APPENDIX 'G'

GEOTECHNICAL REPORT

Quality Engineering | Valued Relationships

Morrison Hershfield

20-R-04 Pavement Renewal Project

Prepared for:

Morrison Hershfield
1-59 Scurfield Boulevard
Winnipeg, MB R3Y 1V2
Attention: Ron Bruce, P. Eng

Project Number:
1000 001 19

Date:
March 3, 2020
Final Report

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TREK GEOTECHNICAL

Quality Engineering | Valued Relationships

March 3, 2020

Our File No. 1000 001 19

Mr. Ron Bruce, P. Eng
Morrison Hershfield
1-59 Scurfield Boulevard
Winnipeg, Manitoba, R3Y 1V2

RE: Sub-Surface Investigation Report for
20-R-04 Pavement Renewal Project

TREK Geotechnical Inc. is pleased to submit our report for the sub-surface investigations for the 20-R-04 Pavement Renewal project.

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:

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	March 3, 2020	Final Report

Authorization Signatures

Prepared By:

Angela Fidler-Kliewer, C. Tech
Manager of Laboratory and Field Services

PROVINCE OF MANITOBA
N. J. FERREIRA
Member
22892
REGISTERED PROFESSIONAL ENGINEER

ENGINEERS GEOSCIENTISTS MANITOBA
Certificate of Authorization
TREK GEOTECHNICAL INC.
No. 4877 Date March 3, 2020

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 road investigation completed for the 20-R-04 Local Streets Pavement Renewal project. The test holes were located along Ashland Ave, Maybank Drive and Farwell Bay. The information collected describes the pavement structure of the existing road as well as the soil stratigraphy beneath the pavement structure.

2.0 Road Investigation and Laboratory Program

The investigation included coring of pavement and drilling test holes at 20 locations as shown on Figures 01 through 03 (attached). Table 1 below summarizes the investigation program per street.

Table 1 – Road Investigation Program

Street	# of Locations	Investigation
Ashland Avenue – Churchill Drive to Darling Street	5	Test Holes
Maybank Drive – Marshall Crescent to Donelly Street	6	Test Holes
Farwell Bay – Donelly Street to Donelly Street	9	Test Holes

The road investigation was conducted between January 30, 2020 and January 31, 2020. The pavement structure (asphalt and/or concrete) was cored by Bryan Hiebert of TREK Geotechnical Inc. (TREK) using a portable coring press equipped with a hollow 150 mm diameter diamond core drill bit. Twenty test holes were drilled to a depth of 2.1 m below road surface by Maple Leaf Drilling Ltd. using a truck mounted drill rig equipped with 125 mm diameter solid stem augers. The sub-surface conditions were observed during drilling and visually classified by Bryan Hiebert of TREK. Other pertinent information such as groundwater and drilling conditions were also recorded during the drilling investigation. Disturbed (auger cuttings) samples and bulk 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. Retrieving core samples was not possible at some locations along Farwell Bay (7 locations) due to the poor condition of the concrete where the concrete broke down and crumbled during coring.

Test hole locations noted on the summary tables and test hole logs are based on UTM coordinates obtained using a hand-held GPS and their location relative to the nearest address, and measured distances from the edge of pavement or other permanent features.

The laboratory testing program consisted of moisture content determination on all samples, as well as Atterberg limits, and grain size analysis (mechanical sieve and hydrometer methods) on select samples

between 0.5 and 1.0 m below pavement as well as Standard Proctor and CBR testing. Information gathered for each street is included in separate appendices (Appendices A through C). The information provided in the Appendices includes test hole logs, laboratory testing summary tables and results, and photos of the concrete cores. Photos of the side wall of the cored pavement are included where core samples could not be retrieved.

Three CBR's were completed on bulk samples of the soil units present below the pavement. Only silty and clay was encountered within the prescribed sample depth for CBR testing and the results are shown in the table below.

Table 2 - CBR Testing Summary

Sample Description	Street	Depth (m)	SPMDD (kg/m^3)	Opt. Moisture (%)	Percent Proctor (%)	Moisture Content (%)	CBR Value at 2.54 mm	CBR Value at 5.08 mm
Silt and Clay	Maybank Drive	0.3-1.5	1462	26.6	94.1	30.0	3.9%	2.9%
Silt and Clay	Farwell Bay	0.3-1.5	1519	24.3	94.9	28.3	4.7%	3.5%
Silt and Clay	Ashland Ave	0.3-1.5	1442	24.9	94.9	28.5	3.8%	3.3%

* Testing completed on combined grab samples from the top 1.5 m of each test hole.

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

0 25 50 75 m
SCALE = 1 : 1000 (279 mm x 432 mm)

LEGEND: TEST HOLE (TREK, 2020)

NOTES:
1. AERIAL IMAGE FROM GOOGLE EARTH (2019)
2. TEST HOLE LOCATIONS OBTAINED USING HAND HELD GPS UNIT AND BY MEASURING DISTANCES OFF EXISTING STRUCTURES.

Figure 01
TEST HOLE LOCATION PLAN

TREK GEOTECHNICAL

1000 001 19
Morrison Hershfield
20-R-04 LOCAL STREET RENEWAL - FARWELL BAY

0 25 50 75 m
SCALE = 1 : 1000 (279 mm x 432 mm)

LEGEND: TEST HOLE (TREK, 2020)

NOTES:
1. AERIAL IMAGE FROM GOOGLE EARTH (2019)
2. TEST HOLE LOCATIONS OBTAINED USING HAND HELD GPS UNIT AND BY MEASURING DISTANCES OFF EXISTING STRUCTURES.

Figure 02
TEST HOLE LOCATION PLAN

0 25 50 75 m
SCALE = 1 : 1000 (279 mm x 432 mm)

LEGEND: TEST HOLE (TREK, 2020)

NOTES:
1. AERIAL IMAGE FROM GOOGLE EARTH (2019)
2. TEST HOLE LOCATIONS OBTAINED USING HAND HELD GPS UNIT AND BY MEASURING DISTANCES OFF EXISTING STRUCTURES.

Figure 03
TEST HOLE LOCATION PLAN

Appendix A

Maybank Drive

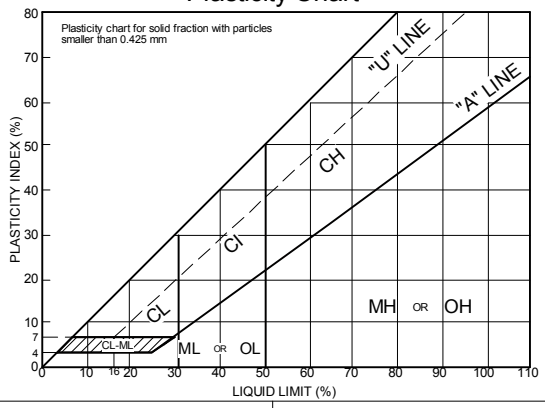
Test Hole Logs, Summary Table, Lab Testing Results and Pavement Core Photos

EXPLANATION OF FIELD AND LABORATORY TESTING

GENERAL NOTES

1. 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.
2. 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.
3. 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
Coarse-Grained soils (More than half the material is larger than No. 200 sieve size)	Gravels (More than half of coarse fraction is larger than 4.75 mm)	Clean gravel (Little or no fines)	GW		Well-graded gravels, gravel-sand mixtures, little or no fines	Determine percentages of sand and gravel from grain size curve, depending on percentage of fines (fraction smaller than No. 200 sieve) coarse-grained soils are classified as follows: Less than 5 percent..... GW, GP, SW, SP; More than 12 percent..... GM, GC, SM, SC; 6 to 12 percent..... Borderline case4s requiring dual symbols*
			GP		Poorly-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
		Gravel with fines (Appreciable amount of fines)	GM		Silty gravels, gravel-sand-silt mixtures	Not meeting all gradation requirements for GW
			GC		Clayey gravels, gravel-sand-silt mixtures	Atterberg limits below "A" line or P.I. less than 4 / 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
	Sands (More than half of coarse fraction is smaller than 4.75 mm)	Clean sands (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
			SP		Poorly-graded sands, gravelly sands, little or no fines	Not meeting all gradation requirements for SW
		Sands with fines (Appreciable amount of fines)	SM		Silty sands, sand-silt mixtures	Atterberg limits below "A" line or P.I. less than 4 / 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
			SC		Clayey sands, sand-clay mixtures	
Fine-Grained soils (More than half the material is smaller than No. 200 sieve size)	Silts and Clays (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	Plasticity Chart
			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	
	Silts and Clays (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	
	Highly Organic Soils		Pt		Peat and other highly organic soils	Von Post Classification Limit: Strong colour or odour, and often fibrous texture



Particle Size			Material
ASTM Sieve sizes	mm		
#10 to #4	2.00 to 4.75		Sand
#40 to #10	0.425 to 2.00		Coarse
#200 to #40	0.075 to 0.425		Medium
< #200	< 0.075		Fine
			Silt or Clay

Particle Size			Material
ASTM Sieve Sizes	mm		
> 12 in.	> 300		Boulders
3 in. to 12 in.	75 to 300		Cobbles
3/4 in. to 3 in.	19 to 75		Gravel
#4 to 3/4 in.	4.75 to 19		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

EXPLANATION OF FIELD AND LABORATORY TESTING

LEGEND OF ABBREVIATIONS AND SYMBOLS

LL - Liquid Limit (%)
PL - Plastic Limit (%)
PI - Plasticity Index (%)
MC - Moisture Content (%)
SPT - Standard Penetration Test
RQD - Rock Quality Designation
Qu - Unconfined Compression
Su - Undrained Shear Strength
VW - Vibrating Wire Piezometer
SI - Slope Inclinometer

▽ Water Level at Time of Drilling

▼ Water Level at End of Drilling

▼ Water Level After Drilling as Indicated on Test Hole Logs

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:

Descriptive Terms	SPT (N) (Blows/300 mm)
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:

Descriptive Terms	SPT (N) (Blows/300 mm)
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:

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

20-R-04 Local Street Renewals - Maybank Drive
Sub-Surface Investigation

Test Hole No.	Test Hole Location	Pavement Surface		Pavement Structure Material		Subgrade Description	Sample Depth (m)		Moisture Content (%)	Grain Size Analysis				Atterberg Limits		
		Type	Thickness (mm)	Type	Thickness (mm)		Top (m)	Bottom (m)		Clay (%)	Silt (%)	Sand (%)	Gravel (%)	Plastic	Liquid	Plasticity Index
TH20-01	UTM : 5522078 N, 632564 E Located near 7 Maybank Drive, 0.7 m North of the South curb.	Asphalt	25	Concrete	130	Silt and Clay	0.3	0.5	34							
						Silt and Clay	0.6	0.8	30	59	38	3	0	20	66	46
						Silt and Clay	0.9	1.1	29							
						Silt and Clay	1.2	1.4	43							
						Silt and Clay	1.5	1.7	46							
						Silt and Clay	2.0	2.1	55							
TH20-02	UTM : 5522072 N, 632555 E Located near 12 Maybank Drive, 0.9 m North of the South curb.	Asphalt	25	Concrete	150	Silt and Clay	0.3	0.5	26							
						Clay	0.6	0.8	40							
						Clay	0.9	1.1	40							
						Clay	1.2	1.4	41							
						Clay	1.5	1.7	45							
						Clay	2.0	2.1	50							
TH20-03	UTM : 5522048 N, 632505 E Located near 25 Maybank Drive, 0.7 m South of the North curb.	Asphalt	25	Concrete	140	Silt and Clay	0.3	0.5	25							
						Silt and Clay	0.6	0.8	24	42	54	4	0	16	51	35
						Clay	0.9	1.1	38							
						Clay	1.2	1.4	37							
						Silt	1.5	1.7	24							
						Silt	2.0	2.1	26							
TH20-04	UTM : 5522023 N, 632462 E Located near 37 Maybank Drive, 0.6 m South of the North curb.	Asphalt	25	Concrete	135	Silt and Clay	0.3	0.5	39							
						Silt and Clay	0.6	0.8	40							
						Silt and Clay	0.9	1.1	35							
						Clay	1.2	1.4	41							
						Clay	1.5	1.7	38							
						Clay	2.0	2.1	43							

20-R-04 Local Street Renewals - Maybank Drive
Sub-Surface Investigation

Test Hole No.	Test Hole Location	Pavement Surface		Pavement Structure Material		Subgrade Description	Sample Depth (m)		Moisture Content (%)	Grain Size Analysis				Atterberg Limits		
		Type	Thickness (mm)	Type	Thickness (mm)		Top (m)	Bottom (m)		Clay (%)	Silt (%)	Sand (%)	Gravel (%)	Plastic	Liquid	Plasticity Index
TH20-05	UTM : 5522008 N, 632433 E Located near 47 Maybank Drive, 0.7 m South of the North curb.	Asphalt	25	Concrete	120	Silt and Clay	0.3	0.5	41							
						Silt	0.6	0.8	26	15	32	3	0	17	27	10
						Silt	0.9	1.1	22							
						Clay	1.2	1.4	36							
						Clay	1.5	1.7	37							
						Clay	2.0	2.1	35							
TH20-06	UTM : 5521989 N, 632410 E Located near 56 Maybank Drive, 1.0 m North of the South curb.	Asphalt	10	Concrete	180	Silt and Clay	0.3	0.3	35							
						Silt and Clay	0.6	0.8	37							
						Silt and Clay	0.9	1.1	33							
						Silt and Clay	1.2	1.4	37							
						Clay	1.5	1.7	43							
						Clay	2.0	2.1	45							

Sub-Surface Log

Test Hole TH20-01
1 of 1

Client:	Morrison Hershfield	**Project Number:**	1000-001-19-400
Project Name:	20-R-04 Local Street Renewals - Maybank Drive	**Location:**	UTM N-5522078, E-632564
Contractor:	Maple Leaf Drilling Ltd.	**Ground Elevation:**	Top of Pavement
Method:	125mm Solid Stem Auger, Acker MP8 Truck Mount	**Date Drilled:**	January 30, 2020

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/m³) 16 17 18 19 20 21 / Particle Size (%) 0 20 40 60 80 100 / PL MC LL	Undrained Shear Strength (kPa) Test Type: Torvane, Pocket Pen., Qu, Field Vane 0 50 100 150 200 250
		ASPHALT - 25 mm thick				
		CONCRETE - 130 mm thick				
		SILT AND CLAY - trace sand, trace organics - dark grey - frozen, moist and soft to firm when thawed - high plasticity		G01		
0.5				G02		
		- stiff below 0.9 m		G03		
1.0						
		CLAY - silty, trace silt inclusions (<10 mm diam.) - brown - frozen to 1.4 m depth, moist and stiff when thawed - high plasticity		G04		
1.5		- firm below 1.5 m		G05		
2.0				G06		

END OF TEST HOLE AT 2.1 m IN CLAY
1) No seepage or sloughing observed.
2) Test hole open to 2.1 m immediately after drilling.
3) Test hole backfilled with auger cuttings, granular fill and cold patch asphalt.
4) Test hole located near 7 Maybank Drive, 0.7 m North of the South curb.

Logged By: Bryan Hiebert **Reviewed By:** Angela Fidler-Kliewer **Project Engineer:** Nelson Ferreira

SUB-SURFACE LOG LOGS 2020-01-31_2020 LOCAL STREETS 20-R-04 _1000-001-19_0_A_BMH.GPJ TREK GEOTECHNICAL.GDT 3/2/20

Sub-Surface Log

Test Hole TH20-02
1 of 1

Client:	Morrison Hershfield	**Project Number:**	1000-001-19-400
Project Name:	20-R-04 Local Street Renewals - Maybank Drive	**Location:**	UTM N-5522072, E-632555
Contractor:	Maple Leaf Drilling Ltd.	**Ground Elevation:**	Top of Pavement
Method:	125mm Solid Stem Auger, Acker MP8 Truck Mount	**Date Drilled:**	January 30, 2020

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
		ASPHALT - 25 mm thick		
		CONCRETE - 150 mm thick		
		SILT AND CLAY - trace sand, trace organics - dark grey - frozen, moist and soft to firm when thawed - high plasticity		G07
0.5		CLAY - silty, trace silt inclusions (<10 mm diam.) - dark grey - frozen to 0.9 m depth, moist and firm when thawed - high plasticity		G08
		- brown below 0.9 m		G09
1.0		- stiff below 1.2 m		G10
1.5				G11
2.0				G12

Bulk Unit Wt (kN/m³): 16 17 18 19 20 21
Particle Size (%): 0 20 40 60 80 100
PL MC LL
Undrained Shear Strength (kPa): 0 50 100 150 200 250
Test Type: △ Torvane △ | ✿ Pocket Pen. ✿ | ☒ Qu ☒ | ○ Field Vane ○

END OF TEST HOLE AT 2.1 m IN CLAY
1) No seepage or sloughing observed.
2) Test hole open to 2.1 m immediately after drilling.
3) Test hole backfilled with auger cuttings, granular fill and cold patch asphalt.
4) Test hole located near 12 Maybank Drive, 0.9 m North of the South Curb.

Logged By: Bryan Hiebert **Reviewed By:** Angela Fidler-Kliewer **Project Engineer:** Nelson Ferreira

SUB-SURFACE LOG LOGS 2020-01-31_2020 LOCAL STREETS 20-R-04 _1000-001-19_0_A_BMH.GPJ TREK GEOTECHNICAL.GDT 3/2/20

Sub-Surface Log

Test Hole TH20-03
1 of 1

Client:	Morrison Hershfield	**Project Number:**	1000-001-19-400
Project Name:	20-R-04 Local Street Renewals - Maybank Drive	**Location:**	UTM N-5522048, E-632506
Contractor:	Maple Leaf Drilling Ltd.	**Ground Elevation:**	Top of Pavement
Method:	125mm Solid Stem Auger, Acker MP8 Truck Mount	**Date Drilled:**	January 30, 2020

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/m³) 16 17 18 19 20 21 / Particle Size (%) 0 20 40 60 80 100 / PL MC LL	Undrained Shear Strength (kPa) 0 50 100 150 200 250
		ASPHALT - 25 mm thick				
		CONCRETE - 140 mm thick				
		SILT AND CLAY - trace sand, trace organics - dark grey - frozen, moist and soft to firm when thawed - intermediate to high plasticity		G13		
0.5				G14		
		CLAY - silty - brown - frozen to 1.4 m depth, moist and stiff when thawed - high plasticity		G15		
1.0				G16		
		SILT - trace sand, trace clay - light brown - moist, soft - low plasticity		G17		
1.5						
2.0				G18		

END OF TEST HOLE AT 2.1 m IN SILT
1) No seepage or sloughing observed.
2) Test hole open to 2.1 m immediately after drilling.
3) Test hole backfilled with auger cuttings, granular fill and cold patch asphalt.
4) Test hole located near 25 Maybank Drive, 0.7 m South of the North curb.

Logged By: Bryan Hiebert **Reviewed By:** Angela Fidler-Kliewer **Project Engineer:** Nelson Ferreira

SUB-SURFACE LOG LOGS 2020-01-31_2020 LOCAL STREETS 20-R-04_1000-001-19_0_A_BMH.GPJ TREK GEOTECHNICAL.GDT 3/2/20

Sub-Surface Log

Test Hole TH20-04
1 of 1

TREK GEOTECHNICAL

Client:	Morrison Hershfield	**Project Number:**	1000-001-19-400
Project Name:	20-R-04 Local Street Renewals - Maybank Drive	**Location:**	UTM N-5522023, E-632462
Contractor:	Maple Leaf Drilling Ltd.	**Ground Elevation:**	Top of Pavement
Method:	125mm Solid Stem Auger, Acker MP8 Truck Mount	**Date Drilled:**	January 30, 2020

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
		ASPHALT - 25 mm thick		
		CONCRETE - 135 mm thick		
		SILT AND CLAY - trace sand, trace organics - mottled dark grey and black - frozen to 1.2 m depth, moist and soft to firm when thawed - high plasticity		G19
0.5				G20
		- no organics, dark grey, firm below 0.9 m		G21
1.0				
		CLAY - silty, trace silt inclusions (<10 mm diam.) - dark grey - moist, stiff - high plasticity		G22
1.5				G23
		- brown below 1.8 m		
2.0				G24

Bulk Unit Wt (kN/m³): 16 17 18 19 20 21
Particle Size (%): 0 20 40 60 80 100
PL MC LL
Undrained Shear Strength (kPa): 0 50 100 150 200 250
Test Type: △ Torvane △ | ✤ Pocket Pen. ✤ | ☒ Qu ☒ | ○ Field Vane ○

END OF TEST HOLE AT 2.1 m IN CLAY
1) No seepage or sloughing observed.
2) Test hole open to 2.1 m immediately after drilling.
3) Test hole backfilled with auger cuttings, granular fill and cold patch asphalt.
4) Test hole located near 37 Maybank Drive, 0.6 m South of the North curb.

Logged By: Bryan Hiebert **Reviewed By:** Angela Fidler-Kliewer **Project Engineer:** Nelson Ferreira

SUB-SURFACE LOG LOGS 2020-01-31_2020 LOCAL STREETS 20-R-04_1000-001-19_0_A_BMH.GPJ TREK GEOTECHNICAL.GDT 3/2/20

Sub-Surface Log

Test Hole TH20-05
1 of 1

TREK GEOTECHNICAL

Client:	Morrison Hershfield	**Project Number:**	1000-001-19-400
Project Name:	20-R-04 Local Street Renewals - Maybank Drive	**Location:**	UTM N-5522008, E-632433
Contractor:	Maple Leaf Drilling Ltd.	**Ground Elevation:**	Top of Pavement
Method:	125mm Solid Stem Auger, Acker MP8 Truck Mount	**Date Drilled:**	January 30, 2020

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/m³) 16 17 18 19 20 21 / Particle Size (%) 0 20 40 60 80 100 / PL MC LL 0 20 40 60 80 100	Undrained Shear Strength (kPa) Test Type △ Torvane △ ✤ Pocket Pen. ✤ ☒ Qu ☒ ○ Field Vane ○ 0 50 100 150 200 250
		ASPHALT - 25 mm thick				
		CONCRETE - 120 mm thick				
		SILT AND CLAY - trace sand, trace organics - dark grey - frozen to 0.9 m depth, moist and soft when thawed - intermediate to high plasticity		G25	●	
0.5						
		SILT - some clay, trace sand, trace organics - dark grey - frozen to 0.9 m depth, moist and soft when thawed - low plasticity		G26	●	
				G27	●	
1.0						
		CLAY - silty, trace silt inclusions (<10 mm diam.) - brown - moist, stiff - high plasticity		G28	●	△ ✤
1.5				G29	●	✤
				G30	●	✤
2.0						

END OF TEST HOLE AT 2.1 m IN CLAY
1) No seepage or sloughing observed.
2) Test hole open to 2.1 m immediately after drilling.
3) Test hole backfilled with auger cuttings, granular fill and cold patch asphalt.
4) Test hole located near 47 Maybank Drive, 0.7 m South of the North curb.

Logged By: Bryan Hiebert **Reviewed By:** Angela Fidler-Kliewer **Project Engineer:** Nelson Ferreira

SUB-SURFACE LOG LOGS 2020-01-31_2020 LOCAL STREETS 20-R-04 _1000-001-19_0_A_BMH.GPJ TREK GEOTECHNICAL.GDT 3/2/20

Sub-Surface Log

Test Hole TH20-06
1 of 1

Client:	Morrison Hershfield	**Project Number:**	1000-001-19-400
Project Name:	20-R-04 Local Street Renewals - Maybank Drive	**Location:**	UTM N-5521989, E-632410
Contractor:	Maple Leaf Drilling Ltd.	**Ground Elevation:**	Top of Pavement
Method:	125mm Solid Stem Auger, Acker MP8 Truck Mount	**Date Drilled:**	January 30, 2020

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
		ASPHALT - 10 mm thick		
		CONCRETE - 180 mm thick		
		SILT AND CLAY - trace sand, trace organics - dark grey - frozen to 1.2 m depth, moist and soft to firm when thawed - high plasticity		G31
0.5				G32
		- stiff below 0.9 m		G33
1.0				G34
1.5		CLAY - silty, trace silt inclusions (<10 mm diam.) - brown - moist, firm to stiff - high plasticity		G35
2.0				G36

Bulk Unit Wt (kN/m³): 16 17 18 19 20 21

Particle Size (%): 0 20 40 60 80 100

PL MC LL: 0 20 40 60 80 100

Undrained Shear Strength (kPa) — Test Type: △ Torvane △, ✿ Pocket Pen. ✿, ☒ Qu ☒, ○ Field Vane ○: 0 50 100 150 200 250

END OF TEST HOLE AT 2.1 m IN CLAY
1) No seepage or sloughing observed.
2) Test hole open to 2.1 m immediately after drilling.
3) Test hole backfilled with auger cuttings, granular fill and cold patch asphalt.
4) Test hole located near 56 Maybank Drive, 1.0 m North of the South curb.

Logged By: Bryan Hiebert **Reviewed By:** Angela Fidler-Kliewer **Project Engineer:** Nelson Ferreira

SUB-SURFACE LOG LOGS 2020-01-31_2020 LOCAL STREETS 20-R-04 _1000-001-19_0_A_BMH.GPJ TREK GEOTECHNICAL.GDT 3/2/20

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Moisture Content Report
ASTM D2216-10

Project No. 1000-001-19
Client Morrison Hershfield
Project 20-R-04 Local Streets - Maybank Drive

Sample Date 30-Jan-20
Test Date 07-Feb-20
Technician BMH

Test Hole	TH20-01	TH20-01	TH20-01	TH20-01	TH20-01	TH20-01
Depth (m)	0.3 - 0.5	0.6 - 0.8	0.9 - 1.1	1.2 - 1.4	1.5 - 1.7	2.0 - 2.1
Sample #	G01	G02	G03	G04	G05	G06
Tare ID	W02	Z67	N57	AB48	H66	A37
Mass of tare	8.4	8.6	8.6	6.8	8.4	8.4
Mass wet + tare	212.1	332.0	177.8	212.2	179.1	233.7
Mass dry + tare	160.3	257.7	139.8	150.9	125.0	153.9
Mass water	51.8	74.3	38.0	61.3	54.1	79.8
Mass dry soil	151.9	249.1	131.2	144.1	116.6	145.5
Moisture %	34.1%	29.8%	29.0%	42.5%	46.4%	54.8%

Test Hole	TH20-02	TH20-02	TH20-02	TH20-02	TH20-02	TH20-02
Depth (m)	0.3 - 0.5	0.6 - 0.8	0.9 - 1.1	1.2 - 1.4	1.5 - 1.7	2.0 - 2.1
Sample #	G07	G08	G09	G10	G11	G12
Tare ID	K27	N16	AB60	Z84	N104	F127
Mass of tare	8.5	8.8	6.6	8.5	8.5	8.4
Mass wet + tare	193.1	220.3	193.9	242.5	207.8	156.9
Mass dry + tare	155.3	159.9	140.7	174.1	145.6	107.3
Mass water	37.8	60.4	53.2	68.4	62.2	49.6
Mass dry soil	146.8	151.1	134.1	165.6	137.1	98.9
Moisture %	25.7%	40.0%	39.7%	41.3%	45.4%	50.2%

Test Hole	TH20-03	TH20-03	TH20-03	TH20-03	TH20-03	TH20-03
Depth (m)	0.3 - 0.5	0.6 - 0.8	0.9 - 1.1	1.2 - 1.4	1.5 - 1.7	2.0 - 2.1
Sample #	G13	G14	G15	G16	G17	G18
Tare ID	W88	AB63	Z139	AC01	N39	W72
Mass of tare	8.4	7.1	8.6	6.7	8.5	8.6
Mass wet + tare	190.7	342.8	89.6	103.3	270.6	265.5
Mass dry + tare	154.3	278.1	67.4	77.0	219.7	213.0
Mass water	36.4	64.7	22.2	26.3	50.9	52.5
Mass dry soil	145.9	271.0	58.8	70.3	211.2	204.4
Moisture %	24.9%	23.9%	37.8%	37.4%	24.1%	25.7%

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Moisture Content Report
ASTM D2216-10

Project No. 1000-001-19
Client Morrison Hershfield
Project 20-R-04 Local Streets - Maybank Drive

Sample Date 30-Jan-20
Test Date 07-Feb-20
Technician BMH

Test Hole	TH20-04	TH20-04	TH20-04	TH20-04	TH20-04	TH20-04
Depth (m)	0.3 - 0.5	0.6 - 0.8	0.9 - 1.1	1.2 - 1.4	1.5 - 1.7	2.0 - 2.1
Sample #	G19	G20	G21	G22	G23	G24
Tare ID	AB87	Z106	N53	C3	N72	AC05
Mass of tare	6.7	8.5	8.5	8.7	8.7	6.8
Mass wet + tare	134.4	115.9	148.9	217.7	160.7	199.7
Mass dry + tare	98.4	85.3	112.7	156.6	118.8	141.8
Mass water	36.0	30.6	36.2	61.1	41.9	57.9
Mass dry soil	91.7	76.8	104.2	147.9	110.1	135.0
Moisture %	39.3%	39.8%	34.7%	41.3%	38.1%	42.9%

Test Hole	TH20-05	TH20-05	TH20-05	TH20-05	TH20-05	TH20-05
Depth (m)	0.3 - 0.5	0.6 - 0.8	0.9 - 1.1	1.2 - 1.4	1.5 - 1.7	2.0 - 2.1
Sample #	G25	G26	G27	G28	G29	G30
Tare ID	H15	G77	W89	H9	C6	K34
Mass of tare	8.8	8.4	8.4	8.7	8.4	8.5
Mass wet + tare	211.4	610.0	183.0	234.9	185.0	228.7
Mass dry + tare	152.7	485.1	151.3	175.4	137.5	171.2
Mass water	58.7	124.9	31.7	59.5	47.5	57.5
Mass dry soil	143.9	476.7	142.9	166.7	129.1	162.7
Moisture %	40.8%	26.2%	22.2%	35.7%	36.8%	35.3%

Test Hole	TH20-06	TH20-06	TH20-06	TH20-06	TH20-06	TH20-06
Depth (m)	0.3 - 0.5	0.6 - 0.8	0.9 - 1.1	1.2 - 1.4	1.5 - 1.7	2.0 - 2.1
Sample #	G31	G32	G33	G34	G35	G36
Tare ID	F99	AB17	K20	K5	AB74	AB47
Mass of tare	8.8	6.8	8.5	8.7	6.8	6.8
Mass wet + tare	127.1	174.3	169.0	254.2	170.4	210.4
Mass dry + tare	96.2	129.3	129.0	187.4	120.9	146.8
Mass water	30.9	45.0	40.0	66.8	49.5	63.6
Mass dry soil	87.4	122.5	120.5	178.7	114.1	140.0
Moisture %	35.4%	36.7%	33.2%	37.4%	43.4%	45.4%

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Atterberg Limits
ASTM D4318-10e1

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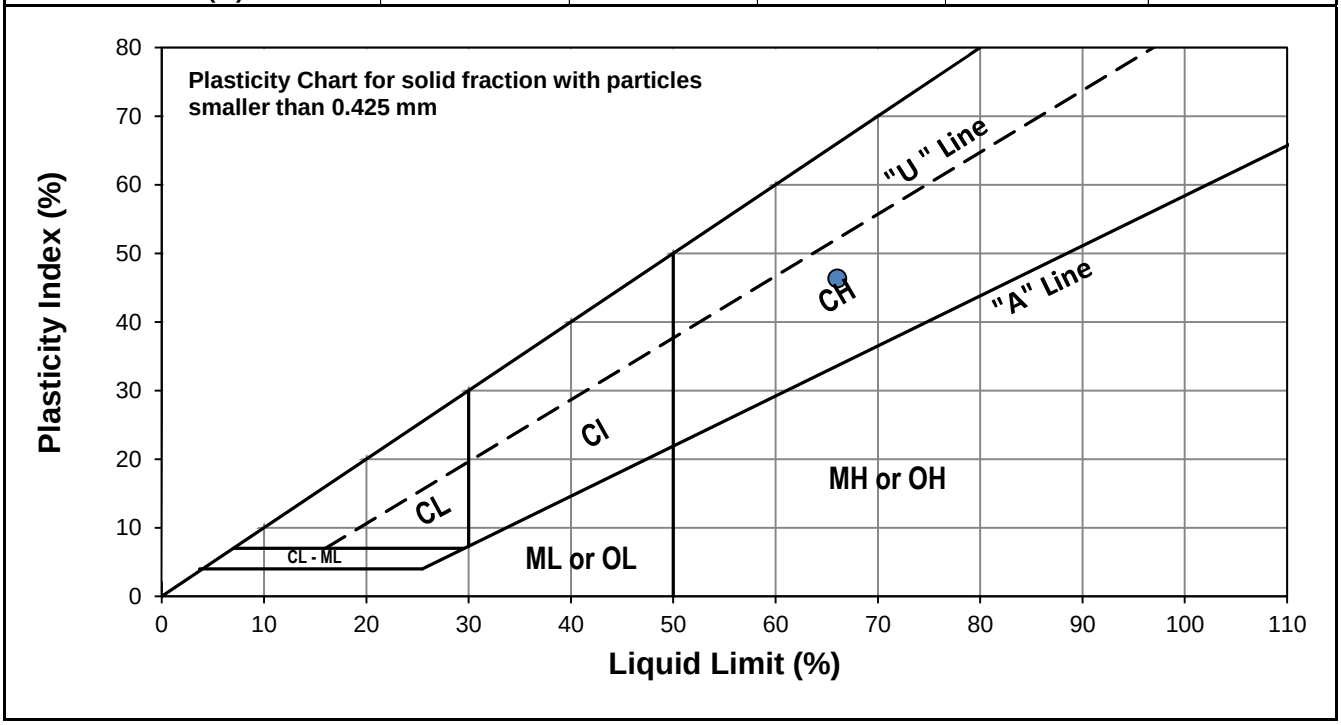
Project No.	1000-001-19
Client	Morrison Hershfield
Project	20-R-04 Local Streets - Maybank Drive
Test Hole	TH20-01
Sample #	G02
Depth (m)	0.6 - 0.8
Sample Date	30-Jan-20
Test Date	10-Feb-20
Technician	DS

Liquid Limit	66
Plastic Limit	20
Plasticity Index	46

Liquid Limit

Trial #	1	2	3		
Number of Blows (N)	15	21	35		
Mass Wet Soil + Tare (g)	25.156	24.333	23.868		
Mass Dry Soil + Tare (g)	20.624	20.171	20.114		
Mass Tare (g)	14.117	14.007	14.201		
Mass Water (g)	4.532	4.162	3.754		
Mass Dry Soil (g)	6.507	6.164	5.913		
Moisture Content (%)	69.648	67.521	63.487		



Plastic Limit

Trial #	1	2	3	4	5
Mass Tare (g)	14.146	14.095			
Mass Wet Soil + Tare (g)	20.919	20.817			
Mass Dry Soil + Tare (g)	19.803	19.709			
Mass Water (g)	1.116	1.108			
Mass Dry Soil (g)	5.657	5.614			
Moisture Content (%)	19.728	19.736			

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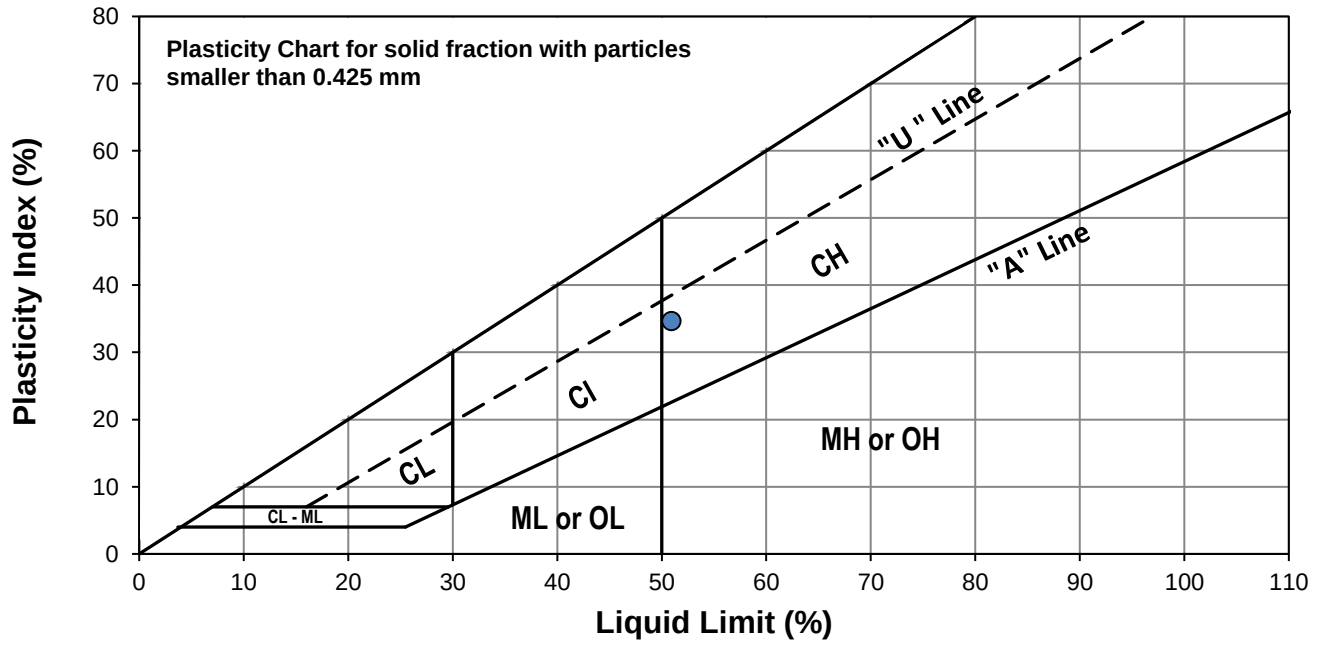
Atterberg Limits
ASTM D4318-10e1

Project No.	1000-001-19
Client	Morrison Hershfield
Project	20-R-04 Local Streets - Maybank Drive
Test Hole	TH20-03
Sample #	G14
Depth (m)	0.6 - 0.8
Sample Date	31-Jan-20
Test Date	10-Feb-20
Technician	DS

Liquid Limit	51
Plastic Limit	16
Plasticity Index	35

Liquid Limit

Trial #	1	2	3		
Number of Blows (N)	15	21	33		
Mass Wet Soil + Tare (g)	23.906	24.016	23.790		
Mass Dry Soil + Tare (g)	20.418	20.685	20.543		
Mass Tare (g)	13.913	14.267	13.973		
Mass Water (g)	3.488	3.331	3.247		
Mass Dry Soil (g)	6.505	6.418	6.570		
Moisture Content (%)	53.620	51.901	49.422		



Plastic Limit

Trial #	1	2	3	4	5
Mass Tare (g)	14.154	14.205			
Mass Wet Soil + Tare (g)	20.119	20.741			
Mass Dry Soil + Tare (g)	19.299	19.810			
Mass Water (g)	0.820	0.931			
Mass Dry Soil (g)	5.145	5.605			
Moisture Content (%)	15.938	16.610			

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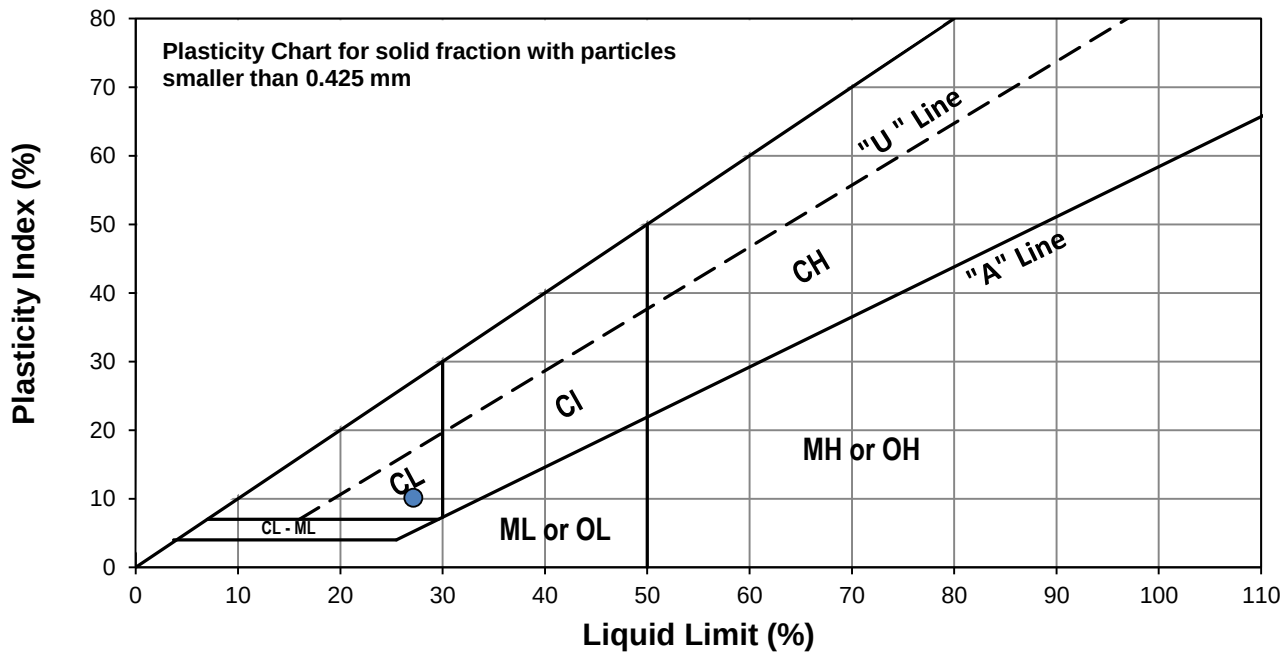
Atterberg Limits
ASTM D4318-10e1

Project No.	1000-001-19
Client	Morrison Hershfield
Project	20-R-04 Local Streets - Maybank Drive
Test Hole	TH20-05
Sample #	G26
Depth (m)	0.6 - 0.8
Sample Date	30-Jan-20
Test Date	11-Feb-20
Technician	DS

Liquid Limit	27
Plastic Limit	17
Plasticity Index	10

Liquid Limit

Trial #	1	2	3		
Number of Blows (N)	15	22	35		
Mass Wet Soil + Tare (g)	29.819	26.099	26.140		
Mass Dry Soil + Tare (g)	26.309	23.537	23.687		
Mass Tare (g)	14.208	14.212	14.251		
Mass Water (g)	3.510	2.562	2.453		
Mass Dry Soil (g)	12.101	9.325	9.436		
Moisture Content (%)	29.006	27.475	25.996		



Plastic Limit

Trial #	1	2	3	4	5
Mass Tare (g)	14.288	14.114			
Mass Wet Soil + Tare (g)	21.342	20.927			
Mass Dry Soil + Tare (g)	20.312	19.940			
Mass Water (g)	1.030	0.987			
Mass Dry Soil (g)	6.024	5.826			
Moisture Content (%)	17.098	16.941			

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Grain Size Analysis (Hydrometer Method)
AASHTO T 88

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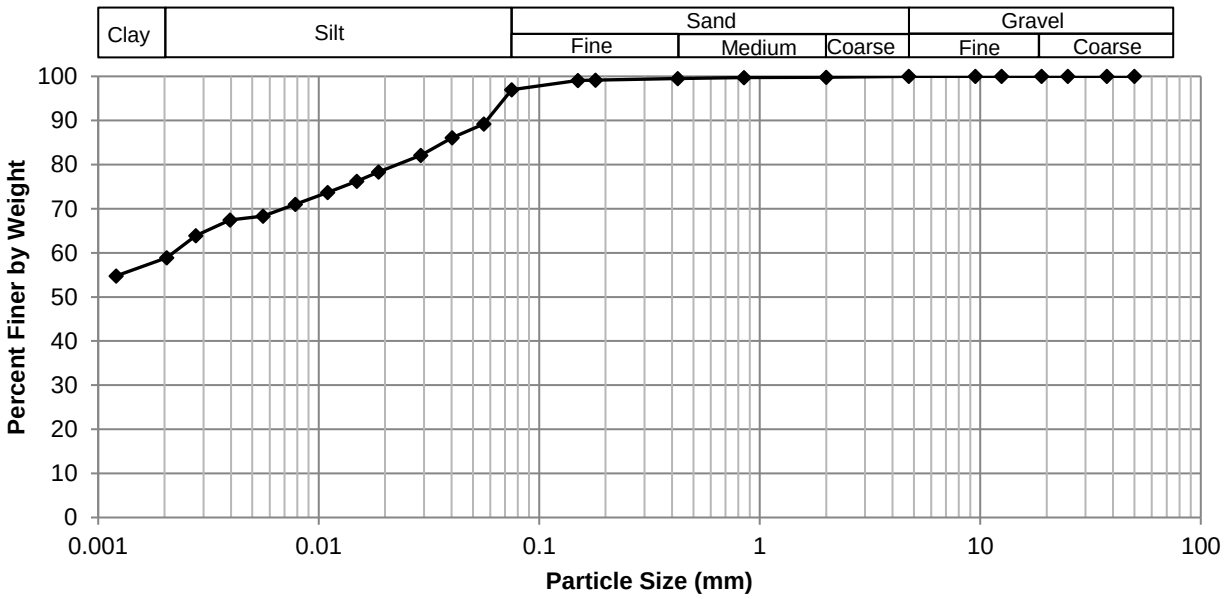
Project No.	1000-001-19
Client	Morrision Hershfield
Project	20-R-04 Local Streets - Maybank Drive
Test Hole	TH20-01
Sample #	G02
Depth (m)	0.6 - 0.8
Sample Date	30-Jan-20
Test Date	7-Feb-20
Technician	HS

Gravel	0.0%
Sand	3.0%
Silt	38.3%
Clay	58.7%

Particle Size Distribution Curve



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	96.95
37.5	100.00	2.00	99.81	0.0561	89.25
25.0	100.00	0.850	99.69	0.0403	86.12
19.0	100.00	0.425	99.51	0.0290	82.07
12.5	100.00	0.180	99.14	0.0187	78.32
9.50	100.00	0.150	99.05	0.0149	76.21
4.75	100.00	0.075	96.95	0.0110	73.72
				0.0078	70.98
				0.0056	68.32
				0.0040	67.46
				0.0028	63.86
				0.0020	58.87
				0.0012	54.75

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Grain Size Analysis (Hydrometer Method)
AASHTO T 88

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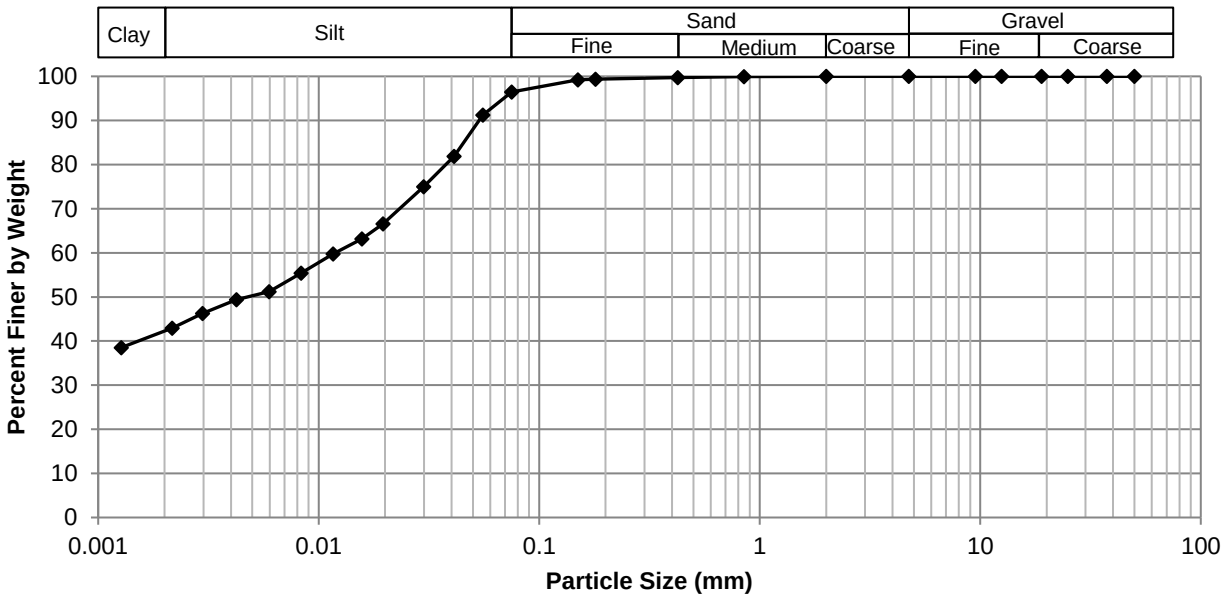
Project No.	1000-001-19
Client	Morrision Hershfield
Project	20-R-04 Local Streets - Maybank Drive
Test Hole	TH20-03
Sample #	G14
Depth (m)	0.6 - 0.8
Sample Date	31-Jan-20
Test Date	7-Feb-20
Technician	HS

Gravel	0.0%
Sand	3.5%
Silt	54.3%
Clay	42.1%

Particle Size Distribution Curve



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	96.48
37.5	100.00	2.00	100.00	0.0556	91.25
25.0	100.00	0.850	99.93	0.0411	81.87
19.0	100.00	0.425	99.74	0.0299	74.99
12.5	100.00	0.180	99.37	0.0196	66.55
9.50	100.00	0.150	99.24	0.0157	63.17
4.75	100.00	0.075	96.48	0.0116	59.73
				0.0083	55.42
				0.0060	51.17
				0.0042	49.36
				0.0030	46.24
				0.0022	42.93
				0.0013	38.54

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Grain Size Analysis (Hydrometer Method)
AASHTO T 88

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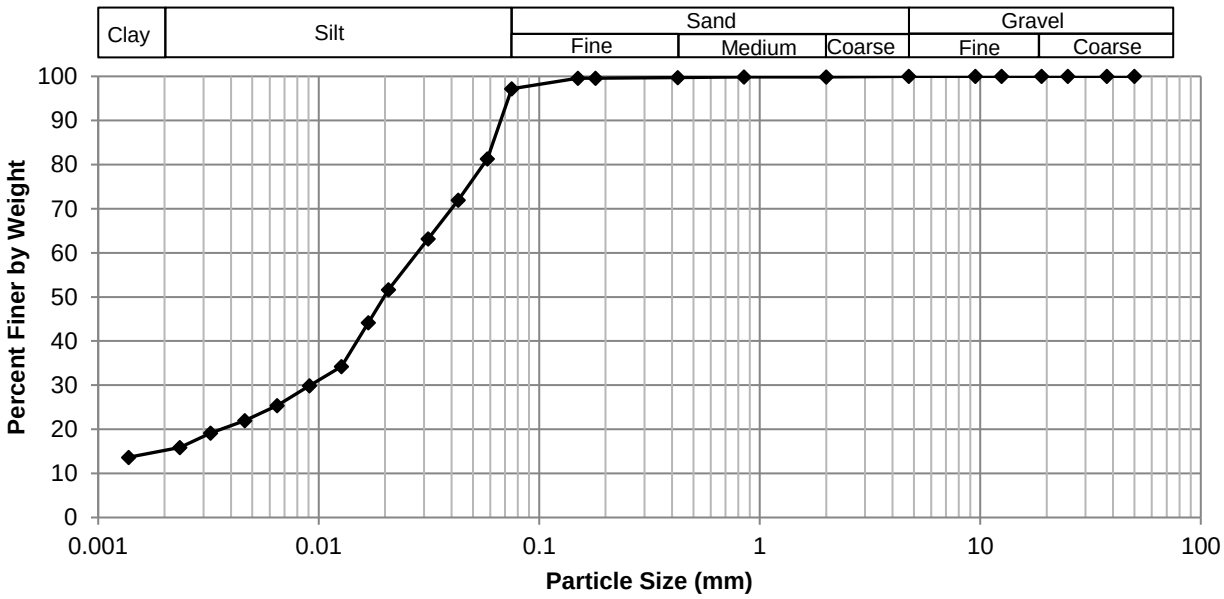
Project No.	1000-001-19
Client	Morrision Hershfield
Project	20-R-04 Local Streets - Maybank Drive
Test Hole	TH20-05
Sample #	G26
Depth (m)	0.6 - 0.8
Sample Date	30-Jan-20
Test Date	7-Feb-20
Technician	HS

Gravel	0.0%
Sand	2.8%
Silt	82.1%
Clay	15.1%

Particle Size Distribution Curve



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	97.18
37.5	100.00	2.00	99.89	0.0582	81.30
25.0	100.00	0.850	99.86	0.0429	71.93
19.0	100.00	0.425	99.76	0.0314	63.19
12.5	100.00	0.180	99.60	0.0207	51.63
9.50	100.00	0.150	99.57	0.0168	44.20
4.75	100.00	0.075	97.18	0.0127	34.20
				0.0091	29.90
				0.0065	25.34
				0.0046	21.97
				0.0032	19.16
				0.0023	15.85
				0.0014	13.66

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Standard Proctor Compaction Test

ASTM D698-12e2

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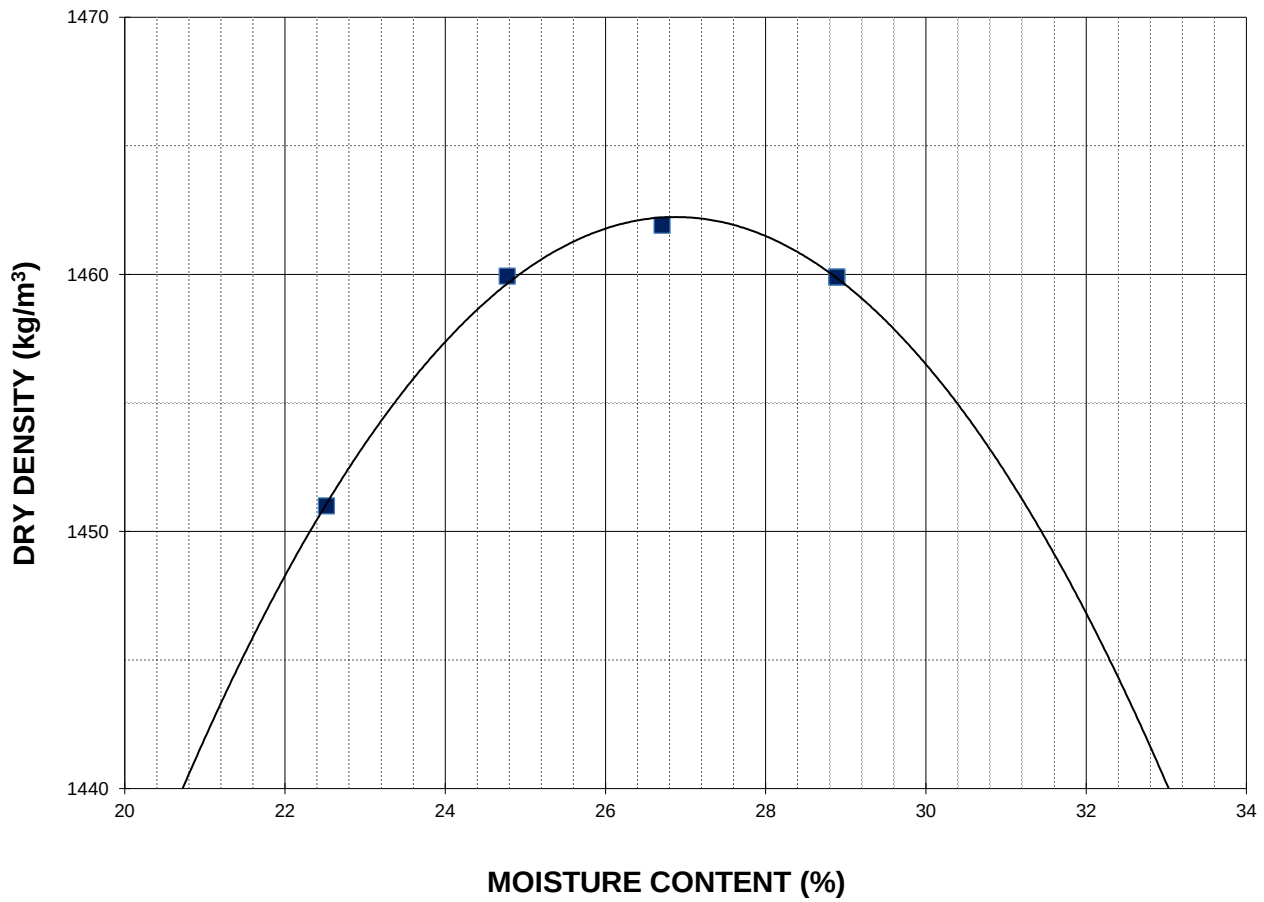
Project No.	1000-001-19
Client	Morrison Hershfield
Project	2020 Local Street Renewals - 20-R-04
Sample #	Maybank Drive
Source	Test holes
Material	Silt and Clay
Sample Date	30-Jan-20
Test Date	11-Feb-20
Technician	AD

Maximum Dry Density (kg/m3)	1462
Optimum Moisture (%)	26.9

Trial Number	1	2	3	4	
Wet Density (kg/m^3)	1778	1822	1852	1882	
Dry Density (kg/m^3)	1451	1460	1462	1460	
Moisture Content (%)	22.5	24.8	26.7	28.9	



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California Bearing Ratio Test Data Sheet

ASTM D1883-16

Project No.	1000-001-19	**Source**	Test holes
Client	Morrison Hershfield	**Material**	Silt and Clay
Project	20-R-04 Local Streets - Maybank Dr.	**Sample Date**	2020-01-30
Sample #	Maybank Drive	**Test Date**	2020-02-26
		Technician	BMH

Proctor Results (ASTM D698)

Maximum Dry Density	1462	kg/m3
Optimum Moisture Content	26.6	%
Material Retained on 19 mm Sieve	0.0	%

CBR Sample Compaction

Dry Density	1376	kg/m3
Initial Moisture Content	30.0	%
Relative Density	94.1	% SPMDD

Soaking Results

Surcharge	4.54	kg
Swell	0.9	%
Moisture Content in top 25 mm	37.2	%
Immersion Period	94	h

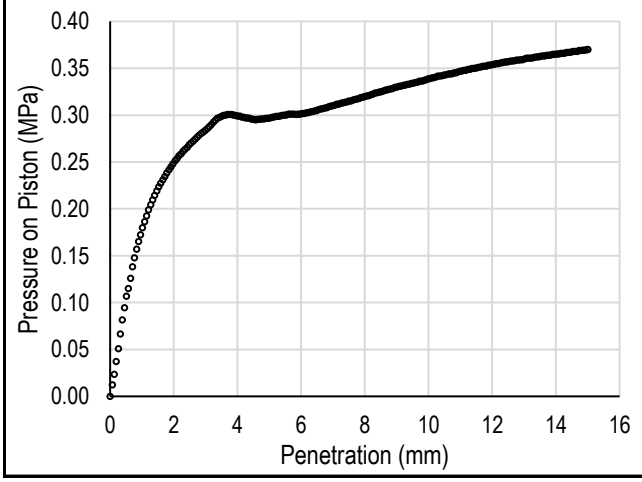
CBR Results

CBR at 2.54 mm	3.9	%
CBR at 5.08 mm	2.9	%
Zero Correction	0	mm

Test Data

Penetration (mm)	Measured Pressure (MPa)	Corrected Pressure (MPa)
0.64	0.13	0.13
1.27	0.20	0.20
1.91	0.25	0.25
2.54	0.27	0.27
3.18	0.29	0.29
3.81	0.30	0.30
4.45	0.30	0.30
5.08	0.30	0.30
7.62	0.32	0.32
10.16	0.34	0.34
12.70	0.36	0.36

Load/Penetration Curve



Comments:

Photo 1: Pavement Core Sample at Test Hole TH20-01

Photo 2: Pavement Core Sample at Test Hole TH20-02

Photo 3: Pavement Core Sample at Test Hole TH20-03

Photo 4: Pavement Core Sample at Test Hole TH20-04

Photo 5: Pavement Core Sample at Test Hole TH20-05

Photo 6: Pavement Core Sample at Test Hole TH20-06

Appendix B

Farwell Bay

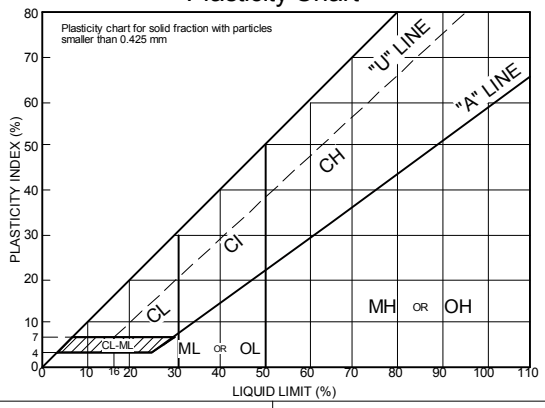
Test Hole Logs, Summary Table, Lab Testing Results and Pavement Core Photos

EXPLANATION OF FIELD AND LABORATORY TESTING

GENERAL NOTES

1. 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.
2. 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.
3. 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
Coarse-Grained soils (More than half the material is larger than No. 200 sieve size)	Gravels (More than half of coarse fraction is larger than 4.75 mm)	Clean gravel (Little or no fines)	GW		Well-graded gravels, gravel-sand mixtures, little or no fines	Determine percentages of sand and gravel from grain size curve, depending on percentage of fines (fraction smaller than No. 200 sieve) coarse-grained soils are classified as follows: Less than 5 percent..... GW, GP, SW, SP; More than 12 percent..... GM, GC, SM, SC; 6 to 12 percent..... Borderline case4s requiring dual symbols*
			GP		Poorly-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
		Gravel with fines (Appreciable amount of fines)	GM		Silty gravels, gravel-sand-silt mixtures	Not meeting all gradation requirements for GW
			GC		Clayey gravels, gravel-sand-silt mixtures	Atterberg limits below "A" line or P.I. less than 4 / 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
	Sands (More than half of coarse fraction is smaller than 4.75 mm)	Clean sands (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
			SP		Poorly-graded sands, gravelly sands, little or no fines	Not meeting all gradation requirements for SW
		Sands with fines (Appreciable amount of fines)	SM		Silty sands, sand-silt mixtures	Atterberg limits below "A" line or P.I. less than 4 / 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
			SC		Clayey sands, sand-clay mixtures	
Fine-Grained soils (More than half the material is smaller than No. 200 sieve size)	Silts and Clays (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	Plasticity Chart
			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	
	Silts and Clays (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	
	Highly Organic Soils		Pt		Peat and other highly organic soils	Von Post Classification Limit: Strong colour or odour, and often fibrous texture



Particle Size			Material
ASTM Sieve sizes	mm		
#10 to #4	2.00 to 4.75		Sand
#40 to #10	0.425 to 2.00		Coarse
#200 to #40	0.075 to 0.425		Medium
< #200	< 0.075		Fine
			Silt or Clay

Particle Size			Material
ASTM Sieve Sizes	mm		
> 12 in.	> 300		Boulders
3 in. to 12 in.	75 to 300		Cobbles
3/4 in. to 3 in.	19 to 75		Gravel
#4 to 3/4 in.	4.75 to 19		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

EXPLANATION OF FIELD AND LABORATORY TESTING

LEGEND OF ABBREVIATIONS AND SYMBOLS

LL - Liquid Limit (%)
PL - Plastic Limit (%)
PI - Plasticity Index (%)
MC - Moisture Content (%)
SPT - Standard Penetration Test
RQD - Rock Quality Designation
Qu - Unconfined Compression
Su - Undrained Shear Strength
VW - Vibrating Wire Piezometer
SI - Slope Inclinometer

▽ Water Level at Time of Drilling

▼ Water Level at End of Drilling

▼ Water Level After Drilling as Indicated on Test Hole Logs

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:

Descriptive Terms	SPT (N) (Blows/300 mm)
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:

Descriptive Terms	SPT (N) (Blows/300 mm)
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:

Descriptive Terms	Undrained Shear Strength (kPa)
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 TH20-07
1 of 1

Client:	Morrison Hershfield	**Project Number:**	1000-001-19
Project Name:	20-R-04 Local Street Renewals - Farwell Bay	**Location:**	UTM N-5521963, E-632354
Contractor:	Maple Leaf Drilling Ltd.	**Ground Elevation:**	Top of Pavement
Method:	125mm Solid Stem Auger, Acker MP8 Truck Mount	**Date Drilled:**	January 30, 2020

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/m³) 16 17 18 19 20 21 / Particle Size (%) 0 20 40 60 80 100 / PL MC LL 0 20 40 60 80 100	Undrained Shear Strength (kPa) Test Type: △ Torvane △ ✿ Pocket Pen. ✿ ☒ Qu ☒ ○ Field Vane ○ 0 50 100 150 200 250
		ASPHALT - 20 mm thick				
		CONCRETE - 170 mm thick				
		SILT AND CLAY - trace sand, trace organics - light brown - frozen, moist and firm when thawed - high plasticity		G37	●	✿
0.5		- greyish brown, stiff below 0.6 m		G38	●	✿
1.0				G39	●	✿
		- brown below 1.2 m		G40	●	✿
1.5		- very stiff below 1.5 m		G41	●	△✿
				G42	●	△✿
2.0		- firm to stiff below 2.0 m		G43	●	✿

END OF TEST HOLE AT 2.1 m IN SILT AND CLAY
1) No seepage or sloughing observed.
2) Test hole open to 2.1 m immediately after drilling.
3) Test hole backfilled with auger cuttings, granular fill and cold patch asphalt.
4) Test hole located near 104 Farwell Bay, 2.0 m South of the North curb.

Logged By: Bryan Hiebert **Reviewed By:** Angela Fidler-Kliewer **Project Engineer:** Nelson Ferreira

SUB-SURFACE LOG LOGS 2020-02-03_2020 LOCAL STREETS 20-R-04 _FARWELL_1000-001-19_0_A_BMH.GPJ TREK GEOTECHNICAL.GDT 3/2/20

Sub-Surface Log

Test Hole TH20-08
1 of 1

Client:	Morrison Hershfield	**Project Number:**	1000-001-19
Project Name:	20-R-04 Local Street Renewals - Farwell Bay	**Location:**	UTM N-5522952, E-632332
Contractor:	Maple Leaf Drilling Ltd.	**Ground Elevation:**	Top of Pavement
Method:	125mm Solid Stem Auger, Acker MP8 Truck Mount	**Date Drilled:**	January 30, 2020

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/m³) 16 17 18 19 20 21 / Particle Size (%) 0 20 40 60 80 100 / PL MC LL 0 20 40 60 80 100	Undrained Shear Strength (kPa) Test Type: △ Torvane △ ✤ Pocket Pen. ✤ ☒ Qu ☒ ○ Field Vane ○ 0 50 100 150 200 250
		ASPHALT - 30 mm thick				
		CONCRETE - 120 mm thick				
		SILT AND CLAY - trace sand, trace silt inclusions (<10 mm diam.) - dark grey - frozen to 1.5 m depth, moist and soft to firm when thawed - high plasticity				
0.5		- stiff below 0.4 m		G45		
				G46		
1.0				G47		
		CLAY - silty - brown - moist, stiff - high plasticity		G48		
1.5				G49		
2.0				G50		

END OF TEST HOLE AT 2.1 m IN CLAY
1) No seepage or sloughing observed.
2) Test hole open to 2.1 m immediately after drilling.
3) Test hole backfilled with auger cuttings, granular fill and cold patch asphalt.
4) Test hole located near 96 Farwell Bay, 1.6 m South of the North curb.

Logged By: Bryan Hiebert **Reviewed By:** Angela Fidler-Kliewer **Project Engineer:** Nelson Ferreira

SUB-SURFACE LOG LOGS 2020-02-03_2020 LOCAL STREETS 20-R-04 _FARWELL_1000-001-19_0_A_BMH.GPJ TREK GEOTECHNICAL.GDT 3/2/20

Sub-Surface Log

Test Hole TH20-09
1 of 1

Client:	Morrison Hershfield	**Project Number:**	1000-001-19
Project Name:	20-R-04 Local Street Renewals - Farwell Bay	**Location:**	UTM N-5522048, E-632506
Contractor:	Maple Leaf Drilling Ltd.	**Ground Elevation:**	Top of Pavement
Method:	125mm Solid Stem Auger, Acker MP8 Truck Mount	**Date Drilled:**	January 30, 2020

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
		ASPHALT - 25 mm thick		
		CONCRETE - 125 mm thick		
		SILT AND CLAY - trace sand, trace organics - dark grey to black - frozen to 1.4 m depth, moist and soft to firm when thawed - high plasticity		G52
0.5		- firm to stiff below 0.5 m		G53
				G54
1.0		- no organics, stiff to very stiff below 1.1 m		G55
				G56
1.5				
2.0		CLAY - silty, trace silt inclusions (<10 mm diam.), mottled brown and grey, moist, stiff, high plasticity		G57

Bulk Unit Wt (kN/m³): 16 17 18 19 20 21
Particle Size (%): 0 20 40 60 80 100
PL MC LL: 0 20 40 60 80 100
Undrained Shear Strength (kPa): 0 50 100 150 200 250
Test Type: △ Torvane △ | ✪ Pocket Pen. ✪ | ☒ Qu ☒ | ○ Field Vane ○

END OF TEST HOLE AT 2.1 m IN CLAY
1) No seepage or sloughing observed.
2) Test hole open to 2.1 m immediately after drilling.
3) Test hole backfilled with auger cuttings, granular fill and cold patch asphalt.
4) Test hole located near 83 Farwell Bay, 3.0 m North of the South curb.

Logged By: Bryan Hiebert **Reviewed By:** Angela Fidler-Kliewer **Project Engineer:** Nelson Ferreira

SUB-SURFACE LOG LOGS 2020-02-03_2020 LOCAL STREETS 20-R-04_FARWELL_1000-001-19_0_A_BMH.GPJ TREK GEOTECHNICAL.GDT 3/2/20

Sub-Surface Log

Test Hole TH20-10
1 of 1

Client:	Morrison Hershfield	**Project Number:**	1000-001-19
Project Name:	20-R-04 Local Street Renewals - Farwell Bay	**Location:**	UTM N-5521905, E-632213
Contractor:	Maple Leaf Drilling Ltd.	**Ground Elevation:**	Top of Pavement
Method:	125mm Solid Stem Auger, Acker MP8 Truck Mount	**Date Drilled:**	January 30, 2020

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/m³) 16 17 18 19 20 21 / Particle Size (%) 0 20 40 60 80 100 / PL MC LL 0 20 40 60 80 100	Undrained Shear Strength (kPa) Test Type △ Torvane △ ✤ Pocket Pen. ✤ ☒ Qu ☒ ○ Field Vane ○ 0 50 100 150 200 250
		ASPHALT - 40 mm thick				
		CONCRETE - 170 mm thick				
		SILT - some clay to clayey - light brown - frozen to 1.2 m depth, moist to wet and soft when thawed - low to intermediate plasticity		G58	●	
0.5		- moist below 0.5 m		G59	●	
				G60	▭	
1.0		TRANSITION: from SILT to CLAY		G61	●	
		CLAY - silty, trace silt inclusions (<10 mm diam.) - brown - moist, stiff to very stiff - high plasticity		G62	●	△✤
1.5		- firm to stiff below 1.8 m				
2.0				G63	●	△✤

END OF TEST HOLE AT 2.1 m IN CLAY
1) No seepage or sloughing observed.
2) Test hole open to 2.1 m immediately after drilling.
3) Test hole backfilled with auger cuttings, granular fill and cold patch asphalt.
4) Test hole located near 57 Farwell Bay, 2.0 m West of the East curb.

Logged By: Bryan Hiebert **Reviewed By:** Angela Fidler-Kliewer **Project Engineer:** Nelson Ferreira

SUB-SURFACE LOG LOGS 2020-02-03_2020 LOCAL STREETS 20-R-04_FARWELL_1000-001-19_0_A_BMH.GPJ TREK GEOTECHNICAL.GDT 3/2/20

Sub-Surface Log

Test Hole TH20-11
1 of 1

Client:	Morrison Hershfield	**Project Number:**	1000-001-19
Project Name:	20-R-04 Local Street Renewals - Farwell Bay	**Location:**	UTM N-5521939, E-632193
Contractor:	Maple Leaf Drilling Ltd.	**Ground Elevation:**	Top of Pavement
Method:	125mm Solid Stem Auger, Acker MP8 Truck Mount	**Date Drilled:**	January 30, 2020

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
		ASPHALT - 20 mm thick		
		CONCRETE - 160 mm thick		
		SILT AND CLAY - trace sand, trace organics - mottled brown and black - frozen, moist and firm when thawed - high plasticity		G64
0.5		SILT - trace sand, trace clay - light brown - frozen to 1.2 m depth, moist and soft when thawed - low plasticity		G65
1.0				G66
				G67
1.5		CLAY - silty, trace silt inclusions (<10 mm diam.) - brown - moist, stiff - high plasticity		G68
2.0				G69

Bulk Unit Wt (kN/m³): 16 17 18 19 20 21

Particle Size (%): 0 20 40 60 80 100

PL MC LL: 0 20 40 60 80 100

Undrained Shear Strength (kPa) — Test Type: △ Torvane △ ✿ Pocket Pen. ✿ ☒ Qu ☒ ○ Field Vane ○: 0 50 100 150 200 250

END OF TEST HOLE AT 2.1 m IN CLAY
1) No seepage or sloughing observed.
2) Test hole open to 2.1 m immediately after drilling.
3) Test hole backfilled with auger cuttings, granular fill and cold patch asphalt.
4) Test hole located near 49 Farwell Bay, 1.2 m East of the West curb.

Logged By: Bryan Hiebert **Reviewed By:** Angela Fidler-Kliewer **Project Engineer:** Nelson Ferreira

SUB-SURFACE LOG LOGS 2020-02-03_2020 LOCAL STREETS 20-R-04 _FARWELL_1000-001-19_0_A_BMH.GPJ TREK GEOTECHNICAL.GDT 3/2/20

Sub-Surface Log

Test Hole TH20-12
1 of 1

Client:	Morrison Hershfield	**Project Number:**	1000-001-19
Project Name:	20-R-04 Local Street Renewals - Farwell Bay	**Location:**	UTM N-5521974, E-632197
Contractor:	Maple Leaf Drilling Ltd.	**Ground Elevation:**	Top of Pavement
Method:	125mm Solid Stem Auger, Acker MP8 Truck Mount	**Date Drilled:**	January 30, 2020

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/m³) 16 17 18 19 20 21 / Particle Size (%) 0 20 40 60 80 100 / PL MC LL 0 20 40 60 80 100	Undrained Shear Strength (kPa) Test Type △ Torvane △ ✿ Pocket Pen. ✿ ☒ Qu ☒ ○ Field Vane ○ 0 50 100 150 200 250
		ASPHALT - 40 mm thick				
		CONCRETE - 170 mm thick				
		SILT AND CLAY - trace sand, trace organics - dark grey - frozen to 1.2 m depth, moist and firm to stiff when thawed - high plasticity		G70	●	✿
0.5				G71	●	✿
1.0				G72	●	✿
		- very stiff below 1.2 m		G73	●	✿
1.5		CLAY - silty, trace silt inclusions (<10 mm diam.) - brown - moist, firm to stiff - high plasticity		G74	●	✿
2.0				G75	●	△

END OF TEST HOLE AT 2.1 m IN CLAY
1) No seepage or sloughing observed.
2) Test hole open to 2.1 m immediately after drilling.
3) Test hole backfilled with auger cuttings, granular fill and cold patch asphalt.
4) Test hole located near 38 Farwell Bay, 2.0 m North of the South curb.

Logged By: Bryan Hiebert **Reviewed By:** Angela Fidler-Kliewer **Project Engineer:** Nelson Ferreira

SUB-SURFACE LOG LOGS 2020-02-03_2020 LOCAL STREETS 20-R-04 _FARWELL_1000-001-19_0_A_BMH.GPJ TREK GEOTECHNICAL.GDT 3/2/20

Sub-Surface Log

Test Hole TH20-13
1 of 1

Client:	Morrison Hershfield	**Project Number:**	1000-001-19
Project Name:	20-R-04 Local Street Renewals - Farwell Bay	**Location:**	UTM N-5521992, E-632222
Contractor:	Maple Leaf Drilling Ltd.	**Ground Elevation:**	Top of Pavement
Method:	125mm Solid Stem Auger, Acker MP8 Truck Mount	**Date Drilled:**	January 30, 2020

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
		ASPHALT - 25 mm thick		
		CONCRETE - 155 mm thick		
		CLAY - silty, trace sand, trace organics - dark grey - frozen to 1.1 m depth, moist and firm to stiff when thawed - high plasticity		
0.5			G	G76
			G	G77
			G	G78
1.0		- no organics, very stiff below 1.1 m	G	G79
		- trace silt inclusions (<10 mm diam.), grey, firm to stiff below 1.4 m	G	G80
1.5				
2.0			G	G81

Bulk Unit Wt (kN/m³): 16 17 18 19 20 21

Particle Size (%): 0 20 40 60 80 100

PL MC LL: 0 20 40 60 80 100

Undrained Shear Strength (kPa): 0 50 100 150 200 250

Test Type: △ Torvane △ | ✤ Pocket Pen. ✤ | ☒ Qu ☒ | ○ Field Vane ○

END OF TEST HOLE AT 2.1 m IN CLAY
1) No seepage or sloughing observed.
2) Test hole open to 2.1 m immediately after drilling.
3) Test hole backfilled with auger cuttings, granular fill and cold patch asphalt.
4) Test hole located near 27 Farwell Bay, 1.5 m South of the North curb.

Logged By: Bryan Hiebert **Reviewed By:** Angela Fidler-Kliewer **Project Engineer:** Nelson Ferreira

SUB-SURFACE LOG LOGS 2020-02-03_2020 LOCAL STREETS 20-R-04 _FARWELL_1000-001-19_0_A_BMH.GPJ TREK GEOTECHNICAL.GDT 3/2/20

Sub-Surface Log

Test Hole TH20-14
1 of 1

Client:	Morrison Hershfield	**Project Number:**	1000-001-19
Project Name:	20-R-04 Local Street Renewals - Farwell Bay	**Location:**	UTM N-5522015, E-632267
Contractor:	Maple Leaf Drilling Ltd.	**Ground Elevation:**	Top of Pavement
Method:	125mm Solid Stem Auger, Acker MP8 Truck Mount	**Date Drilled:**	January 30, 2020

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/m³) 16 17 18 19 20 21 / Particle Size (%) 0 20 40 60 80 100 / PL MC LL	Undrained Shear Strength (kPa) 0 50 100 150 200 250
		ASPHALT - 25 mm thick				
		CONCRETE - 155 mm thick				
		SILT AND CLAY - trace sand, trace organics - brown - frozen to 1.4 m depth, moist and firm to stiff when thawed - high plasticity	G	G82		
0.5			G	G83		
1.0			G	G84		
			G	G85		
1.5			G	G86		
		CLAY - silty, trace silt inclusions (<10 mm diam.) - brown - moist, firm to stiff - high plasticity	G	G87		
2.0						

END OF TEST HOLE AT 2.1 m IN CLAY
1) No seepage or sloughing observed.
2) Test hole open to 2.1 m immediately after drilling.
3) Test hole backfilled with auger cuttings, granular fill and cold patch asphalt.
4) Test hole located near 16 Farwell Bay, 2.2 m North of the South curb.

Logged By: Bryan Hiebert **Reviewed By:** Angela Fidler-Kliewer **Project Engineer:** Nelson Ferreira

SUB-SURFACE LOG LOGS 2020-02-03_2020 LOCAL STREETS 20-R-04 _FARWELL_1000-001-19_0_A_BMH.GPJ TREK GEOTECHNICAL.GDT 3/2/20

Sub-Surface Log

Test Hole TH20-15
1 of 1

Client:	Morrison Hershfield	**Project Number:**	1000-001-19
Project Name:	20-R-04 Local Street Renewals - Farwell Bay	**Location:**	UTM N-5522028, E-632287
Contractor:	Maple Leaf Drilling Ltd.	**Ground Elevation:**	Top of Pavement
Method:	125mm Solid Stem Auger, Acker MP8 Truck Mount	**Date Drilled:**	January 30, 2020

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
		ASPHALT - 30 mm thick CONCRETE - 160 mm thick		
0.5		SILT AND CLAY - trace sand, trace organics - dark grey - frozen, moist and firm when thawed - high plasticity		G88
1.0		SILT - trace to some clay, trace sand - light brown - frozen to 1.1 m depth, moist to wet and soft when thawed - intermediate plasticity		G89
				G90
		- trace clay, moist, low plasticity below 1.1 m		G91
1.5		CLAY - silty, trace silt inclusions (<10 mm diam.) - brown - moist, firm to stiff - high plasticity		G92
2.0				G93

Bulk Unit Wt (kN/m³): 16 17 18 19 20 21

Particle Size (%): 0 20 40 60 80 100

PL MC LL: 0 20 40 60 80 100

Undrained Shear Strength (kPa)

Test Type: △ Torvane △ | ✿ Pocket Pen. ✿ | ☒ Qu ☒ | ○ Field Vane ○

0 50 100 150 200 250

END OF TEST HOLE AT 2.1 m IN CLAY
1) No seepage or sloughing observed.
2) Test hole open to 2.1 m immediately after drilling.
3) Test hole backfilled with auger cuttings, granular fill and cold patch asphalt.
4) Test hole located near 9 Farwell Bay, 1.5 m South of the North curb.

Logged By: Bryan Hiebert **Reviewed By:** Angela Fidler-Kliewer **Project Engineer:** Nelson Ferreira

SUB-SURFACE LOG LOGS 2020-02-03_2020 LOCAL STREETS 20-R-04_FARWELL_1000-001-19_0_A_BMH.GPJ TREK GEOTECHNICAL.GDT 3/2/20

20-R-04 Local Street Renewals - Farwell Bay
Sub-Surface Investigation

Test Hole No.	Test Hole Location	Pavement Surface		Pavement Structure Material		Subgrade Description	Sample Depth (m)		Moisture Content (%)	Grain Size Analysis				Atterberg Limits		
		Type	Thickness (mm)	Type	Thickness (mm)		Top (m)	Bottom (m)		Clay (%)	Silt (%)	Sand (%)	Gravel (%)	Plastic	Liquid	Plasticity Index
TH20-07	UTM : 5521963 N, 632354 E Located near 104 Farwell Bay, 2.0 m South of the North curb.	Asphalt	20	Concrete	170	Silt and Clay	0.3	0.5	30							
						Silt and Clay	0.6	0.8	27							
						Silt and Clay	0.9	1.1	29							
						Silt and Clay	1.2	1.4	28							
						Silt and Clay	1.5	1.7	30							
						Silt and Clay	1.8	2.0	28							
						Silt and Clay	2.0	2.1	24							
TH20-08	UTM : 5522952 N, 632332 E Located near 96 Farwell Bay, 1.6 m South of the North curb.	Asphalt	30	Concrete	120	Silt and Clay	0.5	0.6	31							
						Silt and Clay	0.8	0.9	30	61	37	3	0	21	65	44
						Silt and Clay	1.1	1.2	28							
						Clay	1.4	1.5	36							
						Clay	1.7	1.8	38							
						Clay	2.0	2.1	45							
TH20-09	UTM : 5522048 N, 632506 E Located near 83 Farwell Bay, 3.0 m North of the South curb.	Asphalt	25	Concrete	125	Silt and Clay	0.2	0.3	38							
						Silt and Clay	0.5	0.6	36							
						Silt and Clay	0.8	0.9	32							
						Silt and Clay	1.1	1.2	35							
						Silt and Clay	1.4	1.5	32							
						Clay	2.0	2.1	44							
TH20-10	UTM : 5521905 N, 632213 E Located near 57 Farwell Bay, 2.0 m West of the East curb.	Asphalt	40	Concrete	170	Silt	0.2	0.3	25							
						Silt	0.5	0.6	20							
						Silt	0.8	0.9	22	20	75	4	0	16	31	15
						Transition Silt to Clay	1.1	1.2	32							
						Clay	1.4	1.5	39							
						Clay	2.0	2.1	44							

20-R-04 Local Street Renewals - Farwell Bay
Sub-Surface Investigation

Test Hole No.	Test Hole Location	Pavement Surface		Pavement Structure Material		Subgrade Description	Sample Depth (m)		Moisture Content (%)	Grain Size Analysis				Atterberg Limits		
		Type	Thickness (mm)	Type	Thickness (mm)		Top (m)	Bottom (m)		Clay (%)	Silt (%)	Sand (%)	Gravel (%)	Plastic	Liquid	Plasticity Index
TH20-11	UTM : 5521939 N, 632193 E Located near 49 Farwell Bay, 1.2 m East of the West curb.	Asphalt	20	Concrete	160	Organic Clay	0.3	0.5	34							
						Silt	0.6	0.8	27							
						Silt	0.9	1.1	25							
						Silt	1.2	1.4	21							
						Clay	1.5	1.7	38							
						Clay	1.8	2.0	42							
TH20-12	UTM : 5521974 N, 632197 E Located near 38 Farwell Bay, 2.0 m North of the South curb.	Asphalt	30	Concrete	120	Silt and Clay	0.2	0.3	36							
						Silt and Clay	0.6	0.8	32	61	37	3	0	21	65	44
						Silt and Clay	0.9	1.1	29							
						Silt and Clay	1.2	1.4	28							
						Clay	1.5	1.7	41							
						Clay	2.0	2.1	42							
TH20-13	UTM : 5521992 N, 632222 E Located near 27 Farwell Bay, 1.5 m South of the North curb.	Asphalt	25	Concrete	155	Clay	0.2	0.3	35							
						Clay	0.5	0.6	35							
						Clay	0.8	0.9	35	75	24	1	0	26	80	55
						Clay	1.1	1.2	39							
						Clay	1.4	1.5	35							
						Clay	2.0	2.1	46							
TH20-14	UTM : 5522015 N, 632267 E Located near 16 Farwell Bay, 2.2 m North of the South curb.	Asphalt	25	Concrete	155	Silt and Clay	0.2	0.3	37							
						Silt and Clay	0.5	0.6	35							
						Silt and Clay	0.8	0.9	35							
						Silt and Clay	1.1	1.2	35							
						Silt and Clay	1.4	1.5	30							
						Clay	2.0	2.1	40							

20-R-04 Local Street Renewals - Farwell Bay
Sub-Surface Investigation

Test Hole No.	Test Hole Location	Pavement Surface		Pavement Structure Material		Subgrade Description	Sample Depth (m)		Moisture Content (%)	Grain Size Analysis				Atterberg Limits		
		Type	Thickness (mm)	Type	Thickness (mm)		Top (m)	Bottom (m)		Clay (%)	Silt (%)	Sand (%)	Gravel (%)	Plastic	Liquid	Plasticity Index
TH20-15	UTM : 5522028 N, 632287 E Located near 9 Farwell Bay, 1.5 m South of the North curb.	Asphalt	30	Concrete	160	Silt and Clay	0.3	0.5	33							
						Silt	0.6	0.8	38							
						Silt	0.9	1.1	28							
						Silt	1.2	1.4	19							
						Clay	1.5	1.7	40							
						Clay	1.8	2.0	41							

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Moisture Content Report
ASTM D2216-10

Project No. 1000-001-19
Client Morrison Hershfield
Project 20-R-04 Local Street Renewals - Farwell Bay

Sample Date 30-Jan-20
Test Date 07-Feb-20
Technician BMH

Test Hole	TH20-07	TH20-07	TH20-07	TH20-07	TH20-07	TH20-07
Depth (m)	0.3 - 0.5	0.6 - 0.8	0.9 - 1.1	1.2 - 1.4	1.5 - 1.7	1.8 - 2.0
Sample #	G37	G38	G39	G40	G41	G42
Tare ID	AB11	W19	P27	K29	Z64	N49
Mass of tare	6.9	8.9	8.7	8.4	8.6	8.4
Mass wet + tare	149.4	150.8	149.5	123.6	140.9	145.9
Mass dry + tare	116.4	120.3	118.2	98.3	110.8	115.8
Mass water	33.0	30.5	31.3	25.3	30.1	30.1
Mass dry soil	109.5	111.4	109.5	89.9	102.2	107.4
Moisture %	30.1%	27.4%	28.6%	28.1%	29.5%	28.0%

Test Hole	TH20-07	TH20-08	TH20-08	TH20-08	TH20-08	TH20-08
Depth (m)	2.0 - 2.1	0.5 - 0.6	0.8 - 0.9	1.1 - 1.2	1.4 - 1.5	1.7 - 1.8
Sample #	G43	G45	G46	G47	G48	G49
Tare ID	W12	H25	E16	D32	C18	H56
Mass of tare	8.4	8.5	8.6	8.5	8.7	8.5
Mass wet + tare	133.1	115.1	428.9	254.9	156.6	178.0
Mass dry + tare	109.2	90.2	331.8	200.8	117.2	131.6
Mass water	23.9	24.9	97.1	54.1	39.4	46.4
Mass dry soil	100.8	81.7	323.2	192.3	108.5	123.1
Moisture %	23.7%	30.5%	30.0%	28.1%	36.3%	37.7%

Test Hole	TH20-08	TH20-09	TH20-09	TH20-09	TH20-09	TH20-09
Depth (m)	2.0 - 2.1	0.2 - 0.3	0.5 - 0.6	0.8 - 0.9	1.1 - 1.2	1.4 - 1.5
Sample #	G50	G52	G53	G54	G55	G56
Tare ID	F55	P33	W80	Z07	W22	F132
Mass of tare	8.6	8.6	8.7	8.6	8.6	8.7
Mass wet + tare	254.5	131.5	107.7	141.6	229.8	248.4
Mass dry + tare	177.7	97.7	81.7	109.3	173.1	190.2
Mass water	76.8	33.8	26.0	32.3	56.7	58.2
Mass dry soil	169.1	89.1	73.0	100.7	164.5	181.5
Moisture %	45.4%	37.9%	35.6%	32.1%	34.5%	32.1%

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Moisture Content Report
ASTM D2216-10

Project No. 1000-001-19
Client Morrison Hershfield
Project 20-R-04 Local Street Renewals - Farwell Bay

Sample Date 30-Jan-20
Test Date 07-Feb-20
Technician BMH

Test Hole	TH20-09	TH20-10	TH20-10	TH20-10	TH20-10	TH20-10
Depth (m)	2.0 - 2.1	0.2 - 0.3	0.5 - 0.6	0.8 - 0.9	1.1 - 1.2	1.4 - 1.5
Sample #	G57	G58	G59	G60	G61	G62
Tare ID	E85	C20	N92	H53	AA15	W76
Mass of tare	8.6	8.4	8.6	8.7	6.7	8.5
Mass wet + tare	236.0	161.7	192.1	593.1	285.2	177.2
Mass dry + tare	166.6	130.8	161.0	486.8	218.5	129.9
Mass water	69.4	30.9	31.1	106.3	66.7	47.3
Mass dry soil	158.0	122.4	152.4	478.1	211.8	121.4
Moisture %	43.9%	25.2%	20.4%	22.2%	31.5%	39.0%

Test Hole	TH20-10	TH20-11	TH20-11	TH20-11	TH20-11	TH20-11
Depth (m)	2.0 - 2.1	0.3 - 0.5	0.6 - 0.8	0.9 - 1.1	1.2 - 1.4	1.5 - 1.7
Sample #	G63	G64	G65	G66	G67	G68
Tare ID	Z91	A101	H35	H74	AB12	A25
Mass of tare	8.9	8.7	8.4	8.7	6.8	8.7
Mass wet + tare	254.5	102.7	189.6	104.9	211.5	182.4
Mass dry + tare	179.2	78.7	151.4	85.4	176.0	134.6
Mass water	75.3	24.0	38.2	19.5	35.5	47.8
Mass dry soil	170.3	70.0	143.0	76.7	169.2	125.9
Moisture %	44.2%	34.3%	26.7%	25.4%	21.0%	38.0%

Test Hole	TH20-11	TH20-12	TH20-12	TH20-12	TH20-12	TH20-12
Depth (m)	2.0 - 2.1	0.2 - 0.3	0.6 - 0.8	0.9 - 1.1	1.2 - 1.4	1.5 - 1.7
Sample #	G69	G70	G71	G72	G73	G74
Tare ID	E62	A105	H78	AB80	Z72	A100
Mass of tare	8.5	8.6	8.4	6.8	8.8	8.9
Mass wet + tare	213.4	202.9	158.4	176.7	223.0	196.5
Mass dry + tare	153.0	151.9	121.7	138.8	176.5	141.6
Mass water	60.4	51.0	36.7	37.9	46.5	54.9
Mass dry soil	144.5	143.3	113.3	132.0	167.7	132.7
Moisture %	41.8%	35.6%	32.4%	28.7%	27.7%	41.4%

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Moisture Content Report
ASTM D2216-10

Project No. 1000-001-19
Client Morrison Hershfield
Project 20-R-04 Local Street Renewals - Farwell Bay

Sample Date 30-Jan-20
Test Date 07-Feb-20
Technician BMH

Test Hole	TH20-12	TH20-13	TH20-13	TH20-13	TH20-13	TH20-13
Depth (m)	2.0 - 2.1	0.2 - 0.3	0.5 - 0.6	0.8 - 0.9	1.1 - 1.2	1.4 - 1.5
Sample #	G75	G76	G77	G78	G79	G80
Tare ID	E80	D48	E77	W95	Z114	D30
Mass of tare	8.6	8.6	8.5	8.6	8.7	8.4
Mass wet + tare	237.3	169.1	159.2	492.1	159.2	268.5
Mass dry + tare	169.6	127.2	120.4	366.1	117.2	201.4
Mass water	67.7	41.9	38.8	126.0	42.0	67.1
Mass dry soil	161.0	118.6	111.9	357.5	108.5	193.0
Moisture %	42.0%	35.3%	34.7%	35.2%	38.7%	34.8%

Test Hole	TH20-13	TH20-14	TH20-14	TH20-14	TH20-14	TH20-14
Depth (m)	2.0 - 2.1	0.3 - 0.5	0.6 - 0.8	0.9 - 1.1	1.2 - 1.4	1.5 - 1.7
Sample #	G81	G82	G83	G84	G85	G86
Tare ID	H41	H50	F88	P05	AB13	N22
Mass of tare	9.2	9.1	8.5	8.8	6.8	8.4
Mass wet + tare	174.9	155.3	166.3	172.8	176.9	210.7
Mass dry + tare	122.6	115.9	125.7	130.1	133.0	163.6
Mass water	52.3	39.4	40.6	42.7	43.9	47.1
Mass dry soil	113.4	106.8	117.2	121.3	126.2	155.2
Moisture %	46.1%	36.9%	34.6%	35.2%	34.8%	30.3%

Test Hole	TH20-14	TH20-15	TH20-15	TH20-15	TH20-15	TH20-15
Depth (m)	2.0 - 2.1	0.3 - 0.5	0.6 - 0.8	0.9 - 1.1	1.2 - 1.4	1.5 - 1.7
Sample #	G87	G88	G89	G90	G91	G92
Tare ID	H16	AB49	F49	E18	N85	Z05
Mass of tare	8.4	6.7	8.5	8.5	8.5	8.5
Mass wet + tare	162.9	198.4	141.9	179.6	165.6	142.9
Mass dry + tare	118.7	151.4	105.0	141.9	140.1	104.6
Mass water	44.2	47.0	36.9	37.7	25.5	38.3
Mass dry soil	110.3	144.7	96.5	133.4	131.6	96.1
Moisture %	40.1%	32.5%	38.2%	28.3%	19.4%	39.9%

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Moisture Content Report
ASTM D2216-10

Project No. 1000-001-19
Client Morrison Hershfield
Project 20-R-04 Local Street Renewals - Farwell Bay

Sample Date 30-Jan-20
Test Date 07-Feb-20
Technician BMH

Test Hole	TH20-15					
Depth (m)	2.0 - 2.1					
Sample #	G93					
Tare ID	C10					
Mass of tare	8.8					
Mass wet + tare	186.4					
Mass dry + tare	134.8					
Mass water	51.6					
Mass dry soil	126.0					
Moisture %	41.0%					

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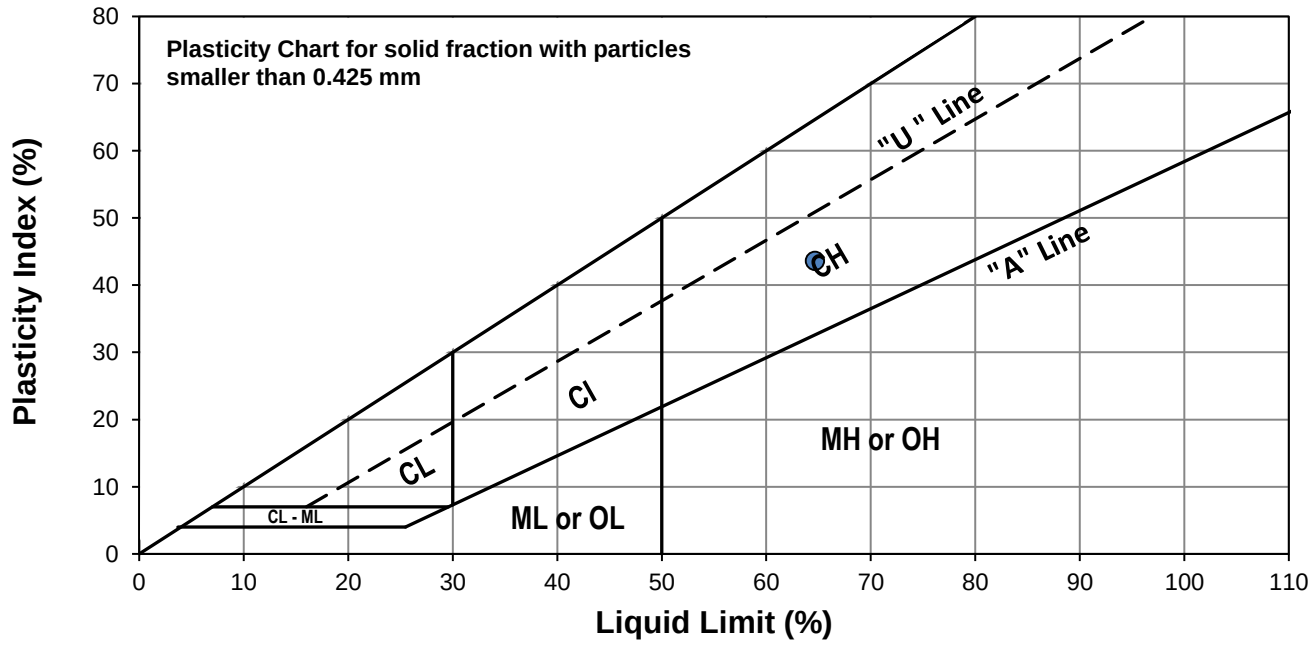
Atterberg Limits
ASTM D4318-10e1

Project No.	1000-001-19
Client	Morrision Hershfield
Project	20-R-04 Local Street Renewals - Farwell Bay
Test Hole	TH20-08
Sample #	G46
Depth (m)	0.8 - 0.9
Sample Date	30-Jan-20
Test Date	11-Feb-20
Technician	HS

Liquid Limit	65
Plastic Limit	21
Plasticity Index	44

Liquid Limit

Trial #	1	2	3		
Number of Blows (N)	18	25	34		
Mass Wet Soil + Tare (g)	24.692	25.525	26.219		
Mass Dry Soil + Tare (g)	20.454	21.078	21.616		
Mass Tare (g)	14.179	14.200	14.190		
Mass Water (g)	4.238	4.447	4.603		
Mass Dry Soil (g)	6.275	6.878	7.426		
Moisture Content (%)	67.538	64.655	61.985		



Plastic Limit

Trial #	1	2	3	4	5
Mass Tare (g)	14.204	14.298			
Mass Wet Soil + Tare (g)	22.214	21.433			
Mass Dry Soil + Tare (g)	20.831	20.183			
Mass Water (g)	1.383	1.250			
Mass Dry Soil (g)	6.627	5.885			
Moisture Content (%)	20.869	21.240			

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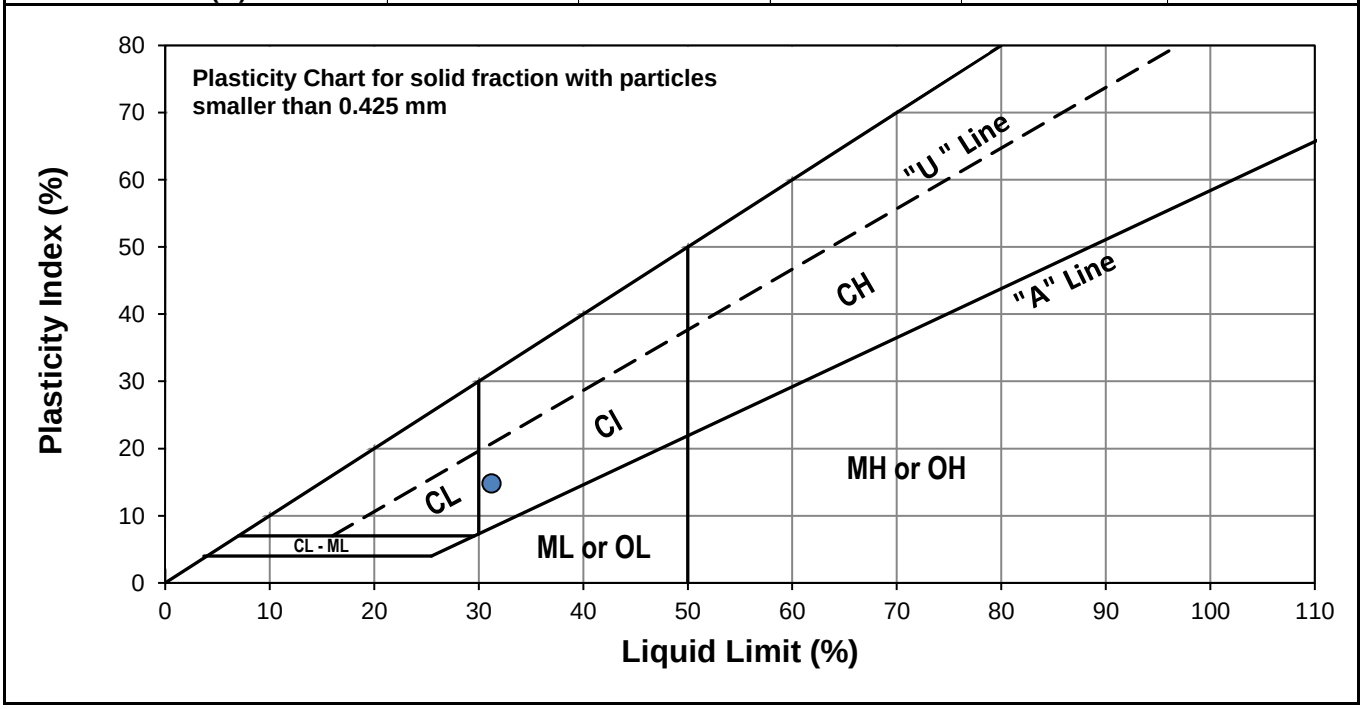
Atterberg Limits
ASTM D4318-10e1

Project No.	1000-001-19
Client	Morrision Hershfield
Project	20-R-04 Local Street Renewals - Farwell Bay
Test Hole	TH20-10
Sample #	G60
Depth (m)	0.8 - 0.9
Sample Date	30-Jan-20
Test Date	13-Feb-20
Technician	HS

Liquid Limit	31
Plastic Limit	16
Plasticity Index	15

Liquid Limit

Trial #	1	2	3		
Number of Blows (N)	18	25	31		
Mass Wet Soil + Tare (g)	27.250	24.232	25.782		
Mass Dry Soil + Tare (g)	24.045	21.903	23.025		
Mass Tare (g)	14.188	14.380	14.007		
Mass Water (g)	3.205	2.329	2.757		
Mass Dry Soil (g)	9.857	7.523	9.018		
Moisture Content (%)	32.515	30.958	30.572		



Plastic Limit

Trial #	1	2	3	4	5
Mass Tare (g)	14.086	14.069			
Mass Wet Soil + Tare (g)	22.637	22.157			
Mass Dry Soil + Tare (g)	21.433	21.016			
Mass Water (g)	1.204	1.141			
Mass Dry Soil (g)	7.347	6.947			
Moisture Content (%)	16.388	16.424			

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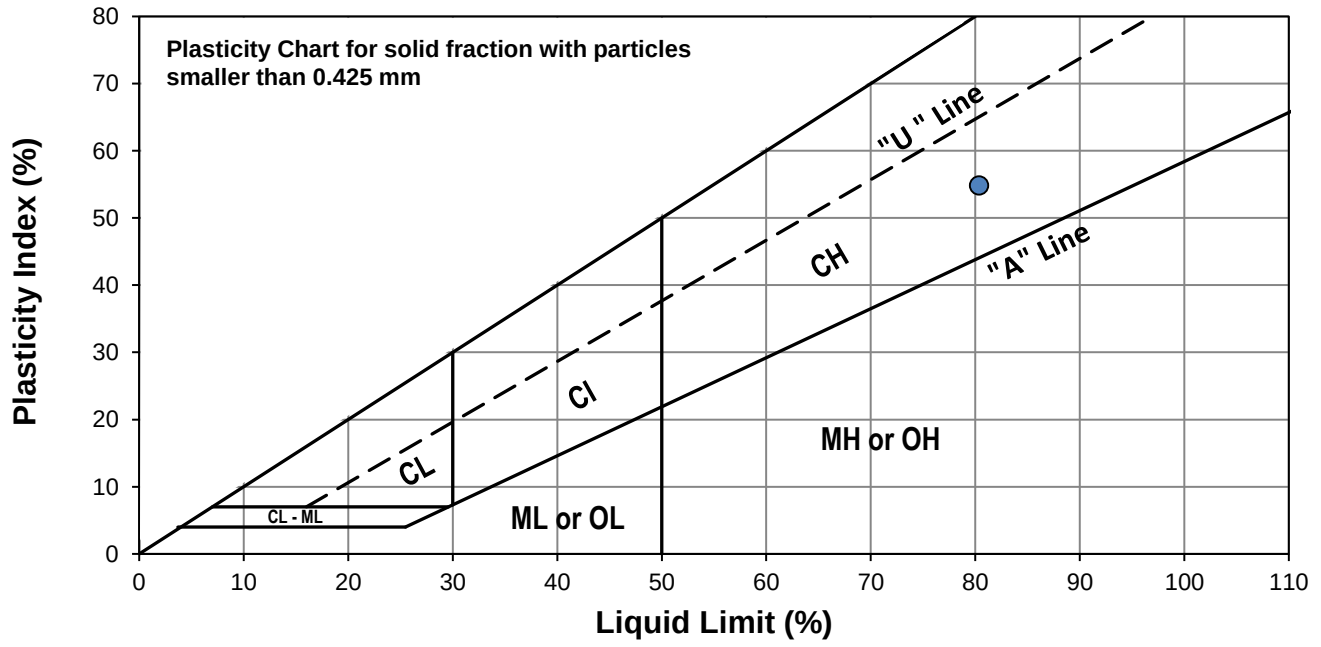
Atterberg Limits
ASTM D4318-10e1

Project No.	1000-001-19
Client	Morrision Hershfield
Project	20-R-04 Local Street Renewals - Farwell Bay
Test Hole	TH20-13
Sample #	G78
Depth (m)	0.8 - 0.9
Sample Date	30-Jan-20
Test Date	19-Feb-20
Technician	BMH

Liquid Limit	80
Plastic Limit	26
Plasticity Index	55

Liquid Limit

Trial #	1	2	3		
Number of Blows (N)	17	24	30		
Mass Wet Soil + Tare (g)	22.726	22.646	22.320		
Mass Dry Soil + Tare (g)	18.842	18.874	18.705		
Mass Tare (g)	14.173	14.202	14.127		
Mass Water (g)	3.884	3.772	3.615		
Mass Dry Soil (g)	4.669	4.672	4.578		
Moisture Content (%)	83.187	80.736	78.965		



Plastic Limit

Trial #	1	2	3	4	5
Mass Tare (g)	14.209	14.137			
Mass Wet Soil + Tare (g)	22.320	20.096			
Mass Dry Soil + Tare (g)	20.663	18.889			
Mass Water (g)	1.657	1.207			
Mass Dry Soil (g)	6.454	4.752			
Moisture Content (%)	25.674	25.400			

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Grain Size Analysis (Hydrometer Method)
AASHTO T 88

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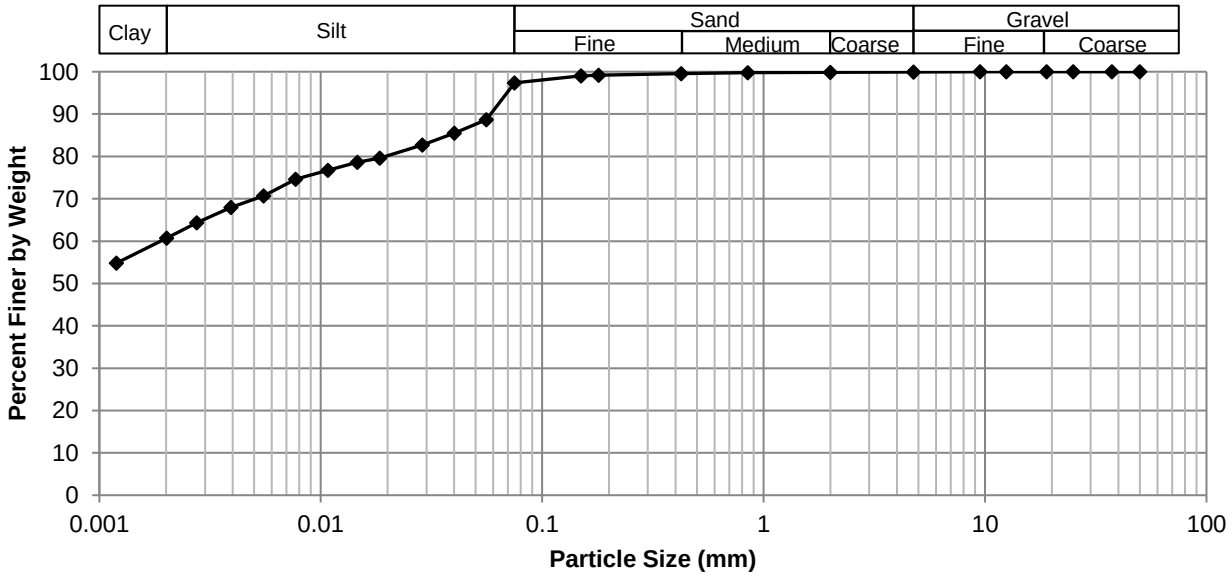
Project No.	1000-001-19
Client	Morrision Hershfield
Project	20-R-04 Local Street Renewals - Farwell Bay
Test Hole	TH20-08
Sample #	G46
Depth (m)	0.8 - 0.9
Sample Date	30-Jan-20
Test Date	7-Feb-20
Technician	HS

Gravel	0.1%
Sand	2.5%
Silt	36.8%
Clay	60.6%

Particle Size Distribution Curve



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	99.92	0.0750	97.40
37.5	100.00	2.00	99.89	0.0560	88.64
25.0	100.00	0.850	99.77	0.0402	85.52
19.0	100.00	0.425	99.55	0.0288	82.71
12.5	100.00	0.180	99.14	0.0185	79.58
9.50	100.00	0.150	99.04	0.0147	78.65
4.75	99.92	0.075	97.40	0.0108	76.77
				0.0077	74.64
				0.0055	70.69
				0.0039	67.99
				0.0028	64.35
				0.0020	60.72
				0.0012	54.82

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Grain Size Analysis (Hydrometer Method)
AASHTO T 88

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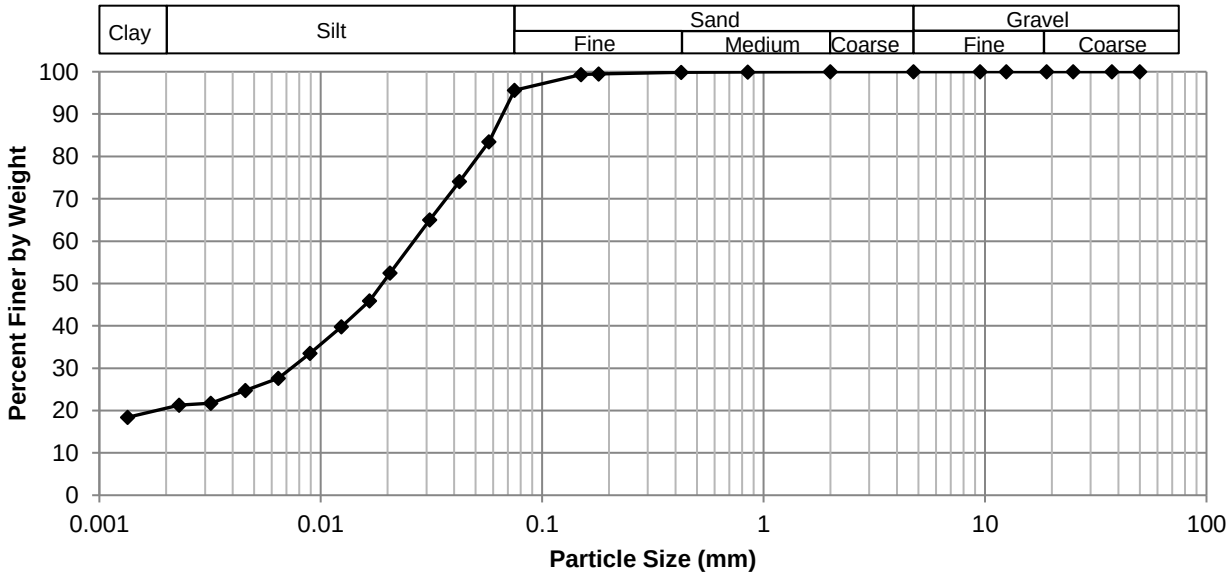
Project No.	1000-001-19
Client	Morrision Hershfield
Project	20-R-04 Local Street Renewals - Farwell Bay
Test Hole	TH20-10
Sample #	G60
Depth (m)	0.8 - 0.9
Sample Date	30-Jan-20
Test Date	7-Feb-20
Technician	HS

Gravel	0.0%
Sand	4.3%
Silt	75.3%
Clay	20.4%

Particle Size Distribution Curve



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	95.66
37.5	100.00	2.00	100.00	0.0574	83.46
25.0	100.00	0.850	99.94	0.0423	74.08
19.0	100.00	0.425	99.83	0.0310	65.01
12.5	100.00	0.180	99.45	0.0206	52.51
9.50	100.00	0.150	99.32	0.0166	45.94
4.75	100.00	0.075	95.66	0.0124	39.76
				0.0089	33.51
				0.0064	27.64
				0.0046	24.74
				0.0032	21.76
				0.0023	21.28
				0.0013	18.41

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Grain Size Analysis (Hydrometer Method)
AASHTO T 88

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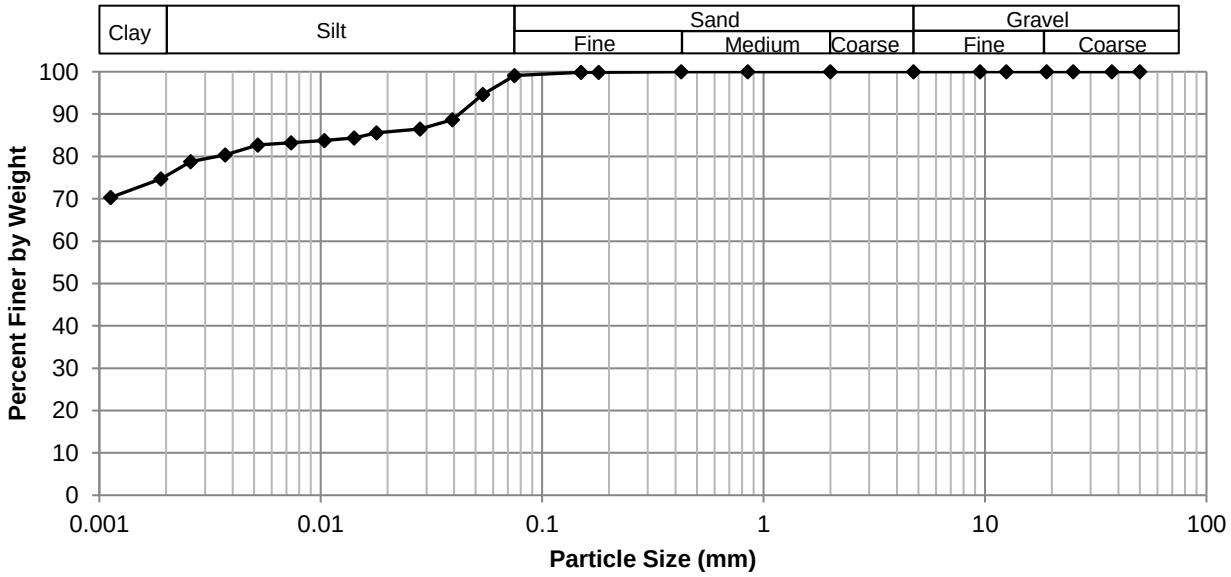
Project No.	1000-001-19
Client	Morrision Hershfield
Project	20-R-04 Local Street Renewals - Farwell Bay
Test Hole	TH20-13
Sample #	G78
Depth (m)	0.8 - 0.9
Sample Date	30-Jan-20
Test Date	20-Feb-20
Technician	JSB

Gravel	0.0%
Sand	0.9%
Silt	23.8%
Clay	75.3%

Particle Size Distribution Curve



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	99.11
37.5	100.00	2.00	100.00	0.0541	94.64
25.0	100.00	0.850	100.00	0.0394	88.70
19.0	100.00	0.425	100.00	0.0281	86.51
12.5	100.00	0.180	99.86	0.0179	85.57
9.50	100.00	0.150	99.84	0.0142	84.38
4.75	100.00	0.075	99.11	0.0104	83.75
				0.0073	83.24
				0.0052	82.72
				0.0037	80.33
				0.0026	78.77
				0.0019	74.70
				0.0011	70.31

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Standard Proctor Compaction Test

ASTM D698-12e2

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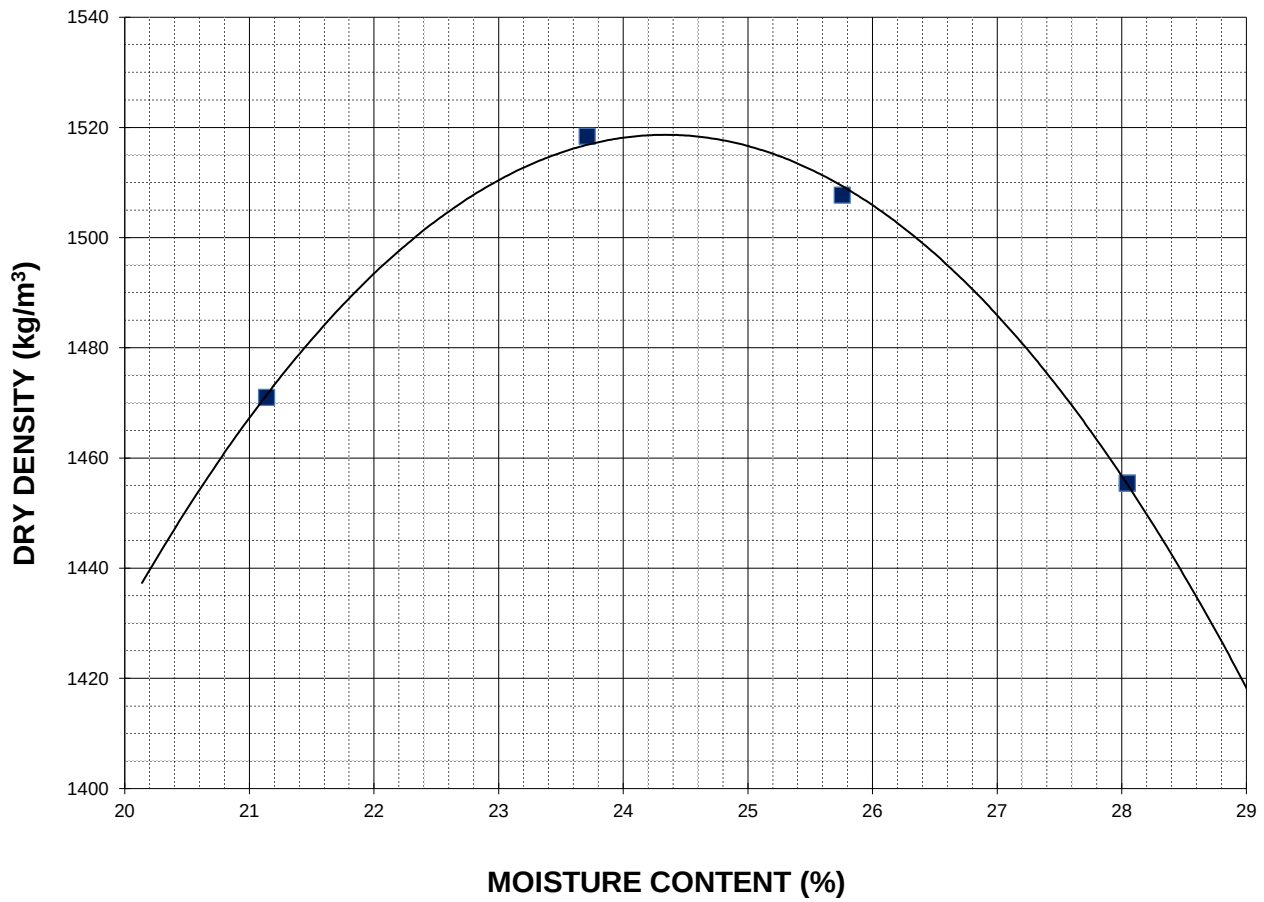
Project No.	1000-001-19
Client	Morrison Hershfield
Project	20-R-04 Local Street Renewals - Farwell Bay

Sample #	Farwell Bay
Source	Test holes
Material	Silt & Clay
Sample Date	30-Jan-20
Test Date	19-Feb-20
Technician	BMH

Maximum Dry Density (kg/m3)	1519
Optimum Moisture (%)	24.3

Trial Number	1	2	3	4	
Wet Density (kg/m^3)	1782	1878	1896	1864	
Dry Density (kg/m^3)	1471	1518	1508	1455	
Moisture Content (%)	21.1	23.7	25.8	28.0	



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California Bearing Ratio Test Data Sheet

ASTM D1883-16

Project No.	1000-001-19	**Source**	Test holes
Client	Morrison Hershfield	**Material**	Silt and Clay
Project	20-R-04 Local Streets - Farwell Bay	**Sample Date**	2020-01-30
Sample #	Farwell Bay	**Test Date**	2020-02-26
		Technician	BMH

Proctor Results (ASTM D698)

Maximum Dry Density	1519	kg/m3
Optimum Moisture Content	24.3	%
Material Retained on 19 mm Sieve	0.0	%

CBR Sample Compaction

Dry Density	1441	kg/m3
Initial Moisture Content	28.3	%
Relative Density	94.9	% SPMDD

Soaking Results

Surcharge	4.54	kg
Swell	0.7	%
Moisture Content in top 25 mm	33.4	%
Immersion Period	94	h

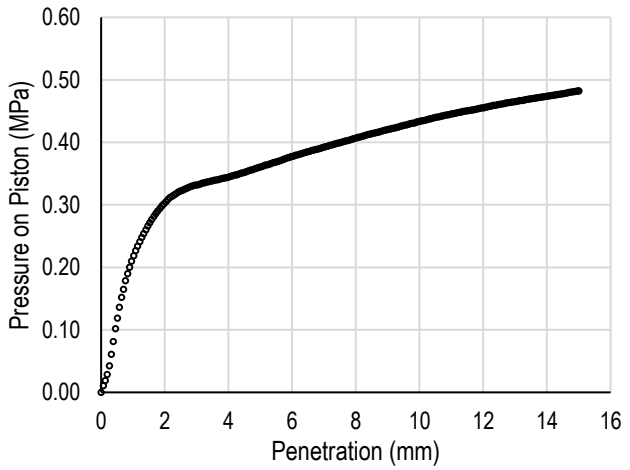
CBR Results

CBR at 2.54 mm	4.7	%
CBR at 5.08 mm	3.5	%
Zero Correction	0	mm

Test Data

Penetration (mm)	Measured Pressure (MPa)	Corrected Pressure (MPa)
0.64	0.15	0.15
1.27	0.25	0.25
1.91	0.30	0.30
2.54	0.32	0.32
3.18	0.33	0.33
3.81	0.34	0.34
4.45	0.35	0.35
5.08	0.36	0.36
7.62	0.40	0.40
10.16	0.44	0.44
12.70	0.46	0.46

Load/Penetration Curve



Comments:

Photo 1: Pavement Core Measurement at Test Hole TH20-07

Photo 2: Pavement Core Sample at Test Hole TH20-08

Photo 3: Pavement Core Sample at Test Hole TH20-09

Photo 4: Pavement Core Measurement at Test Hole TH20-10

Photo 5: Pavement Core Measurement at Test Hole TH20-11

Photo 6: Pavement Core Measurement at Test Hole TH20-12

Photo 7: Pavement Core Measurement at Test Hole TH20-13

Photo 8: Pavement Core Sample at Test Hole TH20-14

Photo 9: Pavement Core Sample at Test Hole TH20-15

Appendix C

Ashland Ave

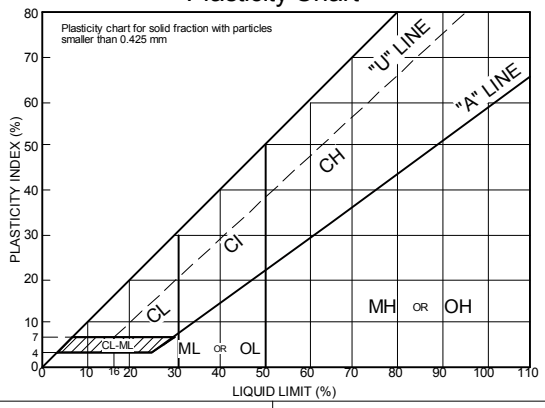
Test Hole Logs, Summary Table, Lab Testing Results and Pavement Core Photos

EXPLANATION OF FIELD AND LABORATORY TESTING

GENERAL NOTES

1. 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.
2. 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.
3. 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
Coarse-Grained soils (More than half the material is larger than No. 200 sieve size)	Gravels (More than half of coarse fraction is larger than 4.75 mm)	Clean gravel (Little or no fines)	GW		Well-graded gravels, gravel-sand mixtures, little or no fines	Determine percentages of sand and gravel from grain size curve, depending on percentage of fines (fraction smaller than No. 200 sieve) coarse-grained soils are classified as follows: Less than 5 percent..... GW, GP, SW, SP; More than 12 percent..... GM, GC, SM, SC; 6 to 12 percent..... Borderline case4s requiring dual symbols*
			GP		Poorly-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
		Gravel with fines (Appreciable amount of fines)	GM		Silty gravels, gravel-sand-silt mixtures	Not meeting all gradation requirements for GW
			GC		Clayey gravels, gravel-sand-silt mixtures	Atterberg limits below "A" line or P.I. less than 4 / 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
	Sands (More than half of coarse fraction is smaller than 4.75 mm)	Clean sands (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
			SP		Poorly-graded sands, gravelly sands, little or no fines	Not meeting all gradation requirements for SW
		Sands with fines (Appreciable amount of fines)	SM		Silty sands, sand-silt mixtures	Atterberg limits below "A" line or P.I. less than 4 / 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
			SC		Clayey sands, sand-clay mixtures	
Fine-Grained soils (More than half the material is smaller than No. 200 sieve size)	Silts and Clays (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	Plasticity Chart
			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	
	Silts and Clays (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	
	Highly Organic Soils		Pt		Peat and other highly organic soils	Von Post Classification Limit: Strong colour or odour, and often fibrous texture



Particle Size			Material
ASTM Sieve sizes	mm		
#10 to #4	2.00 to 4.75		Sand
#40 to #10	0.425 to 2.00		Coarse
#200 to #40	0.075 to 0.425		Medium
< #200	< 0.075		Fine
			Silt or Clay

Particle Size			Material
ASTM Sieve Sizes	mm		
> 12 in.	> 300		Boulders
3 in. to 12 in.	75 to 300		Cobbles
3/4 in. to 3 in.	19 to 75		Gravel
#4 to 3/4 in.	4.75 to 19		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

EXPLANATION OF FIELD AND LABORATORY TESTING

LEGEND OF ABBREVIATIONS AND SYMBOLS

LL - Liquid Limit (%)
PL - Plastic Limit (%)
PI - Plasticity Index (%)
MC - Moisture Content (%)
SPT - Standard Penetration Test
RQD - Rock Quality Designation
Qu - Unconfined Compression
Su - Undrained Shear Strength
VW - Vibrating Wire Piezometer
SI - Slope Inclinometer

▽ Water Level at Time of Drilling

▼ Water Level at End of Drilling

▼ Water Level After Drilling as Indicated on Test Hole Logs

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:

Descriptive Terms	SPT (N) (Blows/300 mm)
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:

Descriptive Terms	SPT (N) (Blows/300 mm)
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:

Descriptive Terms	Undrained Shear Strength (kPa)
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 TH20-16
1 of 1

Client:	Morrison Hershfield	**Project Number:**	1000-001-19
Project Name:	20-R-04 Local Street Renewals - Ashland Ave	**Location:**	UTM N-5525480, E-635436
Contractor:	Maple Leaf Drilling Ltd.	**Ground Elevation:**	Top of Pavement
Method:	125mm Solid Stem Auger, Acker MP8 Truck Mount	**Date Drilled:**	January 31, 2020

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/m³) 16 17 18 19 20 21 / Particle Size (%) 0 20 40 60 80 100 / PL MC LL	Undrained Shear Strength (kPa) Test Type: △ Torvane △ ✤ Pocket Pen. ✤ ☒ Qu ☒ ○ Field Vane ○ 0 50 100 150 200 250
		ASPHALT - 25 mm thick				
		CONCRETE - 195 mm thick				
		SILT AND CLAY - trace sand, trace organics, trace rootlets - brown - frozen to 1.1 m depth, moist and stiff when thawed - high plasticity		G94		
0.5				G95		
		- trace silt inclusions (<10 mm diam.) below 0.9 m		G96		
1.0				G97		
				G98		
1.5		- no organics, no rootlets, very stiff, intermediate plasticity below 1.8 m				
2.0				G99		

END OF TEST HOLE AT 2.1 m IN SILT AND CLAY.
1) No seepage or sloughing observed.
2) Test hole open to 2.1 m immediately after drilling.
3) Test hole backfilled with auger cuttings, granular fill and cold patch asphalt.
4) Test hole located near 261 Churchill drive, 2.0 m South of the North curb.

Logged By: Bryan Hiebert **Reviewed By:** Angela Fidler-Kliewer **Project Engineer:** Nelson Ferreira

SUB-SURFACE LOG LOGS 2020-02-03_2020 LOCAL STREETS 20-R-04_ASHLAND_1000-001-19_0_A_BMH.GPJ TREK GEOTECHNICAL.GDT 3/2/20

Sub-Surface Log

Test Hole TH20-17
1 of 1

Client:	Morrison Hershfield	**Project Number:**	1000-001-19
Project Name:	20-R-04 Local Street Renewals - Ashland Ave	**Location:**	UTM N-5525463, E-635397
Contractor:	Maple Leaf Drilling Ltd.	**Ground Elevation:**	Top of Pavement
Method:	125mm Solid Stem Auger, Acker MP8 Truck Mount	**Date Drilled:**	January 31, 2020

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
		ASPHALT - 25 mm thick		
		CONCRETE - 225 mm thick		
		SILT AND CLAY - trace sand, trace rootlets - brown - frozen to 1.3 m depth, moist and stiff when thawed - high plasticity	Grab	G100
0.5			Grab	G101
1.0			Grab	G102
			Grab	G103
1.5		- trace organics, mottled grey and black, very stiff below 1.5 m	Grab	G104
		- no organics, brown below 1.8 m		
2.0			Grab	G105

Bulk Unit Wt (kN/m³): 16 17 18 19 20 21
Particle Size (%): 0 20 40 60 80 100
PL MC LL
Undrained Shear Strength (kPa): 0 50 100 150 200 250
Test Type: △ Torvane △ ✿ Pocket Pen. ✿ ☒ Qu ☒ ○ Field Vane ○

END OF TEST HOLE AT 2.1 m IN SILT AND CLAY.
1) No seepage or sloughing observed.
2) Test hole open to 2.1 m immediately after drilling.
3) Test hole backfilled with auger cuttings, granular fill and cold patch asphalt.
4) Test hole located near 45 Ashland Ave, 2.0 m South of the North curb.

Logged By: Bryan Hiebert **Reviewed By:** Angela Fidler-Kliewer **Project Engineer:** Nelson Ferreira

SUB-SURFACE LOG LOGS 2020-02-03_2020 LOCAL STREETS 20-R-04_ASHLAND_1000-001-19_0_A_BMH.GPJ TREK GEOTECHNICAL.GDT 3/2/20

Sub-Surface Log

Test Hole TH20-18
1 of 1

Client:	Morrison Hershfield	**Project Number:**	1000-001-19
Project Name:	20-R-04 Local Street Renewals - Ashland Ave	**Location:**	UTM N-5525438, E-635370
Contractor:	Maple Leaf Drilling Ltd.	**Ground Elevation:**	Top of Pavement
Method:	125mm Solid Stem Auger, Acker MP8 Truck Mount	**Date Drilled:**	January 31, 2020

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/m³) 16 17 18 19 20 21 / Particle Size (%) 0 20 40 60 80 100 / PL MC LL	Undrained Shear Strength (kPa) 0 50 100 150 200 250
		ASPHALT - 25 mm thick				
		CONCRETE - 225 mm thick				
		SILT AND CLAY - trace sand, trace rootlets - brown - frozen to 1.1 m depth, moist and stiff when thawed - high plasticity	G	G106	●	✿
0.5			G	G107	● PL MC LL	△✿
		- no rootlets below 0.9 m	G	G108	●	△✿
1.0			G	G109	●	△✿
1.5			G	G110	●	△✿
			G	G111	●	△✿
2.0		END OF TEST HOLE AT 2.1 m IN SILT AND CLAY.				

1) No seepage or sloughing observed.
2) Test hole open to 2.1 m immediately after drilling.
3) Test hole backfilled with auger cuttings, granular fill and cold patch asphalt.
4) Test hole located near 53 Ashland Ave, 1.5 m North of the South curb.

Logged By: Bryan Hiebert **Reviewed By:** Angela Fidler-Kliewer **Project Engineer:** Nelson Ferreira

SUB-SURFACE LOG LOGS 2020-02-03_2020 LOCAL STREETS 20-R-04_ASHLAND_1000-001-19_0_A_BMH.GPJ TREK GEOTECHNICAL.GDT 3/2/20

Sub-Surface Log

Test Hole TH20-19
1 of 1

Client:	Morrison Hershfield	**Project Number:**	1000-001-19
Project Name:	20-R-04 Local Street Renewals - Ashland Ave	**Location:**	UTM N-5525425, E-635344
Contractor:	Maple Leaf Drilling Ltd.	**Ground Elevation:**	Top of Pavement
Method:	125mm Solid Stem Auger, Acker MP8 Truck Mount	**Date Drilled:**	January 31, 2020

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/m³) 16 17 18 19 20 21	Particle Size (%) 0 20 40 60 80 100	PL MC LL 0 20 40 60 80 100	Undrained Shear Strength (kPa) Test Type: Torvane, Pocket Pen., Qu, Field Vane 0 50 100 150 200 250
		ASPHALT - 20 mm thick						
		CONCRETE - 200 mm thick						
		SILT AND CLAY - trace sand, trace organics, trace rootlets - dark grey - frozen to 1.1 m depth, moist and stiff to very stiff when thawed - high plasticity						
0.5				G112				
				G113				
1.0				G114				
		- no organics, no rootlets, brown below 1.2 m		G115				
1.5				G116				
				G117				
2.0								

END OF TEST HOLE AT 2.1 m IN SILT AND CLAY.
1) No seepage or sloughing observed.
2) Test hole open to 2.1 m immediately after drilling.
3) Test hole backfilled with auger cuttings, granular fill and cold patch asphalt.
4) Test hole located near 61 Ashland Ave, 2.0 m South of the North curb.

Logged By: Bryan Hiebert **Reviewed By:** Angela Fidler-Kliewer **Project Engineer:** Nelson Ferreira

SUB-SURFACE LOG LOGS 2020-02-03_2020 LOCAL STREETS 20-R-04_ASHLAND_1000-001-19_0_A_BMH.GPJ TREK GEOTECHNICAL.GDT 3/2/20

Sub-Surface Log

Test Hole TH20-20
1 of 1

Client:	Morrison Hershfield	**Project Number:**	1000-001-19
Project Name:	20-R-04 Local Street Renewals - Ashland Ave	**Location:**	UTM N-5525404, E-635306
Contractor:	Maple Leaf Drilling Ltd.	**Ground Elevation:**	Top of Pavement
Method:	125mm Solid Stem Auger, Acker MP8 Truck Mount	**Date Drilled:**	January 31, 2020

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
		ASPHALT - 25 mm thick		
		CONCRETE - 125 mm thick		
		SILT AND CLAY - trace organics, trace rootlets - dark grey - frozen to 1.1 m, moist and stiff when thawed - high plasticity		G118
0.5				G119
		- no rootlets, trace silt inclusions (<10 mm diam.), brown, very stiff below 0.6 m		G120
1.0				G121
		- stiff below 1.5 m		G122
1.5				
2.0				G123

Bulk Unit Wt (kN/m³): 16 17 18 19 20 21
Particle Size (%): 0 20 40 60 80 100
PL MC LL
Undrained Shear Strength (kPa): 0 50 100 150 200 250
Test Type: △ Torvane △ | ✤ Pocket Pen. ✤ | ☒ Qu ☒ | ○ Field Vane ○

END OF TEST HOLE AT 2.1 m IN SILT AND CLAY.
1) No seepage or sloughing observed.
2) Test hole open to 2.1 m immediately after drilling.
3) Test hole backfilled with auger cuttings, granular fill and cold patch asphalt.
4) Test hole located near 73 Ashland Ave, 1.5 m North of the South curb.

Logged By: Bryan Hiebert **Reviewed By:** Angela Fidler-Kliewer **Project Engineer:** Nelson Ferreira

SUB-SURFACE LOG LOGS 2020-02-03_2020 LOCAL STREETS 20-R-04_ASHLAND_1000-001-19_0_A_BMH.GPJ TREK GEOTECHNICAL.GDT 3/2/20

20-R-04 Local Street Renewals - Ashland Ave
Sub-Surface Investigation

Test Hole No.	Test Hole Location	Pavement Surface		Pavement Structure Material		Subgrade Description	Sample Depth (m)		Moisture Content (%)	Grain Size Analysis				Atterberg Limits		
		Type	Thickness (mm)	Type	Thickness (mm)		Top (m)	Bottom (m)		Clay (%)	Silt (%)	Sand (%)	Gravel (%)	Plastic	Liquid	Plasticity Index
TH20-16	UTM : 5525480 N, 635436 E Located near 261 Churchill Drive, 2.0 m South of the North curb of Ashland Ave.	Asphalt	25	Concrete	195	Silt and Clay	0.3	0.5	33							
						Silt and Clay	0.6	0.8	31	46	54	0	0	25	71	46
						Silt and Clay	0.9	1.1	27							
						Silt and Clay	1.2	1.4	27							
						Silt and Clay	1.5	1.7	28							
						Silt and Clay	2.0	2.1	21							
TH20-17	UTM : 5525463 N, 635397 E Located near 45 Ashland Ave, 2.0 m South of North curb.	Asphalt	25	Concrete	225	Silt and Clay	0.3	0.5	33							
						Silt and Clay	0.6	0.8	28							
						Silt and Clay	0.9	1.1	28							
						Silt and Clay	1.2	1.4	27							
						Silt and Clay	1.5	1.7	32							
						Silt and Clay	2.0	2.1	28							
TH20-18	UTM : 5525438 N, 635370 E Located near 53 Ashland Ave, 1.5 m North of the South curb.	Asphalt	25	Concrete	225	Silt and Clay	0.3	0.5	30							
						Silt and Clay	0.6	0.8	30	50	47	3	0	22	67	46
						Silt and Clay	0.9	1.1	32							
						Silt and Clay	1.2	1.4	31							
						Silt and Clay	1.5	1.7	29							
						Silt and Clay	2.0	2.1	31							
TH20-19	UTM : 5525425 N, 635344 E Located near 61 Ashland Ave, 2.0 m South of the North curb.	Asphalt	20	Concrete	200	Silt and Clay	0.3	0.5	34							
						Silt and Clay	0.6	0.8	30							
						Silt and Clay	0.9	1.1	29							
						Silt and Clay	1.2	1.4	27							
						Silt and Clay	1.5	1.7	29							
						Silt and Clay	2.0	2.1	28							

20-R-04 Local Street Renewals - Ashland Ave
Sub-Surface Investigation

Test Hole No.	Test Hole Location	Pavement Surface		Pavement Structure Material		Subgrade Description	Sample Depth (m)		Moisture Content (%)	Grain Size Analysis				Atterberg Limits		
		Type	Thickness (mm)	Type	Thickness (mm)		Top (m)	Bottom (m)		Clay (%)	Silt (%)	Sand (%)	Gravel (%)	Plastic	Liquid	Plasticity Index
TH20-20	UTM : 5525404 N, 635306 E Located near 73 Ashland Ave, 1.5 m North of the South curb.	Asphalt	25	Concrete	125	Silt and Clay	0.3	0.5	33							
						Silt and Clay	0.6	0.8	31	51	48	1	0	23	73	50
						Silt and Clay	0.9	1.1	27							
						Silt and Clay	1.2	1.4	27							
						Silt and Clay	1.5	1.7	28							
						Silt and Clay	2.0	2.1	21							
						Silt and Clay	2.0	2.1	24							

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Moisture Content Report
ASTM D2216-10

Project No. 1000-001-19
Client Morrison Hershfield
Project 20-R-04 Local Streets - Ashland Ave.

Sample Date 31-Jan-20
Test Date 18-Feb-20
Technician DS/BMH

Test Hole	TH20-16	TH20-16	TH20-16	TH20-16	TH20-16	TH20-16
Depth (m)	0.3 - 0.5	0.6 - 0.8	0.9 - 1.1	1.2 - 1.4	1.5 - 1.7	2.0 - 2.1
Sample #	G94	G95	G96	G97	G98	G99
Tare ID	N49	D34	A14	Z82	Z123	A36
Mass of tare	8.3	8.8	8.4	8.3	8.4	8.3
Mass wet + tare	260.1	396.3	268.4	199.9	285.1	181.7
Mass dry + tare	197.8	305.2	212.7	159.7	225.4	151.3
Mass water	62.3	91.1	55.7	40.2	59.7	30.4
Mass dry soil	189.5	296.4	204.3	151.4	217.0	143.0
Moisture %	32.9%	30.7%	27.3%	26.6%	27.5%	21.3%

Test Hole	TH20-17	TH20-17	TH20-17	TH20-17	TH20-17	TH20-17
Depth (m)	0.3 - 0.5	0.6 - 0.8	0.9 - 1.1	1.2 - 1.4	1.5 - 1.7	2.0 - 2.1
Sample #	G100	G101	G102	G103	G104	G105
Tare ID	AB23	N21	E128	AA12	N35	W63
Mass of tare	6.7	8.5	8.4	6.7	8.4	8.5
Mass wet + tare	172.3	203.0	126.3	147.2	157.1	150.5
Mass dry + tare	131.4	160.4	100.9	117.6	121.3	119.6
Mass water	40.9	42.6	25.4	29.6	35.8	30.9
Mass dry soil	124.7	151.9	92.5	110.9	112.9	111.1
Moisture %	32.8%	28.0%	27.5%	26.7%	31.7%	27.8%

Test Hole	TH20-18	TH20-18	TH20-18	TH20-18	TH20-18	TH20-18
Depth (m)	0.3 - 0.5	0.6 - 0.8	0.9 - 1.1	1.2 - 1.4	1.5 - 1.7	2.0 - 2.1
Sample #	G106	G107	G108	G109	G110	G111
Tare ID	D44	W70	N88	E4	F89	C26
Mass of tare	8.5	8.6	8.7	8.7	8.5	8.6
Mass wet + tare	131.5	407.3	211.3	165.0	152.7	200.4
Mass dry + tare	103.1	315.9	162.3	127.7	120.7	155.2
Mass water	28.4	91.4	49.0	37.3	32.0	45.2
Mass dry soil	94.6	307.3	153.6	119.0	112.2	146.6
Moisture %	30.0%	29.7%	31.9%	31.3%	28.5%	30.8%

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Moisture Content Report
ASTM D2216-10

Project No. 1000-001-19
Client Morrison Hershfield
Project 20-R-04 Local Streets - Ashland Ave.

Sample Date 31-Jan-20
Test Date 18-Feb-20
Technician DS/BMH

Test Hole	TH20-19	TH20-19	TH20-19	TH20-19	TH20-19	TH20-19
Depth (m)	0.3 - 0.5	0.6 - 0.8	0.9 - 1.1	1.2 - 1.4	1.5 - 1.7	2.0 - 2.1
Sample #	G112	G113	G114	G115	G116	G117
Tare ID	AC18	H4	AB22	K34	N96	AB95
Mass of tare	6.8	8.8	7.2	8.5	8.6	6.7
Mass wet + tare	149.1	151.8	154.2	186.0	170.7	184.0
Mass dry + tare	113.0	119.1	120.9	148.1	134.1	145.4
Mass water	36.1	32.7	33.3	37.9	36.6	38.6
Mass dry soil	106.2	110.3	113.7	139.6	125.5	138.7
Moisture %	34.0%	29.6%	29.3%	27.1%	29.2%	27.8%

Test Hole	TH20-20	TH20-20	TH20-20	TH20-20	TH20-20	TH20-20
Depth (m)	0.3 - 0.5	0.6 - 0.8	0.9 - 1.1	1.2 - 1.4	1.5 - 1.7	2.0 - 2.1
Sample #	G118	G119	G120	G121	G122	G123
Tare ID	D1	F62	H61	Z89	Z31	AC15
Mass of tare	8.6	8.6	8.5	8.5	8.4	7.0
Mass wet + tare	120.5	408.7	252.3	160.7	179.0	183.4
Mass dry + tare	91.2	310.4	196.1	124.5	140.8	140.0
Mass water	29.3	98.3	56.2	36.2	38.2	43.4
Mass dry soil	82.6	301.8	187.6	116.0	132.4	133.0
Moisture %	35.5%	32.6%	30.0%	31.2%	28.9%	32.6%

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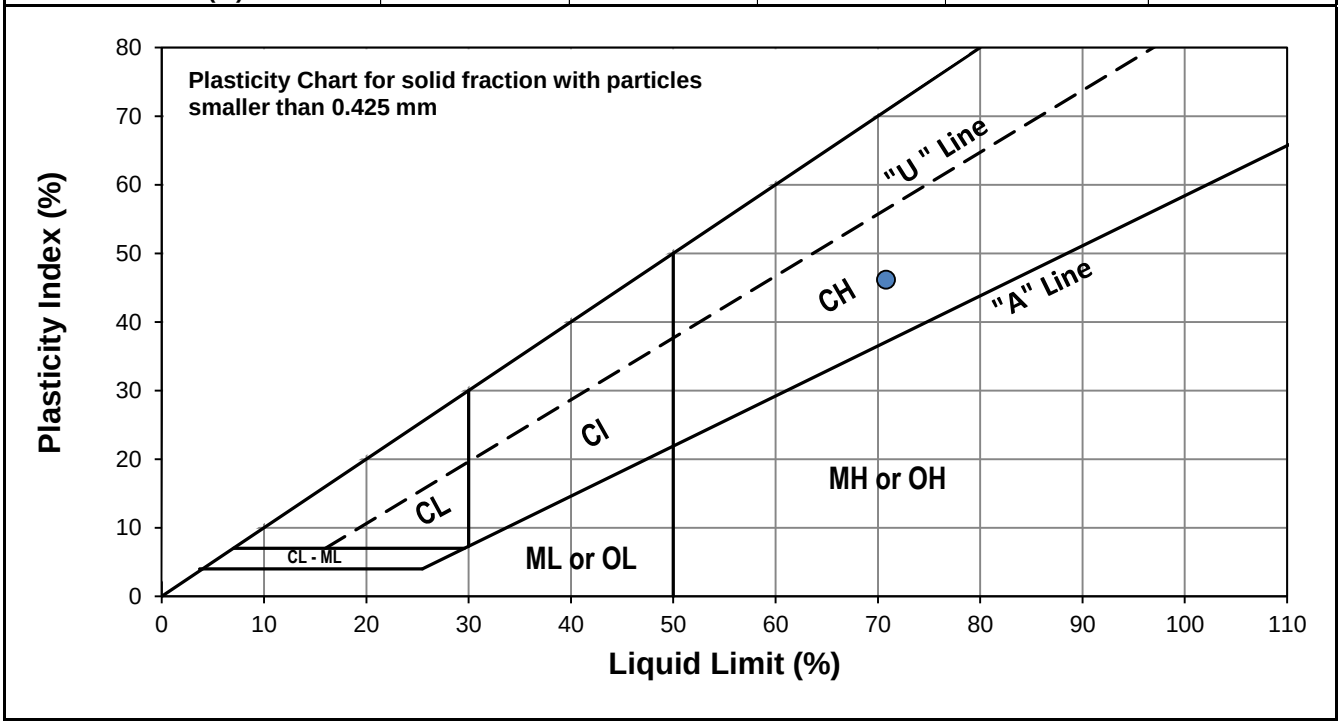
Atterberg Limits
ASTM D4318-10e1

Project No.	1000-001-19
Client	Morrison Hershfield
Project	20-R-04 Local Streets - Ashland Ave.
Test Hole	TH20-16
Sample #	G95
Depth (m)	0.6 - 0.8
Sample Date	31-Jan-20
Test Date	20-Feb-20
Technician	DS

Liquid Limit	71
Plastic Limit	25
Plasticity Index	46

Liquid Limit

Trial #	1	2	3		
Number of Blows (N)	16	21	34		
Mass Wet Soil + Tare (g)	25.953	22.445	23.609		
Mass Dry Soil + Tare (g)	20.992	18.947	19.764		
Mass Tare (g)	14.258	14.078	14.183		
Mass Water (g)	4.961	3.498	3.845		
Mass Dry Soil (g)	6.734	4.869	5.581		
Moisture Content (%)	73.671	71.842	68.894		



Plastic Limit

Trial #	1	2	3	4	5
Mass Tare (g)	14.132	14.138			
Mass Wet Soil + Tare (g)	20.424	21.890			
Mass Dry Soil + Tare (g)	19.169	20.366			
Mass Water (g)	1.255	1.524			
Mass Dry Soil (g)	5.037	6.228			
Moisture Content (%)	24.916	24.470			

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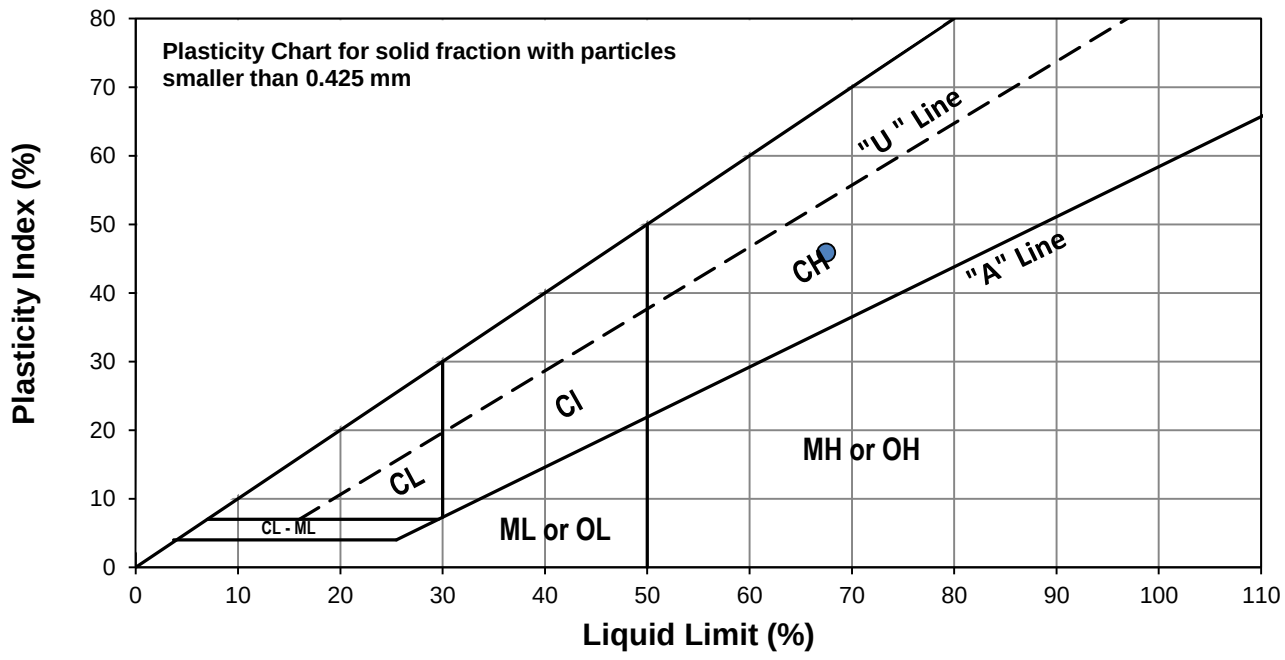
Atterberg Limits
ASTM D4318-10e1

Project No.	1000-001-19
Client	Morrison Hershfield
Project	20-R-04 Local Streets - Ashland Ave.
Test Hole	TH20-18
Sample #	G107
Depth (m)	0.6 - 0.8
Sample Date	31-Jan-20
Test Date	20-Feb-20
Technician	DS

Liquid Limit	67
Plastic Limit	22
Plasticity Index	46

Liquid Limit

Trial #	1	2	3		
Number of Blows (N)	16	28	35		
Mass Wet Soil + Tare (g)	24.966	24.706	22.564		
Mass Dry Soil + Tare (g)	20.563	20.416	19.229		
Mass Tare (g)	14.336	13.970	14.115		
Mass Water (g)	4.403	4.290	3.335		
Mass Dry Soil (g)	6.227	6.446	5.114		
Moisture Content (%)	70.708	66.553	65.213		



Plastic Limit

Trial #	1	2	3	4	5
Mass Tare (g)	14.247	14.135			
Mass Wet Soil + Tare (g)	20.949	20.957			
Mass Dry Soil + Tare (g)	19.756	19.746			
Mass Water (g)	1.193	1.211			
Mass Dry Soil (g)	5.509	5.611			
Moisture Content (%)	21.655	21.583			

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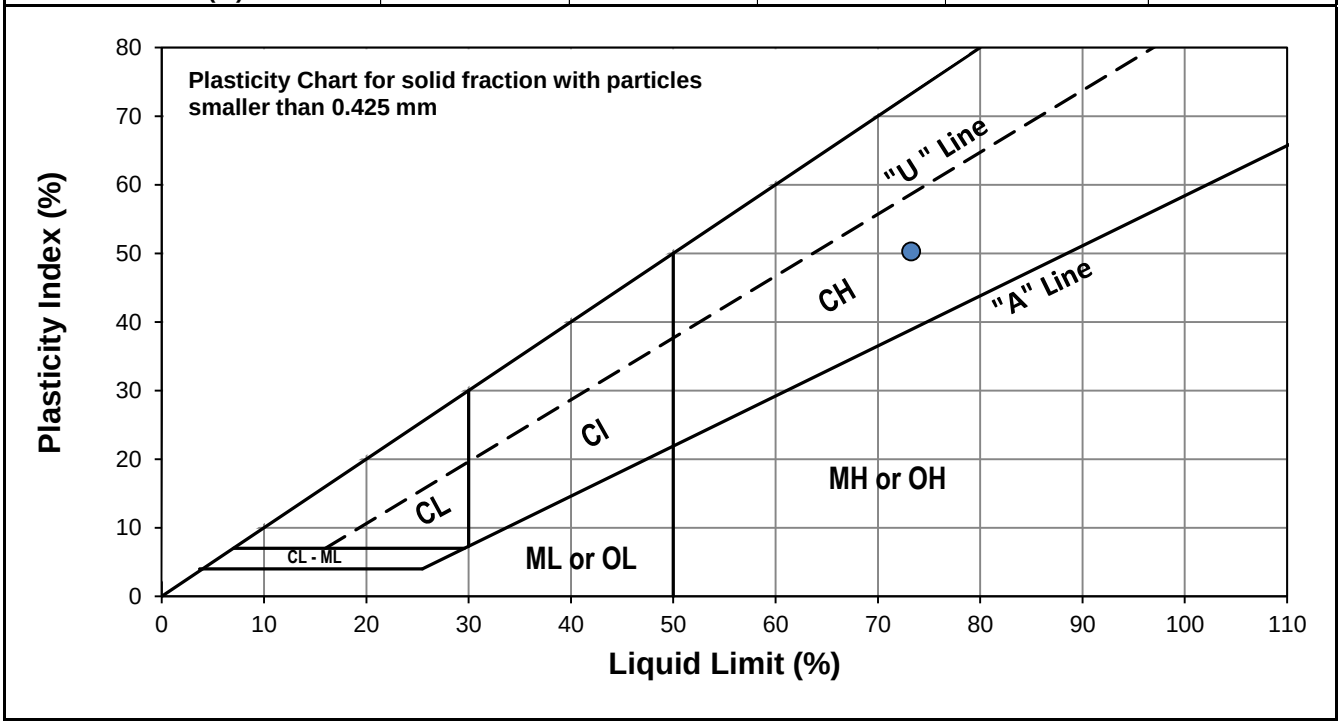
Atterberg Limits
ASTM D4318-10e1

Project No.	1000-001-19
Client	Morrison Hershfield
Project	20-R-04 Local Streets - Ashland Ave.
Test Hole	TH20-20
Sample #	G119
Depth (m)	0.6 - 0.8
Sample Date	31-Jan-20
Test Date	20-Feb-20
Technician	DS

Liquid Limit	73
Plastic Limit	23
Plasticity Index	50

Liquid Limit

Trial #	1	2	3		
Number of Blows (N)	18	27	32		
Mass Wet Soil + Tare (g)	24.207	22.658	23.948		
Mass Dry Soil + Tare (g)	19.856	19.133	19.847		
Mass Tare (g)	14.107	14.284	14.106		
Mass Water (g)	4.351	3.525	4.101		
Mass Dry Soil (g)	5.749	4.849	5.741		
Moisture Content (%)	75.683	72.695	71.434		



Plastic Limit

Trial #	1	2	3	4	5
Mass Tare (g)	13.925	14.087			
Mass Wet Soil + Tare (g)	20.871	20.895			
Mass Dry Soil + Tare (g)	19.593	19.602			
Mass Water (g)	1.278	1.293			
Mass Dry Soil (g)	5.668	5.515			
Moisture Content (%)	22.548	23.445			

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Standard Proctor Compaction Test

ASTM D698-12e2

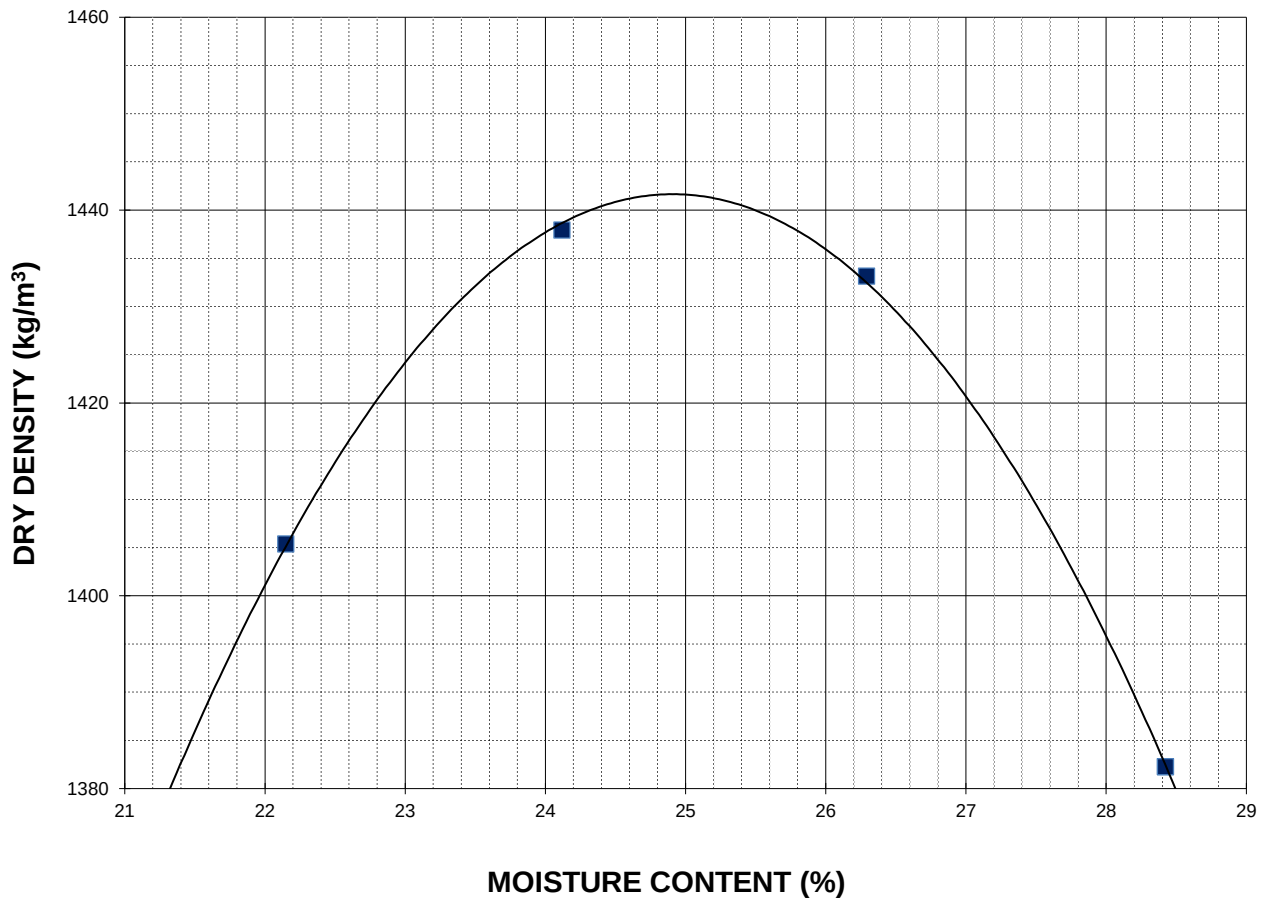
CERTIFIED BY CCIL Canadian Council of Independent Laboratories For specific tests as listed on www.ccil.com

Project No.	1000-001-19
Client	Morrison Hershfield
Project	20-R-04 Local Street Renewals - Ashland Ave

Sample #	Ashland Ave
Source	Test Holes
Material	Silt and Clay
Sample Date	31-Jan-20
Test Date	22-Feb-20
Technician	BMH

Maximum Dry Density (kg/m3)	1442
Optimum Moisture (%)	24.9

Trial Number	1	2	3	4	
Wet Density (kg/m^3)	1717	1785	1810	1775	
Dry Density (kg/m^3)	1405	1438	1433	1382	
Moisture Content (%)	22.1	24.1	26.3	28.4	



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California Bearing Ratio Test Data Sheet

ASTM D1883-16

Project No.	1000-001-19	**Source**	Test holes
Client	Morrison Hershfield	**Material**	Silt and Clay
Project	20-R-04 Local Street Renewals - Ashl	**Sample Date**	2020-01-30
Sample #	Ashland Ave	**Test Date**	2020-02-28
		Technician	BMH

Proctor Results (ASTM D698)

Maximum Dry Density	1442	kg/m3
Optimum Moisture Content	24.9	%
Material Retained on 19 mm Sieve	0.0	%

CBR Sample Compaction

Dry Density	1369	kg/m3
Initial Moisture Content	28.5	%
Relative Density	94.9	% SPMDD

Soaking Results

Surcharge	4.54	kg
Swell	1.0	%
Moisture Content in top 25 mm	35.5	%
Immersion Period	95	h

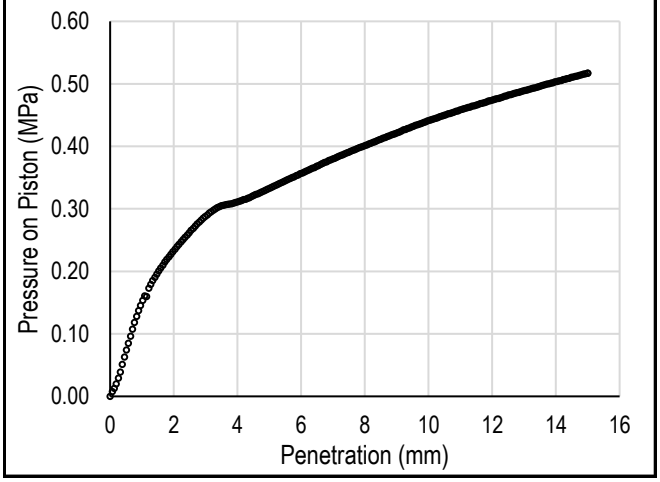
CBR Results

CBR at 2.54 mm	3.8	%
CBR at 5.08 mm	3.3	%
Zero Correction	0	mm

Test Data

Penetration (mm)	Measured Pressure (MPa)	Corrected Pressure (MPa)
0.64	0.10	0.10
1.27	0.18	0.18
1.91	0.23	0.23
2.54	0.27	0.27
3.18	0.30	0.30
3.81	0.31	0.31
4.45	0.32	0.32
5.08	0.33	0.33
7.62	0.39	0.39
10.16	0.44	0.44
12.70	0.48	0.48

Load/Penetration Curve



Comments:

Photo 1: Pavement Core Sample at Test Hole TH20-16

Photo 2: Pavement Core Sample at Test Hole TH20-17

Photo 3: Pavement Core Sample at Test Hole TH20-18

Photo 4: Pavement Core Sample at Test Hole TH20-19

Photo 5: Pavement Core Sample at Test Hole TH20-20