.1	1.2 - 1.4
<b>Sample #</b>	G50	G51	G52	G53	G54	G55
<b>Tare ID</b>	N11	N112	P85	W25	Z63	N99
<b>Mass of tare</b>	8.6	8.4	8.6	8.3	8.4	8.4
<b>Mass wet + tare</b>	300.2	310.6	304.7	307.4	313.6	331.9
<b>Mass dry + tare</b>	207.0	272.2	258.8	238.7	237.7	265.2
<b>Mass water</b>	93.2	38.4	45.9	68.7	75.9	66.7
<b>Mass dry soil</b>	198.4	263.8	250.2	230.4	229.3	256.8
<b>Moisture %</b>	47.0%	14.6%	18.3%	29.8%	33.1%	26.0%



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**Moisture Content Report  
 ASTM D2216-10**

**Project No.** 0035-057-00  
**Client** Morrison Hershfield  
**Project** Local Streets 18-R-05 Tache Ave.

**Sample Date** 14-Dec-17  
**Test Date** 2-Jan-18  
**Technician** DS

<b>Test Pit</b>	TH17-07	TH17-07	TH17-07	TH17-08	TH17-08	TH17-08
<b>Depth (m)</b>	1.5 - 1.7	1.8 - 2.0	2.3 - 2.4	0.2 - 0.3	0.5 - 0.6	0.8 - 0.9
<b>Sample #</b>	G56	G57	G58	G59	G60	G61
<b>Tare ID</b>	AC22	F145	E77	AB67	AC40	AB76
<b>Mass of tare</b>	6.7	8.4	8.4	6.9	6.6	6.8
<b>Mass wet + tare</b>	323.8	318.3	363.8	325.9	334.6	304.2
<b>Mass dry + tare</b>	231.5	228.2	257.5	276.5	286.0	227.4
<b>Mass water</b>	92.3	90.1	106.3	49.4	48.6	76.8
<b>Mass dry soil</b>	224.8	219.8	249.1	269.6	279.4	220.6
<b>Moisture %</b>	41.1%	41.0%	42.7%	18.3%	17.4%	34.8%

<b>Test Pit</b>	TH17-08	TH17-08	TH17-08	TH17-08	TH17-08	
<b>Depth (m)</b>	0.9 - 1.1	1.2 - 1.4	1.5 - 1.7	1.8 - 2.0	2.1 - 2.3	
<b>Sample #</b>	G62	G63	G64	G65	G66	
<b>Tare ID</b>	AC19	Z44	F145	E120	K16	
<b>Mass of tare</b>	6.7	8.6	8.6	8.5	8.6	
<b>Mass wet + tare</b>	310.2	325.3	347.9	341.9	340.1	
<b>Mass dry + tare</b>	231.8	251.4	262.2	257.3	265.4	
<b>Mass water</b>	78.4	73.9	85.7	84.6	74.7	
<b>Mass dry soil</b>	225.1	242.8	253.6	248.8	256.8	
<b>Moisture %</b>	34.8%	30.4%	33.8%	34.0%	29.1%	



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**Atterberg Limits**  
**ASTM D4318-10e1**

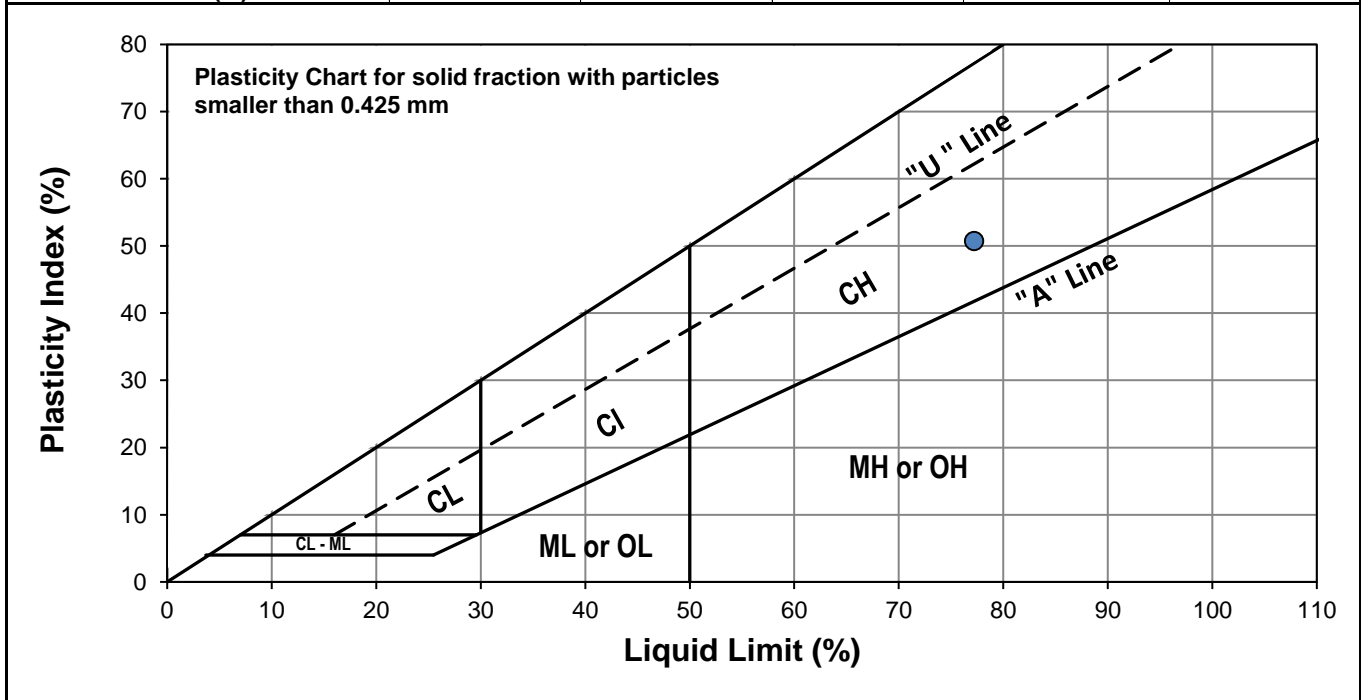
**Project No.** 0035-057-00  
**Client** Morrison Hershfield  
**Project** Local Streets 18-R-05 Tache Ave.

**Test Hole** TH17-03  
**Sample #** G20  
**Depth (m)** 0.8 - 0.9  
**Sample Date** 14-Dec-17  
**Test Date** 7-Jan-18  
**Technician** JB

<b>Liquid Limit</b>	77
<b>Plastic Limit</b>	26
<b>Plasticity Index</b>	51

**Liquid Limit**

Trial #	1	2	3		
<b>Number of Blows (N)</b>	18	23	30		
<b>Mass Wet Soil + Tare (g)</b>	27.507	24.169	27.043		
<b>Mass Dry Soil + Tare (g)</b>	21.676	19.734	21.512		
<b>Mass Tare (g)</b>	14.346	14.069	14.193		
<b>Mass Water (g)</b>	5.831	4.435	5.531		
<b>Mass Dry Soil (g)</b>	7.330	5.665	7.319		
<b>Moisture Content (%)</b>	79.550	78.288	75.570		



**Plastic Limit**

Trial #	1	2	3	4	5
<b>Mass Tare (g)</b>	19.034	19.804			
<b>Mass Wet Soil + Tare (g)</b>	18.042	18.612			
<b>Mass Dry Soil + Tare (g)</b>	14.289	14.117			
<b>Mass Water (g)</b>	0.992	1.192			
<b>Mass Dry Soil (g)</b>	3.753	4.495			
<b>Moisture Content (%)</b>	26.432	26.518			



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**Atterberg Limits**  
**ASTM D4318-10e1**

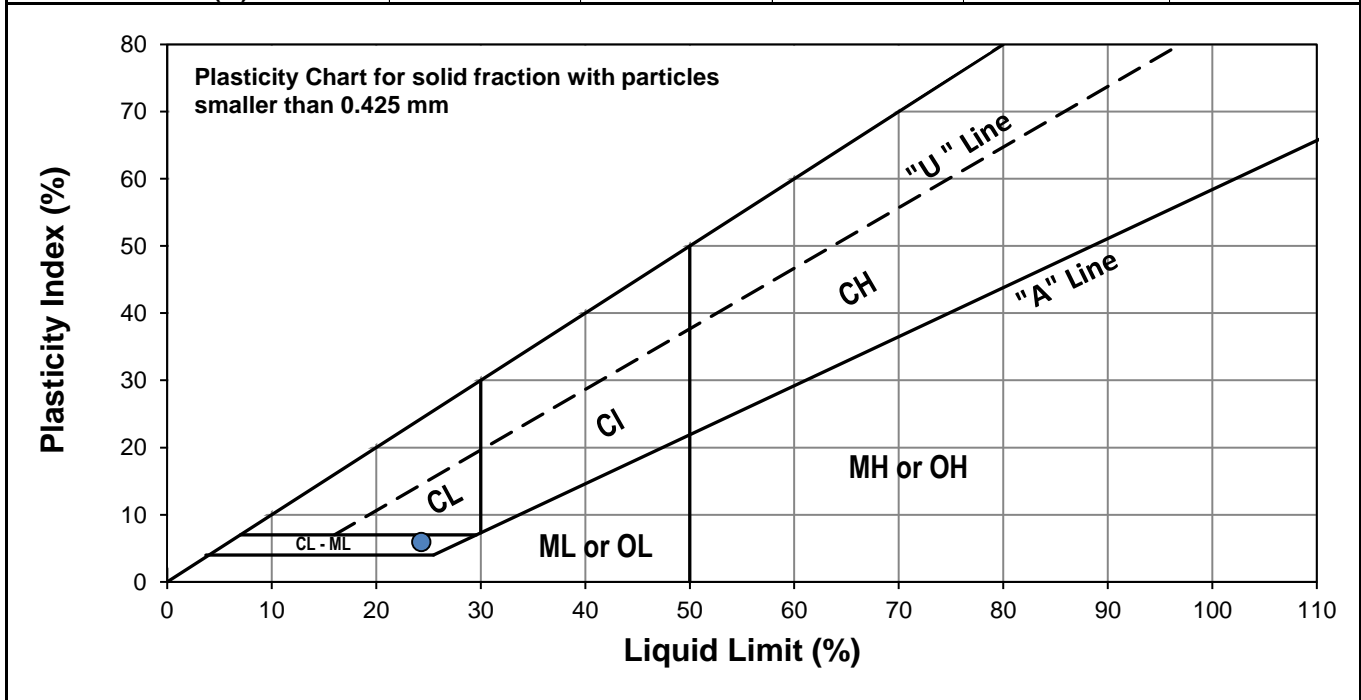
**Project No.** 0035-057-00  
**Client** Morrison Hershfield  
**Project** Local Streets 18-R-05 Tache Ave.

**Test Hole** TH17-05  
**Sample #** G37  
**Depth (m)** 0.8 - 0.9  
**Sample Date** 14-Dec-17  
**Test Date** 7-Jan-18  
**Technician** JB

<b>Liquid Limit</b>	24
<b>Plastic Limit</b>	18
<b>Plasticity Index</b>	6

**Liquid Limit**

Trial #	1	2	3		
<b>Number of Blows (N)</b>	18	26	30		
<b>Mass Wet Soil + Tare (g)</b>	24.465	23.181	22.708		
<b>Mass Dry Soil + Tare (g)</b>	22.480	21.434	20.979		
<b>Mass Tare (g)</b>	14.496	14.210	13.798		
<b>Mass Water (g)</b>	1.985	1.747	1.729		
<b>Mass Dry Soil (g)</b>	7.984	7.224	7.181		
<b>Moisture Content (%)</b>	24.862	24.183	24.077		



**Plastic Limit**

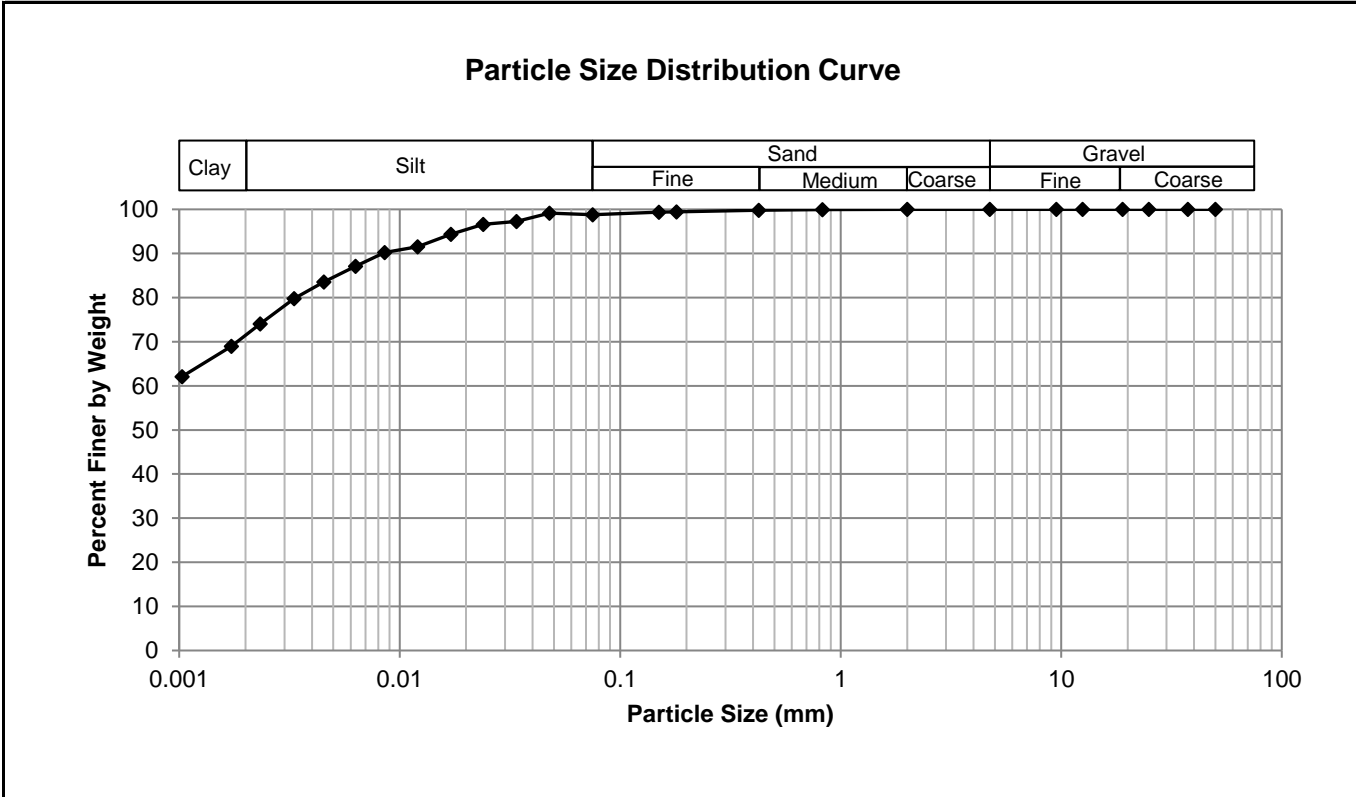
Trial #	1	2	3	4	5
<b>Mass Tare (g)</b>	20.088	20.792			
<b>Mass Wet Soil + Tare (g)</b>	19.228	19.758			
<b>Mass Dry Soil + Tare (g)</b>	14.531	14.164			
<b>Mass Water (g)</b>	0.860	1.034			
<b>Mass Dry Soil (g)</b>	4.697	5.594			
<b>Moisture Content (%)</b>	18.310	18.484			



**Project No.** 0035-057-00  
**Client** Morrison Hershfield  
**Project** Local Streets 18-R-03 Tache Ave.

**Test Hole** TH17-03  
**Sample #** G20  
**Depth (m)** 0.8 - 0.9  
**Sample Date** 14-Dec-17  
**Test Date** 5-Jan-18  
**Technician** LI/DS

<b>Gravel</b>	0.0%
<b>Sand</b>	1.2%
<b>Silt</b>	27.5%
<b>Clay</b>	71.3%



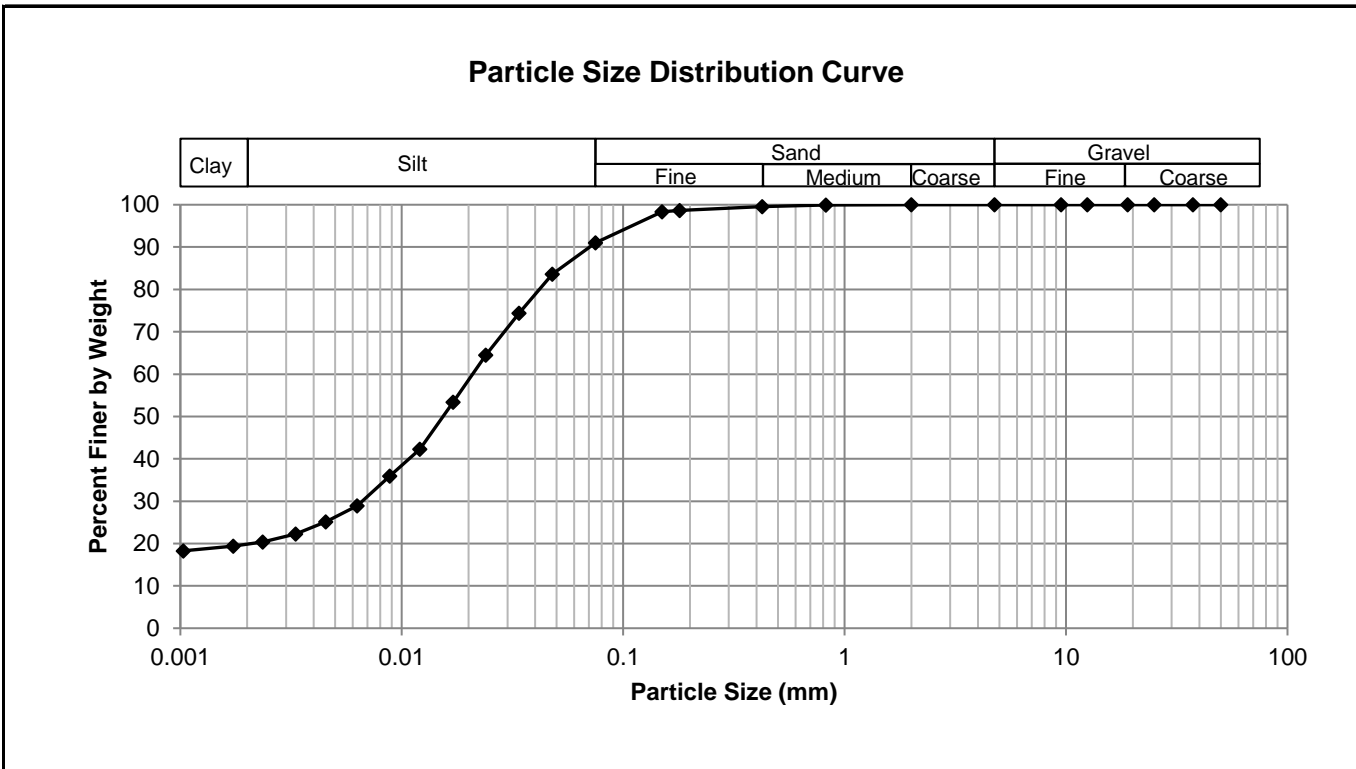
Gravel		Sand		Silt and Clay	
Particle Size (mm)	Percent Passing	Particle Size (mm)	Percent Passing	Particle Size (mm)	Percent Passing
50.0	100.00	4.75	100.00	0.0750	98.81
37.5	100.00	2.00	100.00	0.0479	99.14
25.0	100.00	0.825	99.92	0.0338	97.24
19.0	100.00	0.425	99.78	0.0239	96.60
12.5	100.00	0.180	99.43	0.0171	94.38
9.50	100.00	0.150	99.34	0.0121	91.52
4.75	100.00	0.075	98.81	0.0085	90.25
				0.0063	87.07
				0.0045	83.58
				0.0033	79.77
				0.0023	74.05
				0.0017	68.97
				0.0010	62.11



**Project No.** 0035-057-00  
**Client** Morrison Hershfield  
**Project** Local Streets 18-R-03 Tache Ave.

**Test Hole** TH17-05  
**Sample #** G37  
**Depth (m)** 0.8 - 0.9  
**Sample Date** 14-Dec-17  
**Test Date** 5-Jan-18  
**Technician** LI/DS

<b>Gravel</b>	0.0%
<b>Sand</b>	9.0%
<b>Silt</b>	71.2%
<b>Clay</b>	19.8%



Gravel		Sand		Silt and Clay	
Particle Size (mm)	Percent Passing	Particle Size (mm)	Percent Passing	Particle Size (mm)	Percent Passing
50.0	100.00	4.75	100.00	0.0750	91.02
37.5	100.00	2.00	100.00	0.0479	83.58
25.0	100.00	0.825	99.91	0.0338	74.37
19.0	100.00	0.425	99.59	0.0239	64.52
12.5	100.00	0.180	98.63	0.0171	53.40
9.50	100.00	0.150	98.37	0.0121	42.28
4.75	100.00	0.075	91.02	0.0088	35.93
				0.0063	28.94
				0.0045	25.13
				0.0033	22.27
				0.0024	20.37
				0.0017	19.41
				0.0010	18.27



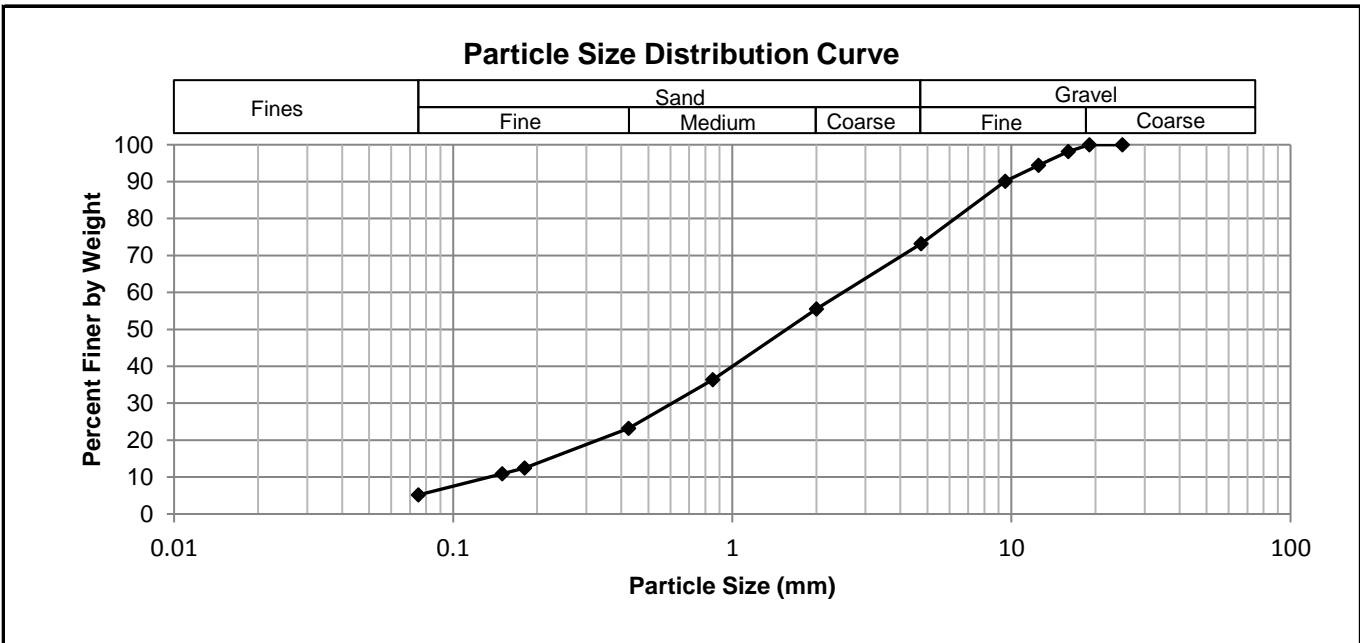
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**Grain Size Analysis (Sieve Method)**  
**ASTM C136-06**

**Project No.** 0035-057-00  
**Client** Morrison Hershfield  
**Project** Local Streets 18-R-03 Tache Ave.

**Test Hole** TH17-01  
**Sample #** G01  
**Depth (m)** 1.0 - 1.5  
**Date Sampled** 17-Dec-17  
**Date Tested** 7-Jan-18  
**Technician** DS

<b>Total Weight (g)</b>	534.5
<b>Gravel %</b>	26.8
<b>Sand %</b>	68.1
<b>Fines %</b>	5.2



Sieve Number	Sieve Opening (mm)	Percent Passing	Specification (Min-Max)
6"	150		
5"	125		
4"	100		
3"	75.0		
2"	50.0		
1 1/2"	37.5		
1"	25.0	100	
3/4"	19.0	100	
5/8"	16.0	98	
1/2"	12.5	94	
3/8"	9.50	90	
no. 4	4.75	73	
no. 10	2.00	56	
no. 20	0.850	36	
no. 40	0.425	23	
no. 80	0.180	12	
no. 100	0.150	11	
no. 200	0.075	5	



Photo 1: Pavement Core Sample at Test Hole TH17-01



Photo 2: Pavement Core Sample at Test Hole TH17-02





Photo 3: Pavement Core Sample at Test Hole TH17-03



Photo 4: Pavement Core Sample at Test Hole TH17-04



Photo 5: Pavement Core Sample at Test Hole TH17-05



Photo 6: Pavement Core Sample at Test Hole TH17-06



Photo 7: Pavement Core Sample at Test Hole TH17-07



Photo 8: Pavement Core Sample at Test Hole TH17-08