

# **APPENDIX 'A'**

# **GEOTECHNICAL REPORT**



Quality Engineering | Valued Relationships

Morrison Hershfield

## **19-C-10 Sargent Avenue Pavement Renewal**

**Prepared for:**

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

**Project Number:**

0035 082 00 403

**Date:**

November 19, 2019  
Final Report



Quality Engineering | Valued Relationships

November 19, 2019

Our File No. 0035 082 00

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

**RE: Sub-Surface Investigation Report for  
19-C-10 Sargent Avenue Pavement Renewal**

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TREK Geotechnical Inc. is pleased to submit our report for the sub-surface investigations for the 19-C-10 Sargent Avenue 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:**

A handwritten signature in blue ink, appearing to read "N. Ferreira". The signature is fluid and cursive, written over a light blue grid background.

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	November 19, 2019	Final Report

## Authorization Signatures

Prepared By:



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



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 19-C-10 Sargent Ave Pavement Renewal project. The test holes were located along Sargent Avenue between Erin Street and Arlington Street. The information collected describes the pavement structure of the existing road as well as the soil stratigraphy beneath the pavement structure at select locations.

## **2.0 Road Investigation and Laboratory Program**

The investigation included coring of pavement and drilling test holes. TREK Geotechnical and Morrison Hershfield selected the investigation locations as shown on Figure 01 (attached). The road investigation was conducted between October 3, 2019, October 10, 2019 and October 18, 2019. The pavement structure (asphalt and/or concrete) was cored by Harsimran Singh of TREK Geotechnical Inc. (TREK) using a portable coring press equipped with a hollow 150 mm diameter diamond core drill bit. Fourteen test holes were drilled to a depth of 3.0 m below road surface by Maple Leaf Drilling Ltd. using a truck mounted drill rig equipped with 125 mm diameter solid stem augers. Due to overhead powerlines, one test hole was drilled using a 50 mm diameter hand auger to a depth of 2.1 m below the road surface. 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.

Core and 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. Laboratory testing results are included on the test hole logs in Appendix A, while the individual test results are included in Appendix B with a summary table. Photos of the asphalt and concrete pavement cores are included in Appendix C.

Three CBR's were completed on bulk samples of differing soil units and the results are shown in the table below.

**Table 1. CBR Testing Summary**

Sample Description	Test Hole	Depth (m)	SPMDD (kg/m <sup>3</sup> )	Opt. Moisture (%)	Percent Proctor (%)	Moisture Content (%)	CBR Value at 2.54 mm	CBR Value at 5.08 mm
Silt and Clay	TH19-05	0.4-1.5	1645	21.1	96.1	21.3	3.5%	2.9%
Silt, Sand and Clay	TH19-01	0.3-1.5	1622	21.3	94.1	25.8	4.8%	3.8%
	TH19-04	0.3-1.5						
Silt and Clay	TH19-03	0.3-1.5	1726	17.8	95.6	20.9	3.4%	3.0%

\* Testing completed on bulk samples

### 3.0 Closure

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

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

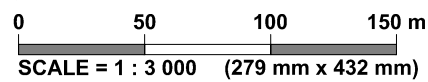
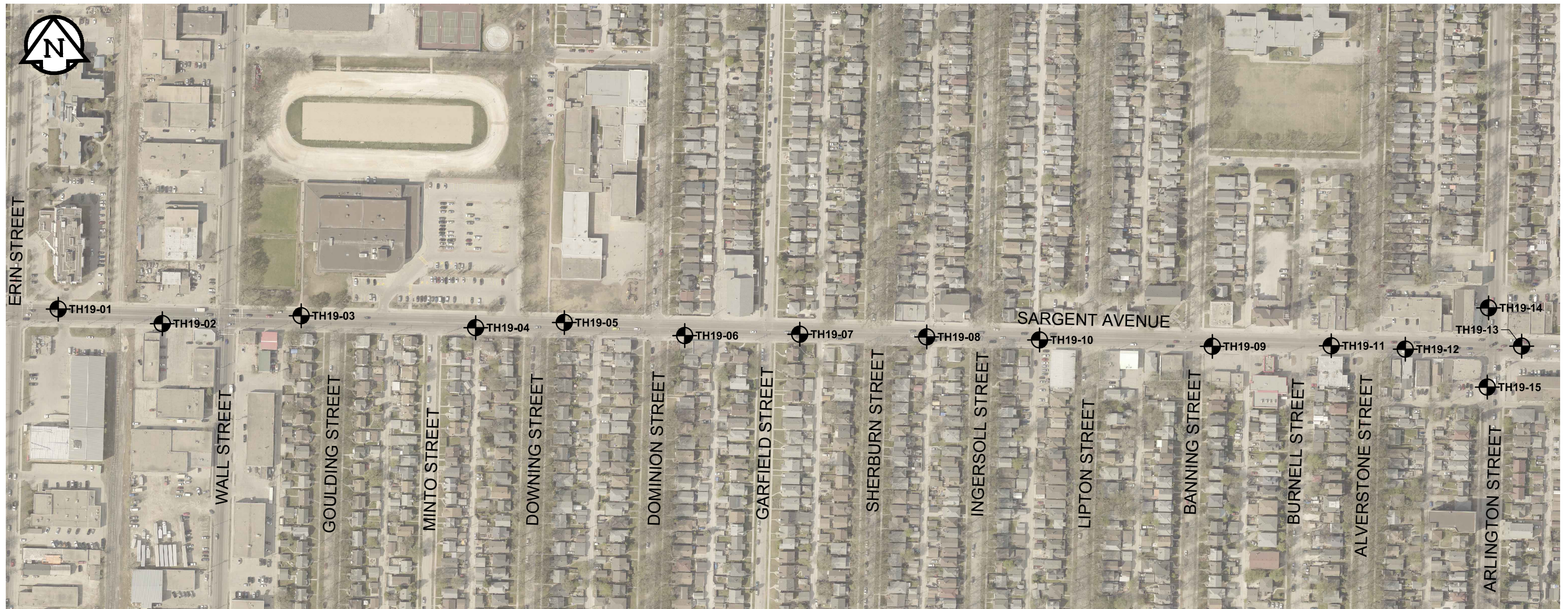
This report has been prepared by TREK Geotechnical Inc. (the Consultant) for the exclusive use of Morrison Hershfield (the Client) and their agents for the work product presented in the report. Any findings or recommendations provided in this report are not to be used or relied upon by any third parties,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

## Figures

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Z:\Projects\0035 Morrison Hershfield\0035 082 00 19-C-10 Erin-Wall-Sargent\3 Survey and Dwg\3.4 CAD\3.4.3 Working Folder\SARGENT AVENUE\FIG 01\_19-11-08\_SARGENT AVE TH LOC\_0\_B\_DWG\_0035-082-00.dwg, 11/8/2019 10:23:47 AM



**LEGEND:** TEST HOLE (TREK, 2019)

**NOTES:**

1. AERIAL PHOTO FROM CITY OF WINNIPEG 2018
2. COORDINATES FROM HAND HELD GPS UNIT

**FIGURE 01**  
TEST HOLE LOCATION PLAN



**Appendix A**  
**Test Hole Logs**

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

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

### Other Symbol Types

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

### LEGEND OF ABBREVIATIONS AND SYMBOLS

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

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

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

### TERMS DESCRIBING CONSISTENCY OR COMPACTION CONDITION

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

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

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

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

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

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



# Sub-Surface Log

Test Hole TH19-01

1 of 1

Client: Morrison Hershfield Project Number: 0035-082-00-403  
 Project Name: 19-C-10 Pavement Renewals - Sargent Ave Location: N-5528801, E-630445  
 Contractor: Maple Leaf Drilling Ltd. Ground Elevation: Top of Pavement  
 Method: 125 mm Solid Stem Auger, CME55 Truck Mount Date Drilled: October 10, 2019

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

Particle Size Legend:  Fines  Clay  Silt  Sand  Gravel  Cobbles  Boulders

Depth (m)	Soil Symbol	MATERIAL DESCRIPTION	Sample Type	Sample Number	Bulk Unit Wt (kN/m <sup>3</sup> )		Particle Size (%)		Undrained Shear Strength (kPa)								
					16	17	18	19	20	21	0	50	100	150	200	250	
0.0 - 0.1		ASPHALT - 130 mm thick															
0.1 - 0.4		CONCRETE - 240 mm thick															
0.4 - 1.4		SILT AND CLAY - sandy, trace gravel (<10 mm diam.), trace organics - black - moist, firm to stiff - intermediate plasticity	Grab (G)	G78													
			Grab (G)	G79													
			Grab (G)	G80													
1.4 - 1.7		CLAY - silty - grey - moist, firm to stiff - high plasticity	Grab (G)	G81													
			Grab (G)	G82													
			Grab (G)	G83													

END OF TEST HOLE AT 3.0 m IN CLAY  
 1) No seepage or sloughing observed.  
 2) Test hole open to 2.4 m immediately after drilling.  
 3) Test hole backfilled with auger cuttings, granular fill and cold patch asphalt.  
 4) Test hole located in Westbound median lane, 4 m South of curb and 51 m East of Wall St.

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

SUB-SURFACE LOG LOGS 2019-10-21\_SARGENT STREET\_0035-082-00\_0\_A\_BMH.GPJ\_TREK GEOTECHNICAL.GDT 11/19/19



# Sub-Surface Log

Test Hole TH19-02

1 of 1

Client: Morrison Hershfield Project Number: 0035-082-00-403  
 Project Name: 19-C-10 Pavement Renewals - Sargent Ave Location: N-5528786, E-630524  
 Contractor: Maple Leaf Drilling Ltd. Ground Elevation: Top of Pavement  
 Method: 125 mm Solid Stem Auger, CME55 Truck Mount Date Drilled: October 10, 2019

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

Particle Size Legend:  Fines  Clay  Silt  Sand  Gravel  Cobbles  Boulders

Depth (m)	Soil Symbol	MATERIAL DESCRIPTION	Sample Type	Sample Number	Bulk Unit Wt (kN/m <sup>3</sup> )		Particle Size (%)		Undrained Shear Strength (kPa)									
					16	17	18	19	20	21	0	50	100	150	200	250		
0.0 - 0.1		ASPHALT - 140 mm thick																
0.1 - 0.4		CONCRETE - 290 mm thick																
0.4 - 2.3		SAND (FILL) - gravelly, trace silt, trace clay - brown - moist, compact - well graded sand to gravel (<20 mm diam.) - sub-rounded to angular  - moist to wet below 1.1 m	<input checked="" type="checkbox"/>	G19														
			<input checked="" type="checkbox"/>	G20														
			<input checked="" type="checkbox"/>	G21														
			<input checked="" type="checkbox"/>	G22														
			<input checked="" type="checkbox"/>	G23A														
2.3 - 3.0		CLAY - silty, trace silt inclusions (<10 mm diam.) - mottled brown and grey - moist to wet, soft - intermediate plasticity	<input checked="" type="checkbox"/>	G23														

END OF TEST HOLE AT 3.0 m IN CLAY  
 1) Seepage observed below 1.5 m.  
 2) Sloughing from sand and gravel layer observed between 0.4 to 2.3 m depth.  
 3) Test hole open to 0.6 m immediately after drilling.  
 4) Test hole backfilled with auger cuttings, granular fill and cold patch asphalt.  
 5) Test hole located in Eastbound curb lane, 2 m North of curb and 41 m West of Wall St.

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

SUB-SURFACE LOG LOGS 2019-10-21 SARGENT STREET 0035-082-00 0 A\_BMH.GPJ\_TREK GEOTECHNICAL.GDT 11/19/19



# Sub-Surface Log

Test Hole TH19-03

1 of 1

Client: Morrison Hershfield Project Number: 0035-082-00-403  
 Project Name: 19-C-10 Pavement Renewals - Sargent Ave Location: N-5528792, E-630629  
 Contractor: Maple Leaf Drilling Ltd. Ground Elevation: Top of Pavement  
 Method: 125 mm Solid Stem Auger, CME55 Truck Mount Date Drilled: October 10, 2019

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

Particle Size Legend:  Fines  Clay  Silt  Sand  Gravel  Cobbles  Boulders

Depth (m)	Soil Symbol	MATERIAL DESCRIPTION	Sample Type	Sample Number	Bulk Unit Wt (kN/m <sup>3</sup> )		Particle Size (%)		Undrained Shear Strength (kPa)									
					16	17	18	19	20	21	0	50	100	150	200	250		
0.0 - 0.1		ASPHALT - 100 mm thick																
0.1 - 0.2		CONCRETE - 200 mm thick																
0.2 - 0.7		SILT AND CLAY - some sand to sandy, trace organics - black - moist, firm - intermediate plasticity  - trace sand, stiff, high plasticity below 0.6 m	<input checked="" type="checkbox"/>	G72														
0.7 - 1.0		SILT - some clay, trace sand - grey - moist to wet, soft - low plasticity  - light brown below 1.2 m	<input checked="" type="checkbox"/>	G73														
1.0 - 1.5		SILT - some clay, trace sand - grey - moist to wet, soft - low plasticity  - light brown below 1.2 m	<input checked="" type="checkbox"/>	G74														
1.5 - 2.5		CLAY - silty - brown - moist, firm - high plasticity	<input checked="" type="checkbox"/>	G75														
2.5 - 3.0		CLAY - silty - brown - moist, firm - high plasticity	<input checked="" type="checkbox"/>	G76														
			<input checked="" type="checkbox"/>	G77														

END OF TEST HOLE AT 3.0 m IN CLAY  
 1) No seepage observed.  
 2) Sloughing from silt layer observed between 0.7 to 1.5 m depth.  
 3) Test hole open to 1.4 m immediately after drilling.  
 4) Test hole backfilled with auger cuttings, granular fill and cold patch asphalt.  
 5) Test hole located in Westbound median lane, 4 m South of curb and 51 m East of Wall St.

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

SUB-SURFACE LOG LOGS 2019-10-21\_SARGENT STREET\_0035-082-00\_0\_A\_BMH.GPJ\_TREK GEOTECHNICAL.GDT 11/19/19



# Sub-Surface Log

Test Hole TH19-04

1 of 1

Client: Morrison Hershfield Project Number: 0035-082-00-403  
 Project Name: 19-C-10 Pavement Renewals - Sargent Ave Location: N-5528783, E-630761  
 Contractor: Maple Leaf Drilling Ltd. Ground Elevation: Top of Pavement  
 Method: 125 mm Solid Stem Auger, CME55 Truck Mount Date Drilled: October 10, 2019

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

Particle Size Legend:  Fines  Clay  Silt  Sand  Gravel  Cobbles  Boulders

Depth (m)	Soil Symbol	MATERIAL DESCRIPTION	Sample Type	Sample Number	Bulk Unit Wt (kN/m <sup>3</sup> )		Particle Size (%)		Undrained Shear Strength (kPa)									
					16	17	18	19	20	21	0	50	100	150	200	250		
0.0 - 0.1		ASPHALT - 110 mm thick																
0.1 - 0.2		CONCRETE - 180 mm thick																
0.2 - 1.7		SILT AND CLAY - trace sand, trace organics - black - moist, stiff to very stiff - intermediate to high plasticity	G	G24														
			G	G25														
			G	G26														
1.7 - 2.1		CLAY - silty - light grey - moist, stiff - intermediate to high plasticity	G	G27														
			G	G28														
2.1 - 2.6		- mottled brown and grey, high plasticity below 1.8 m  - soft to firm below 2.1 m																
			G	G29														

END OF TEST HOLE AT 3.0 m IN CLAY

- 1) No seepage or sloughing observed.
- 2) Test hole open to 2.6 m immediately after drilling.
- 3) Test hole backfilled with auger cuttings, granular fill and cold patch asphalt.
- 4) Test hole located in Eastbound median lane, 4.5 m North of curb and 30 m East of Minto St.

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

SUB-SURFACE LOG LOGS 2019-10-21 SARGENT STREET 0035-082-00 0 A\_BMH.GPJ TREK GEOTECHNICAL.GDT 11/19/19





# Sub-Surface Log

Test Hole TH19-05

1 of 1

Client: Morrison Hershfield Project Number: 0035-082-00-403  
 Project Name: 19-C-10 Pavement Renewals - Sargent Ave Location: N-5528791, E-630828  
 Contractor: Maple Leaf Drilling Ltd. Ground Elevation: Top of Pavement  
 Method: 125 mm Solid Stem Auger, CME55 Truck Mount Date Drilled: October 10, 2019

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

Particle Size Legend:  Fines  Clay  Silt  Sand  Gravel  Cobbles  Boulders

Depth (m)	Soil Symbol	MATERIAL DESCRIPTION	Sample Type	Sample Number	Bulk Unit Wt (kN/m <sup>3</sup> )		Particle Size (%)		Undrained Shear Strength (kPa)									
					16	17	18	19	20	21	0	50	100	150	200	250		
0.0 - 0.1		ASPHALT - 100 mm thick																
0.1 - 0.3		CONCRETE - 250 mm thick																
0.3 - 0.7		SILT AND CLAY - some sand, trace organics - black - moist, firm to stiff - intermediate plasticity - trace sand, grey, high plasticity below 0.6 m	<input checked="" type="checkbox"/>	G66														
0.7 - 1.0		SILT - trace clay, trace sand - light brown - moist to wet, soft - low plasticity	<input checked="" type="checkbox"/>	G67														
1.0 - 1.5		CLAY - silty - brown - moist, stiff - high plasticity	<input checked="" type="checkbox"/>	G68														
1.5 - 2.1		- firm below 1.5 m	<input checked="" type="checkbox"/>	G69														
2.1 - 2.5		- soft to firm below 2.1 m	<input checked="" type="checkbox"/>	G70														
2.5 - 3.0			<input checked="" type="checkbox"/>	G71														

END OF TEST HOLE AT 3.0 m IN CLAY

- 1) No seepage observed.
- 2) Sloughing from silt layer observed between 0.7 to 1.1 m depth.
- 3) Test hole open to 1.2 m immediately after drilling.
- 4) Test hole backfilled with auger cuttings, granular fill and cold patch asphalt.
- 5) Test hole located in Westbound median lane, 6 m North of curb and 15 m East of Downing St.

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

SUB-SURFACE LOG LOGS 2019-10-21\_SARGENT STREET\_0035-082-00\_0\_A\_BMH.GPJ\_TREK GEOTECHNICAL.GDT\_11/19/19



# Sub-Surface Log

Test Hole TH19-06

1 of 1

Client: Morrison Hershfield Project Number: 0035-082-00-403  
 Project Name: 19-C-10 Pavement Renewals - Sargent Ave Location: N-5528777, E-630919  
 Contractor: Maple Leaf Drilling Ltd. Ground Elevation: Top of Pavement  
 Method: 125 mm Solid Stem Auger, CME55 Truck Mount Date Drilled: October 10, 2019

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

Particle Size Legend:  Fines  Clay  Silt  Sand  Gravel  Cobbles  Boulders

Depth (m)	Soil Symbol	MATERIAL DESCRIPTION	Sample Type	Sample Number	Bulk Unit Wt (kN/m <sup>3</sup> )						Undrained Shear Strength (kPa)					
					16	17	18	19	20	21	Test Type					
					Particle Size (%)											
					0	20	40	60	80	100						
					PL MC LL											
					0	20	40	60	80	100	0	50	100	150	200	250
0.0 - 0.1		ASPHALT - 110 mm thick														
0.1 - 0.2		CONCRETE - 180 mm thick														
0.2 - 0.6		SILT AND CLAY - some sand, trace gravel (<40 mm diam.), trace organics - black - moist, stiff - intermediate plasticity - trace sand, high plasticity below 0.6 m	<input checked="" type="checkbox"/>	G30												
0.6 - 1.0		SILT - trace clay, trace sand - light brown - moist to wet, soft - low plasticity	<input checked="" type="checkbox"/>	G31												
1.0 - 1.5		SILT - trace clay, trace sand - light brown - moist to wet, soft - low plasticity	<input checked="" type="checkbox"/>	G32												
1.5 - 2.3		CLAY - silty, trace silt inclusions (<10 mm diam.) - mottled brown and grey - moist, stiff - high plasticity	<input checked="" type="checkbox"/>	G33												
2.3 - 3.0		CLAY - silty, trace silt inclusions (<10 mm diam.) - mottled brown and grey - moist, stiff - high plasticity  - firm below 2.3 m	<input checked="" type="checkbox"/>	G34												
			<input checked="" type="checkbox"/>	G35												

END OF TEST HOLE AT 3.0 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 in Eastbound curb lane, 2 m North of curb and 17 m East of Dominion St.

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

SUB-SURFACE LOG LOGS 2019-10-21\_SARGENT STREET\_0035-082-00\_0\_A\_BMH.GPJ\_TREK GEOTECHNICAL.GDT 11/19/19



# Sub-Surface Log

Test Hole TH19-07

1 of 1

Client: Morrison Hershfield Project Number: 0035-082-00-403  
 Project Name: 19-C-10 Pavement Renewals - Sargent Ave Location: N-5528778, E-631006  
 Contractor: Maple Leaf Drilling Ltd. Ground Elevation: Top of Pavement  
 Method: 125 mm Solid Stem Auger, CME55 Truck Mount Date Drilled: October 10, 2019

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

Particle Size Legend:  Fines  Clay  Silt  Sand  Gravel  Cobbles  Boulders

Depth (m)	Soil Symbol	MATERIAL DESCRIPTION	Sample Type	Sample Number	Bulk Unit Wt (kN/m <sup>3</sup> )						Undrained Shear Strength (kPa)					
					16	17	18	19	20	21	Test Type					
					Particle Size (%)											
					0	20	40	60	80	100						
					PL ——— MC ——— LL 0 20 40 60 80 100											
					0	20	40	60	80	100	0	50	100	150	200	250
		ASPHALT - 130 mm thick														
		CONCRETE - 290 mm thick														
0.5		SAND (FILL) - gravelly, some silt, trace to some clay, brown, wet, compact, well graded sand to gravel (<20 mm diam.), sub-rounded to angular		G36												
0.8		CLAY - silty some sand - dark grey - moist, stiff to very stiff - high plasticity		G37												
1.2				G38												
1.5				G39												
1.8				G40												
2.2				G41												
2.5																
3.0		- firm below 2.1 m														

END OF TEST HOLE AT 3.0 m IN CLAY

- 1) No seepage or sloughing observed.
- 2) Test hole open to 2.7 m immediately after drilling.
- 3) Test hole backfilled with auger cuttings, granular fill and cold patch asphalt.
- 4) Test hole located in Eastbound median lane, 4 m North of curb and 22 m East of Garfield St.

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

SUB-SURFACE LOG LOGS 2019-10-21\_SARGENT STREET\_0035-082-00\_0\_A\_BMH.GPJ\_TREK GEOTECHNICAL.GDT 11/19/19



# Sub-Surface Log

Test Hole TH19-08

1 of 1

Client: Morrison Hershfield Project Number: 0035-082-00-403  
 Project Name: 19-C-10 Pavement Renewals - Sargent Ave Location: N-5528776, E-631102  
 Contractor: TREK Geotechnical Ground Elevation: Top of Pavement  
 Method: Hand Auger Date Drilled: October 18, 2019

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

Particle Size Legend:  Fines  Clay  Silt  Sand  Gravel  Cobbles  Boulders

Depth (m)	Soil Symbol	MATERIAL DESCRIPTION	Sample Type	Sample Number	Bulk Unit Wt (kN/m <sup>3</sup> )		Particle Size (%)		Undrained Shear Strength (kPa)								
					16	17	18	19	20	21	0	50	100	150	200	250	
0.0 - 0.1		ASPHALT - 120 mm thick															
0.1 - 0.4		CONCRETE - 380 mm thick															
0.4 - 0.6		GRAVEL (FILL) - trace sand - light brown - damp, compact - poorly graded coarse gravel (<50 mm diam.), angular limestone		G84													
0.6 - 1.0		SILT AND CLAY - trace sand - light brown - moist, firm to stiff - intermediate to high plasticity		G85													
1.0 - 1.2		- stiff to very stiff below 1.2 m		G86													
1.2 - 1.5				G87													
1.5 - 2.0				G88													
2.0 - 2.1		- stiff below 2.0 m		G89													

END OF TEST HOLE AT 2.1 m in SILT AND CLAY  
 2) No seepage or sloughing observed.  
 1) 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 in Eastbound median lane, 5 m North of curb and 35 m East of Sherburn St.

SUB-SURFACE LOG LOGS 2019-10-21\_SARGENT STREET\_0035-082-00\_0\_A\_BMH.GPJ\_TREK GEOTECHNICAL.GDT 11/19/19

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



# Sub-Surface Log

Test Hole TH19-09

1 of 1

Client: Morrison Hershfield Project Number: 0035-082-00-403  
 Project Name: 19-C-10 Pavement Renewals - Sargent Ave Location: N-5528767, E-631318  
 Contractor: Maple Leaf Drilling Ltd. Ground Elevation: Top of Pavement  
 Method: 125 mm Solid Stem Auger, CME55 Truck Mount Date Drilled: October 10, 2019

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

Particle Size Legend:  Fines  Clay  Silt  Sand  Gravel  Cobbles  Boulders

Depth (m)	Soil Symbol	MATERIAL DESCRIPTION	Sample Type	Sample Number	Bulk Unit Wt (kN/m <sup>3</sup> )		Particle Size (%)					Undrained Shear Strength (kPa)								
					16	17	18	19	20	21	0	20	40	60	80	100	0	50	100	150
0.0 - 0.2		ASPHALT - 230 mm thick																		
0.2 - 0.4		SAND (FILL) - gravelly, some silt, some clay - light brown - moist, compact - well graded sand to gravel (<20 mm diam.) - sub-rounded to angular	<input checked="" type="checkbox"/>	G43																
0.4 - 0.7		SILT AND CLAY - trace sand, trace organics - black - moist, firm - intermediate plasticity	<input checked="" type="checkbox"/>	G44																
0.7 - 1.0		SILT - trace clay, trace sand - light brown - moist to wet, soft - low plasticity	<input checked="" type="checkbox"/>	G45																
1.0 - 1.5		SILT - trace clay, trace sand - light brown - moist to wet, soft - low plasticity	<input checked="" type="checkbox"/>	G46																
1.5 - 2.3		CLAY - silty, trace silt inclusions (<10 mm diam.) - mottled brown and grey - moist, stiff - high plasticity	<input checked="" type="checkbox"/>	G47																
2.3 - 3.0		- firm below 2.3 m	<input checked="" type="checkbox"/>	G48																

END OF TEST HOLE AT 3.0 m IN CLAY

- 1) No seepage observed.
- 2) Sloughing from silt layer observed between 0.9 to 1.5 m depth.
- 3) Test hole open to 1.2 m immediately after drilling.
- 4) Test hole backfilled with auger cuttings, granular fill and cold patch asphalt.
- 5) Test hole located in Eastbound curb lane, 2 m North of curb and 10 m West of Banning St.

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

SUB-SURFACE LOG LOGS 2019-10-21 SARGENT STREET 0035-082-00 0 A\_BMH.GPJ TREK GEOTECHNICAL.GDT 11/19/19



# Sub-Surface Log

Test Hole TH19-10

1 of 1

Client: Morrison Hershfield Project Number: 0035-082-00-403  
 Project Name: 19-C-10 Pavement Renewals - Sargent Ave Location: N-5528766, E-631187  
 Contractor: Maple Leaf Drilling Ltd. Ground Elevation: Top of Pavement  
 Method: 125 mm Solid Stem Auger, CME55 Truck Mount Date Drilled: October 10, 2019

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

Particle Size Legend:  Fines  Clay  Silt  Sand  Gravel  Cobbles  Boulders

Depth (m)	Soil Symbol	MATERIAL DESCRIPTION	Sample Type	Sample Number	Bulk Unit Wt (kN/m <sup>3</sup> )		Undrained Shear Strength (kPa)	
					16	17	18	19
0.0 - 0.1		ASPHALT - 80 mm thick						
0.1 - 0.3		CONCRETE - 220 mm thick						
0.3 - 1.5		SAND (FILL) - gravelly, some silt, trace clay - brown - moist, compact - well graded sand to gravel (<20 mm diam.) - sub-rounded to angular	G	G48, G49, G50, G51				
1.5 - 2.1		TRANSITION: SAND (FILL) to CLAY						
2.1 - 3.0		CLAY - silty - grey - moist, stiff - high plasticity	G	G52, G53				

END OF TEST HOLE AT 3.0 m IN CLAY

- 1) No seepage observed.
- 2) Sloughing from sand and gravel layer observed between 0.3 to 2.1 m depth.
- 3) Test hole open to 2.1 m immediately after drilling.
- 4) Test hole backfilled with auger cuttings, granular fill and cold patch asphalt.
- 5) Test hole located in Eastbound median lane, 5 m North of curb and 16 m West of Lipton St.

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

SUB-SURFACE LOG LOGS 2019-10-21\_SARGENT STREET\_0035-082-00\_0\_A\_BMH.GPJ\_TREK GEOTECHNICAL.GDT 11/19/19



# Sub-Surface Log

Test Hole TH19-11

1 of 1

Client: Morrison Hershfield Project Number: 0035-082-00-403  
 Project Name: 19-C-10 Pavement Renewals - Sargent Ave Location: N-5528777, E-631408  
 Contractor: Maple Leaf Drilling Ltd. Ground Elevation: Top of Pavement  
 Method: 125 mm Solid Stem Auger, CME55 Truck Mount Date Drilled: October 10, 2019

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

Particle Size Legend:  Fines  Clay  Silt  Sand  Gravel  Cobbles  Boulders

Depth (m)	Soil Symbol	MATERIAL DESCRIPTION	Sample Type	Sample Number	Bulk Unit Wt (kN/m <sup>3</sup> )		Particle Size (%)		Undrained Shear Strength (kPa)									
					16	17	18	19	20	21	0	50	100	150	200	250		
0.0 - 0.2		ASPHALT - 230 mm thick																
0.2 - 0.5		CONCRETE AND WOOD - 150 mm diam. wood embedded in concrete																
0.5 - 0.9		SILT AND CLAY - sandy, trace gravel (<20 mm diam.) - brown - moist, firm - intermediate to high plasticity	<input checked="" type="checkbox"/>	G60														
0.9 - 1.5		SILT - trace clay, trace sand - light brown - moist to wet, soft - low plasticity	<input checked="" type="checkbox"/>	G61														
1.5 - 2.0		CLAY - silty - brown - moist, firm to stiff - high plasticity	<input checked="" type="checkbox"/>	G62														
2.0 - 2.5			<input checked="" type="checkbox"/>	G63														
2.5 - 3.0			<input checked="" type="checkbox"/>	G64														
3.0 - 3.5			<input checked="" type="checkbox"/>	G65														

END OF TEST HOLE AT 3.0 m IN CLAY

- 1) No seepage observed.
- 2) Sloughing from silt layer between 0.9 to 1.5 m depth.
- 3) Test hole open to 1.2 m immediately after drilling.
- 4) Test hole backfilled with auger cuttings, granular fill and cold patch asphalt.
- 5) Test hole located in Eastbound median lane, 4 m North of curb and 15 m East of Burnell St.

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

SUB-SURFACE LOG LOGS 2019-10-21 SARGENT STREET 0035-082-00 0 A\_BMH.GPJ\_TREK GEOTECHNICAL\_GDT 11/19/19



# Sub-Surface Log

Test Hole TH19-12

1 of 1

Client: Morrison Hershfield Project Number: 0035-082-00-403  
 Project Name: 19-C-10 Pavement Renewals - Sargent Ave Location: N-5528771, E-631464  
 Contractor: Maple Leaf Drilling Ltd. Ground Elevation: Top of Pavement  
 Method: 125 mm Solid Stem Auger, CME55 Truck Mount Date Drilled: October 10, 2019

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

Particle Size Legend:  Fines  Clay  Silt  Sand  Gravel  Cobbles  Boulders

Depth (m)	Soil Symbol	MATERIAL DESCRIPTION	Sample Type	Sample Number	Bulk Unit Wt (kN/m <sup>3</sup> )		Particle Size (%)		Undrained Shear Strength (kPa)								
					16	17	18	19	20	21	0	50	100	150	200	250	
0.0		ASPHALT - 120 mm thick															
0.0		CONCRETE - 220 thick															
0.0		CONCRETE AND WOOD - 150 mm diam. wood embedded in concrete															
0.5		SILT AND CLAY - some sand - brown - moist, firm - intermediate plasticity		G54													
0.5		SILT - trace clay, trace sand - light brown - moist to wet, soft - low plasticity		G55													
1.0		SILT - trace clay, trace sand - light brown - moist to wet, soft - low plasticity		G56													
1.5		CLAY - silty - brown - moist, very stiff - high plasticity		G57													
1.5		CLAY - silty - brown - moist, very stiff - high plasticity		G58													
2.0		- firm below 2.1 m		G59													
2.5																	
3.0																	

END OF TEST HOLE AT 3.0 m IN CLAY

- 1) No seepage or sloughing observed.
- 2) Test hole open to 2.7 m immediately after drilling.
- 3) Test hole backfilled with auger cuttings, granular fill and cold patch asphalt.
- 4) Test hole located in Eastbound median lane, 5 m North of curb and 26 m East of Alverstone St.

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

SUB-SURFACE LOG LOGS 2019-10-21\_SARGENT STREET\_0035-082-00\_0\_A\_BMH.GPJ\_TREK GEOTECHNICAL.GDT 11/19/19





# Sub-Surface Log

Test Hole TH19-13

1 of 1

Client: Morrison Hershfield Project Number: 0035-082-00-403  
 Project Name: 19-C-10 Pavement Renewals - Sargent Ave Location: N-5528769, E-631552  
 Contractor: Maple Leaf Drilling Ltd. Ground Elevation: Top of Pavement  
 Method: 125 mm Solid Stem Auger, CME55 Truck Mount Date Drilled: October 3, 2019

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

Particle Size Legend:  Fines  Clay  Silt  Sand  Gravel  Cobbles  Boulders

Depth (m)	Soil Symbol	MATERIAL DESCRIPTION	Sample Type	Sample Number	Bulk Unit Wt (kN/m <sup>3</sup> )		Particle Size (%)		Undrained Shear Strength (kPa)										
					16	17	18	19	20	21	0	50	100	150	200	250			
0.0 - 0.2		ASPHALT - 220 mm thick																	
0.2 - 0.5		CONCRETE - 390 mm thick																	
0.5 - 0.9		SILT AND CLAY - some sand - light brown - moist, very stiff - low to intermediate plasticity	<input checked="" type="checkbox"/>	G13															
0.9 - 1.0		SILT - trace clay, trace sand - light brown - moist to wet, soft - low plasticity	<input checked="" type="checkbox"/>	G14															
1.0 - 1.4			<input checked="" type="checkbox"/>	G15															
1.4 - 1.8			<input checked="" type="checkbox"/>	G16															
1.8 - 2.2			<input checked="" type="checkbox"/>	G17															
2.2 - 2.6			<input checked="" type="checkbox"/>	G18															

END OF TEST HOLE AT 3.0 m IN SILT.  
 1) No seepage observed.  
 2) Sloughing from silt layer observed between 2.0 to 3.0 m depth.  
 3) Test hole open to 2.0 m immediately after drilling.  
 4) Test hole backfilled with auger cuttings, granular fill and cold patch asphalt.  
 5) Test hole located in Eastbound median lane, 4 m North of curb across from 795 Sargent Ave.

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

SUB-SURFACE LOG LOGS 2019-10-21\_SARGENT STREET\_0035-082-00\_0\_A\_BMH.GPJ\_TREK GEOTECHNICAL.GDT 11/19/19



# Sub-Surface Log

Test Hole TH19-14

1 of 1

Client: Morrison Hershfield Project Number: 0035-082-00-403  
 Project Name: 19-C-10 Pavement Renewals - Sargent Ave Location: N-5528798, E-631527  
 Contractor: Maple Leaf Drilling Ltd. Ground Elevation: Top of Pavement  
 Method: 125 mm Solid Stem Auger, CME55 Truck Mount Date Drilled: October 3, 2019

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

Particle Size Legend:  Fines  Clay  Silt  Sand  Gravel  Cobbles  Boulders

Depth (m)	Soil Symbol	MATERIAL DESCRIPTION	Sample Type	Sample Number	Bulk Unit Wt (kN/m <sup>3</sup> )						Undrained Shear Strength (kPa)					
					16	17	18	19	20	21	Test Type					
					Particle Size (%)											
					0	20	40	60	80	100						
					PL MC LL											
					0	20	40	60	80	100	0	50	100	150	200	250
		ASPHALT - 50 mm thick														
		CONCRETE - 200 mm thick														
0.5		SAND (FILL) - gravelly, some silt, trace clay - brown - moist, compact - well graded sand to gravel (<20 mm diam.) - sub-rounded to angular	<input checked="" type="checkbox"/>	G01												
0.8		CLAY - silty, trace sand - grey - moist, very stiff - high plasticity	<input checked="" type="checkbox"/>	G02												△
1.0		SILT - trace clay, trace sand - light brown - moist to wet, soft - low plasticity	<input checked="" type="checkbox"/>	G03												
1.3			<input checked="" type="checkbox"/>	G04												
1.6			<input checked="" type="checkbox"/>	G05												
2.5		CLAY - silty - mottled brown and grey - moist, firm to stiff - high plasticity	<input checked="" type="checkbox"/>	G06												△

END OF TEST HOLE AT 3.0 m IN CLAY

- 1) No seepage observed.
- 2) Sloughing from silt layer observed between 0.9 to 2.4 m depth.
- 3) Test hole open to 2.6 m immediately after drilling.
- 4) Test hole backfilled with auger cuttings, granular fill and cold patch asphalt.
- 5) Test hole located in Arlington Southbound curb lane, 2 m East of curb and 19 m South of 666 Arlington St.

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

SUB-SURFACE LOG LOGS 2019-10-21\_SARGENT STREET\_0035-082-00\_0\_A\_BMH.GPJ\_TREK GEOTECHNICAL.GDT 11/19/19



# Sub-Surface Log

Test Hole TH19-15

1 of 1

Client: Morrison Hershfield Project Number: 0035-082-00-403  
 Project Name: 19-C-10 Pavement Renewals - Sargent Ave Location: N-5528738, E-631526  
 Contractor: Maple Leaf Drilling Ltd. Ground Elevation: Top of Pavement  
 Method: 125 mm Solid Stem Auger, CME55 Truck Mount Date Drilled: October 3, 2019

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

Particle Size Legend:  Fines  Clay  Silt  Sand  Gravel  Cobbles  Boulders

Depth (m)	Soil Symbol	MATERIAL DESCRIPTION	Sample Type	Sample Number	Bulk Unit Wt (kN/m <sup>3</sup> )						Undrained Shear Strength (kPa)					
					16	17	18	19	20	21	Test Type					
					Particle Size (%)											
					0	20	40	60	80	100						
					PL _____ MC _____ LL _____ 0 20 40 60 80 100											
					0	20	40	60	80	100	0	50	100	150	200	250
		ASPHALT - 50 mm thick														
		CONCRETE - 170 mm thick														
		SAND (FILL) - gravelly, some silt, trace clay - brown, moist, compact, well graded sand to gravel (<20 mm diam.) - sub-rounded to angular	Grab (G)	G07												
0.5		SILT AND SAND - some clay, trace gravel (<20 mm diam.), trace organics - black - moist, soft - low to intermediate plasticity	Grab (G)	G08												
1.0		SILT AND CLAY - trace sand - grey - moist, stiff - intermediate plasticity	Grab (G)	G09												
			Grab (G)	G10												
1.5		CLAY - silty - grey - moist, firm - high plasticity	Grab (G)	G11												
			Grab (G)	G12												

END OF TEST HOLE AT 2.3 m IN CLAY

- 1) No seepage or sloughing observed.
- 2) Test hole open to 2.3 m immediately after drilling.
- 3) Test hole backfilled with auger cuttings, granular fill and cold patch asphalt.
- 4) Test hole located in Arlington Southbound lane, 9 m West and 10 m South of fire hydrant near the intersection of Sargent Ave and Arlington St.

SUB-SURFACE LOG LOGS 2019-10-21\_SARGENT STREET\_0035-082-00\_0\_A\_BMH.GPJ\_TREK GEOTECHNICAL\_GDT 11/19/19

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

## **Appendix B**

### **Summary Table & Lab Testing Results**

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**19-C-10 Sargent Avenue Street Renewal  
Sub-Surface Investigation  
Sargent Avenue**

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
TH19-01	UTM : 5528801 N, 630445 E Located in Westbound median lane, 4 m South of curb and 51 m East of Wall St.	Asphalt	130	Concrete	240	Silt and Sand	0.3	0.5	30	15	45	35	5	24	48	24
						Silt and Sand	0.6	0.8	31							
						Silt and Sand	0.9	1.1	23							
						Clay	1.2	1.4	30							
						Clay	1.5	1.7	34							
TH19-02	UTM : 5528786 N, 630524 E Located in Eastbound curb lane, 2 m North of curb and 41 m West of Wall St.									-	Fines (%)	Sand (%)	Gravel (%)	Plastic	Liquid	Plasticity Index
		Asphalt	140	Concrete	290	Sand (Fill)	0.5	0.6	13							
						Sand (Fill)	0.8	0.9	14		7	71	22			
						Sand (Fill)	1.1	1.2	16							
						Sand (Fill)	1.4	1.5	17							
						Sand (Fill)	1.7	1.8	18							
TH19-03	UTM : 5528792 N, 630629 E Located in Westbound median lane, 4 m South of curb and 51 m East of Wall Street	Asphalt	100	Concrete	200	Silt and Clay	0.3	0.5	21							
						Silt and Clay	0.6	0.8	33							
						Silt	0.9	1.1	21	16	73	5		16	29	14
						Silt	1.2	1.4	23							
						Clay	1.5	1.7	39							
						Clay	2.3	2.4	51							
TH19-04	UTM : 5528783 N, 630761 E Located in Eastbound median lane, 4.5 m North of curb and 30 m East of Minto St.	Asphalt	110	Concrete	180	Silt and Clay	0.3	0.5	42							
						Silt and Clay	0.6	0.8	31							
						Silt and Clay	0.9	1.1	27							
						Clay	1.2	1.4	33							
						Clay	1.5	1.7	38							
				Clay	2.3	2.4	50									











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## Moisture Content Report ASTM D2216-10

**Project No.** 0035-082-00-403  
**Client** Morrison Hershfield  
**Project** 19-C-10 Pavement Renewal - Sargent Ave

**Sample Date** 10-Oct-19  
**Test Date** 22-Oct-19  
**Technician** HS

Test Hole	TH19-01	TH19-01	TH19-01	TH19-01	TH19-01	TH19-01
Depth (m)	0.3 - 0.5	0.6 - 0.8	0.9 - 1.1	1.2 - 1.4	1.5 - 1.7	2.4 - 2.6
Sample #	G78	G79	G80	G81	G82	G83
Tare ID	D32	Z102	F44	C22	P20	P85
Mass of tare	8.6	8.5	8.5	8.6	8.6	8.6
Mass wet + tare	376.2	272.8	287.7	232.5	253.1	214.4
Mass dry + tare	290.4	210.2	235.2	180.8	190.7	152.8
Mass water	85.8	62.6	52.5	51.7	62.4	61.6
Mass dry soil	281.8	201.7	226.7	172.2	182.1	144.2
Moisture %	30.4%	31.0%	23.2%	30.0%	34.3%	42.7%

Test Hole	TH19-02	TH19-02	TH19-02	TH19-02	TH19-02	TH19-02
Depth (m)	0.5 - 0.6	0.8 - 0.9	1.1 - 1.2	1.4 - 1.5	1.7 - 1.8	2.3 - 2.4
Sample #	G19	G20	G21	G22	G23A	G23
Tare ID	Z16	STEPHEN	A13	AC03	F35	Z134
Mass of tare	8.7	255.8	8.4	6.8	8.5	8.4
Mass wet + tare	404.4	790.3	221.0	176.3	153.2	222.8
Mass dry + tare	358.7	723.3	191.0	151.5	131.5	172.8
Mass water	45.7	67.0	30.0	24.8	21.7	50.0
Mass dry soil	350.0	467.5	182.6	144.7	123.0	164.4
Moisture %	13.1%	14.3%	16.4%	17.1%	17.6%	30.4%

Test Hole	TH19-03	TH19-03	TH19-03	TH19-03	TH19-03	TH19-03
Depth (m)	0.3 - 0.5	0.6 - 0.8	0.9 - 1.1	1.2 - 1.4	1.5 - 1.7	2.3 - 2.4
Sample #	G72	G73	G74	G75	G76	G77
Tare ID	F129	D49	D10	AB18	N62	F144
Mass of tare	8.4	8.5	8.6	6.8	8.6	8.5
Mass wet + tare	277.8	247.3	422.0	318.5	223.8	213.1
Mass dry + tare	231.7	188.2	349.4	259.5	163.4	144.1
Mass water	46.1	59.1	72.6	59.0	60.4	69.0
Mass dry soil	223.3	179.7	340.8	252.7	154.8	135.6
Moisture %	20.6%	32.9%	21.3%	23.3%	39.0%	50.9%



**Project No.** 0035-082-00-403  
**Client** Morrison Hershfield  
**Project** 19-C-10 Pavement Renewal - Sargent Ave

**Sample Date** 10-Oct-19  
**Test Date** 22-Oct-19  
**Technician** HS

Test Hole	TH19-04	TH19-04	TH19-04	TH19-04	TH19-04	TH19-04
Depth (m)	0.3 - 0.5	0.6 - 0.8	0.9 - 1.1	1.2 - 1.4	1.5 - 1.7	2.3 - 2.4
Sample #	G24	G25	G26	G27	G28	G29
Tare ID	H13	Z116	W97	H90	D47	D19
Mass of tare	8.6	8.7	8.5	8.5	8.5	8.4
Mass wet + tare	163.1	185.0	196.9	185.9	198.0	198.5
Mass dry + tare	117.4	143.0	157.3	142.4	146.0	135.0
Mass water	45.7	42.0	39.6	43.5	52.0	63.5
Mass dry soil	108.8	134.3	148.8	133.9	137.5	126.6
Moisture %	42.0%	31.3%	26.6%	32.5%	37.8%	50.2%

Test Hole	TH19-05	TH19-05	TH19-05	TH19-05	TH19-05	TH19-05
Depth (m)	0.3 - 0.5	0.6 - 0.8	0.9 - 1.1	1.2 - 1.4	1.5 - 1.7	2.1 - 2.3
Sample #	G66	G67	G68	G69	G70	G71
Tare ID	AB47	W27	AC29	AB60	F8	F38
Mass of tare	6.8	8.4	6.9	6.6	8.8	8.5
Mass wet + tare	265.7	177.1	200.3	193.2	218.9	258.3
Mass dry + tare	213.0	134.9	161.7	145.9	155.1	176.8
Mass water	52.7	42.2	38.6	47.3	63.8	81.5
Mass dry soil	206.2	126.5	154.8	139.3	146.3	168.3
Moisture %	25.6%	33.4%	24.9%	34.0%	43.6%	48.4%

Test Hole	TH19-06	TH19-06	TH19-06	TH19-06	TH19-06	TH19-06
Depth (m)	0.3 - 0.5	0.6 - 0.8	0.9 - 1.1	1.2 - 1.4	1.5 - 1.7	2.3 - 2.4
Sample #	G30	G31	G32	G33	G34	G35
Tare ID	W36	N01	AB09	K10	H9	F9
Mass of tare	8.5	8.6	6.7	8.5	8.8	8.9
Mass wet + tare	199.4	191.3	213.2	166.3	178.0	172.2
Mass dry + tare	166.8	147.2	173.6	134.7	129.3	121.2
Mass water	32.6	44.1	39.6	31.6	48.7	51.0
Mass dry soil	158.3	138.6	166.9	126.2	120.5	112.3
Moisture %	20.6%	31.8%	23.7%	25.0%	40.4%	45.4%



**Project No.** 0035-082-00-403  
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**Technician** HS

Test Hole	TH19-07	TH19-07	TH19-07	TH19-07	TH19-07	TH19-07
Depth (m)	0.5 - 0.6	0.8 - 0.9	1.1 - 1.2	1.4 - 1.5	1.7 - 1.8	2.3 - 2.4
Sample #	G36	G37	G38	G39	G40	G41
Tare ID	N02	E13	AB43	F124	E2	K4
Mass of tare	8.6	8.8	6.7	8.5	8.8	8.6
Mass wet + tare	251.7	485.1	228.7	207.6	196.0	174.0
Mass dry + tare	217.0	355.4	168.9	155.3	148.1	123.1
Mass water	34.7	129.7	59.8	52.3	47.9	50.9
Mass dry soil	208.4	346.6	162.2	146.8	139.3	114.5
Moisture %	16.7%	37.4%	36.9%	35.6%	34.4%	44.5%

Test Hole	TH19-08	TH19-08	TH19-08	TH19-08	TH19-08	TH19-08
Depth (m)	0.6 - 0.8	0.9 - 1.1	1.2 - 1.4	1.5 - 1.7	1.8 - 2.0	2.0 - 2.1
Sample #	G84	G85	G86	G87	G88	G89
Tare ID	Z1	Z11	AB100	Z118	F131	Z93
Mass of tare	238.0	8.8	7.0	8.4	8.5	8.8
Mass wet + tare	1665.8	234.6	208.5	174.8	190.1	226.6
Mass dry + tare	1605.8	185.2	164.3	133.5	143.9	172.6
Mass water	60.0	49.4	44.2	41.3	46.2	54.0
Mass dry soil	1367.8	176.4	157.3	125.1	135.4	163.8
Moisture %	4.4%	28.0%	28.1%	33.0%	34.1%	33.0%

Test Hole	TH19-09	TH19-09	TH19-09	TH19-09	TH19-09	TH19-09
Depth (m)	0.3 - 0.5	0.6 - 0.8	0.9 - 1.1	1.2 - 1.4	1.5 - 1.7	2.1 - 2.3
Sample #	G42	G43	G44	G45	G46	G47
Tare ID	F56	W29	W41	F42	AB88	Z24
Mass of tare	8.4	8.6	8.6	8.4	6.7	8.4
Mass wet + tare	278.7	238.7	246.4	253.5	213.9	234.3
Mass dry + tare	234.0	181.7	197.6	207.0	151.4	162.0
Mass water	44.7	57.0	48.8	46.5	62.5	72.3
Mass dry soil	225.6	173.1	189.0	198.6	144.7	153.6
Moisture %	19.8%	32.9%	25.8%	23.4%	43.2%	47.1%



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## Moisture Content Report ASTM D2216-10

**Project No.** 0035-082-00-403  
**Client** Morrison Hershfield  
**Project** 19-C-10 Pavement Renewal - Sargent Ave

**Sample Date** 10-Oct-19  
**Test Date** 22-Oct-19  
**Technician** HS

Test Hole	TH19-10	TH19-10	TH19-10	TH19-10	TH19-10	TH19-10
Depth (m)	0.3 - 0.5	0.6 - 0.8	0.9 - 1.1	1.2 - 1.4	1.5 - 1.7	2.1 - 2.3
Sample #	G48	G49	G50	G51	G52	G53
Tare ID	E8	P24	A17	P10	K1	N56
Mass of tare	8.6	8.6	8.6	8.9	8.4	8.4
Mass wet + tare	201.1	186.9	184.1	188.7	234.8	238.8
Mass dry + tare	175.7	171.9	172.2	180.0	183.7	169.6
Mass water	25.4	15.0	11.9	8.7	51.1	69.2
Mass dry soil	167.1	163.3	163.6	171.1	175.3	161.2
Moisture %	15.2%	9.2%	7.3%	5.1%	29.2%	42.9%

Test Hole	TH19-11	TH19-11	TH19-11	TH19-11	TH19-11	TH19-11
Depth (m)	0.3 - 0.5	0.6 - 0.8	0.9 - 1.1	1.2 - 1.4	1.5 - 1.7	2.1 - 2.3
Sample #	G60	G61	G62	G63	G64	G65
Tare ID	D12	W35	W103	K5	C19	AA23
Mass of tare	8.4	8.4	8.4	8.6	8.6	6.8
Mass wet + tare	124.4	393.6	287.6	397.8	220.8	303.4
Mass dry + tare	91.5	314.6	231.4	326.5	161.6	208.4
Mass water	32.9	79.0	56.2	71.3	59.2	95.0
Mass dry soil	83.1	306.2	223.0	317.9	153.0	201.6
Moisture %	39.6%	25.8%	25.2%	22.4%	38.7%	47.1%

Test Hole	TH19-12	TH19-12	TH19-12	TH19-12	TH19-12	TH19-12
Depth (m)	0.3 - 0.5	0.6 - 0.8	0.9 - 1.1	1.2 - 1.4	1.5 - 1.7	2.1 - 2.3
Sample #	G54	G55	G56	G57	G58	G59
Tare ID	P14	N113	Z44	F50	F48	A109
Mass of tare	9	8.6	8.6	8.6	8.6	8.4
Mass wet + tare	123.6	288.8	152.0	254.2	283.4	293.4
Mass dry + tare	87.8	229.9	128.0	210.6	217.4	201.2
Mass water	35.8	58.9	24.0	43.6	66.0	92.2
Mass dry soil	78.8	221.3	119.4	202.0	208.8	192.8
Moisture %	45.4%	26.6%	20.1%	21.6%	31.6%	47.8%



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## Moisture Content Report ASTM D2216-10

**Project No.** 0035-082-00-403  
**Client** Morrison Hershfield  
**Project** 19-C-10 Pavement Renewal - Sargent Ave

**Sample Date** 10-Oct-19  
**Test Date** 22-Oct-19  
**Technician** HS

Test Hole	TH19-13	TH19-13	TH19-13	TH19-13	TH19-13	TH19-13
Depth (m)	0.8 - 0.9	1.1 - 1.2	1.4 - 1.5	1.7 - 1.8	2.0 - 2.1	2.3 - 2.4
Sample #	G13	G14	G15	G16	G17	G18
Tare ID	H6	E92	C8	W91	F98	AB19
Mass of tare	8.6	8.4	8.4	8.6	8.5	6.7
Mass wet + tare	192.2	195.4	212.3	199.3	248.7	253.0
Mass dry + tare	159.0	164.6	177.9	168.4	206.0	203.8
Mass water	33.2	30.8	34.4	30.9	42.7	49.2
Mass dry soil	150.4	156.2	169.5	159.8	197.5	197.1
Moisture %	22.1%	19.7%	20.3%	19.3%	21.6%	25.0%

Test Hole	TH19-14	TH19-14	TH19-14	TH19-14	TH19-14	TH19-14
Depth (m)	0.3 - 0.5	0.6 - 0.8	0.9 - 1.1	1.2 - 1.4	1.8 - 2.0	2.4 - 2.6
Sample #	G01	G02	G03	G04	G05	G06
Tare ID	F128	E110	C14	AB91	N110	E53
Mass of tare	8.7	8.6	8.5	6.6	8.5	8.6
Mass wet + tare	268.4	342.8	231.2	441.9	252.0	272.1
Mass dry + tare	255.4	267.3	188.1	363.5	205.5	209.8
Mass water	13.0	75.5	43.1	78.4	46.5	62.3
Mass dry soil	246.7	258.7	179.6	356.9	197.0	201.2
Moisture %	5.3%	29.2%	24.0%	22.0%	23.6%	31.0%

Test Hole	TH19-15	TH19-15	TH19-15	TH19-15	TH19-15	TH19-15
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 #	G07	G08	G09	G10	G11	G12
Tare ID	W35	E110	W59	N27	Z77	E15
Mass of tare	8.7	8.6	8.5	8.6	8.5	9
Mass wet + tare	257.1	131.0	199.1	184.2	180.2	251.1
Mass dry + tare	231.6	117.2	164.5	143.9	124.0	167.4
Mass water	25.5	13.8	34.6	40.3	56.2	83.7
Mass dry soil	222.9	108.6	156.0	135.3	115.5	158.4
Moisture %	11.4%	12.7%	22.2%	29.8%	48.7%	52.8%



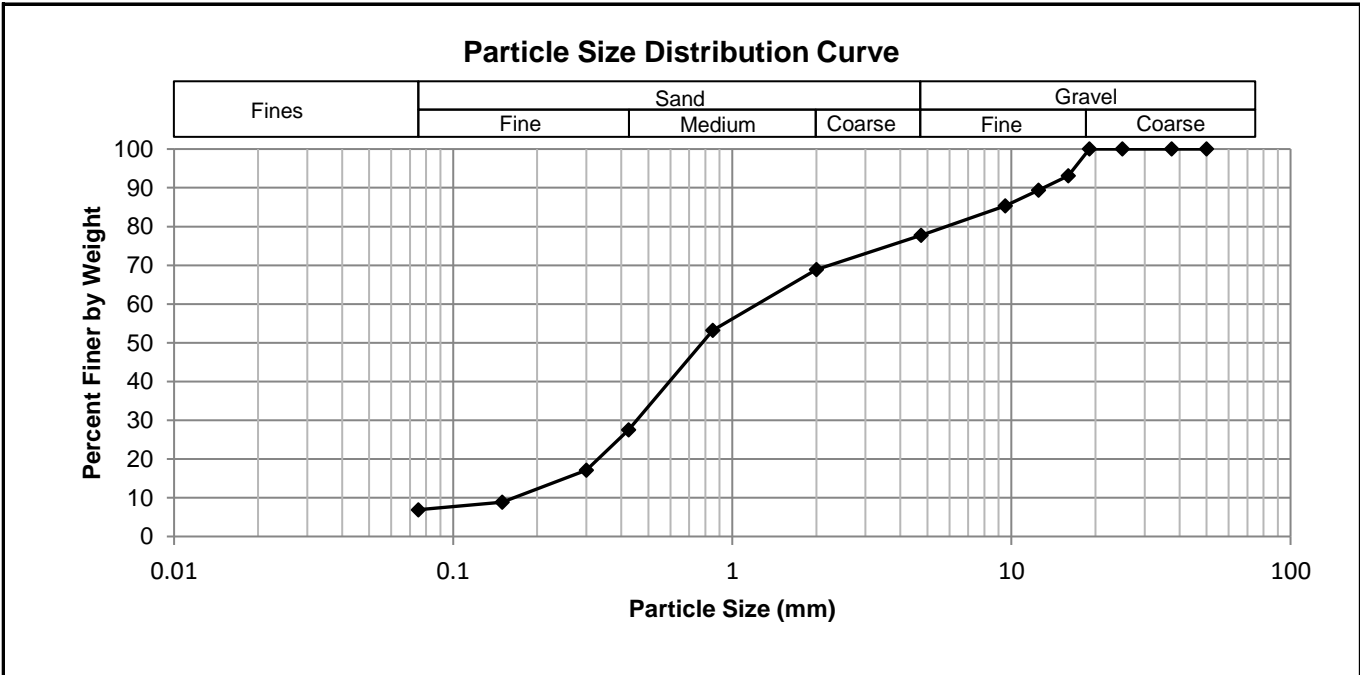
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**Grain Size Analysis (Sieve Method)**  
**ASTM C136-14**

**Project No.** 0035-082-00-403  
**Client** Morrison Hershfield  
**Project** 19-C-10 Pavement Renewal - Sargent Ave

**Test Hole** TH19-02  
**Sample #** G20  
**Depth** 0.8 - 0.9  
**Date Sampled** 10-Oct-19  
**Date Tested** 28-Oct-19  
**Technician** HS

<b>Gravel %</b>	22.3
<b>Sand %</b>	70.8
<b>Fines %</b>	6.9



Sieve Number	Sieve Opening (mm)	Percent Passing	Specification (Min-Max)
3/4"	19.0	100	-
5/8"	16.0	93	-
1/2"	12.5	89	-
3/8"	9.50	85	-
no. 4	4.75	78	-
no. 10	2.00	69	-
no. 20	0.850	53	-
no. 40	0.425	27	-
no. 50	0.300	17	-
no. 100	0.150	8.8	-
no. 200	0.075	6.9	-



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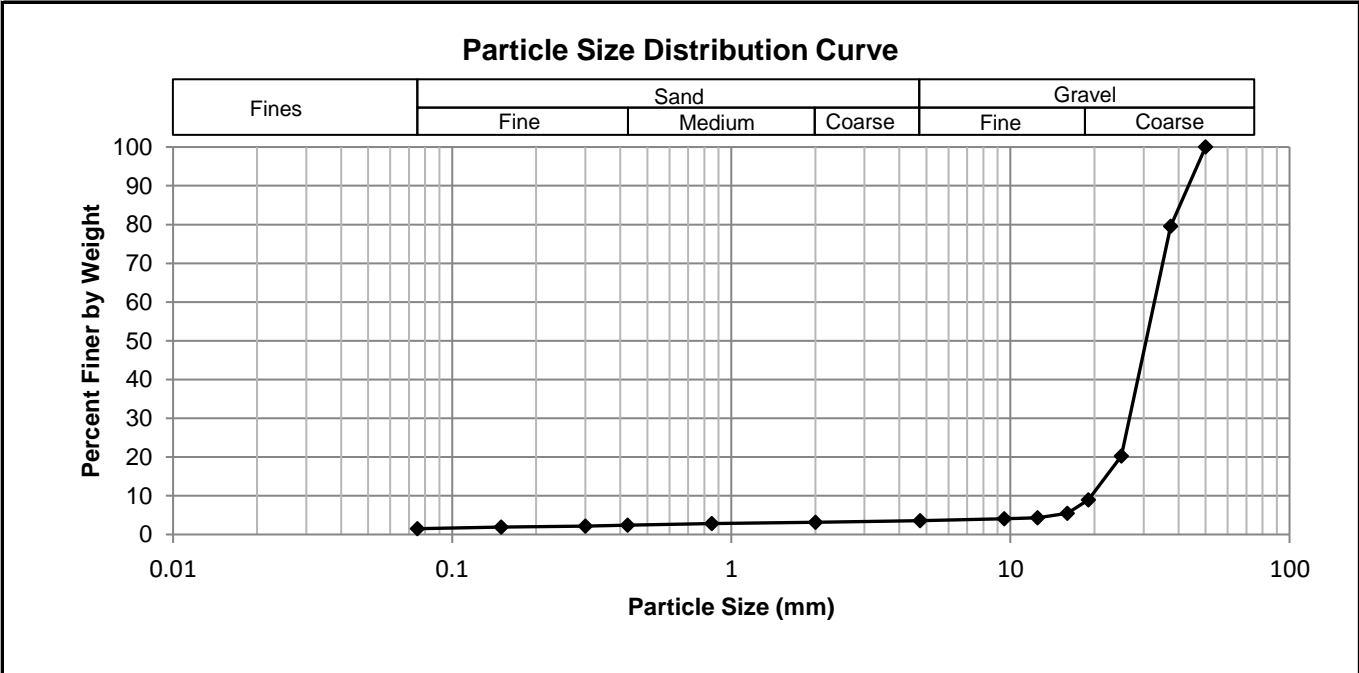
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**Grain Size Analysis (Sieve Method)**  
**ASTM C136-14**

**Project No.** 0035-082-00-403  
**Client** Morrison Hershfield  
**Project** 19-C-10 Pavement Renewal - Sargent Ave

**Test Hole** TH19-08  
**Sample #** G84  
**Depth** 0.6 - 0.8  
**Date Sampled** 10-Oct-19  
**Date Tested** 28-Oct-19  
**Technician** HS

<b>Gravel %</b>	96.4
<b>Sand %</b>	2.1
<b>Fines %</b>	1.5



Sieve Number	Sieve Opening (mm)	Percent Passing	Specification (Min-Max)
2"	50.0	100	-
1 1/2"	37.5	80	-
1"	25.0	20	-
3/4"	19.0	9.0	-
5/8"	16.0	5.5	-
1/2"	12.5	4.3	-
3/8"	9.50	4.0	-
no. 4	4.75	3.6	-
no. 10	2.00	3.2	-
no. 20	0.850	2.8	-
no. 40	0.425	2.4	-
no. 50	0.300	2.2	-
no. 100	0.150	1.9	-
no. 200	0.075	1.5	-



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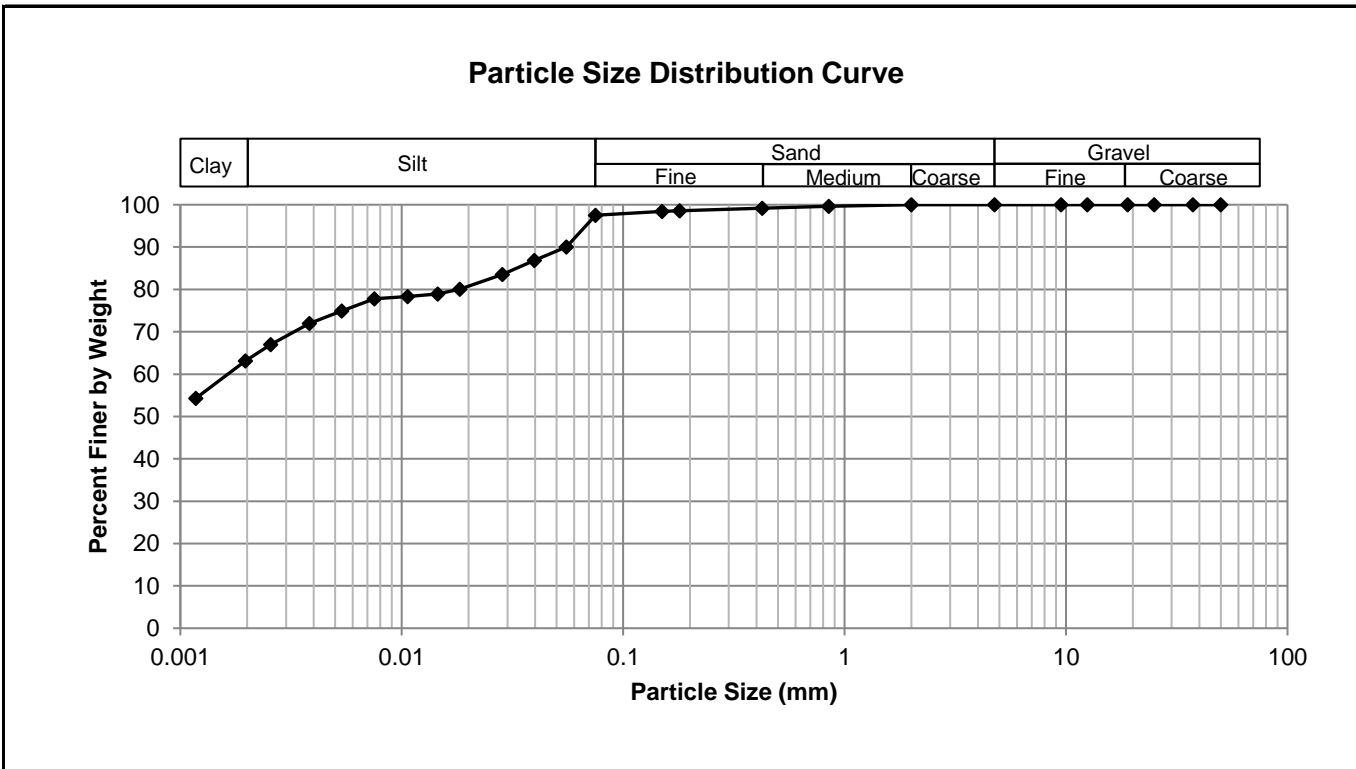
**Grain Size Analysis (Hydrometer Method)**  
**AASHTO T 88**

**Project No.** 0035-082-00-403  
**Client** Morrison Hershfield  
**Project** 19-C-10 Pavement Renewal - Sargent Ave



**Test Hole** TH19-14  
**Sample #** G02  
**Depth (m)** 0.6 - 0.8  
**Sample Date** 10-Oct-19  
**Test Date** 23-Oct-19  
**Technician** AFK

<b>Gravel</b>	0.0%
<b>Sand</b>	2.5%
<b>Silt</b>	34.2%
<b>Clay</b>	63.3%



Gravel		Sand		Silt and Clay	
Particle Size (mm)	Percent Passing	Particle Size (mm)	Percent Passing	Particle Size (mm)	Percent Passing
50.0	100.00	4.75	100.00	0.0750	97.51
37.5	100.00	2.00	100.00	0.0554	90.01
25.0	100.00	0.850	99.61	0.0398	86.88
19.0	100.00	0.425	99.19	0.0285	83.52
12.5	100.00	0.180	98.54	0.0183	80.08
9.50	100.00	0.150	98.42	0.0145	78.90
4.75	100.00	0.075	97.51	0.0106	78.35
				0.0075	77.80
				0.0054	74.89
				0.0038	71.99
				0.0026	66.97
				0.0020	63.13
				0.0012	54.30





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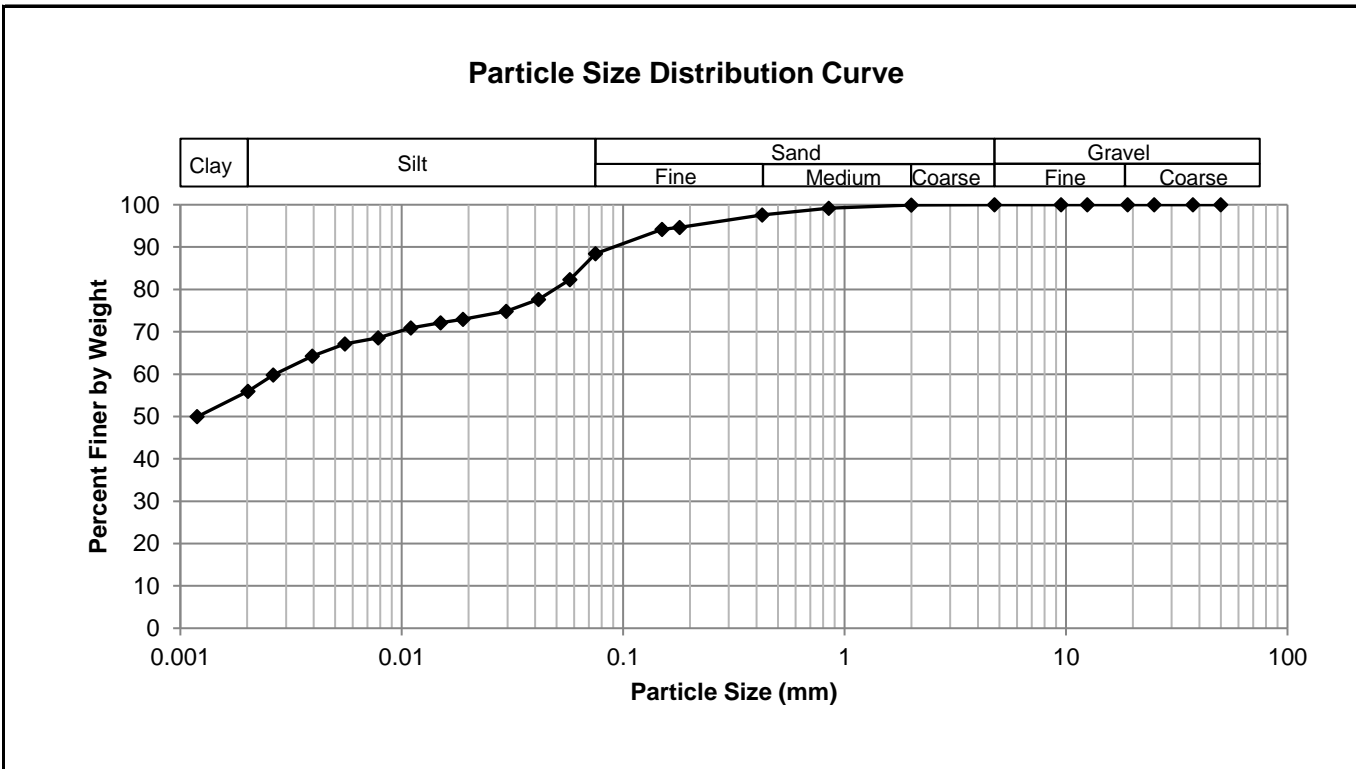
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**AASHTO T 88**

**Project No.** 0035-082-00-403  
**Client** Morrison Hershfield  
**Project** 19-C-10 Pavement Renewal - Sargent Ave



**Test Hole** TH19-07  
**Sample #** G37  
**Depth (m)** 0.8 - 0.9  
**Sample Date** 10-Oct-19  
**Test Date** 23-Oct-19  
**Technician** AFK

<b>Gravel</b>	0.0%
<b>Sand</b>	11.6%
<b>Silt</b>	32.6%
<b>Clay</b>	55.8%



Gravel		Sand		Silt and Clay	
Particle Size (mm)	Percent Passing	Particle Size (mm)	Percent Passing	Particle Size (mm)	Percent Passing
50.0	100.00	4.75	100.00	0.0750	88.42
37.5	100.00	2.00	99.95	0.0574	82.34
25.0	100.00	0.850	99.20	0.0415	77.66
19.0	100.00	0.425	97.57	0.0297	74.84
12.5	100.00	0.180	94.65	0.0189	72.97
9.50	100.00	0.150	94.19	0.0150	72.10
4.75	100.00	0.075	88.42	0.0110	70.91
				0.0078	68.54
				0.0055	67.11
				0.0039	64.25
				0.0026	59.82
				0.0020	55.95
				0.0012	49.95



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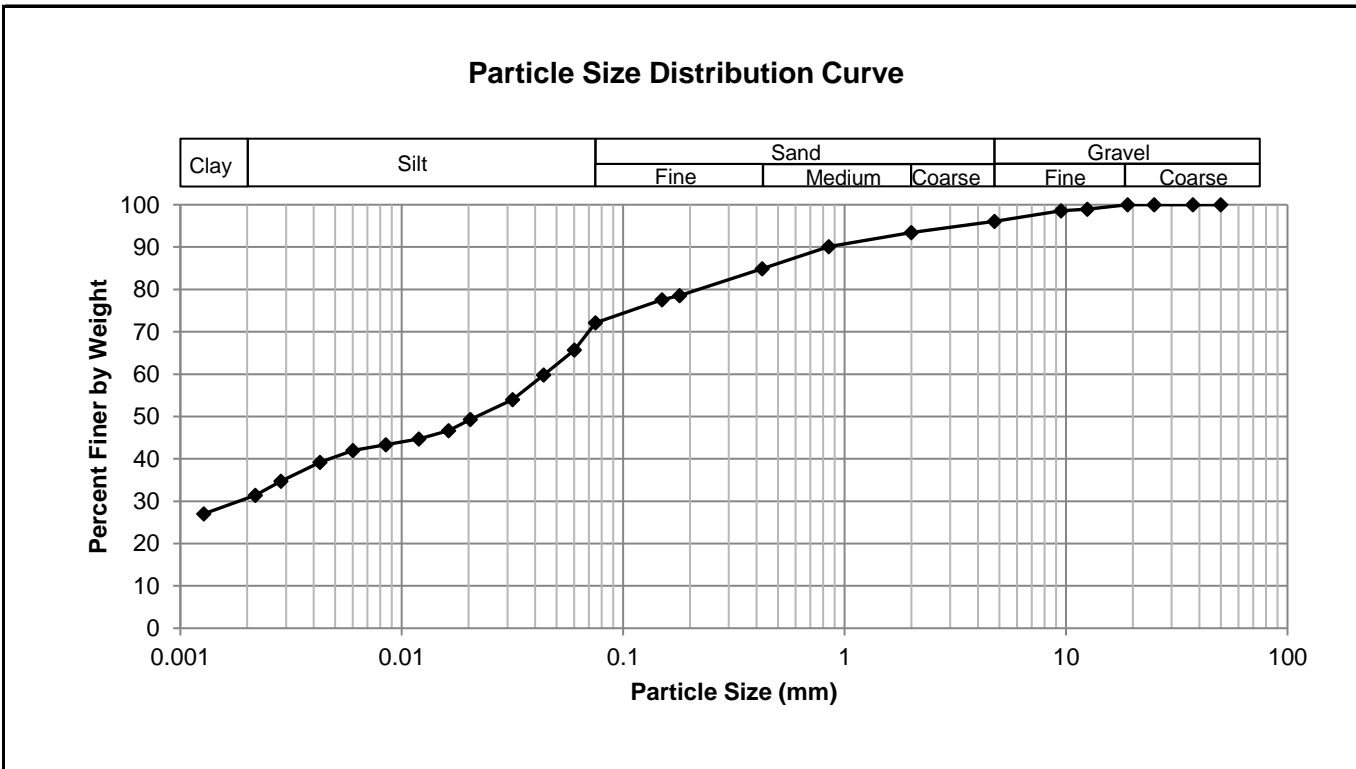
**Grain Size Analysis (Hydrometer Method)**  
**AASHTO T 88**

**Project No.** 0035-082-00-403  
**Client** Morrison Hershfield  
**Project** 19-C-10 Pavement Renewal - Sargent Ave



**Test Hole** TH19-11  
**Sample #** G61  
**Depth (m)** 0.6 - 0.8  
**Sample Date** 10-Oct-19  
**Test Date** 23-Oct-19  
**Technician** AFK

<b>Gravel</b>	3.9%
<b>Sand</b>	24.0%
<b>Silt</b>	41.6%
<b>Clay</b>	30.5%



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	96.09	0.0750	72.11
37.5	100.00	2.00	93.42	0.0603	65.68
25.0	100.00	0.850	90.11	0.0437	59.84
19.0	100.00	0.425	84.88	0.0317	54.00
12.5	98.97	0.180	78.55	0.0204	49.32
9.50	98.54	0.150	77.58	0.0163	46.69
4.75	96.09	0.075	72.11	0.0120	44.70
				0.0085	43.34
				0.0060	41.99
				0.0043	39.22
				0.0028	34.75
				0.0022	31.40
				0.0013	27.02



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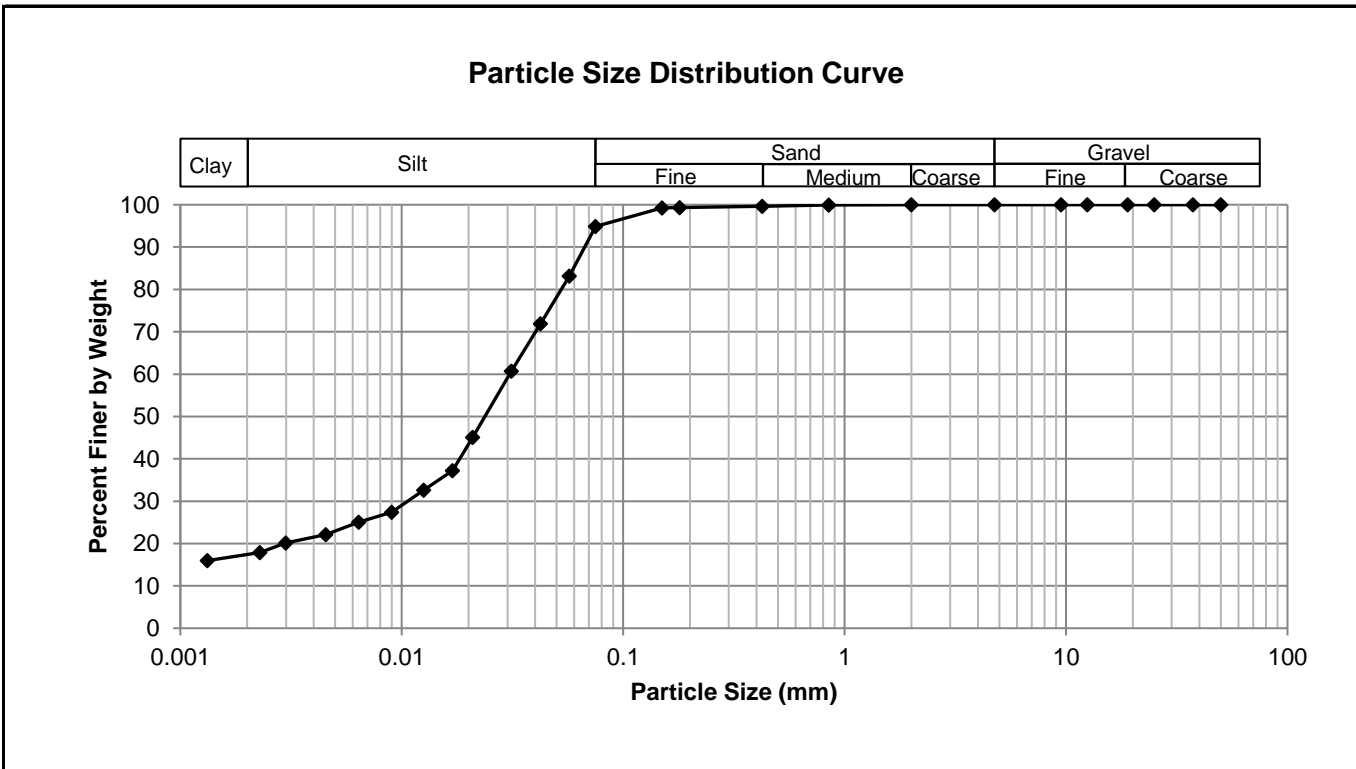
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**AASHTO T 88**

**Project No.** 0035-082-00-403  
**Client** Morrison Hershfield  
**Project** 19-C-10 Pavement Renewal - Sargent Ave



**Test Hole** TH19-03  
**Sample #** G74  
**Depth (m)** 0.9 - 1.1  
**Sample Date** 10-Oct-19  
**Test Date** 23-Oct-19  
**Technician** AFK

<b>Gravel</b>	0.0%
<b>Sand</b>	5.1%
<b>Silt</b>	79.3%
<b>Clay</b>	15.6%



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	94.90
37.5	100.00	2.00	100.00	0.0571	83.14
25.0	100.00	0.850	99.91	0.0424	71.89
19.0	100.00	0.425	99.65	0.0313	60.70
12.5	100.00	0.180	99.33	0.0209	45.06
9.50	100.00	0.150	99.27	0.0170	37.25
4.75	100.00	0.075	94.90	0.0126	32.62
				0.0090	27.37
				0.0064	25.07
				0.0045	22.14
				0.0030	20.15
				0.0023	17.84
				0.0013	15.96



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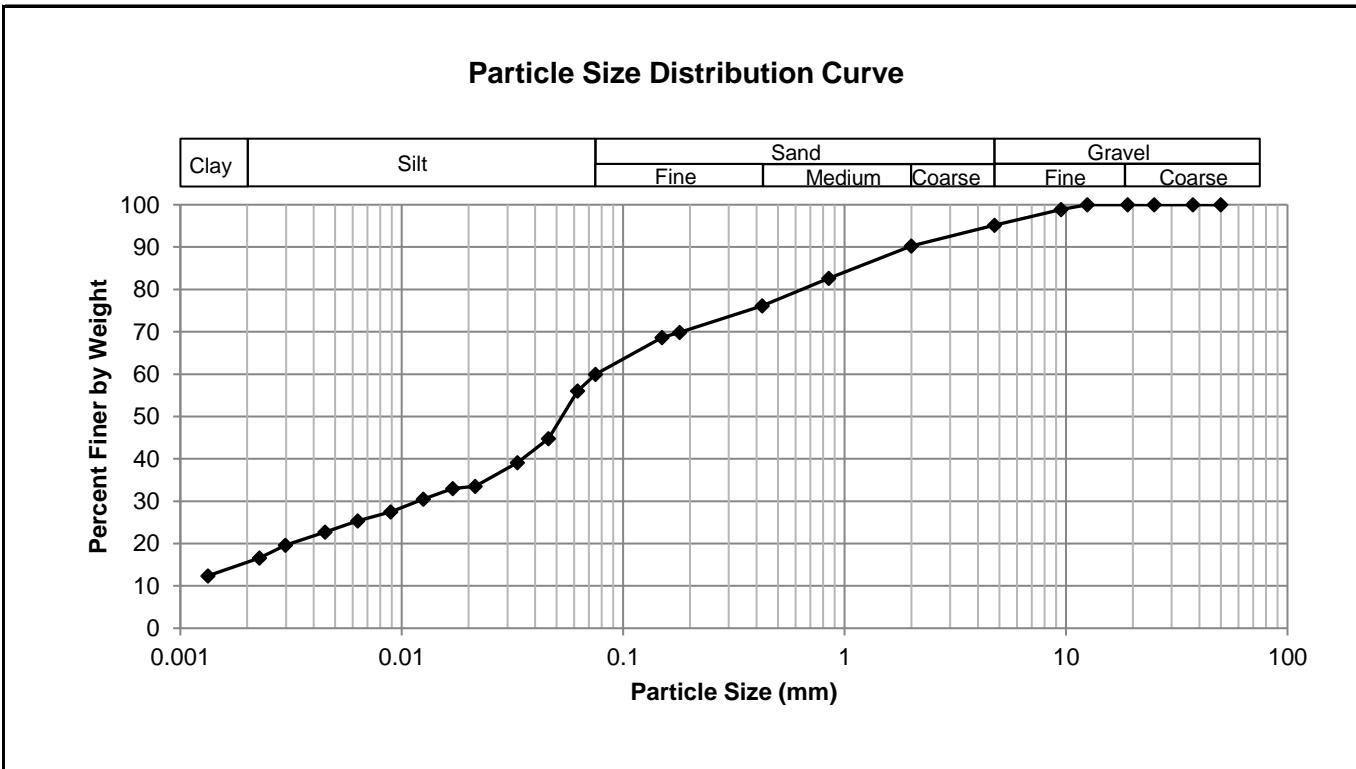
**Grain Size Analysis (Hydrometer Method)**  
**AASHTO T 88**

**Project No.** 0035-082-00-403  
**Client** Morrison Hershfield  
**Project** 19-C-10 Pavement Renewal - Sargent Ave



**Test Hole** TH19-01  
**Sample #** G78  
**Depth (m)** 0.3 - 0.5  
**Sample Date** 10-Oct-19  
**Test Date** 23-Oct-19  
**Technician** AFK

<b>Gravel</b>	4.8%
<b>Sand</b>	35.2%
<b>Silt</b>	44.6%
<b>Clay</b>	15.4%



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	95.17	0.0750	59.95
37.5	100.00	2.00	90.27	0.0622	56.05
25.0	100.00	0.850	82.61	0.0461	44.76
19.0	100.00	0.425	76.15	0.0333	39.11
12.5	100.00	0.180	69.89	0.0215	33.54
9.50	98.88	0.150	68.65	0.0170	32.97
4.75	95.17	0.075	59.95	0.0125	30.50
				0.0089	27.46
				0.0063	25.34
				0.0045	22.72
				0.0030	19.60
				0.0023	16.63
				0.0013	12.39



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

**Project No.** 0035-82-00-403  
**Client** Morrison Hershfield  
**Project** 19-C-10 Pavement Renewal - Sargent Ave

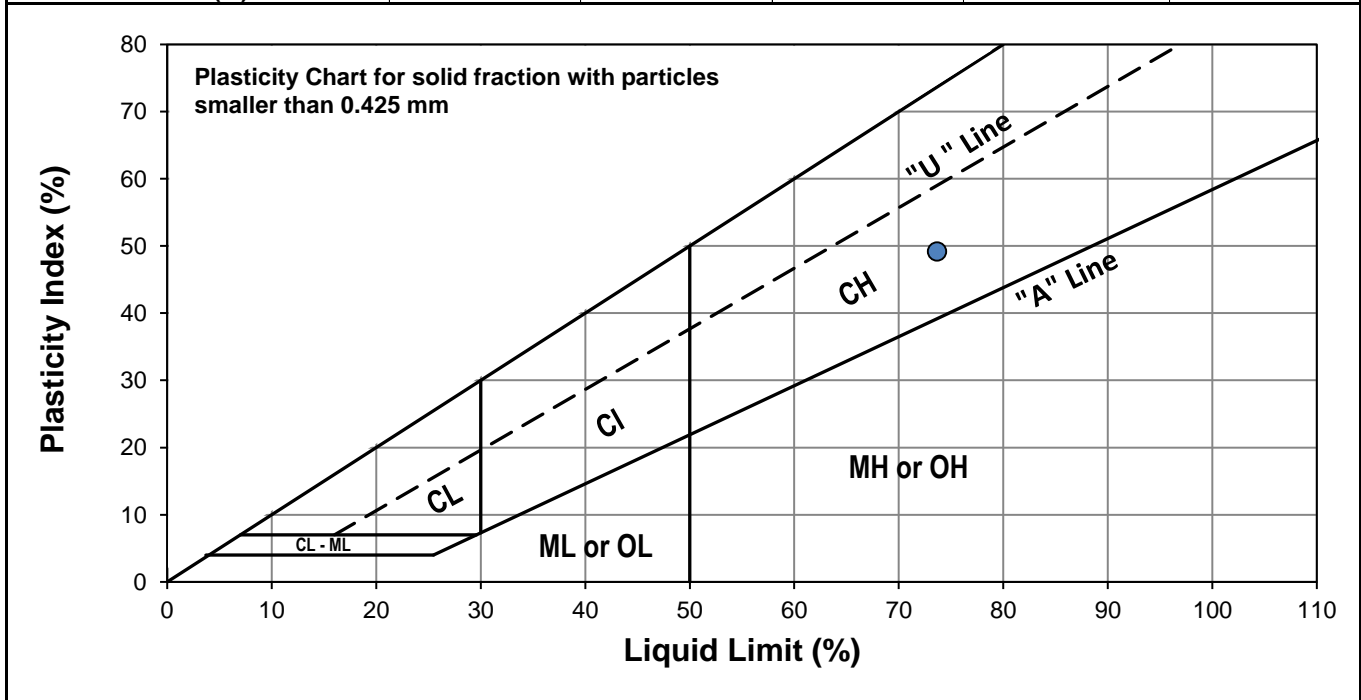


**Test Hole** TH19-14  
**Sample #** G02  
**Depth (m)** 0.6 - 0.8  
**Sample Date** 10-Oct-19  
**Test Date** 23-Oct-19  
**Technician** HS

<b>Liquid Limit</b>	74
<b>Plastic Limit</b>	24
<b>Plasticity Index</b>	49

**Liquid Limit**

Trial #	1	2	3
<b>Number of Blows (N)</b>	19	21	32
<b>Mass Wet Soil + Tare (g)</b>	27.544	28.680	25.630
<b>Mass Dry Soil + Tare (g)</b>	21.605	22.326	20.818
<b>Mass Tare (g)</b>	14.031	14.031	13.889
<b>Mass Water (g)</b>	5.939	6.354	4.812
<b>Mass Dry Soil (g)</b>	7.574	8.295	6.929
<b>Moisture Content (%)</b>	78.413	76.600	69.447



**Plastic Limit**

Trial #	1	2	3	4	5
<b>Mass Tare (g)</b>	13.961	14.150			
<b>Mass Wet Soil + Tare (g)</b>	20.411	23.424			
<b>Mass Dry Soil + Tare (g)</b>	19.146	21.593			
<b>Mass Water (g)</b>	1.265	1.831			
<b>Mass Dry Soil (g)</b>	5.185	7.443			
<b>Moisture Content (%)</b>	24.397	24.600			



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**Project No.** 0035-82-00-403  
**Client** Morrison Hershfield  
**Project** 19-C-10 Pavement Renewal - Sargent Ave

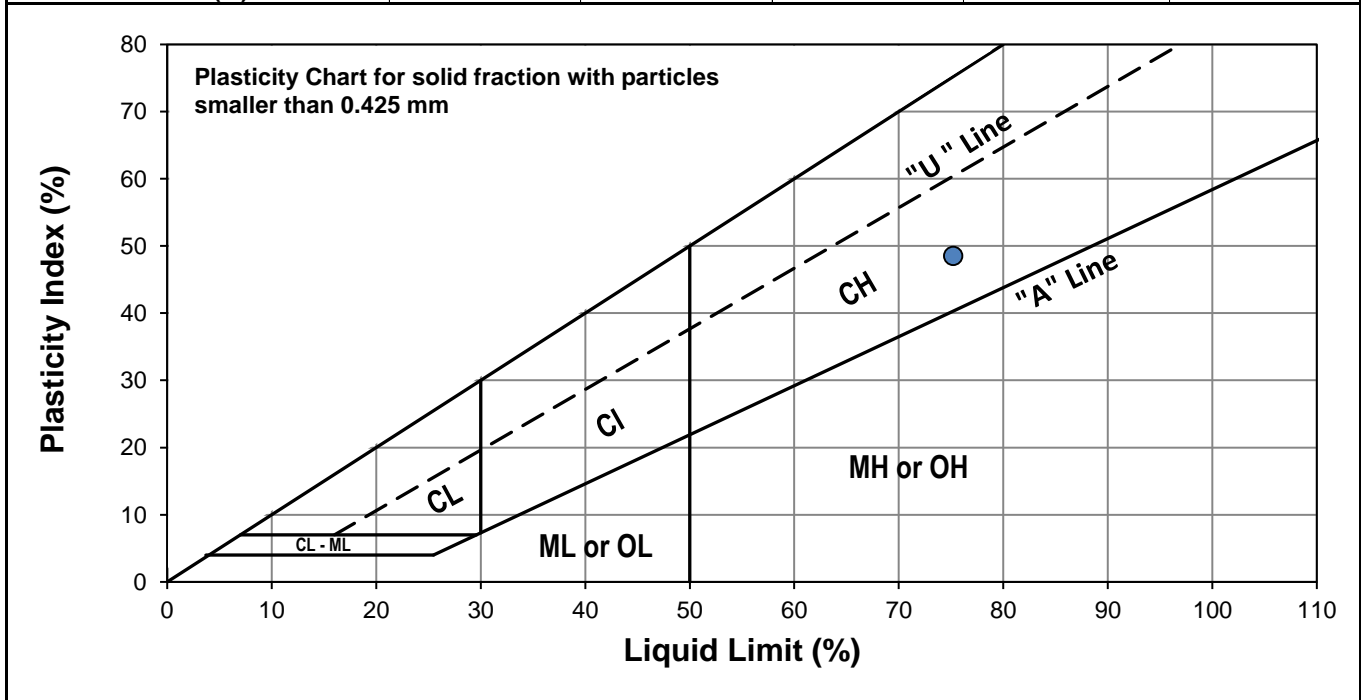


**Test Hole** TH19-07  
**Sample #** G37  
**Depth (m)** 0.8 - 0.9  
**Sample Date** 10-Oct-19  
**Test Date** 23-Oct-19  
**Technician** HS

<b>Liquid Limit</b>	75
<b>Plastic Limit</b>	27
<b>Plasticity Index</b>	49

**Liquid Limit**

Trial #	1	2	3
<b>Number of Blows (N)</b>	17	23	34
<b>Mass Wet Soil + Tare (g)</b>	31.046	29.434	29.430
<b>Mass Dry Soil + Tare (g)</b>	23.414	22.727	22.976
<b>Mass Tare (g)</b>	13.677	13.896	14.085
<b>Mass Water (g)</b>	7.632	6.707	6.454
<b>Mass Dry Soil (g)</b>	9.737	8.831	8.891
<b>Moisture Content (%)</b>	78.381	75.948	72.590



**Plastic Limit**

Trial #	1	2	3	4	5
<b>Mass Tare (g)</b>	14.260	14.121			
<b>Mass Wet Soil + Tare (g)</b>	22.170	21.610			
<b>Mass Dry Soil + Tare (g)</b>	20.497	20.041			
<b>Mass Water (g)</b>	1.673	1.569			
<b>Mass Dry Soil (g)</b>	6.237	5.920			
<b>Moisture Content (%)</b>	26.824	26.503			



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**Project** 19-C-10 Pavement Renewal - Sargent Ave

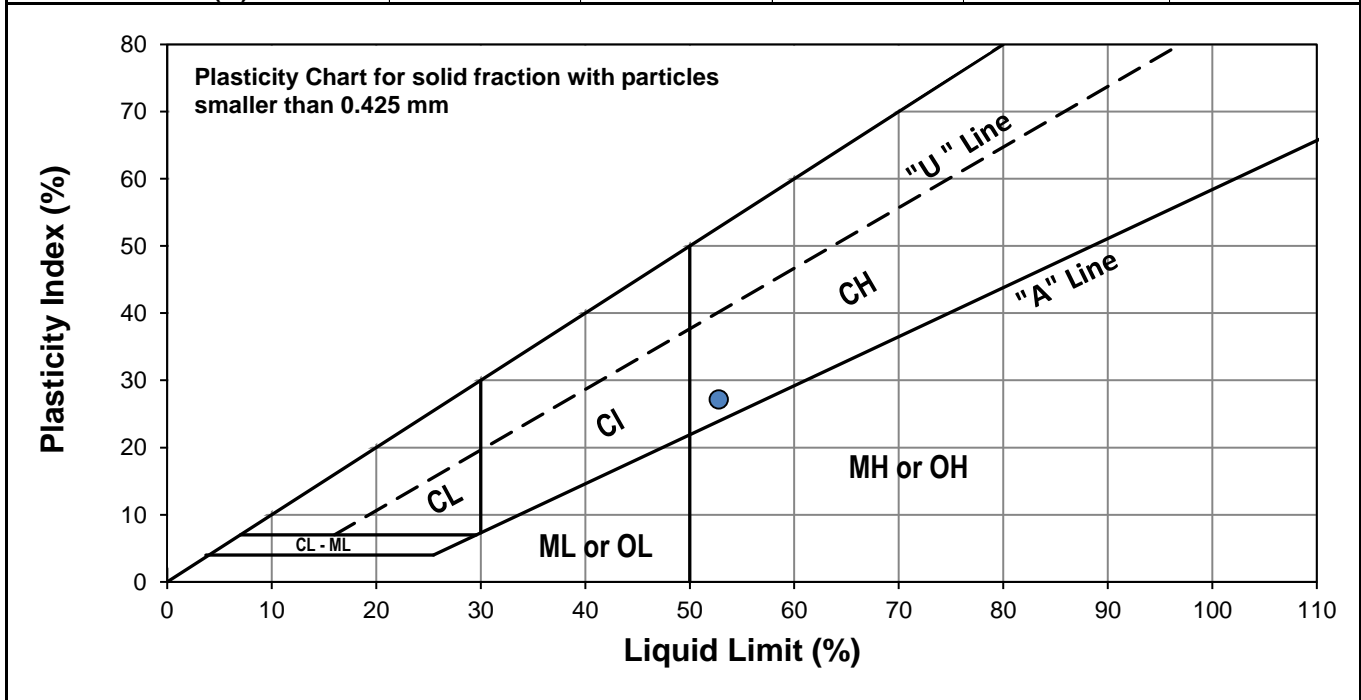


**Test Hole** TH19-11  
**Sample #** G61  
**Depth (m)** 0.6 - 0.8  
**Sample Date** 10-Oct-19  
**Test Date** 23-Oct-19  
**Technician** HS

<b>Liquid Limit</b>	53
<b>Plastic Limit</b>	26
<b>Plasticity Index</b>	27

**Liquid Limit**

Trial #	1	2	3
<b>Number of Blows (N)</b>	21	27	34
<b>Mass Wet Soil + Tare (g)</b>	27.358	30.620	34.765
<b>Mass Dry Soil + Tare (g)</b>	22.742	24.972	27.829
<b>Mass Tare (g)</b>	14.230	14.146	14.001
<b>Mass Water (g)</b>	4.616	5.648	6.936
<b>Mass Dry Soil (g)</b>	8.512	10.826	13.828
<b>Moisture Content (%)</b>	54.229	52.171	50.159



**Plastic Limit**

Trial #	1	2	3	4	5
<b>Mass Tare (g)</b>	14.290	14.197			
<b>Mass Wet Soil + Tare (g)</b>	23.512	21.570			
<b>Mass Dry Soil + Tare (g)</b>	21.612	20.082			
<b>Mass Water (g)</b>	1.900	1.488			
<b>Mass Dry Soil (g)</b>	7.322	5.885			
<b>Moisture Content (%)</b>	25.949	25.285			



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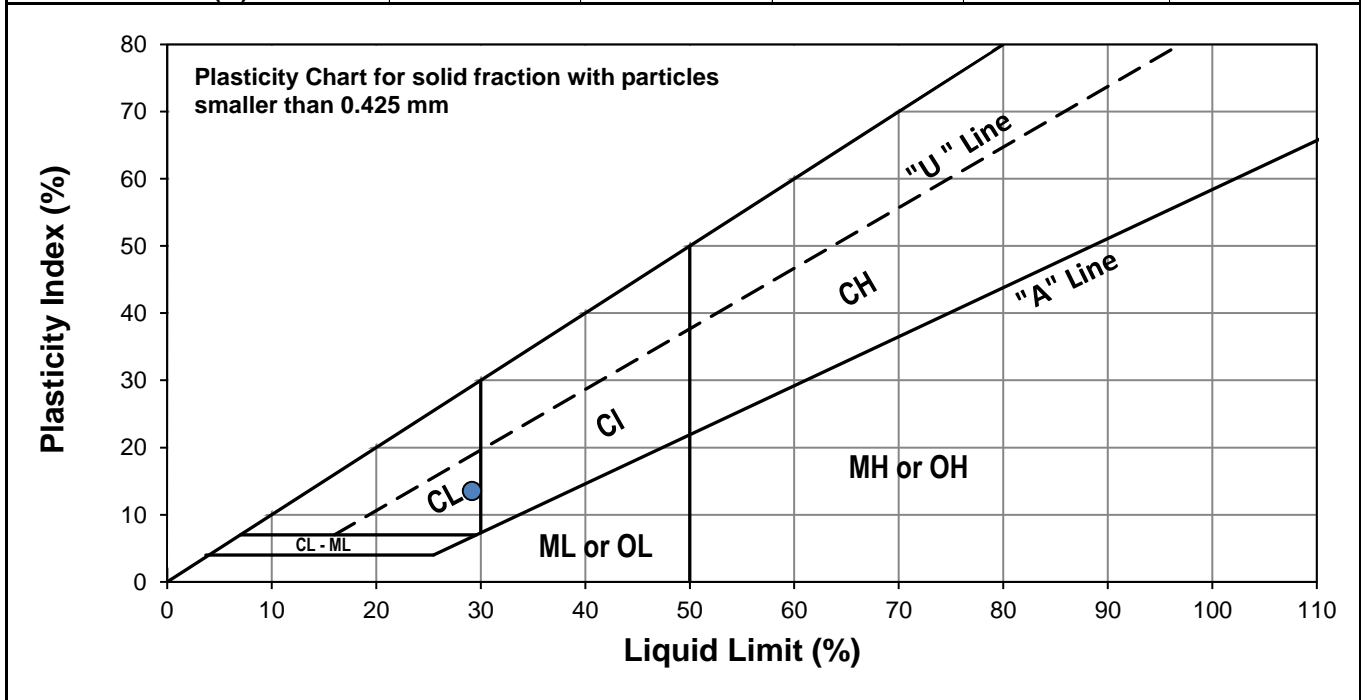


**Test Hole** TH19-03  
**Sample #** G74  
**Depth (m)** 0.9 - 1.1  
**Sample Date** 10-Oct-19  
**Test Date** 23-Oct-19  
**Technician** HS

<b>Liquid Limit</b>	29
<b>Plastic Limit</b>	16
<b>Plasticity Index</b>	14

**Liquid Limit**

Trial #	1	2	3
<b>Number of Blows (N)</b>	15	20	30
<b>Mass Wet Soil + Tare (g)</b>	36.251	36.298	33.447
<b>Mass Dry Soil + Tare (g)</b>	31.077	31.241	29.138
<b>Mass Tare (g)</b>	14.105	14.120	14.167
<b>Mass Water (g)</b>	5.174	5.057	4.309
<b>Mass Dry Soil (g)</b>	16.972	17.121	14.971
<b>Moisture Content (%)</b>	30.486	29.537	28.782



**Plastic Limit**

Trial #	1	2	3	4	5
<b>Mass Tare (g)</b>	14.257	14.189			
<b>Mass Wet Soil + Tare (g)</b>	22.328	21.351			
<b>Mass Dry Soil + Tare (g)</b>	21.238	20.383			
<b>Mass Water (g)</b>	1.090	0.968			
<b>Mass Dry Soil (g)</b>	6.981	6.194			
<b>Moisture Content (%)</b>	15.614	15.628			





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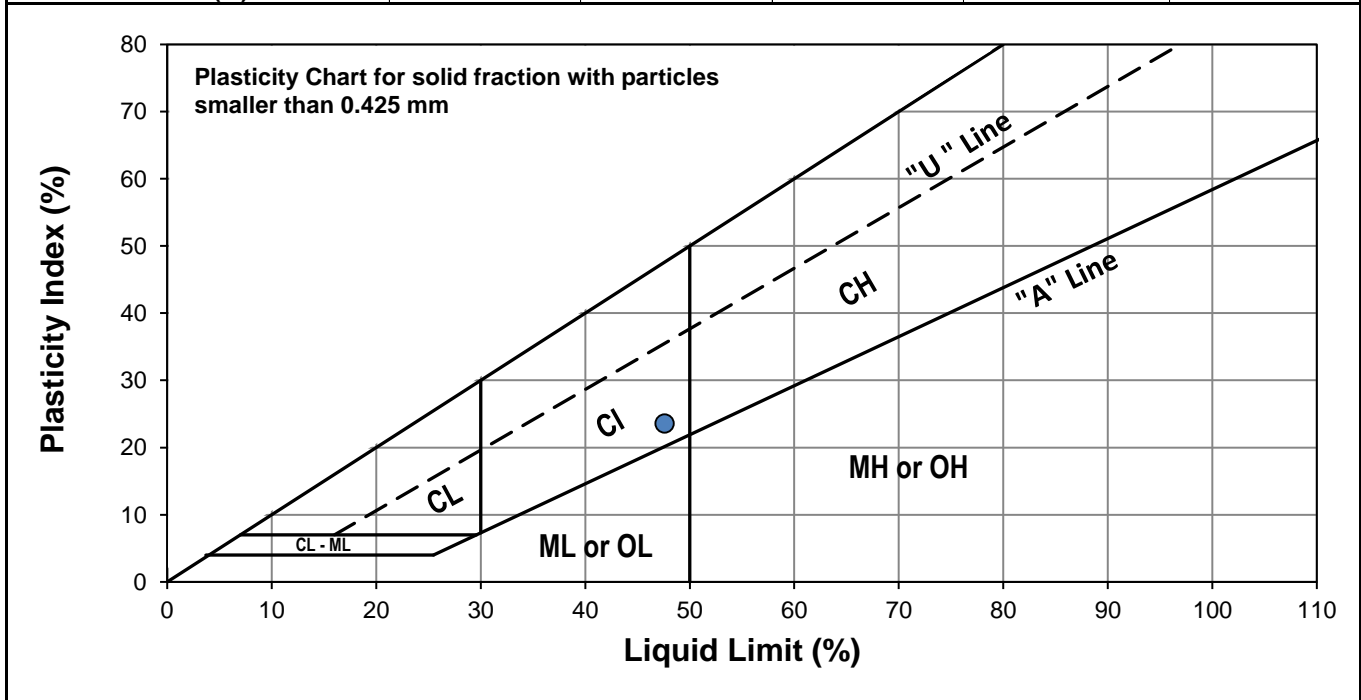


**Test Hole** TH19-01  
**Sample #** G78  
**Depth (m)** 0.3 - 0.5  
**Sample Date** 10-Oct-19  
**Test Date** 23-Oct-19  
**Technician** HS

<b>Liquid Limit</b>	48
<b>Plastic Limit</b>	24
<b>Plasticity Index</b>	24

**Liquid Limit**

Trial #	1	2	3
<b>Number of Blows (N)</b>	18	23	34
<b>Mass Wet Soil + Tare (g)</b>	32.089	29.785	36.125
<b>Mass Dry Soil + Tare (g)</b>	26.127	24.715	29.242
<b>Mass Tare (g)</b>	14.134	14.209	14.122
<b>Mass Water (g)</b>	5.962	5.070	6.883
<b>Mass Dry Soil (g)</b>	11.993	10.506	15.120
<b>Moisture Content (%)</b>	49.712	48.258	45.522



**Plastic Limit**

Trial #	1	2	3	4	5
<b>Mass Tare (g)</b>	14.232	14.117			
<b>Mass Wet Soil + Tare (g)</b>	21.509	21.688			
<b>Mass Dry Soil + Tare (g)</b>	20.102	20.217			
<b>Mass Water (g)</b>	1.407	1.471			
<b>Mass Dry Soil (g)</b>	5.870	6.100			
<b>Moisture Content (%)</b>	23.969	24.115			



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**Standard Proctor Compaction Test**  
**ASTM D698-12e2**

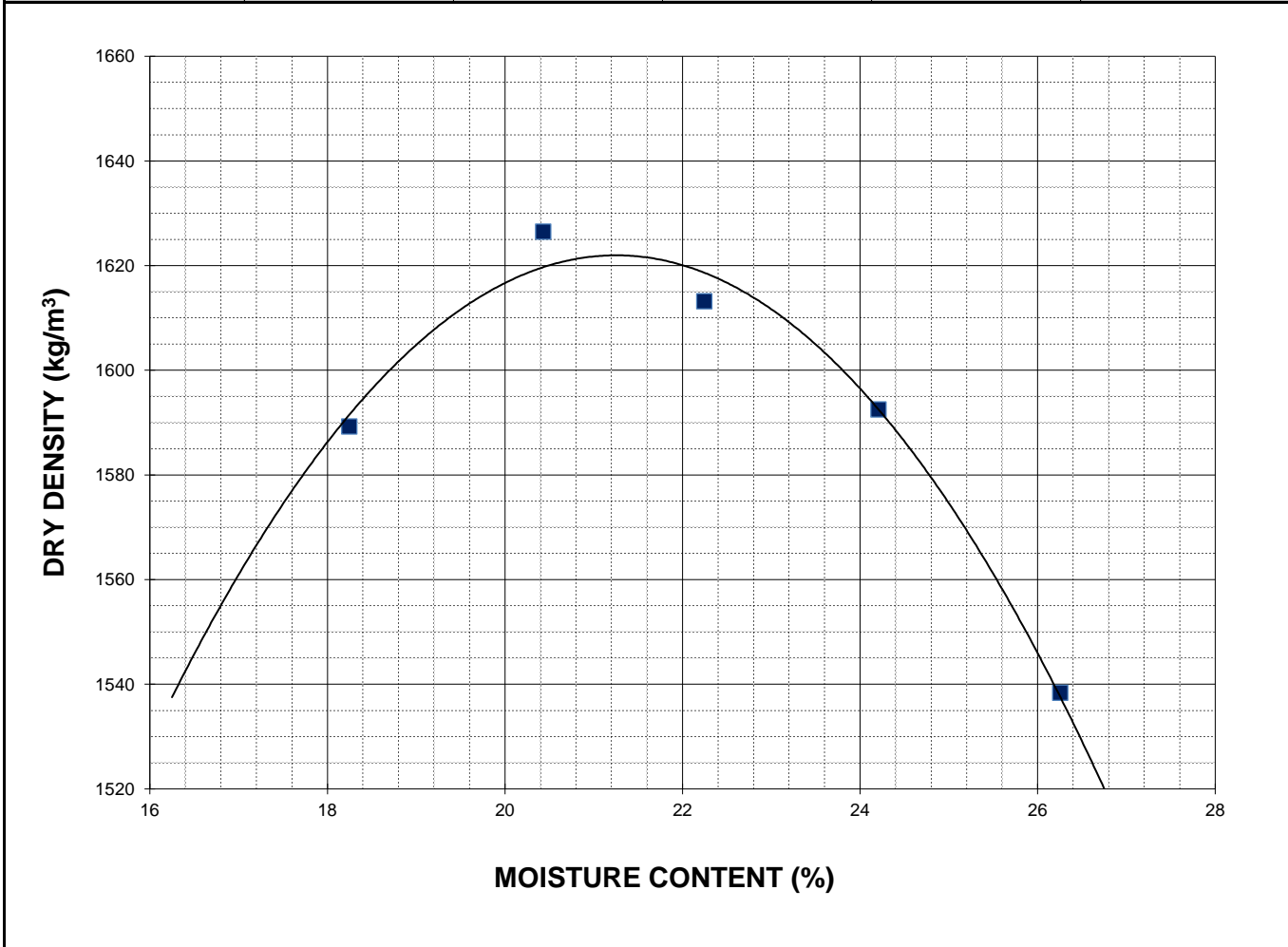
**Project No.** 0035-082-00-403  
**Client** Morrison Hershfield  
**Project** 19-C-10 Pavement Renewal - Sargent Ave



**Sample #** Bulk (TH19-01 & TH19-04)  
**Source** TH19-01 & TH19-04  
**Material** Clay  
**Sample Date** 10-Oct-19  
**Test Date** 27-Oct-19  
**Technician** HS

<b>Maximum Dry Density (kg/m<sup>3</sup>)</b>	1622
<b>Optimum Moisture (%)</b>	21.3

Trial Number	1	2	3	4	5
<b>Wet Density (kg/m<sup>3</sup>)</b>	1879	1959	1972	1978	1942
<b>Dry Density (kg/m<sup>3</sup>)</b>	1589	1627	1613	1593	1538
<b>Moisture Content (%)</b>	18.2	20.4	22.2	24.2	26.3





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# Standard Proctor Compaction Test

ASTM D698-12e2

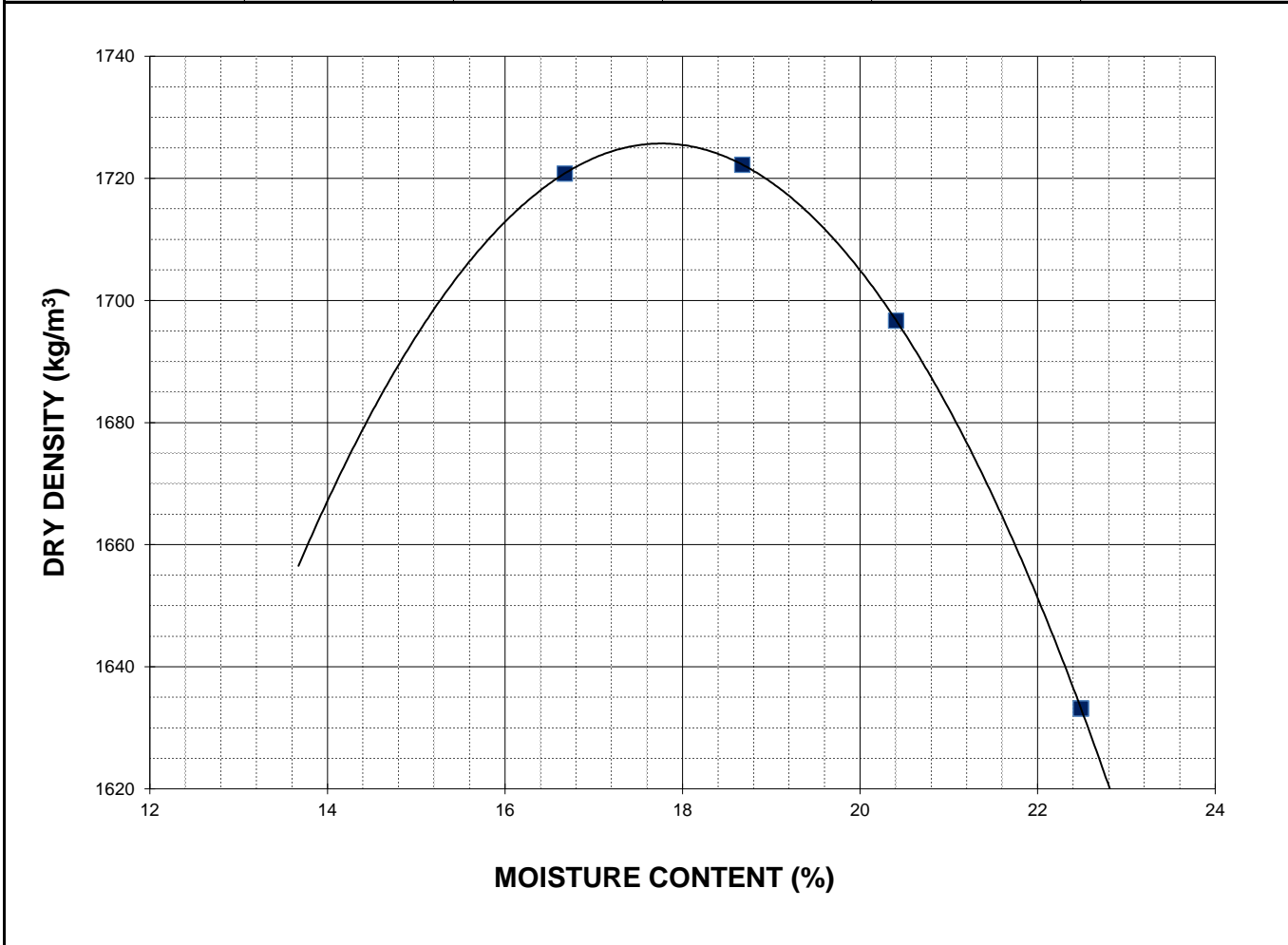
**Project No.** 0035-082-00-403  
**Client** Morrison Hershfield  
**Project** 19-C-10 Pavement Renewal - Sargent Ave



**Sample #** Bulk TH19-03  
**Source** TH19-03  
**Material** Silt and Clay  
**Sample Date** 10-Oct-19  
**Test Date** 26-Oct-19  
**Technician** HS

<b>Maximum Dry Density (kg/m<sup>3</sup>)</b>	1726
<b>Optimum Moisture (%)</b>	17.8

Trial Number	1	2	3	4	
Wet Density (kg/m <sup>3</sup> )	2008	2044	2043	2000	
Dry Density (kg/m <sup>3</sup> )	1721	1722	1697	1633	
Moisture Content (%)	16.7	18.7	20.4	22.5	





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# Standard Proctor Compaction Test

ASTM D698-12e2

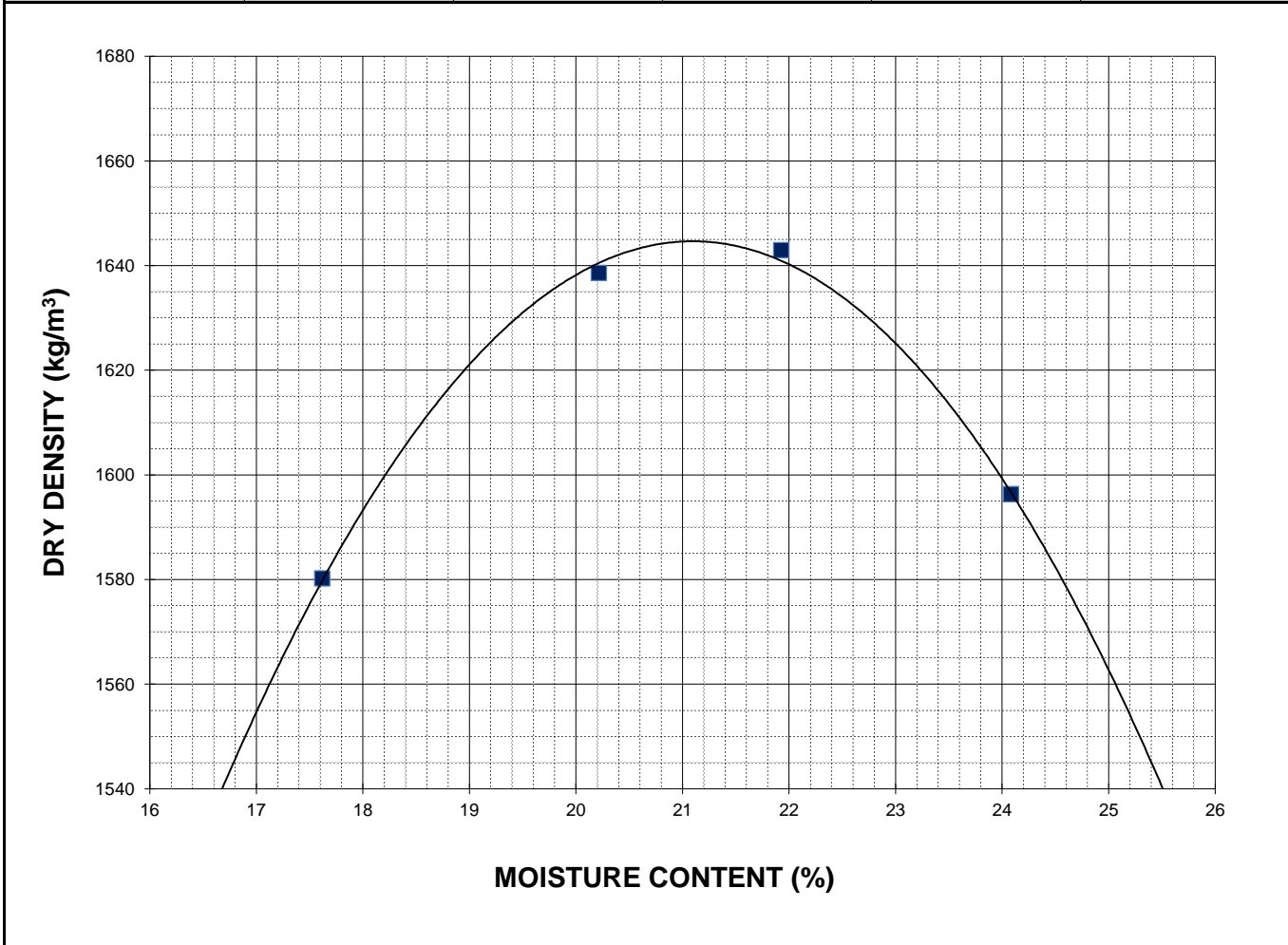
**Project No.** 0035-082-00-403  
**Client** Morrison Hershfield  
**Project** 19-C-10 Pavement Renewal - Sargent Ave



**Sample #** Bulk TH19-05  
**Source** TH19-05  
**Material** Silt and Clay  
**Sample Date** 10-Oct-19  
**Test Date** 26-Oct-19  
**Technician** HS

<b>Maximum Dry Density (kg/m<sup>3</sup>)</b>	1645
<b>Optimum Moisture (%)</b>	21.1

Trial Number	1	2	3	4	
Wet Density (kg/m <sup>3</sup> )	1859	1970	2003	1981	
Dry Density (kg/m <sup>3</sup> )	1580	1639	1643	1596	
Moisture Content (%)	17.6	20.2	21.9	24.1	





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**California Bearing Ratio Test Data Sheet**  
**ASTM D1883-16**

<b>Project No.</b>	0035-082-00-403	<b>Source</b>	TH19-01 & TH19-04
<b>Client</b>	Morrison Hershfield	<b>Material</b>	Silt, Sand and Clay
<b>Project</b>	19-C-10 Pavement Renewal - Sargen	<b>Sample Date</b>	2019-10-03
<b>Sample #</b>		<b>Test Date</b>	2019-11-07
		<b>Technician</b>	BMH

**Proctor Results (ASTM D698)**

Maximum Dry Density	1622 kg/m <sup>3</sup>
Optimum Moisture Content	21.3 %
Material Retained on 19 mm Sieve	0.0 %

**CBR Sample Compaction**

Dry Density	1527 kg/m <sup>3</sup>
Initial Moisture Content	25.8 %
Relative Density	94.1 % SPMD

**Soaking Results**

Surcharge	4.54 kg
Swell	0.1 %
Moisture Content in top 25 mm	26.5 %
Immersion Period	96 h

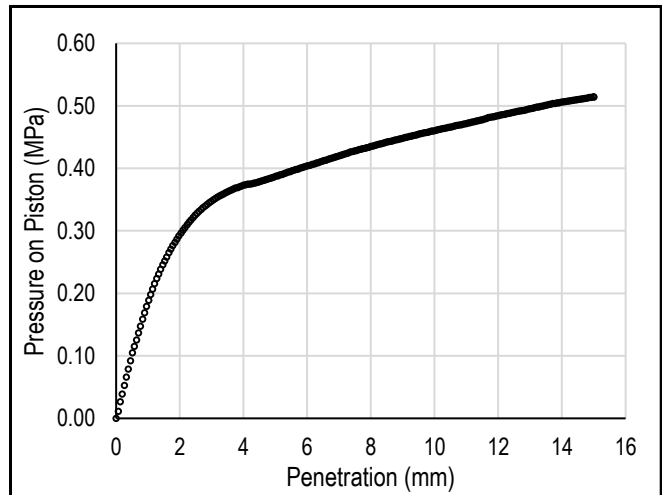
**CBR Results**

CBR at 2.54 mm	4.8 %
CBR at 5.08 mm	3.8 %
Zero Correction	0 mm

**Test Data**

Penetration (mm)	Measured Pressure (MPa)	Corrected Pressure (MPa)
0.64	0.13	0.13
1.27	0.22	0.22
1.91	0.29	0.29
2.54	0.33	0.33
3.18	0.35	0.35
3.81	0.37	0.37
4.45	0.38	0.38
5.08	0.39	0.39
7.62	0.43	0.43
10.16	0.46	0.46
12.70	0.49	0.49

**Load/Penetration Curve**



**Comments:**



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**California Bearing Ratio Test Data Sheet**  
**ASTM D1883-16**

<b>Project No.</b>	0035-082-00-403	<b>Source</b>	TH19-03
<b>Client</b>	Morrison Hershfield	<b>Material</b>	Silt and Clay
<b>Project</b>	19-C-10 Pavement Renewal - Sargen	<b>Sample Date</b>	2019-10-03
<b>Sample #</b>		<b>Test Date</b>	2019-11-07
		<b>Technician</b>	BMH

**Proctor Results (ASTM D698)**

Maximum Dry Density	1726 kg/m <sup>3</sup>
Optimum Moisture Content	17.8 %
Material Retained on 19 mm Sieve	0.0 %

**CBR Sample Compaction**

Dry Density	1651 kg/m <sup>3</sup>
Initial Moisture Content	20.9 %
Relative Density	95.6 % SPMD

**Soaking Results**

Surcharge	4.54 kg
Swell	0.1 %
Moisture Content in top 25 mm	21.7 %
Immersion Period	96 h

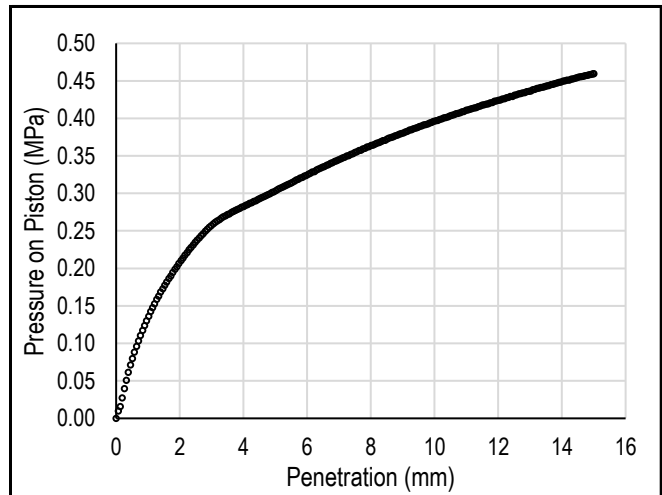
**CBR Results**

CBR at 2.54 mm	3.4 %
CBR at 5.08 mm	3.0 %
Zero Correction	0 mm

**Test Data**

Penetration (mm)	Measured Pressure (MPa)	Corrected Pressure (MPa)
0.64	0.10	0.10
1.27	0.16	0.16
1.91	0.20	0.20
2.54	0.24	0.24
3.18	0.26	0.26
3.81	0.28	0.28
4.45	0.29	0.29
5.08	0.31	0.31
7.62	0.36	0.36
10.16	0.40	0.40
12.70	0.43	0.43

**Load/Penetration Curve**



**Comments:**



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**California Bearing Ratio Test Data Sheet**  
**ASTM D1883-16**

<b>Project No.</b>	0035-082-00-403	<b>Source</b>	TH19-05
<b>Client</b>	Morrison Hershfield	<b>Material</b>	Silt and Clay
<b>Project</b>	19-C-10 Pavement Renewal - Sargen	<b>Sample Date</b>	2019-10-03
<b>Sample #</b>		<b>Test Date</b>	2019-11-04
		<b>Technician</b>	SB

**Proctor Results (ASTM D698)**

Maximum Dry Density	1645 kg/m <sup>3</sup>
Optimum Moisture Content	21.1 %
Material Retained on 19 mm Sieve	0.0 %

**CBR Sample Compaction**

Dry Density	1580 kg/m <sup>3</sup>
Initial Moisture Content	21.3 %
Relative Density	96.1 % SPMD

**Soaking Results**

Surcharge	4.54 kg
Swell	0.7 %
Moisture Content in top 25 mm	26.9 %
Immersion Period	96 h

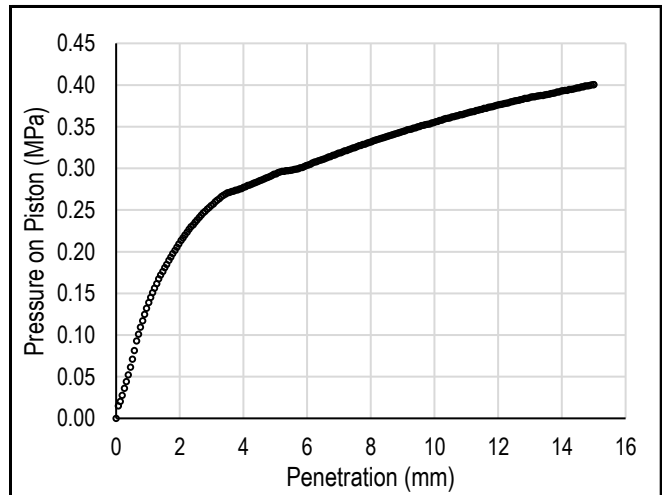
**CBR Results**

CBR at 2.54 mm	3.5 %
CBR at 5.08 mm	2.9 %
Zero Correction	0 mm

**Test Data**

Penetration (mm)	Measured Pressure (MPa)	Corrected Pressure (MPa)
0.64	0.09	0.09
1.27	0.16	0.16
1.91	0.21	0.21
2.54	0.24	0.24
3.18	0.26	0.26
3.81	0.27	0.27
4.45	0.28	0.28
5.08	0.30	0.30
7.62	0.33	0.33
10.16	0.36	0.36
12.70	0.38	0.38

**Load/Penetration Curve**



**Comments:**

## **Appendix C**

### **Photographs of Pavement Core Samples**

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Photo 1: Pavement Core Sample at Test Hole TH19-01



Photo 2: Pavement Core Sample at Test Hole TH19-02



Photo 3: Pavement Core Sample at Test Hole TH19-03



Photo 4: Pavement Core Sample at Test Hole TH19-04



Photo 5: Pavement Core Sample at Test Hole TH19-05



Photo 6: Pavement Core Sample at Test Hole TH19-06





Photo 7: Pavement Core Sample at Test Hole TH19-07



Photo 8: Pavement Core Sample at Test Hole TH19-08

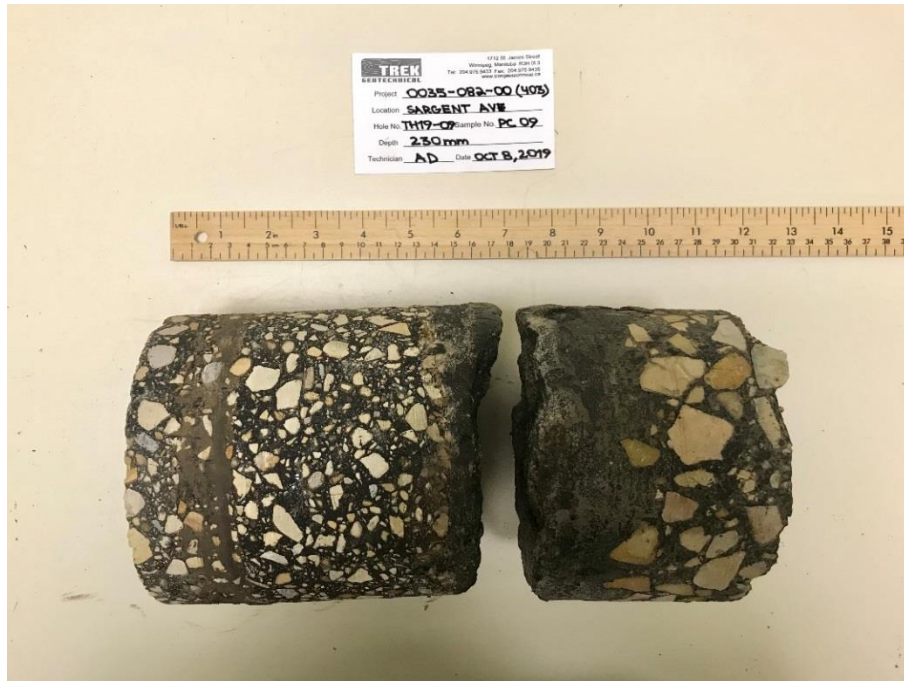


Photo 9: Pavement Core Sample at Test Hole TH19-09



Photo 10: Pavement Core Sample at Test Hole TH19-10



Photo 11: Pavement Core Sample at Test Hole TH19-11A



Photo 12: Pavement Core Sample at Test Hole TH19-11B





Photo 13: Pavement Core Sample at Test Hole TH19-12



Photo 14: Pavement Core Sample at Test Hole TH19-13



Photo 15: Pavement Core Sample at Test Hole TH19-14



Photo 16: Pavement Core Sample at Test Hole TH19-15