APPENDIX 'A'

GEOTECHNICAL REPORT

Quality Engineering | Valued Relationships

WSP Canada Group Ltd

19-C-09 Pavement Renewal - Munroe Ave and Johnson Ave

Prepared for:

WSP Canada Group Ltd.
111-93 Lombard Ave.
Winnipeg, MB R3B
Attention: Kelly Groff. P. Eng.

Project Number:
0395 010 00 401

Date:
December 5, 2019
Final Report

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TREK GEOTECHNICAL

Quality Engineering | Valued Relationships

December 5, 2019

Our File No. 0395 010 00

Kelly Groff, P.Eng.
WSP Canada Group Ltd.
111-93 Lombard Avenue
Winnipeg, Manitoba, R3B 3B1

RE: Sub-Surface Investigation Report for
19-C-09 Pavement Renewal - Munroe Ave and Johnson Ave

TREK Geotechnical Inc. is pleased to submit our report for the sub-surface investigations for the 19-C-09 Pavement Renewal - Munroe Ave and Johnson Ave.

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	December 5, 2019	Final Report

Authorization Signatures

Prepared By:

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

PROVINCE OF MANITOBA
FERREIRA
Member
22892
REGISTERED PROFESSIONAL ENGINEER
Dec. 5, 2019

ENGINEERS GEOSCIENTISTS MANITOBA
Certificate of Authorization
TREK GEOTECHNICAL INC.
No. 4877 Date: Dec. 5, 2019

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-09 Pavement Renewal project. The test holes were completed along Munroe Ave and Johnson Ave. The information collected describes the pavement structure of the existing road as well as the soil stratigraphy beneath the pavement structure at the test hole locations.

2.0 Road Investigation and Laboratory Program

The investigation included coring of pavement and drilling of test holes. WSP selected the investigation locations as shown on Figure 01 and Figure 02 (attached) and Table 1 below summarizes the investigation program per street.

Table 1 Road Investigation Program

Street	# of Locations	Investigation
Munroe Ave. – Henderson Hwy to Raleigh St.	11	Pavement Cores and Test Holes
Johnson Ave. – Henderson Hwy to Levis St.	9	Pavement Cores and Test Holes

The road investigation was conducted between September 23, 2019 and November 5, 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. The test holes were drilled to a depth between 1.5 m and 1.8 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 Harsimran Singh 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 were not possible at some locations along Johnson Ave (7) and Munroe Ave (2) due to the poor condition of the concrete where the concrete broke down and crumbled.

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 and B). 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.

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 distance from the edge of pavement or other permanent features.

Three CBR's were completed on bulk samples of differing soil units and the results are shown in the Table 2 below.

Table 2 CBR Testing Summary

Sample Description	Test Hole	Depth (m)	SPMDD (kg/m³)	Opt. Moisture (%)	Percent Proctor (%)	Moisture Content (%)	CBR Value at 2.54 mm	CBR Value at 5.08 mm
Clay	TH19-22	0.6-1.5	1462	27.1	95.3	31.7	5.9%	4.2%
	TH19-27	0.6-1.5						
Silt	TH19-23	1.1-1.7	1812	16.5	96.1	19.3	3.0%	2.8%
	TH19-24	1.4-1.8						
	TH19-25	0.7-1.7						
	TH19-29	1.7-1.8						
Clay	TH19-26	0.7-1.6	1565	23.9	94.6	35.8	4.1%	3.1%
Clay	TH19-13	0.5-1.5	1459	27.9	94.2	31.8	4.4%	3.2%
	TH19-14	0.5-1.5						
Clay	TH19-15	0.5-1.2	1491	25.9	94.2	30.3	2.9%	2.1%
	TH19-16	0.5-1.5						
Silt	TH19-20	1.5-1.7	1818	15.4	96.2	18.8	2.0%	2.1%

* Testing completed on bulk samples and some bulk samples were combined to achieve samples sizes required for testing.

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 WSP Canada Group (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 50 100 150 200 250 m
SCALE = 1 : 5 000 (279 mm x 432 mm)

LEGEND: TEST HOLE (TREK, NOVEMBER 2019)

NOTES:
1. AERIAL PHOTOGRAPH FROM CITY of WINNIPEG 2016
2. GPS COORDINATES FROM HAND HELD DEVICE

Figure 01
TEST HOLE LOCATION PLAN

TREK GEOTECHNICAL

0395 010 00
WSP GROUP CANADA LTD.
19-C-09 Johnson Avenue Pavement Renewal

0 25 50 75 100 m
SCALE = 1 : 2 250 (279 mm x 432 mm)

LEGEND: TEST HOLE (TREK, NOVEMBER 2019)

NOTES:
1. AERIAL PHOTOGRAPH FROM CITY of WINNIPEG 2016
2. GPS COORDINATES FROM HAND HELD DEVICE

Figure 02
TEST HOLE LOCATION PLAN

ANSI full bleed B (11.00 x 17.00 Inches)
Z:\Projects\0395 WSP\0395 010 00 Pavement Renewals\3 Survey and Dwg\3.4 CAD\3.4.3 Working Folder\FIG 02_19-12-04_TH LOCATION JOHNSON AVE_0_A_DW_0395-010-00.dwg, 12/4/2019 12:36:31 PM

Appendix A

Munroe Avenue – Henderson Hwy to Raleigh St.

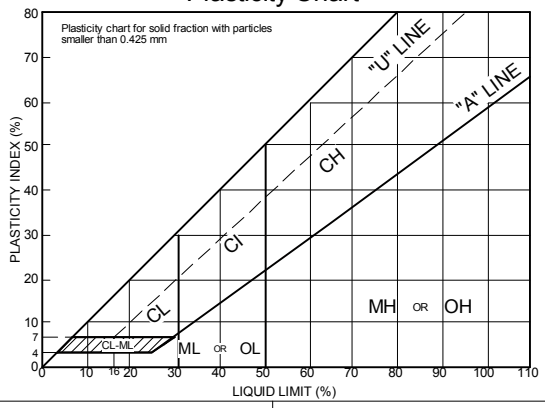
Test Hole Logs, Summary Table, Lab Testing Results and Photographs of Pavement Core Samples

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 TH19-10
1 of 1

Client:	WSP Group Canada Inc	**Project Number:**	0395-010-00
Project Name:	19-C-09 Pavement Renewals - Munroe Ave.	**Location:**	UTM N-5531539, E-635879
Contractor:	Maple Leaf Drilling	**Ground Elevation:**	Top of Pavement
Method:	125 mm Solid Stem Auger, CME55 Truck Mount	**Date Drilled:**	November 8, 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/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 - 50 mm thick				
		CONCRETE - 150 mm thick				
		SAND (Fill) - gravelly (<50 mm diam.), trace silt, trace clay, brown, sub-rounded to rounded gravel, well graded, dry, loose, no plasticity, AASHTO: A-1-b				
		CLAY - silty, trace sand, trace organics, trace gravel (<20 mm diam.) - black - moist, stiff - high plasticity - AASHTO: A-7-6		G134	●	△ ✤
0.5				G135	●	△ ✤
		SILT - some clay - brown - moist, soft - low to intermediate plasticity - AASHTO: A-6(13)		G136	●	
1.0				G137	●	
1.5						

END OF TEST HOLE AT 1.5 m IN SILT
1) No seepage observed.
2) Sloughing from silt layer observed between 0.6 to 1.5 m depth.
3) Test hole open to 0.9 m immediately after drilling.
4) Test hole backfilled with auger cuttings, granular fill and cold patch asphalt.
5) Test hole located at 256 Munroe Ave in Eastbound curb lane, 1.8 m North of curb.

Logged By: Harsimran Singh **Reviewed By:** Angela Fidler-Kliewer **Project Engineer:** Nelson Ferreira

SUB-SURFACE LOG LOGS 2019-11-13_MUNROE AVE_0395-010-00_0_A_HS.GPJ TREK GEOTECHNICAL.GDT 12/5/19

Sub-Surface Log

Test Hole TH19-11
1 of 1

Client:	WSP Group Canada Inc	**Project Number:**	0395-010-00
Project Name:	19-C-09 Pavement Renewals - Munroe Ave.	**Location:**	UTM N-5531418, E-636155
Contractor:	Maple Leaf Drilling	**Ground Elevation:**	Top of Pavement
Method:	125 mm Solid Stem Auger, CME55 Truck Mount	**Date Drilled:**	November 8, 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/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 - 100 mm thick				
		CONCRETE - 200 mm thick				
		SAND (Fill) - gravelly (<50 mm diam.), trace silt, trace clay, brown, sub-rounded to rounded gravel, well graded, dry loose, no plasticity, AASHTO: A-1-b				
0.5		CLAY - silty, trace sand, trace gravel (<20 mm diam.) to 0.6 m - black, moist, very stiff, high plasticity - AASHTO: A-7-6 - grey, below 0.6 m		G138	●	△✿
				G139	●	△✿
1.0				G140	●	✿
		- stiff below 1.2 m				
1.5				G141	●	△✿

END OF TEST HOLE AT 1.5 m IN CLAY
1) No seepage or sloughing observed.
2) Test hole open to 1.5 m immediately after drilling.
3) Test hole backfilled with auger cuttings, granular fill and cold patch asphalt.
4) Test hole located at 358 Munroe Ave in Westbound curb lane, 2 m South of curb.

Logged By: Harsimran Singh **Reviewed By:** Angela Fidler-Kliewer **Project Engineer:** Nelson Ferreira

SUB-SURFACE LOG LOGS 2019-11-13_MUNROE AVE_0395-010-00_0_A_HS.GPJ TREK GEOTECHNICAL.GDT 12/5/19

Sub-Surface Log

Test Hole TH19-12
1 of 1

Client:	WSP Group Canada Inc	**Project Number:**	0395-010-00
Project Name:	19-C-09 Pavement Renewals - Munroe Ave.	**Location:**	UTM N-5531286, E-636421
Contractor:	Maple Leaf Drilling	**Ground Elevation:**	Top of Pavement
Method:	125 mm Solid Stem Auger, CME55 Truck Mount	**Date Drilled:**	November 1, 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/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 - 55 mm thick				
		CONCRETE - 190 mm thick				
		SAND (Fill) - gravelly (<50 mm diam.), trace silt, trace clay, brown, sub-rounded to rounded gravel, well graded, dry loose, no plasticity, AASHTO: A-1-b				
0.5		CLAY - silty, trace sand, trace silt inclusions (< 20 mm diam.), trace oxidation,trace organics, trace gravel (<20 mm diam.) to 0.6 m - black - moist, stiff - high plasticity - AASHTO: A-7-6		G78	●	△✤
				G79	●	△✤
1.0				G80	●	△✤
				G81	●	△✤
1.5		END OF TEST HOLE AT 1.5 m IN CLAY				

1) No seepage observed.
2) Sloughing from clay fill layer observed between 0.3 to 0.6 m depth.
3) Test hole open to 0.9 m immediately after drilling.
4) Test hole backfilled with auger cuttings, granular fill and cold patch asphalt.
5) Test hole located at 308 Munroe Ave in Westbound curb lane, 2 m South of curb.

Logged By: Harsimran Singh **Reviewed By:** Angela Fidler-Kliewer **Project Engineer:** Nelson Ferreira

SUB-SURFACE LOG LOGS 2019-11-13_MUNROE AVE_0395-010-00_0_A_HS.GPJ TREK GEOTECHNICAL.GDT 12/5/19

Sub-Surface Log

Test Hole TH19-13
1 of 1

Client:	WSP Group Canada Inc	**Project Number:**	0395-010-00
Project Name:	19-C-09 Pavement Renewals - Munroe Ave.	**Location:**	UTM N-5531353, E-636288
Contractor:	Maple Leaf Drilling	**Ground Elevation:**	Top of Pavement
Method:	125 mm Solid Stem Auger, CME55 Truck Mount	**Date Drilled:**	November 1, 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/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 - 85 mm thick				
		CONCRETE - 200 mm thick				
		SAND (Fill) - gravelly (<50 mm diam.), trace silt, trace clay, brown, sub-rounded to rounded gravel, well graded, dry loose, no plasticity, AASHTO: A-1-b		G82	●	
0.5		CLAY - silty, trace sand, trace rootless, trace organics, trace silt inclusions (< 10 mm diam.) - black - moist, stiff - high plasticity - AASHTO: A-7-6				
		- grey, very stiff below 0.9 m		G83	●	△ ✤
1.0				G84	●	✤
				G85	●	✤
1.5		END OF TEST HOLE AT 1.5 m IN CLAY				

1) No seepage or sloughing observed.
2) Test hole open to 1.5 m immediately after drilling.
3) Test hole backfilled with auger cuttings, granular fill and cold patch asphalt.
4) Test hole located at 406 Munroe Ave in Westbound curb lane, 2 m South of curb.

Logged By: Harsimran Singh **Reviewed By:** Angela Fidler-Kliewer **Project Engineer:** Nelson Ferreira

SUB-SURFACE LOG LOGS 2019-11-13_MUNROE AVE_0395-010-00_0_A_HS.GPJ TREK GEOTECHNICAL.GDT 12/5/19

Sub-Surface Log

Test Hole TH19-14
1 of 1

Client:	WSP Group Canada Inc	**Project Number:**	0395-010-00
Project Name:	19-C-09 Pavement Renewals - Munroe Ave.	**Location:**	UTM N-5531484, E-636011
Contractor:	Maple Leaf Drilling	**Ground Elevation:**	Top of Pavement
Method:	125 mm Solid Stem Auger, CME55 Truck Mount	**Date Drilled:**	November 1, 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/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 - 65 mm thick				
		CONCRETE - 190 mm thick				
		SAND (Fill) - gravelly (<50 mm diam.), trace silt, trace clay, brown, sub-rounded to rounded gravel, well graded, dry loose, no plasticity, AASHTO: A-1-b		G86	●	
0.5		CLAY - silty, trace sand, trace organics, trace silt inclusions (<15 mm diam.) - black - moist, very stiff - high plasticity - AASHTO: A-7-6		G87	●	✤
				G88	●	✤
		- brown, stiff below 0.9 m				
1.0				G89	●	△ ✤
				G90	●	△ ✤
1.5		END OF TEST HOLE AT 1.5 m IN CLAY				

1) No seepage or sloughing observed.
2) Test hole open to 1.5 m immediately after drilling.
3) Test hole backfilled with auger cuttings, granular fill and cold patch asphalt.
4) Test hole located at 310 Munroe Ave in Westbound curb lane, 2.2 m South of curb.

Logged By: Harsimran Singh **Reviewed By:** Angela Fidler-Kliewer **Project Engineer:** Nelson Ferreira

SUB-SURFACE LOG LOGS 2019-11-13_MUNROE AVE_0395-010-00_0_A_HS.GPJ TREK GEOTECHNICAL.GDT 12/5/19

Sub-Surface Log

Test Hole TH19-15
1 of 1

Client:	WSP Group Canada Inc	**Project Number:**	0395-010-00
Project Name:	19-C-09 Pavement Renewals - Munroe Ave.	**Location:**	UTM N-5531141, E-636703
Contractor:	Maple Leaf Drilling	**Ground Elevation:**	Top of Pavement
Method:	125 mm Solid Stem Auger, CME55 Truck Mount	**Date Drilled:**	November 1, 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/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 - 80 mm thick				
		CONCRETE - 190 mm thick				
		SAND (Fill) - gravelly (<50 mm diam.), trace silt, trace clay, brown, sub-rounded to rounded gravel, well graded, dry loose, no plasticity, AASHTO: A-1-b				
0.5		CLAY - silty, trace sand, trace silt inclusions (<5 mm diam.) - grey - moist, stiff - high plasticity - AASHTO: A-7-6		G56	●	△ ✤
				G57	●	△ ✤
1.0				G58	●	△ ✤
		SILT - some clay - brown - moist, soft - low to intermediate plasticity - AASHTO: A-6		G59	●	
1.5				G60	●	

END OF TEST HOLE AT 2.0 m IN SILT
1) No seepage observed.
2) Sloughing from silt layer observed between 1.2 to 2.0 m depth.
3) Test hole open to 1.5 m immediately after drilling.
4) Test hole backfilled with auger cuttings, granular fill and cold patch asphalt.
5) Test hole located at 550 Munroe Ave in Eastbound curb lane, 2.2 m North of curb.

Logged By: Harsimran Singh **Reviewed By:** Angela Fidler-Kliewer **Project Engineer:** Nelson Ferreira

SUB-SURFACE LOG LOGS 2019-11-13_MUNROE AVE_0395-010-00_0_A_HS.GPJ TREK GEOTECHNICAL.GDT 12/5/19

Sub-Surface Log

Test Hole TH19-16
1 of 1

Client:	WSP Group Canada Inc	**Project Number:**	0395-010-00
Project Name:	19-C-09 Pavement Renewals - Munroe Ave.	**Location:**	UTM N-5531008, E-636979
Contractor:	Maple Leaf Drilling	**Ground Elevation:**	Top of Pavement
Method:	125 mm Solid Stem Auger, CME55 Truck Mount	**Date Drilled:**	November 1, 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/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 - 80 mm thick				
		CONCRETE - 175 mm thick				
		SAND (Fill) - gravelly (<50 mm diam.), trace silt, trace clay, brown, sub-rounded to rounded gravel, well graded, dry loose, no plasticity, AASHTO: A-1-b	G	G61	●	
0.5		CLAY - some silt, trace sand, trace silt inclusions (< 10 mm diam.) - grey - moist, stiff - high plasticity - AASHTO: A-7-6(68)	G	G62	PL MC LL	△ ✤
1.0			G	G63	●	△ ✤
			G	G64	●	△ ✤
1.5		END OF TEST HOLE AT 1.5 m IN CLAY				

1) No seepage or sloughing observed.
2) Test hole open to 1.5 m immediately after drilling.
3) Test hole backfilled with auger cuttings, granular fill and cold patch asphalt.
4) Test hole located at 565 Munroe Ave in Eastbound curb lane, 2 m North of curb.

Logged By: Harsimran Singh **Reviewed By:** Angela Fidler-Kliewer **Project Engineer:** Nelson Ferreira

SUB-SURFACE LOG LOGS 2019-11-13_MUNROE AVE_0395-010-00_0_A_HS.GPJ TREK GEOTECHNICAL.GDT 12/5/19

Sub-Surface Log

Test Hole TH19-17
1 of 1

Client:	WSP Group Canada Inc	**Project Number:**	0395-010-00
Project Name:	19-C-09 Pavement Renewals - Munroe Ave.	**Location:**	UTM N-5530942, E-637122
Contractor:	Maple Leaf Drilling	**Ground Elevation:**	Top of Pavement
Method:	125 mm Solid Stem Auger, CME55 Truck Mount	**Date Drilled:**	November 1, 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/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 - 80 mm thick				
		CONCRETE - 165 mm thick				
		SAND (Fill) - gravelly (<50 mm diam.), trace silt, trace clay, brown, sub-rounded to rounded gravel, well graded, dry loose, no plasticity, AASHTO: A-1-b		G65	●	
		CLAY - silty, trace sand - grey - moist, stiff - high plasticity - AASHTO: A-7-6		G66	●	△ ✤
0.5				G67	●	△ ✤
1.0				G68	●	△ ✤
				G69	●	△ ✤
1.5		END OF TEST HOLE AT 1.5 m IN CLAY				

1) No seepage observed.
2) Sloughing from clay layer observed between 0.3 to 1.5 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 at 595 Munroe Ave in Westbound median lane, 6 m South of curb.

Logged By: Harsimran Singh **Reviewed By:** Angela Fidler-Kliewer **Project Engineer:** Nelson Ferreira

SUB-SURFACE LOG LOGS 2019-11-13_MUNROE AVE_0395-010-00_0_A_HS.GPJ TREK GEOTECHNICAL.GDT 12/5/19

Sub-Surface Log

Test Hole TH19-18
1 of 1

Client:	WSP Group Canada Inc	**Project Number:**	0395-010-00
Project Name:	19-C-09 Pavement Renewals - Munroe Ave.	**Location:**	UTM N-5531081, E-636844
Contractor:	Maple Leaf Drilling	**Ground Elevation:**	Top of Pavement
Method:	125 mm Solid Stem Auger, CME55 Truck Mount	**Date Drilled:**	November 1, 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/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 - 70 mm thick				
		CONCRETE - 140 mm thick				
		SAND (Fill) - gravelly (<20 mm diam.), trace silt, trace clay, brown, sub-rounded to rounded gravel, well graded, dry loose, no plasticity, AASHTO: A-1-b(0)		G70		
0.5		CLAY - silty, trace sand - grey - moist, very stiff - high plasticity - AASHTO: A-7-6		G71		
		- stiff below 0.9 m		G72		
1.0		- trace silt inclusions (< 5 mm diam.), very stiff below 1.2 m		G73		
1.5		END OF TEST HOLE AT 1.5 m IN CLAY				

1) No seepage observed. Sloughing from sand and gravel layer observed between 0.7 to 1.3 m depth.
2) Test hole open to 0.9 m immediately after drilling.
3) Test hole backfilled with auger cuttings, granular fill and cold patch asphalt.
4) Test hole located at 550 Munroe Ave in Westbound curb lane, 2 m South of curb.

Logged By: Harsimran Singh **Reviewed By:** Angela Fidler-Kliewer **Project Engineer:** Nelson Ferreira

SUB-SURFACE LOG LOGS 2019-11-13_MUNROE AVE_0395-010-00_0_A_HS.GPJ TREK GEOTECHNICAL.GDT 12/5/19

Sub-Surface Log

Test Hole TH19-19
1 of 1

Client:	WSP Group Canada Inc	**Project Number:**	0395-010-00
Project Name:	19-C-09 Pavement Renewals - Munroe Ave.	**Location:**	UTM N-5531212, E-636569
Contractor:	Maple Leaf Drilling	**Ground Elevation:**	Top of Pavement
Method:	125 mm Solid Stem Auger, CME55 Truck Mount	**Date Drilled:**	November 1, 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/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 - 70 mm thick				
		CONCRETE - 180 mm thick				
		SAND (Fill) - gravelly (<50 mm diam.), trace silt, trace clay, brown, sub-rounded to rounded gravel, well graded, dry loose, no plasticity, AASHTO: A-1-b		G74	●	
0.5		CLAY - silty, trace sand, trace silt inclusions (< 10 mm diam.) - grey - moist, stiff - high plasticity - AASHTO: A-7-6		G75	●	✤
		black, trace organics, very stiff below 0.9 m		G76	●	△ ✤
1.0		- grey, no organics stiff below 1.2 m		G77	●	△ ✤
1.5		END OF TEST HOLE AT 1.5 m IN CLAY				

1) No seepage observed.
2) Sloughing from clay fill observed between 1.1 to 1.5 m depth.
3) Test hole open to 0.9 m immediately after drilling.
4) Test hole backfilled with auger cuttings, granular fill and cold patch asphalt.
5) Test hole located at 505 Munroe Ave in Westbound median lane, 4 m South of curb.

Logged By: Harsimran Singh **Reviewed By:** Angela Fidler-Kliewer **Project Engineer:** Nelson Ferreira

SUB-SURFACE LOG LOGS 2019-11-13_MUNROE AVE_0395-010-00_0_A_HS.GPJ TREK GEOTECHNICAL.GDT 12/5/19

Sub-Surface Log

Test Hole TH19-20
1 of 1

Client:	WSP Group Canada Inc	**Project Number:**	0395-010-00
Project Name:	19-C-09 Pavement Renewals - Munroe Ave.	**Location:**	UTM N-5531617, E-635732
Contractor:	Maple Leaf Drilling	**Ground Elevation:**	Top of Pavement
Method:	125 mm Solid Stem Auger, CME55 Truck Mount	**Date Drilled:**	November 1, 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/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 - 70 mm thick				
		CONCRETE - 170 mm thick				
		SAND (Fill) - gravelly (<50 mm diam.), trace silt, trace clay, brown, sub-rounded to rounded gravel, well graded, dry loose, no plasticity, AASHTO: A-1-b		G91	●	
		CLAY - silty, trace sand, trace rootless to 0.6 m, - brown - moist, stiff - high plasticity - AASHTO: A-7-6(58)		G92	●	✤
0.5		- black, trace organics very stiff below 0.6 m		G93	●	✤
		- stiff below 0.9 m		G94	PL MC LL	△✤
1.0				G95	●	△✤
1.5		SILT - some clay - brown - moist, soft - low to intermediate plasticity - AASHTO: A-6		G96	●	

END OF TEST HOLE AT 2.0 m IN SILT
1) Seepage observed at 1.7 m from silt layer.
2) No sloughing observed.
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 Westbound curb lane, 11 m North and 9 m West of fire hydrant Northwest of 539 Henderson Hwy

Logged By: Harsimran Singh **Reviewed By:** Angela Fidler-Kliewer **Project Engineer:** Nelson Ferreira

SUB-SURFACE LOG LOGS 2019-11-13_MUNROE AVE_0395-010-00_0_A_HS.GPJ TREK GEOTECHNICAL.GDT 12/5/19

19-C-09 Munroe Pavement Renewals
Sub-Surface Investigation
Munroe Ave

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
TH19-10	UTM : 5530968 N, 636427 E Located at 256 Munroe Ave in Eastbound curb lane, 1.8 m North of curb.	Asphalt	50	Concrete	150	Clay	0.3	0.5	27							
						Clay	0.6	0.8	31							
						Silt	0.9	1.1	25	17	81	2	0	16	30	14
						Silt	1.3	1.5	24							
TH19-11	UTM : 5531539 N, 635879 E Located at 358 Munroe Ave in Westbound curb lane, 2 m South of curb.	Asphalt	100	Concrete	200	Clay	0.4	0.5	25							
						Clay	0.7	0.9	28							
						Clay	1.0	1.2	29							
						Clay	1.4	1.5	30							
TH19-12	UTM : 5531539 N, 635879 E Located at 308 Munroe Ave in Westbound curb lane, 2 m South of curb.	Asphalt	55	Concrete	190	Clay	0.4	0.5	32							
						Clay	0.7	0.8	32							
						Clay	1.0	1.1	31							
						Clay	1.3	1.4	31							
TH19-13	UTM : 553153 N, 636288 E Located at 406 Munroe Ave in Westbound curb lane, 2 m South of curb.	Asphalt	85	Concrete	200	Sand (Fill)	0.4	0.5	7							
						Clay	0.7	0.9	35							
						Clay	1.0	1.2	31							
						Clay	1.3	1.4	30							
TH19-14	UTM : 5531484 N, 636011 E Located at 310 Munroe Ave in Westbound curb lane, 2.2 m South of curb.	Asphalt	65	Concrete	190	Sand (Fill)	0.2	0.3	8							
						Clay	0.4	0.5	37							
						Clay	0.7	0.9	37							
						Clay	1.0	1.2	28							
						Clay	1.3	1.4	25							

19-C-09 Munroe Pavement Renewals
Sub-Surface Investigation
Munroe Ave

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
TH19-15	UTM : 5531141 N, 636703 E Located at 550 Munroe Ave in Eastbound curb lane, 2.2 m North of curb.	Asphalt	80	Concrete	190	Clay	0.4	0.5	33							
						Clay	0.7	0.9	34							
						Clay	1.0	1.2	33							
						Silt	1.3	1.4	26							
						Silt	1.6	1.7	24							
TH19-16	UTM : 5531008 N, 636979 E Located at 565 Munroe Ave in Eastbound curb lane, 2 m North of curb.	Asphalt	80	Concrete	175	Sand (Fill)	0.2	0.3	14							
						Clay	0.7	0.8	34							
						Clay	1.0	1.1	32	79	20	1	0	21	81	60
						Clay	1.2	1.4	37							
TH19-17	UTM : 5530942 N, 637122 E Located at 595 Munroe Ave in Westbound median lane, 6 m South of curb.	Asphalt	80	Concrete	165	Sand (Fill)	0.2	0.3	12							
						Clay	0.6	0.8	33							
						Clay	0.9	1.1	31							
						Clay	1.2	1.4	32							
TH19-18	UTM : 5531081 N, 636844 E Located at 550 Munroe Ave in Westbound curb lane, 2 m South of curb.	Asphalt	70	Concrete	140						%Fines	Sand	Gravel			
						Sand (Fill)	0.2	0.4	9		17	62	21			
						Clay	0.6	0.8	25							
						Clay	0.9	1.1	31							
						Clay	1.2	1.4	31							
TH19-19	UTM : 5531212 N, 636569 E Located at 505 Munroe Ave in Westbound median lane, 4 m South of curb.	Asphalt	70	Concrete	180	Sand (Fill)	0.2	0.3	7							
						Clay	0.7	0.8	25							
						Clay	1.0	1.1	29							
						Clay	1.2	1.4	30							

19-C-09 Munroe Pavement Renewals
Sub-Surface Investigation
Munroe Ave

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
TH19-20	UTM : 5531617 N, 635732 E Located in Westbound curb lane, 11 m North and 9 m West of fire hydrant Northwest of 539 Henderson Hwy	Asphalt	70	Concrete	170	Sand (Fill)	0.2	0.3	7							
						Clay	0.3	0.5	28							
						Clay	0.6	0.8	35							
						Clay	0.9	1.1	35	77	20	3	0	21	74	52
						Clay	1.2	1.4	37							
						Silt	1.8	2.0	31							

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Moisture Content Report
ASTM D2216-10

Project No. 0395-010-00
Client WSP Group Canada Ltd.
Project Munroe Avenue Pavement Renewals

Sample Date 1-Nov-19 & 8-Nov-19
Test Date 13-Nov-19
Technician HS

Test Hole	TH19-10	TH19-10	TH19-10	TH19-10	TH19-11	TH19-11
Depth (m)	0.3 - 0.5	0.6 - 0.8	0.9 - 1.1	1.3 - 1.5	0.4 - 0.5	0.7 - 0.9
Sample #	G134	G135	G136	G137	G138	G139
Tare ID	Z44	W103	K5	F50	C19	E48
Mass of tare	8.6	8.6	8.6	8.6	8.4	8.6
Mass wet + tare	238.8	255.4	516.0	323.6	208.8	279.0
Mass dry + tare	189.8	197.2	415.2	263.6	168.2	219.6
Mass water	49.0	58.2	100.8	60.0	40.6	59.4
Mass dry soil	181.2	188.6	406.6	255.0	159.8	211.0
Moisture %	27.0%	30.9%	24.8%	23.5%	25.4%	28.2%

Test Hole	TH19-11	TH19-11	TH19-12	TH19-12	TH19-12	TH19-12
Depth (m)	1.0 - 1.2	1.4 - 1.5	0.4 - 0.5	0.7 - 0.8	1.0 - 1.1	1.3 - 1.4
Sample #	G140	G141	G78	G79	G80	G81
Tare ID	AA23	A109	E18	W70	F100	W13
Mass of tare	6.6	8.4	8.4	8.6	8.4	8.4
Mass wet + tare	182.8	149.6	221.8	192.4	217.6	171.0
Mass dry + tare	143.4	117.4	170.6	148.2	167.8	132.6
Mass water	39.4	32.2	51.2	44.2	49.8	38.4
Mass dry soil	136.8	109.0	162.2	139.6	159.4	124.2
Moisture %	28.8%	29.5%	31.6%	31.7%	31.2%	30.9%

Test Hole	TH19-13	TH19-13	TH19-13	TH19-13	TH19-14	TH19-14
Depth (m)	0.4 - 0.5	0.7 - 0.9	1.0 - 1.2	1.3 - 1.4	0.2 - 0.3	0.4 - 0.5
Sample #	G82	G83	G84	G85	G86	G87
Tare ID	N47	E60	W96	PO8	E53	Z134
Mass of tare	8.4	8.4	8.6	8.6	8.6	8.4
Mass wet + tare	168.6	214.0	154.4	134.6	393.8	167.6
Mass dry + tare	158.0	160.2	120.0	105.2	365.0	124.6
Mass water	10.6	53.8	34.4	29.4	28.8	43.0
Mass dry soil	149.6	151.8	111.4	96.6	356.4	116.2
Moisture %	7.1%	35.4%	30.9%	30.4%	8.1%	37.0%

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Moisture Content Report
ASTM D2216-10

Project No. 0395-010-00
Client WSP Group Canada Ltd.
Project Munroe Avenue Pavement Renewals

Sample Date 1-Nov-19 & 8-Nov-19
Test Date 13-Nov-19
Technician HS

Test Hole	TH19-14	TH19-14	TH19-14	TH19-15	TH19-15	TH19-15
Depth (m)	0.7 - 0.9	1.0 - 1.2	1.3 - 1.4	0.4 - 0.5	0.7 - 0.9	1.0 - 1.2
Sample #	G88	G89	G90	G56	G57	G58
Tare ID	N62	AA21	A13	Z16	D28	AB33
Mass of tare	8.6	6.8	8.4	8.8	8.6	6.6
Mass wet + tare	151.4	199.6	140.4	174.4	206.2	229.6
Mass dry + tare	113.2	158.0	114.0	133.2	156.2	174.4
Mass water	38.2	41.6	26.4	41.2	50.0	55.2
Mass dry soil	104.6	151.2	105.6	124.4	147.6	167.8
Moisture %	36.5%	27.5%	25.0%	33.1%	33.9%	32.9%

Test Hole	TH19-15	TH19-15	TH19-16	TH19-16	TH19-16	TH19-16
Depth (m)	1.3 - 1.4	1.6 - 1.7	0.2 - 0.3	0.7 - 0.8	1.0 - 1.1	1.2 - 1.4
Sample #	G59	G60	G61	G62	G63	G64
Tare ID	AC22	F129	D49	AB18	H6	E12
Mass of tare	6.6	8.4	8.4	6.8	8.6	8.4
Mass wet + tare	238.6	343.2	228.8	163.8	327.0	267.8
Mass dry + tare	191.2	278.2	201.0	123.6	250.2	198.4
Mass water	47.4	65.0	27.8	40.2	76.8	69.4
Mass dry soil	184.6	269.8	192.6	116.8	241.6	190.0
Moisture %	25.7%	24.1%	14.4%	34.4%	31.8%	36.5%

Test Hole	TH19-17	TH19-17	TH19-17	TH19-17	TH19-17	TH19-18
Depth (m)	0.2 - 0.3	0.3 - 0.5	0.6 - 0.8	0.9 - 1.1	1.2 - 1.4	0.2 - 0.4
Sample #	G65	G66	G67	G68	G69	G70
Tare ID	E8	F98	P24	A17	P10	K1
Mass of tare	8.6	8.4	8.6	8.6	8.6	8.4
Mass wet + tare	186.6	174.8	198.4	199.6	167.0	245.6
Mass dry + tare	167.6	137.4	151.0	154.0	128.8	227.0
Mass water	19.0	37.4	47.4	45.6	38.2	18.6
Mass dry soil	159.0	129.0	142.4	145.4	120.2	218.6
Moisture %	11.9%	29.0%	33.3%	31.4%	31.8%	8.5%

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Moisture Content Report
ASTM D2216-10

Project No. 0395-010-00
Client WSP Group Canada Ltd.
Project Munroe Avenue Pavement Renewals

Sample Date 1-Nov-19 & 8-Nov-19
Test Date 13-Nov-19
Technician HS

Test Hole	TH19-18	TH19-18	TH19-18	TH19-19	TH19-19	TH19-19
Depth (m)	0.6 - 0.8	0.9 - 1.1	1.2 - 1.4	0.2 - 0.3	0.7 - 0.8	1.0 - 1.1
Sample #	G71	G72	G73	G74	G75	G76
Tare ID	AB19	N56	W35	F128	C14	E110
Mass of tare	6.6	8.4	8.6	8.6	8.8	8.6
Mass wet + tare	198.2	180.0	258.6	428.0	188.4	213.0
Mass dry + tare	160.4	139.8	198.8	400.0	152.4	166.6
Mass water	37.8	40.2	59.8	28.0	36.0	46.4
Mass dry soil	153.8	131.4	190.2	391.4	143.6	158.0
Moisture %	24.6%	30.6%	31.4%	7.2%	25.1%	29.4%

Test Hole	TH19-19	TH19-20	TH19-20	TH19-20	TH19-20	TH19-20
Depth (m)	1.2 - 1.4	0.2 - 0.3	0.3 - 0.5	0.6 - 0.8	0.9 - 1.1	1.2 - 1.4
Sample #	G77	G91	G92	G93	G94	G95
Tare ID	W59	N27	Z77	AB91	N110	E15
Mass of tare	8.6	8.6	8.4	6.8	8.6	8.8
Mass wet + tare	199.2	213.0	235.6	225.0	277.4	188.8
Mass dry + tare	155.8	199.0	186.0	168.4	207.2	140.6
Mass water	43.4	14.0	49.6	56.6	70.2	48.2
Mass dry soil	147.2	190.4	177.6	161.6	198.6	131.8
Moisture %	29.5%	7.4%	27.9%	35.0%	35.3%	36.6%

Test Hole	TH19-20					
Depth (m)	1.8 - 2.0					
Sample #	G96					
Tare ID	W91					
Mass of tare	8.4					
Mass wet + tare	233.4					
Mass dry + tare	180.0					
Mass water	53.4					
Mass dry soil	171.6					
Moisture %	31.1%					

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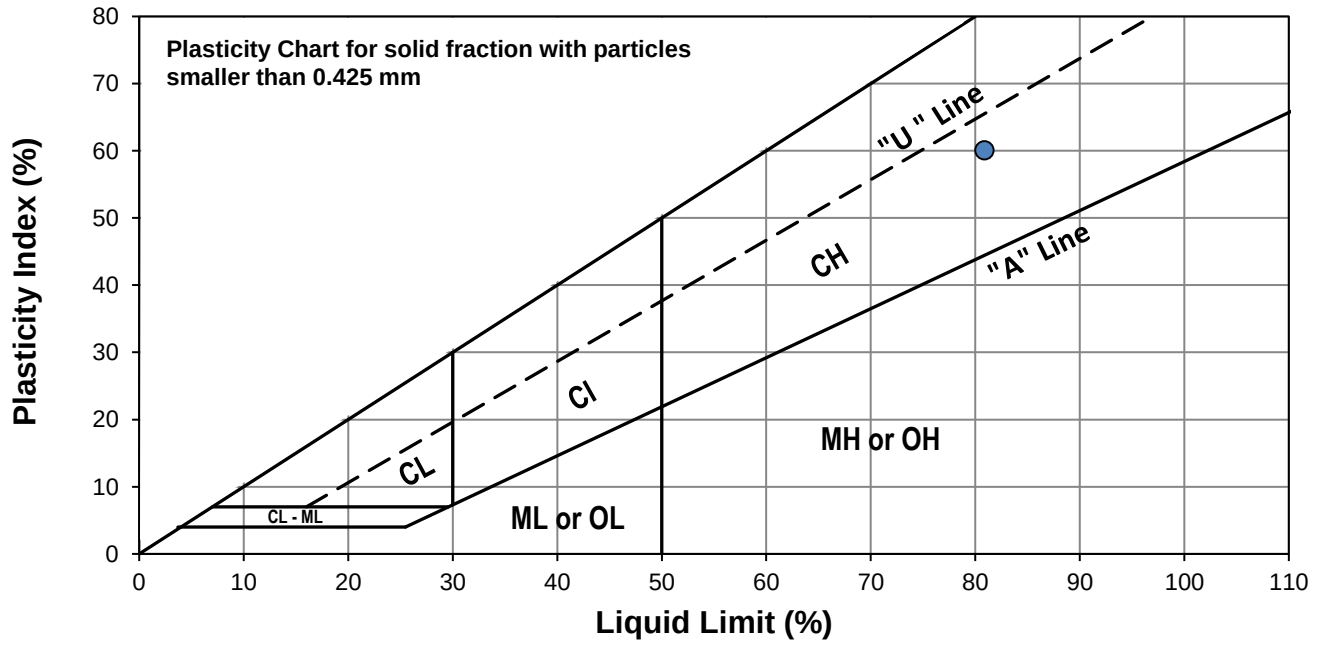
Atterberg Limits
ASTM D4318-10e1

Project No.	0395-010-00
Client	WSP Group Canada Ltd.
Project	19-C-09 Munroe Avenue Pavement Renewals
Test Hole	TH19-16
Sample #	G63
Depth (m)	1.0 - 1.1
Sample Date	1-Nov-19
Test Date	18-Nov-19
Technician	AD

Liquid Limit	81
Plastic Limit	21
Plasticity Index	60

Liquid Limit

Trial #	1	2	3		
Number of Blows (N)	15	23	32		
Mass Wet Soil + Tare (g)	24.447	26.958	23.380		
Mass Dry Soil + Tare (g)	19.692	21.194	19.293		
Mass Tare (g)	14.029	14.115	14.142		
Mass Water (g)	4.755	5.764	4.087		
Mass Dry Soil (g)	5.663	7.079	5.151		
Moisture Content (%)	83.966	81.424	79.344		



Plastic Limit

Trial #	1	2	3	4	5
Mass Tare (g)	13.678	14.200			
Mass Wet Soil + Tare (g)	21.540	21.730			
Mass Dry Soil + Tare (g)	20.183	20.434			
Mass Water (g)	1.357	1.296			
Mass Dry Soil (g)	6.505	6.234			
Moisture Content (%)	20.861	20.789			

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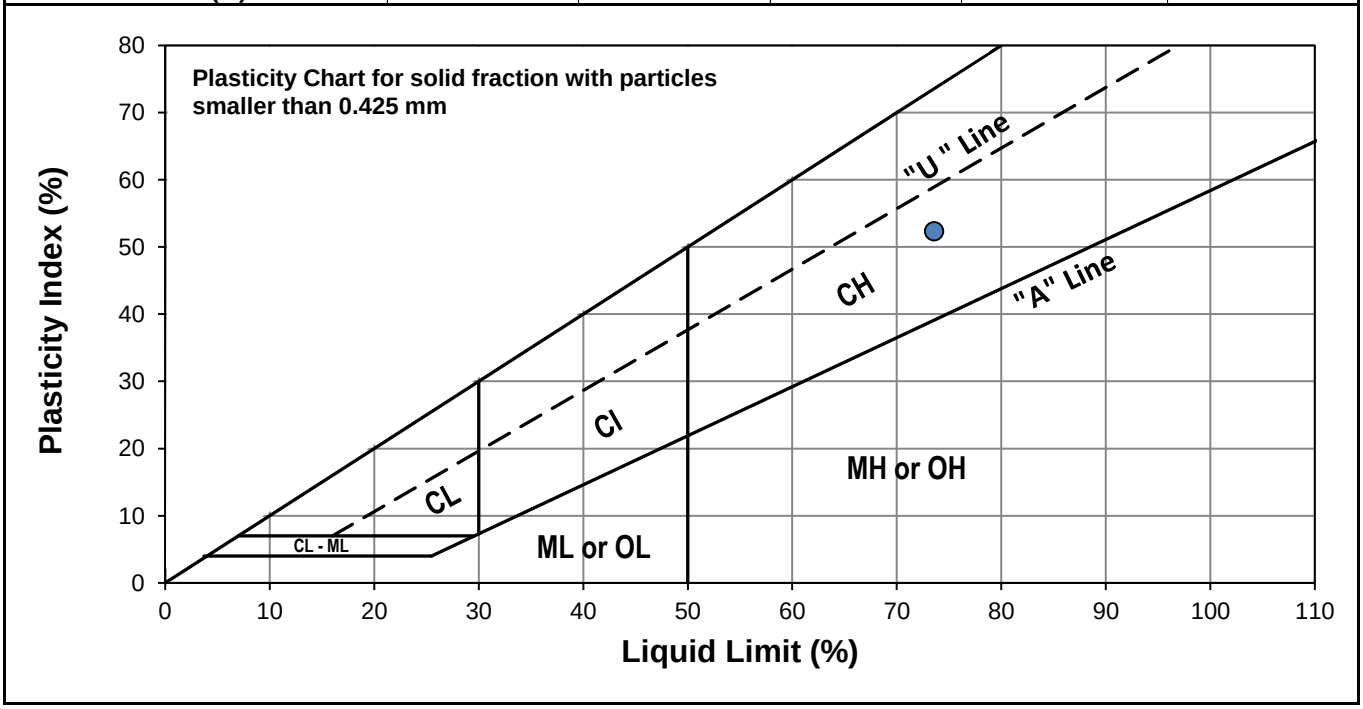
Atterberg Limits
ASTM D4318-10e1

Project No.	0395-010-00
Client	WSP Group Canada Ltd.
Project	19-C-09 Munroe Avenue Pavement Renewals
Test Hole	TH19-20
Sample #	G94
Depth (m)	0.9 - 1.1
Sample Date	1-Nov-19
Test Date	18-Nov-19
Technician	AD

Liquid Limit	74
Plastic Limit	21
Plasticity Index	52

Liquid Limit

Trial #	1	2	3		
Number of Blows (N)	17	28	33		
Mass Wet Soil + Tare (g)	22.846	28.194	24.954		
Mass Dry Soil + Tare (g)	19.130	22.254	20.468		
Mass Tare (g)	14.254	14.098	14.207		
Mass Water (g)	3.716	5.940	4.486		
Mass Dry Soil (g)	4.876	8.156	6.261		
Moisture Content (%)	76.210	72.830	71.650		



Plastic Limit

Trial #	1	2	3	4	5
Mass Tare (g)	14.213	14.205			
Mass Wet Soil + Tare (g)	20.945	20.921			
Mass Dry Soil + Tare (g)	19.748	19.762			
Mass Water (g)	1.197	1.159			
Mass Dry Soil (g)	5.535	5.557			
Moisture Content (%)	21.626	20.857			

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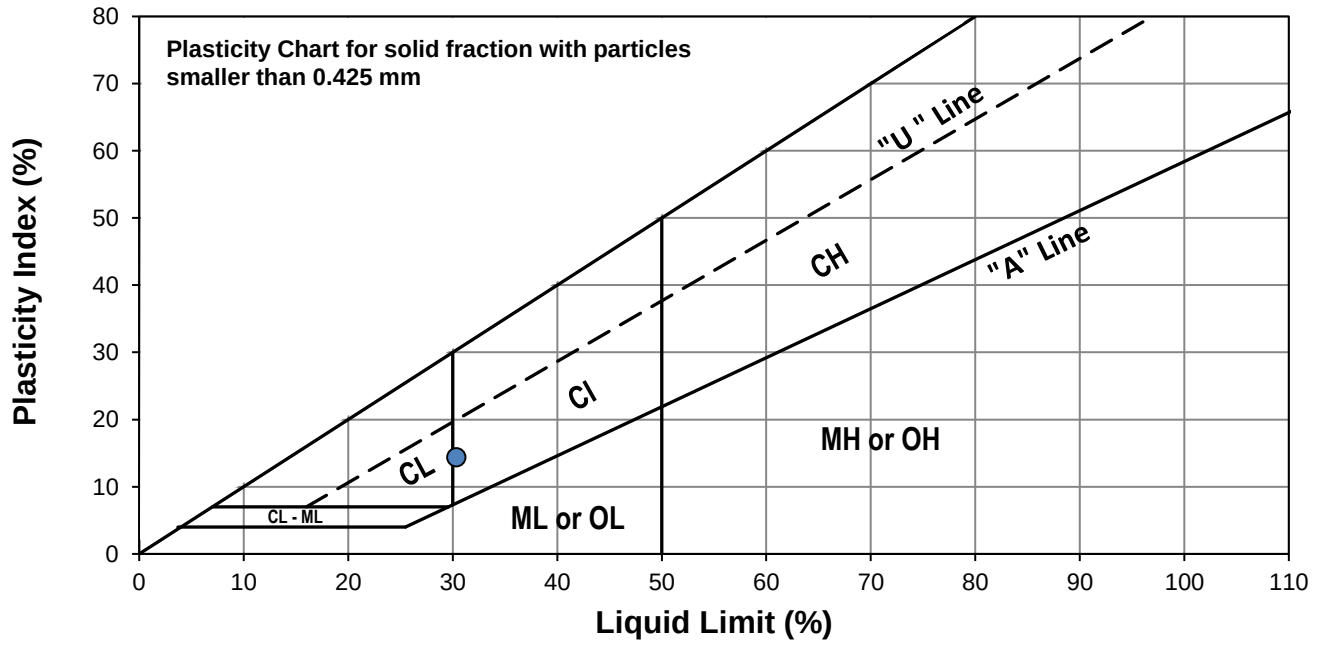
Atterberg Limits
ASTM D4318-10e1

Project No.	0395-010-00
Client	WSP Group Canada Ltd.
Project	19-C-09 Munroe Avenue Pavement Renewals
Test Hole	TH19-10
Sample #	G136
Depth (m)	0.9 - 1.1
Sample Date	1-Nov-19
Test Date	18-Nov-19
Technician	AD

Liquid Limit	30
Plastic Limit	16
Plasticity Index	14

Liquid Limit

Trial #	1	2	3		
Number of Blows (N)	19	24	32		
Mass Wet Soil + Tare (g)	26.353	27.600	26.770		
Mass Dry Soil + Tare (g)	23.437	24.448	23.860		
Mass Tare (g)	14.147	14.116	13.969		
Mass Water (g)	2.916	3.152	2.910		
Mass Dry Soil (g)	9.290	10.332	9.891		
Moisture Content (%)	31.389	30.507	29.421		



Plastic Limit

Trial #	1	2	3	4	5
Mass Tare (g)	13.989	14.102			
Mass Wet Soil + Tare (g)	21.871	21.297			
Mass Dry Soil + Tare (g)	20.806	20.286			
Mass Water (g)	1.065	1.011			
Mass Dry Soil (g)	6.817	6.184			
Moisture Content (%)	15.623	16.349			

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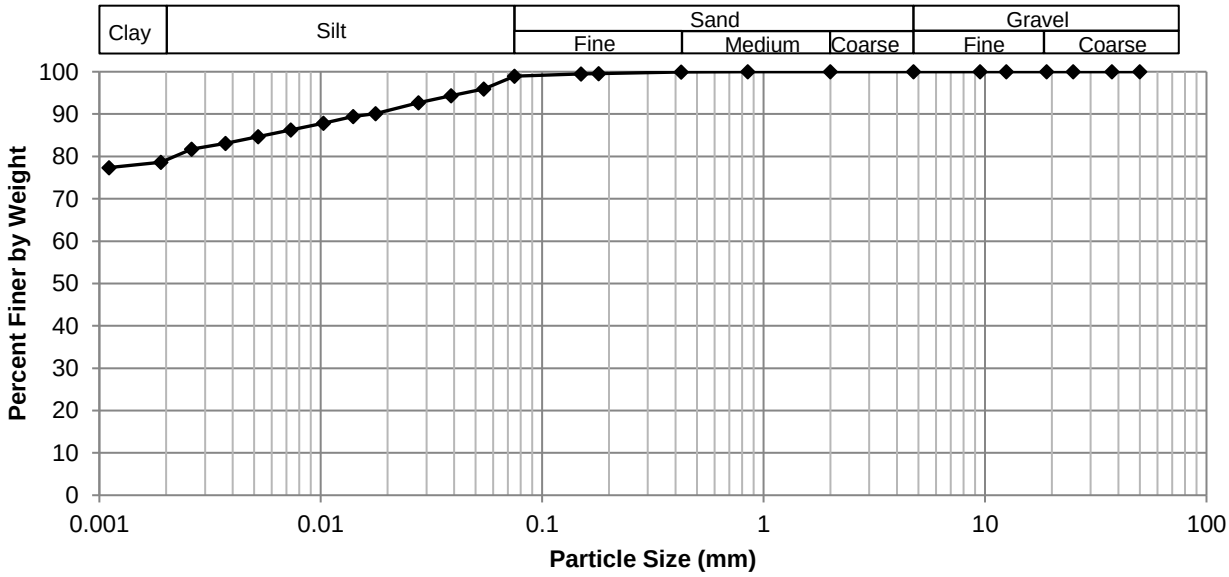
Grain Size Analysis (Hydrometer Method)
ASTM D7928

Project No.	0395 010 00
Client	WSP Group Canada Ltd.
Project	Munroe Ave Pavement Renewals
Test Hole	TH19-16
Sample #	G63
Depth (m)	1.0 - 1.1
Sample Date	1-Nov-19
Test Date	18-Nov-19
Technician	HS

Gravel	0.0%
Sand	1.0%
Silt	19.9%
Clay	79.1%

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	98.98
37.5	100.00	2.00	100.00	0.0544	95.95
25.0	100.00	0.850	100.00	0.0388	94.32
19.0	100.00	0.425	99.93	0.0276	92.69
12.5	100.00	0.180	99.57	0.0177	90.08
9.50	100.00	0.150	99.50	0.0140	89.43
4.75	100.00	0.075	98.98	0.0103	87.88
				0.0073	86.25
				0.0052	84.69
				0.0037	83.06
				0.0026	81.74
				0.0019	78.64
				0.0011	77.37

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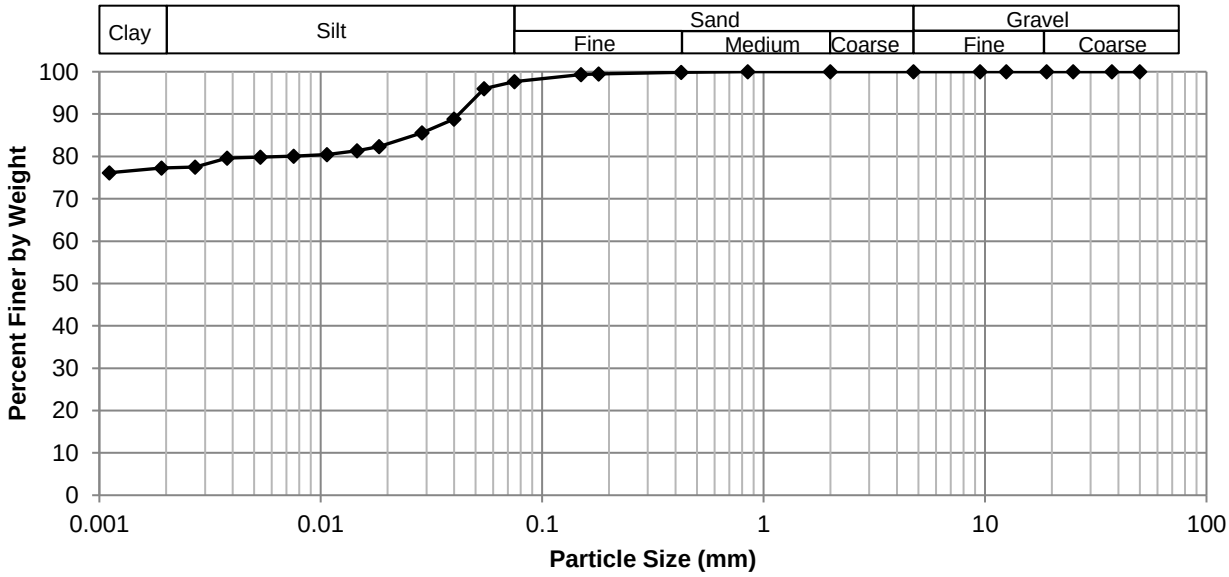
Grain Size Analysis (Hydrometer Method)
ASTM D7928

Project No.	0395 010 00
Client	WSP Group Canada Ltd.
Project	Munroe Ave Pavement Renewals
Test Hole	TH19-20
Sample #	G94
Depth (m)	0.9 - 1.1
Sample Date	1-Nov-19
Test Date	18-Nov-19
Technician	HS/AD

Gravel	0.0%
Sand	2.3%
Silt	20.4%
Clay	77.3%

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	97.70
37.5	100.00	2.00	100.00	0.0547	96.01
25.0	100.00	0.850	99.98	0.0399	88.83
19.0	100.00	0.425	99.84	0.0287	85.57
12.5	100.00	0.180	99.47	0.0184	82.30
9.50	100.00	0.150	99.35	0.0146	81.32
4.75	100.00	0.075	97.70	0.0107	80.41
				0.0076	80.08
				0.0053	79.83
				0.0038	79.64
				0.0027	77.49
				0.0019	77.23
				0.0011	76.15

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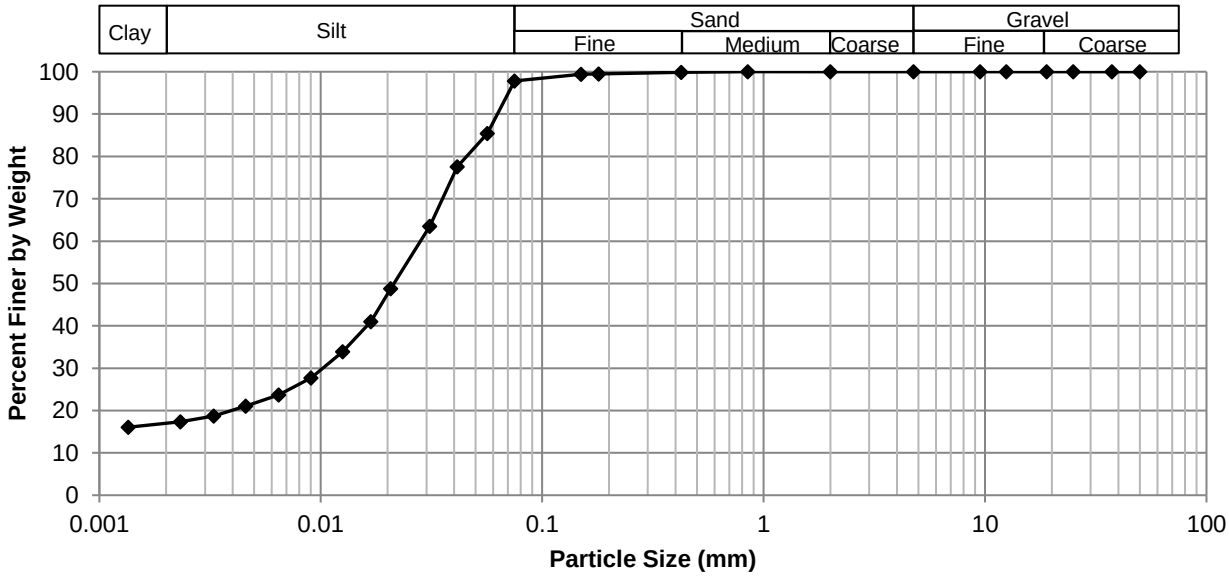
Grain Size Analysis (Hydrometer Method)
ASTM D7928

Project No.	0395 010 00
Client	WSP Group Canada Ltd.
Project	Munroe Ave Pavement Renewals
Test Hole	TH19-10
Sample #	G136
Depth (m)	0.9 - 1.1
Sample Date	1-Nov-19
Test Date	18-Nov-19
Technician	HS/AD

Gravel	0.0%
Sand	2.2%
Silt	80.9%
Clay	16.9%

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	97.80
37.5	100.00	2.00	100.00	0.0566	85.39
25.0	100.00	0.850	99.98	0.0414	77.58
19.0	100.00	0.425	99.85	0.0310	63.51
12.5	100.00	0.180	99.49	0.0207	48.81
9.50	100.00	0.150	99.38	0.0168	41.00
4.75	100.00	0.075	97.80	0.0125	33.88
				0.0090	27.70
				0.0065	23.71
				0.0046	21.04
				0.0033	18.69
				0.0023	17.35
				0.0014	16.06

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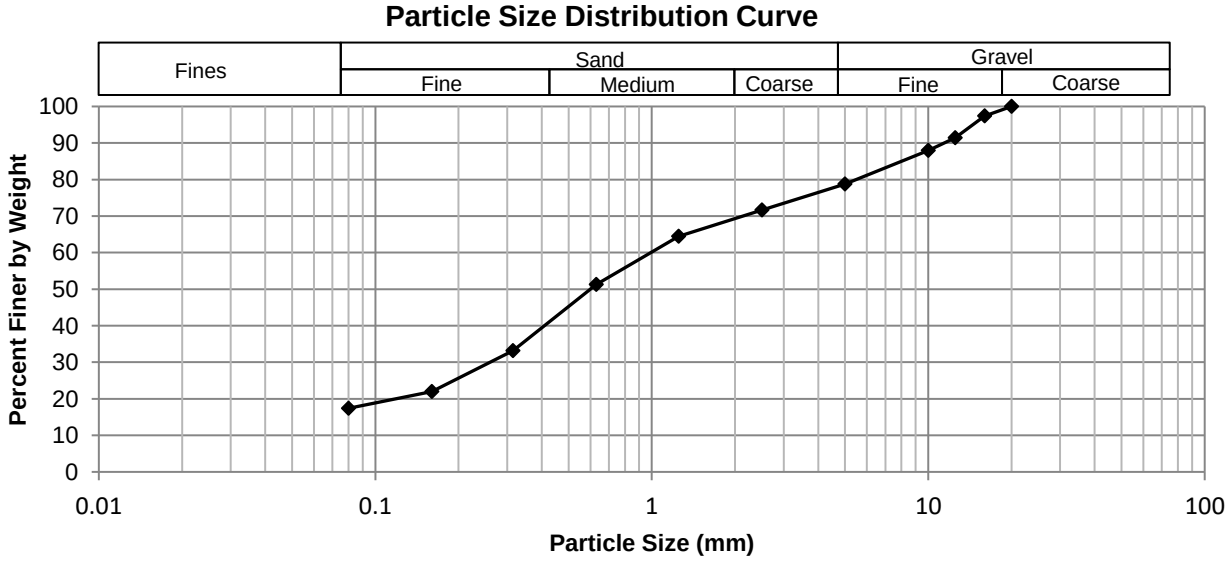
Grain Size Analysis (Sieve Method)
ASTM C136-06

Project No.	0395-010-00
Client	WSP Group Canada
Project	19-C-09 Munroe Avenue Pavement Renewals
Test Hole	TH19-18
Sample #	G70
Depth (m)	0.2 - 0.4
Date Sampled	1-Nov-19
Date Tested	22-Nov-19
Technician	AD

Total Weight (g)	1107.8
Gravel %	21.2
Sand %	61.4
Fines %	17.4



Sieve Opening (mm)	Percent Passing	Specification (Min-Max)
20.0	100	-
16.0	97	-
12.5	91	-
10.0	88	-
5.0	79	-
2.50	72	-
1.25	64	-
0.630	51	-
0.315	33	-
0.160	22	-
0.080	17	-

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Standard Proctor Compaction Test

ASTM D698-12e2

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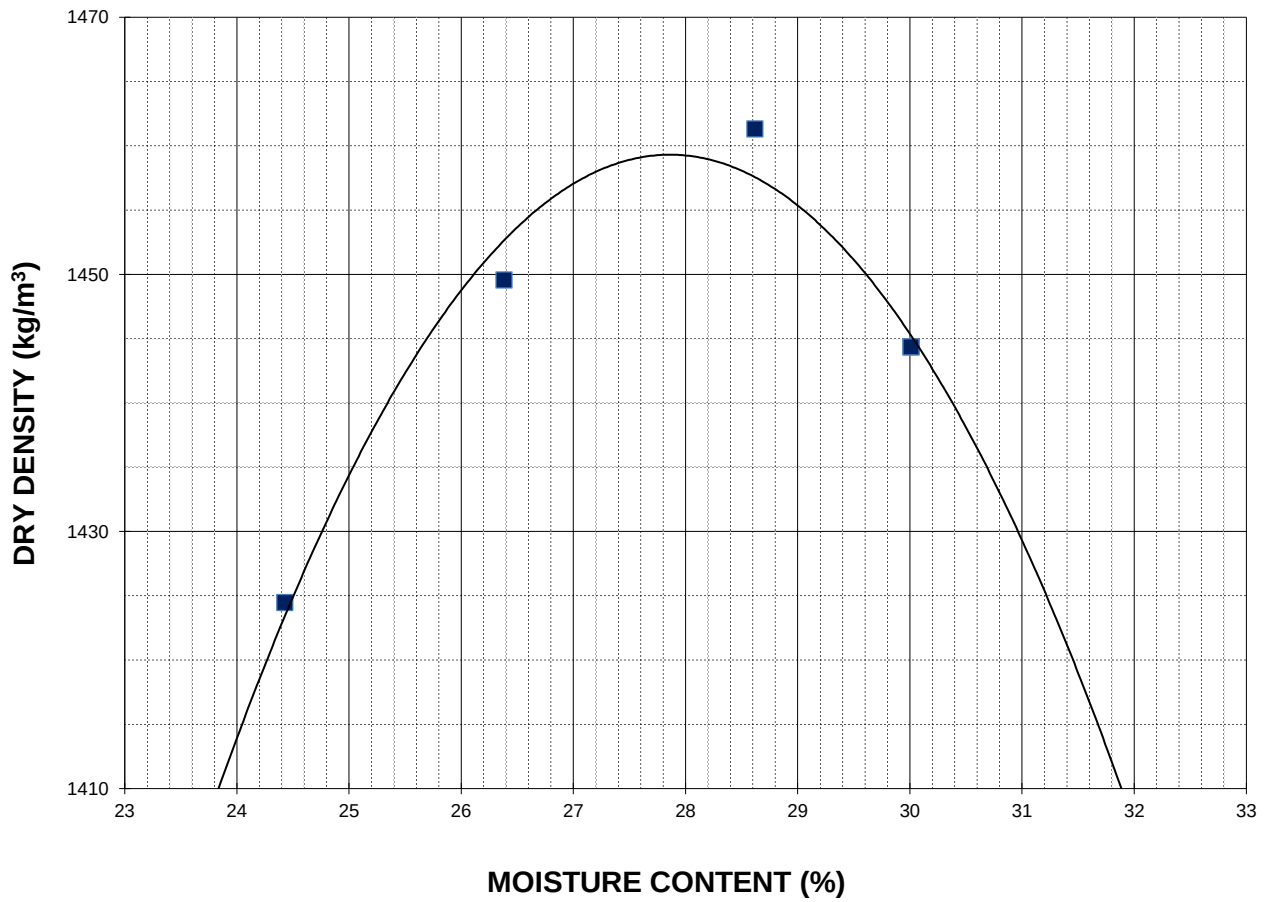
Project No.	0395-010-00
Client	WSP Group Canada Ltd.
Project	19-C-09 Munroe Ave Pavement Renewals
Sample #	Bulk 1
Source	TH19-13 & TH19-14
Material	Clay
Sample Date	01-Nov-19
Test Date	20-Nov-19
Technician	AD

Maximum Dry Density (kg/m3)	1459
Optimum Moisture (%)	27.9

Trial Number	1	2	3	4	
Wet Density (kg/m^3)	1772	1832	1880	1878	
Dry Density (kg/m^3)	1424	1450	1461	1444	
Moisture Content (%)	24.4	26.4	28.6	30.0	



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Standard Proctor Compaction Test

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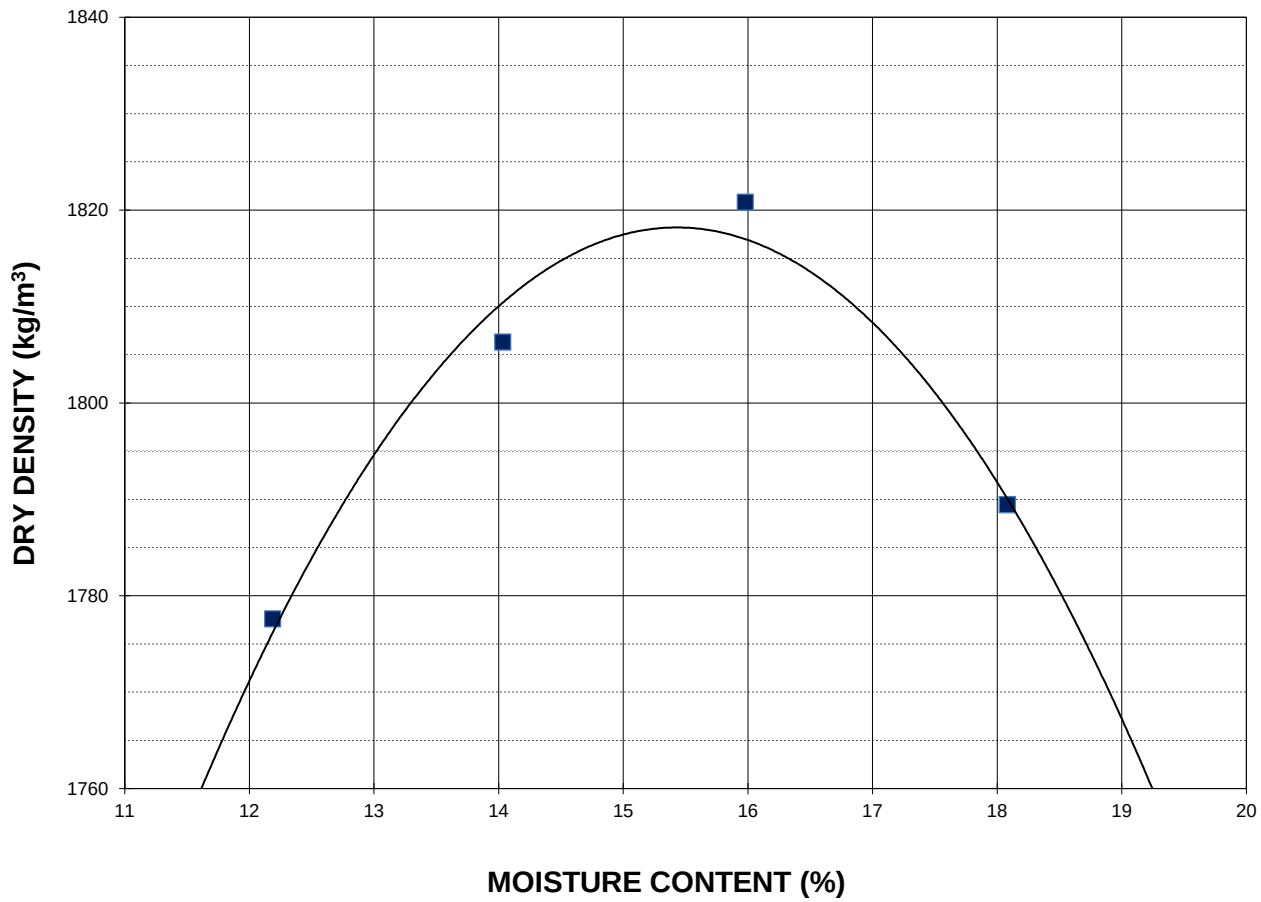
Project No.	0395-010-00
Client	WSP Group Canada Ltd.
Project	19-C-09 Munroe Ave Pavement Renewals

Sample #	Bulk 3
Source	TH19-20
Material	Silt
Sample Date	1-Nov-19
Test Date	21-Nov-19
Technician	AD

Maximum Dry Density (kg/m3)	1818
Optimum Moisture (%)	15.4

Trial Number	1	2	3	4	
Wet Density (kg/m^3)	1994	2060	2112	2113	
Dry Density (kg/m^3)	1778	1806	1821	1789	
Moisture Content (%)	12.2	14.0	16.0	18.1	



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Standard Proctor Compaction Test

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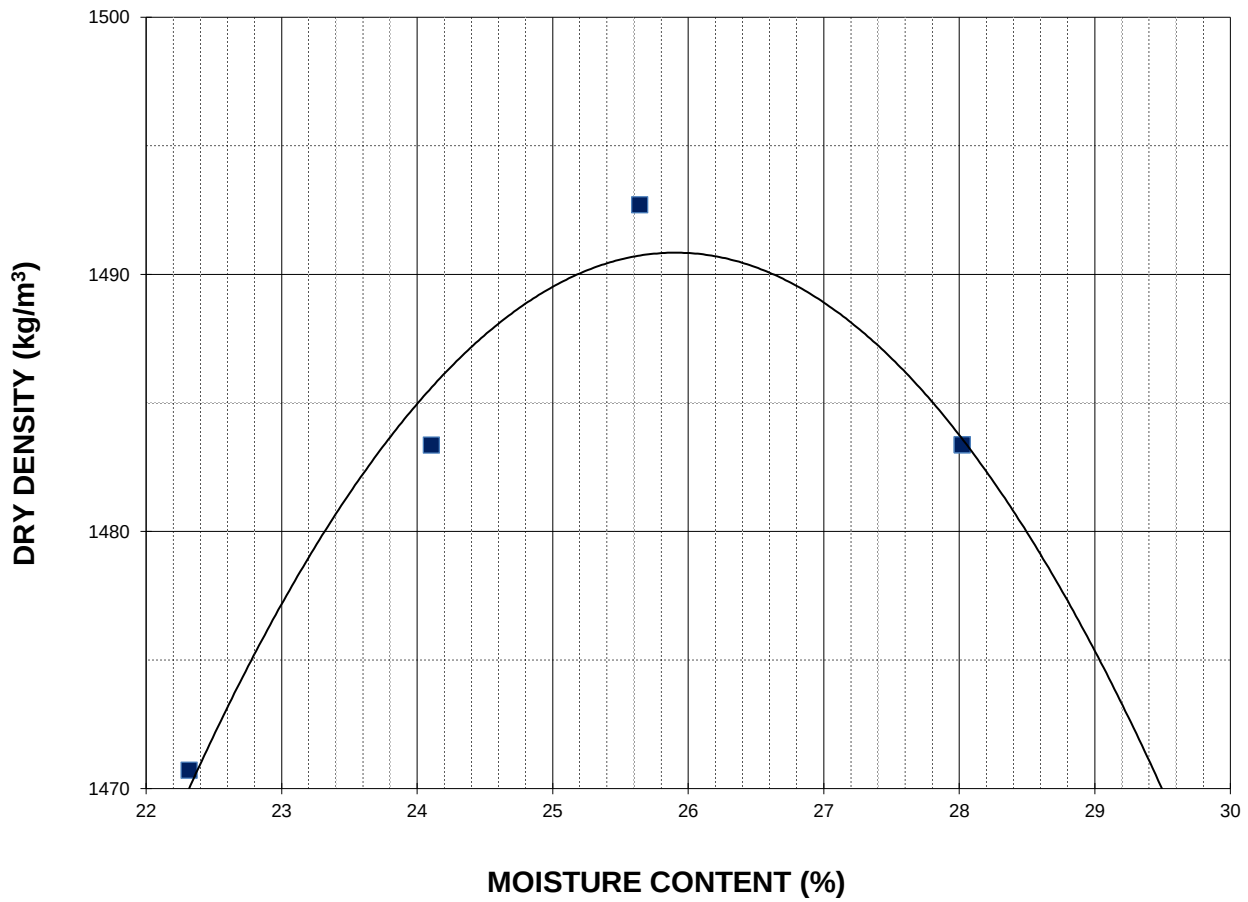
Project No.	0395-010-00
Client	WSP Group Canada Ltd.
Project	19-C-09 Munroe Ave Pavement Renewals

Sample #	Bulk 2
Source	TH19-15,16
Material	Clay
Sample Date	1-Nov-19
Test Date	20-Nov-19
Technician	AD

Maximum Dry Density (kg/m3)	1491
Optimum Moisture (%)	25.9

Trial Number	1	2	3	4	
Wet Density (kg/m^3)	1799	1841	1876	1899	
Dry Density (kg/m^3)	1471	1483	1493	1483	
Moisture Content (%)	22.3	24.1	25.6	28.0	



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California Bearing Ratio Test Data Sheet

ASTM D1883-16

Project No.	0395-010-00	**Source**	TH19-13 & TH19-14
Client	WSP Group Canada Ltd.	**Material**	Clay
Project	19-C-09 Munroe Ave Pavement Renewals	**Sample Date**	11/1/2019
Sample #	Bulk 1	**Test Date**	11/27/2019
		Technician	BMH

Proctor Results (ASTM D698)

Maximum Dry Density	1459	kg/m3
Optimum Moisture Content	27.9	%
Material Retained on 19 mm Sieve	0.0	%

CBR Sample Compaction

Dry Density	1375	kg/m3
Initial Moisture Content	31.8	%
Relative Density	94.2	% SPMDD

Soaking Results

Surcharge	4.54	kg
Swell	0.6	%
Moisture Content in top 25 mm	38.5	%
Immersion Period	96	h

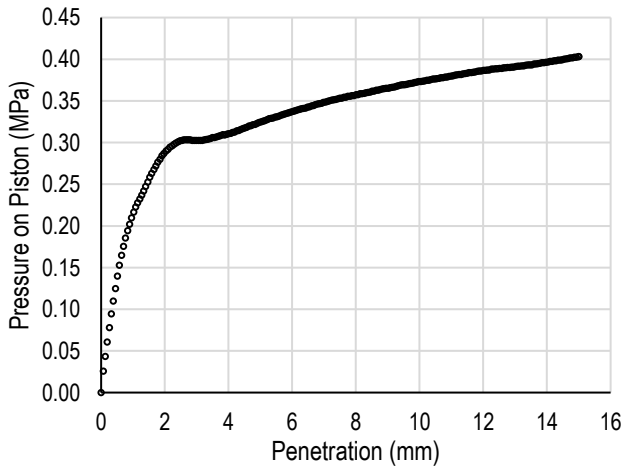
CBR Results

CBR at 2.54 mm	4.4	%
CBR at 5.08 mm	3.2	%
Zero Correction	0	mm

Test Data

Penetration (mm)	Measured Pressure (MPa)	Corrected Pressure (MPa)
0.64	0.17	0.17
1.27	0.24	0.24
1.91	0.28	0.28
2.54	0.30	0.30
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	0.35	0.35
10.16	0.37	0.37
12.70	0.39	0.39

Load/Penetration Curve



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California Bearing Ratio Test Data Sheet

ASTM D1883-16

Project No.	0395-010-00	**Source**	TH19-15 & TH19-16
Client	WSP Group Canada Ltd.	**Material**	Clay
Project	19-C-09 Munroe Ave Pavement Renewals	**Sample Date**	11/1/2019
Sample #	Bulk 2	**Test Date**	11/27/2019
		Technician	AD

Proctor Results (ASTM D698)

Maximum Dry Density	1491	kg/m3
Optimum Moisture Content	25.9	%
Material Retained on 19 mm Sieve	0.0	%

CBR Sample Compaction

Dry Density	1405	kg/m3
Initial Moisture Content	30.3	%
Relative Density	94.2	% SPMDD

Soaking Results

Surcharge	4.54	kg
Swell	0.9	%
Moisture Content in top 25 mm	41.7	%
Immersion Period	95	h

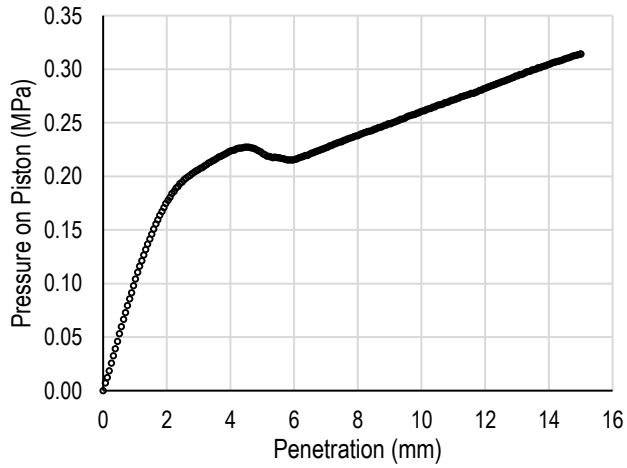
CBR Results

CBR at 2.54 mm	2.9	%
CBR at 5.08 mm	2.1	%
Zero Correction	0	mm

Test Data

Penetration (mm)	Measured Pressure (MPa)	Corrected Pressure (MPa)
0.64	0.07	0.07
1.27	0.13	0.13
1.91	0.17	0.17
2.54	0.20	0.20
3.18	0.21	0.21
3.81	0.22	0.22
4.45	0.23	0.23
5.08	0.22	0.22
7.62	0.23	0.23
10.16	0.26	0.26
12.70	0.29	0.29

Load/Penetration Curve



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California Bearing Ratio Test Data Sheet

ASTM D1883-16

Project No.	0395-010-00	**Source**	TH19-20
Client	WSP Group Canada Ltd.	**Material**	Silt
Project	19-C-09 Munroe Ave Pavement Renewals	**Sample Date**	11/1/2019
Sample #	Bulk 3	**Test Date**	11/26/2019
		Technician	AD

Proctor Results (ASTM D698)

Maximum Dry Density	1818	kg/m3
Optimum Moisture Content	15.4	%
Material Retained on 19 mm Sieve	0.0	%

CBR Sample Compaction

Dry Density	1749	kg/m3
Initial Moisture Content	18.8	%
Relative Density	96.2	% SPMDD

Soaking Results

Surcharge	4.54	kg
Swell	0.0	%
Moisture Content in top 25 mm	19.5	%
Immersion Period	24	h

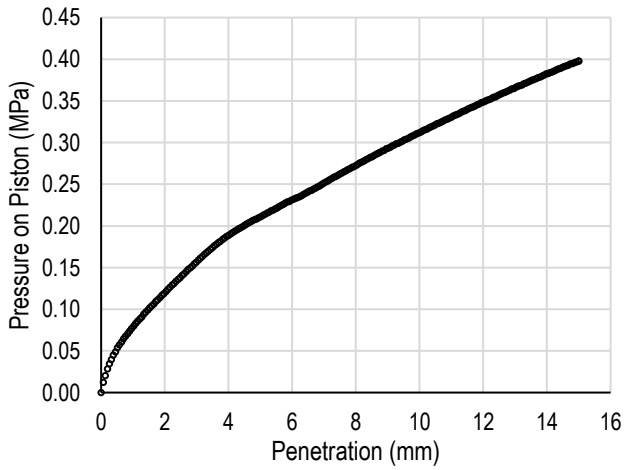
CBR Results

CBR at 2.54 mm	2.0	%
CBR at 5.08 mm	2.1	%
Zero Correction	0	mm

Test Data

Penetration (mm)	Measured Pressure (MPa)	Corrected Pressure (MPa)
0.64	0.06	0.06
1.27	0.09	0.09
1.91	0.12	0.12
2.54	0.14	0.14
3.18	0.16	0.16
3.81	0.18	0.18
4.45	0.20	0.20
5.08	0.21	0.21
7.62	0.27	0.27
10.16	0.32	0.32
12.70	0.36	0.36

Load/Penetration Curve



Comments:

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

Photo 11: Pavement Core Measurement at Test Hole TH19-11

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

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

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

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

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

Photo 17: Pavement Core Sample at Test Hole TH19-17

Photo 18: Pavement Core Sample at Test Hole TH19-18

Photo 19: Pavement Core Sample at Test Hole TH19-19

Photo 20: Pavement Core Sample at Test Hole TH19-20

Appendix B

Johnson Avenue – Henderson Hwy to Levi St.

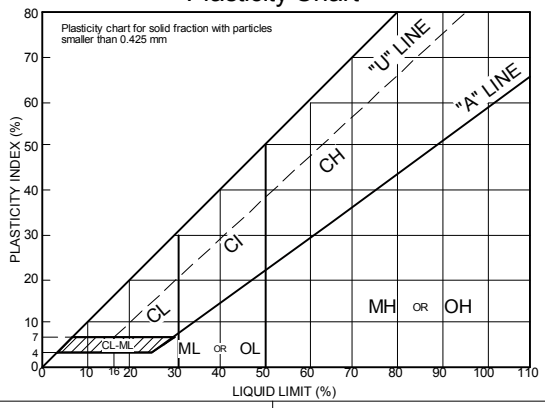
Test Hole Logs, Summary Table, Lab Testing Results and Photographs of Pavement Core Samples

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

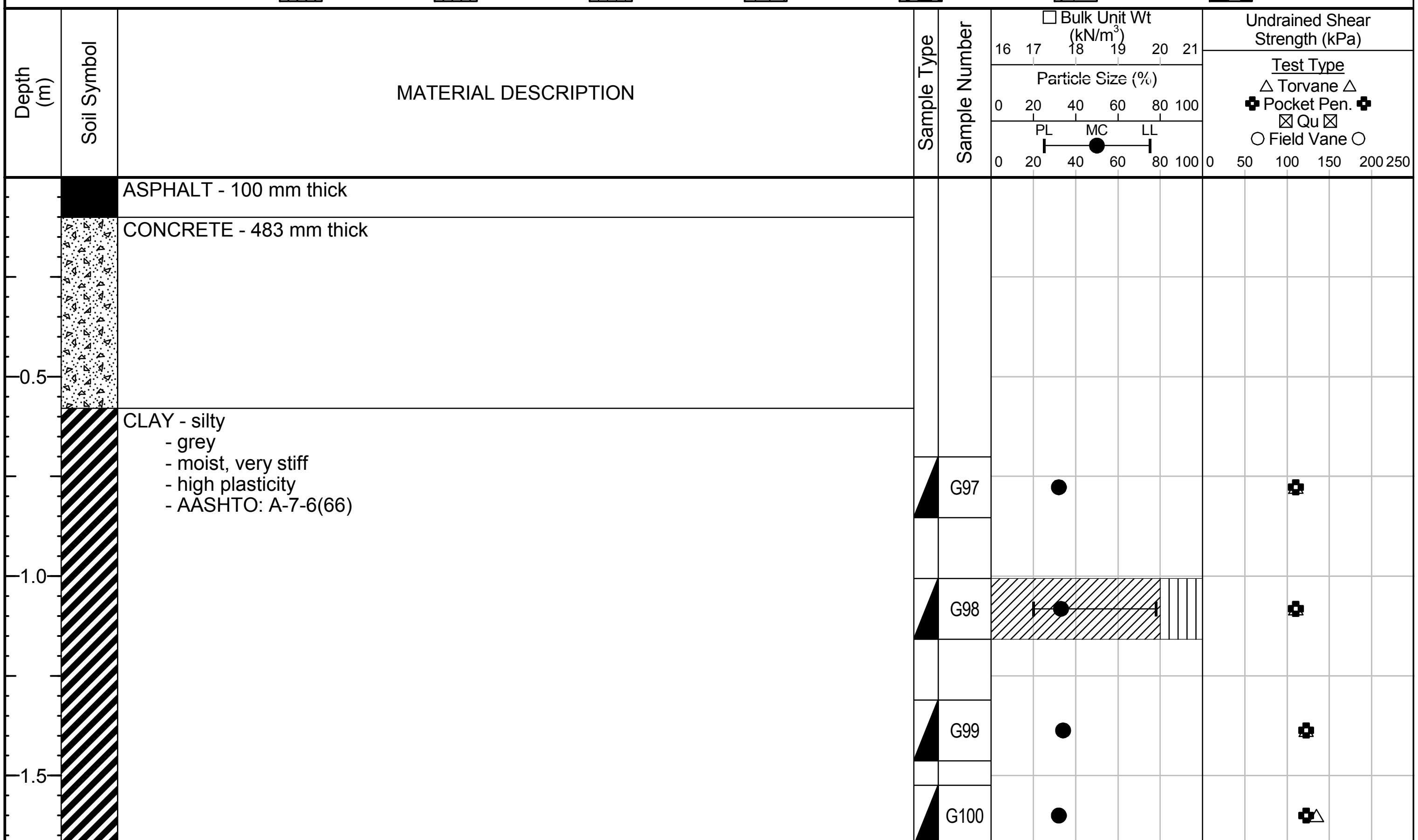
Sub-Surface Log

TREK GEOTECHNICAL

Client:	WSP Group Canada Inc.	**Project Number:**	0395-010-00
Project Name:	19-C-09 Pavement Renewals - Johnson Ave.	**Location:**	UTM N-5530802, E-635384
Contractor:	Maple Leaf Drilling	**Ground Elevation:**	Top of Pavement
Method:	125 mm Solid Stem Auger, CME55 Truck Mount	**Date Drilled:**	November 5, 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



END OF TEST HOLE AT 1.7 m IN CLAY.
1) No seepage or sloughing observed.
2) Test hole open to 1.7 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, 25 m East of Henderson Hwy and 5 m North of curb.

Logged By: Harsimran Singh **Reviewed By:** Angela Fidler-Kliewer **Project Engineer:** Nelson Ferreira

Sub-Surface Log

Test Hole TH19-22
1 of 1

Client:	WSP Group Canada Inc.	**Project Number:**	0395-010-00
Project Name:	19-C-09 Pavement Renewals - Johnson Ave.	**Location:**	UTM N-5530648, E-635720
Contractor:	Maple Leaf Drilling	**Ground Elevation:**	Top of Pavement
Method:	125 mm Solid Stem Auger, CME55 Truck Mount	**Date Drilled:**	November 5, 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/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 - 190 mm thick				
		CONCRETE - 435 mm thick				
0.5		CLAY (FILL) - silty, trace sand, trace gravel (<20 mm diam.), trace rootless - grey - moist, very stiff - high plasticity - AASHTO: A-7-6		G101	●	✤
1.0		- black, trace organics below 1.2 m		G102	●	△ ✤
				G103	●	△ ✤
		TOPSOIL - silty, trace sand, trace organics, trace rootless - black, moist, very stiff, high plasticity, AASHTO: A-7-6		G104	●	△ ✤
1.5						

END OF TEST HOLE AT 1.5 m TOPSOIL.
1) No seepage or sloughing observed.
2) Test hole open to 1.5 m immediately after drilling.
3) Test hole backfilled with auger cuttings, granular fill and cold patch asphalt.
4) Test hole located at 266 Johnson Ave in Eastbound median lane, 5 m North of curb.

Logged By: Harsimran Singh **Reviewed By:** Angela Fidler-Kliewer **Project Engineer:** Nelson Ferreira

SUB-SURFACE LOG LOGS 2019-11-13_JOHNSON AVE_0395-010-00_0_A_HS.GPJ TREK GEOTECHNICAL.GDT 12/5/19

Sub-Surface Log

Test Hole TH19-23
1 of 1

Client:	WSP Group Canada Inc.	**Project Number:**	0395-010-00
Project Name:	19-C-09 Pavement Renewals - Johnson Ave.	**Location:**	UTM N-5530520, E-635975
Contractor:	Maple Leaf Drilling	**Ground Elevation:**	Top of Pavement
Method:	125 mm Solid Stem Auger, CME55 Truck Mount	**Date Drilled:**	November 5, 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/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 - 200 mm thick				
		CONCRETE - 450 mm thick with 100 mm diam. wood embedded in concrete				
0.5						
		CLAY - silty, trace sand - grey - moist, very stiff - high plasticity - AASHTO: A-7-6		G105	●	✤
1.0				G106	●	✤
		SILT - some clay, trace sand - moist, soft - brown - intermediate plasticity - AASHTO: A-6		G107	●	
1.5		- trace clay, low plasticity below 1.5 m		G108	●	

END OF TEST HOLE AT 1.7 m IN SILT.
1) No seepage or sloughing observed.
2) Test hole open to 1.7 m immediately after drilling.
3) Test hole backfilled with auger cuttings, granular fill and cold patch asphalt.
4) Test hole located at 341 Johnson Ave in Eastbound, median lane, 5 m North of curb.

Logged By: Harsimran Singh **Reviewed By:** Angela Fidler-Kliewer **Project Engineer:** Nelson Ferreira

SUB-SURFACE LOG LOGS 2019-11-13_JOHNSON AVE_0395-010-00_0_A_HS.GPJ TREK GEOTECHNICAL.GDT 12/5/19

Sub-Surface Log

Test Hole TH19-24
1 of 1

Client:	WSP Group Canada Inc.	**Project Number:**	0395-010-00
Project Name:	19-C-09 Pavement Renewals - Johnson Ave.	**Location:**	UTM N-5530492, E-636043
Contractor:	Maple Leaf Drilling	**Ground Elevation:**	Top of Pavement
Method:	125 mm Solid Stem Auger, CME55 Truck Mount	**Date Drilled:**	November 5, 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/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 - 150 mm thick				
		CONCRETE - 381 mm thick				
0.5		CLAY - silty, trace sand - grey - moist, very stiff - high plasticity - AASHTO: A-7-6(58)		G109	●	✤ △
1.0				G110	●	△ ✤
		- firm to stiff below 1.2 m		G111	●	△ ✤
1.5		SILT - some clay, trace sand - brown - moist, soft - intermediate plasticity - AASHTO: A-6		G112	●	

END OF TEST HOLE AT 1.8 m IN SILT.
1) No seepage or sloughing observed.
2) Test hole open to 1.8 m immediately after drilling.
3) Test hole backfilled with auger cuttings, granular fill and cold patch asphalt.
4) Test hole located at 359B Johnson Ave in Westbound median lane, 5 m South of curb.

Logged By: Harsimran Singh **Reviewed By:** Angela Fidler-Kliewer **Project Engineer:** Nelson Ferreira

SUB-SURFACE LOG LOGS 2019-11-13_JOHNSON AVE_0395-010-00_0_A_HS.GPJ TREK GEOTECHNICAL.GDT 12/5/19

Sub-Surface Log

Test Hole TH19-25
1 of 1

Client:	WSP Group Canada Inc.	**Project Number:**	0395-010-00
Project Name:	19-C-09 Pavement Renewals - Johnson Ave.	**Location:**	UTM N-5530554, E-635902
Contractor:	Maple Leaf Drilling	**Ground Elevation:**	Top of Pavement
Method:	125 mm Solid Stem Auger, CME55 Truck Mount	**Date Drilled:**	November 5, 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/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 - 150 mm thick				
		CONCRETE - 400 mm thick				
0.5		CLAY - silty, trace sand, trace gravel (<20 mm diam.), trace rootless, trace organics - black, moist, firm to stiff, high plasticity - AASHTO: A-7-6		G113	●	✤
		SILT - some clay, trace sand - brown - moist, soft - intermediate plasticity - AASHTO: A-6		G114	●	
1.0		- trace clay, low plasticity below 1.2 m		G115	●	
1.5				G116	●	

END OF TEST HOLE AT 1.7 m IN SILT.
1) No seepage or sloughing observed.
2) Test hole open to 1.7 m immediately after drilling.
3) Test hole backfilled with auger cuttings, granular fill and cold patch asphalt.
4) Test hole located at 319 Johnson Ave in Westbound median lane, 5 m South of curb.

Logged By: Harsimran Singh **Reviewed By:** Angela Fidler-Kliewer **Project Engineer:** Nelson Ferreira

SUB-SURFACE LOG LOGS 2019-11-13_JOHNSON AVE_0395-010-00_0_A_HS.GPJ TREK GEOTECHNICAL.GDT 12/5/19

Sub-Surface Log

Test Hole TH19-26
1 of 1

Client:	WSP Group Canada Inc.	**Project Number:**	0395-010-00
Project Name:	19-C-09 Pavement Renewals - Johnson Ave.	**Location:**	UTM N-5530606, E-635796
Contractor:	Maple Leaf Drilling	**Ground Elevation:**	Top of Pavement
Method:	125 mm Solid Stem Auger, CME55 Truck Mount	**Date Drilled:**	November 5, 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/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 - 200 mm thick				
		CONCRETE - 450 mm thick with 100 mm diam. wood embedded in concrete				
0.5						
		CLAY - silty, trace sand - grey - moist, very stiff - high plasticity - AASHTO: A-7-6		G117	●	✤ △
1.0				G118	●	✤
1.5				G119	●	✤
		SILT - some clay, trace sand - brown, moist, soft, intermediate plasticity - AASHTO: A-6		G120	●	

END OF TEST HOLE AT 1.8 m IN SILT.
1) No seepage or sloughing observed.
2) Test hole open to 1.7 m immediately after drilling.
3) Test hole backfilled with auger cuttings, granular fill and cold patch asphalt.
4) Test hole located at 287 Johnson Ave in Westbound median lane, 5 m South of curb.

Logged By: Harsimran Singh **Reviewed By:** Angela Fidler-Kliewer **Project Engineer:** Nelson Ferreira

SUB-SURFACE LOG LOGS 2019-11-13_JOHNSON AVE_0395-010-00_0_A_HS.GPJ TREK GEOTECHNICAL.GDT 12/5/19

Sub-Surface Log

Test Hole TH19-27
1 of 1

Client:	WSP Group Canada Inc.	**Project Number:**	0395-010-00
Project Name:	19-C-09 Pavement Renewals - Johnson Ave.	**Location:**	UTM N-5530684, E-635634
Contractor:	Maple Leaf Drilling	**Ground Elevation:**	Top of Pavement
Method:	125 mm Solid Stem Auger, CME55 Truck Mount	**Date Drilled:**	November 5, 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/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 - 200 mm thick				
		CONCRETE - 400 mm thick with 100 mm diam. wood embedded in concrete				
0.5		SAND (FILL) - some silt, brown, moist, loose, poorly graded sand, AASHTO: A-3		G121	●	
		CLAY - silty, trace sand, trace rootless, trace organics, trace gravel (<20 mm diam.) to 0.9 m - black - moist, very stiff - high plasticity - AASHTO: A-7-6		G122	●	△ ✤
1.0				G123	●	△ ✤
				G124	●	△ ✤
1.5		END OF TEST HOLE AT 1.5 m IN CLAY.				

1) No seepage or sloughing observed.
2) Test hole open to 1.5 m immediately after drilling.
3) Test hole backfilled with auger cuttings, granular fill and cold patch asphalt.
4) Test hole located at 227 Johnson Ave in Westbound median lane, 5 m South of curb.

Logged By: Harsimran Singh **Reviewed By:** Angela Fidler-Kliewer **Project Engineer:** Nelson Ferreira

SUB-SURFACE LOG LOGS 2019-11-13_JOHNSON AVE_0395-010-00_0_A_HS.GPJ TREK GEOTECHNICAL.GDT 12/5/19

Sub-Surface Log

Test Hole TH19-28
1 of 1

Client:	WSP Group Canada Inc.	**Project Number:**	0395-010-00
Project Name:	19-C-09 Pavement Renewals - Johnson Ave.	**Location:**	UTM N-5530765, E-635463
Contractor:	Maple Leaf Drilling	**Ground Elevation:**	Top of Pavement
Method:	125 mm Solid Stem Auger, CME55 Truck Mount	**Date Drilled:**	November 5, 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/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
0		ASPHALT - 150 mm thick				
		CONCRETE - 450 mm thick				
0.5		CLAY - silty, trace sand - grey - moist, very stiff - high plasticity - AASHTO: A-7-6		G125		
1.0		SILT - some clay, trace sand - moist, soft - brown - intermediate plasticity - AASHTO: A-6(13)		G126		
				G127		
1.5				G128		

END OF TEST HOLE AT 1.5 m IN SILT.
1) No seepage or sloughing observed.
2) Test hole open to 1.5 m immediately after drilling.
3) Test hole backfilled with auger cuttings, granular fill and cold patch asphalt.
4) Test hole located at 179 Johnson Ave in Westbound median lane, 5 m South of curb.

Logged By: Harsimran Singh **Reviewed By:** Angela Fidler-Kliewer **Project Engineer:** Nelson Ferreira

SUB-SURFACE LOG LOGS 2019-11-13_JOHNSON AVE_0395-010-00_0_A_HS.GPJ TREK GEOTECHNICAL.GDT 12/5/19

Sub-Surface Log

Test Hole TH19-29

Client:	WSP Group Canada Inc.	**Project Number:**	0395-010-00
Project Name:	19-C-09 Pavement Renewals - Johnson Ave.	**Location:**	UTM N-5530720, E-635548
Contractor:	Maple Leaf Drilling	**Ground Elevation:**	Top of Pavement
Method:	125 mm Solid Stem Auger, CME55 Truck Mount	**Date Drilled:**	November 5, 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/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 - 200 mm thick				
		CONCRETE - 400 mm thick				
0.5		CLAY - silty, trace sand, trace gravel (<20 mm diam.) - grey - moist, firm to stiff - high plasticity - AASHTO: A-7-6		G129	●	△ ✿
1.0		SILT - some clay, trace sand - moist, soft - brown - intermediate plasticity - AASHTO: A-6		G130	●	
1.5		SILT AND CLAY - moist, soft to firm - grey - intermediate plasticity - AASHTO: A-7-5		G131	●	✿
				G132	●	✿
		- stiff below 1.7 m		G133	●	△ ✿

END OF TEST HOLE AT 1.8 m IN CLAY AND SILT.
1) No seepage or sloughing observed.
2) Test hole open to 1.8 m immediately after drilling.
3) Test hole backfilled with auger cuttings, granular fill and cold patch asphalt.
4) Test hole located at 204 Johnson Ave in Eastbound median lane, 5 m North of curb.

Logged By: Harsimran Singh **Reviewed By:** Angela Fidler-Kliewer **Project Engineer:** Nelson Ferreira

19-C-09 Johnson Ave Pavement Renewals
Sub-Surface Investigation
Johnson Ave

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
TH19-21	UTM : 5530802 N, 635384 E Located in Eastbound median lane, 25 m East of Henderson Hwy and 5 m North of curb.	Asphalt	100	Concrete	483	Clay	0.7	0.9	32							
						Clay	1.0	1.2	33	80	20	0	0	20	78	58
						Clay	1.3	1.5	34							
						Clay	1.5	1.7	32							
TH19-22	UTM : 5530648 N, 635720 E Located at 266 Johnson Ave in Eastbound median lane, 5 m North of curb.	Asphalt	190	Concrete	435	Clay	0.7	0.9	15							
						Clay	1.0	1.2	29							
						Clay	1.2	1.4	37							
						Topsoil	1.4	1.5	45							
TH19-23	UTM : 5530520 N, 635975 E Located at 341 Johnson Ave in Eastbound, median lane, 5 m North of curb.	Asphalt	200	Concrete	350	Clay	0.7	0.8	31							
				Wood	100	Clay	0.9	1.1	31							
						Silt	1.1	1.2	26							
						Silt	1.5	1.7	21							
TH19-24	UTM : 5530492 N, 636043 E Located at 359B Johnson Ave in Westbound median lane, 5 m South of curb.	Asphalt	150	Concrete	381	Clay	0.6	0.8	33							
						Clay	0.9	1.1	34	78	21	1	0	30	79	49
						Clay	1.2	1.4	34							
						Silt	1.5	1.7	27							
TH19-25	UTM : 5530554 N, 635902 E Located at 319 Johnson Ave in Westbound median lane, 5 m South of curb.	Asphalt	150	Concrete	400	Clay	0.6	0.8	31							
						Silt	0.9	1.1	23							
						Silt	1.2	1.4	28							
						Silt	1.5	1.7	22							

19-C-09 Johnson Ave Pavement Renewals
Sub-Surface Investigation
Johnson Ave

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
TH19-26	UTM : 5530606 N, 635796 E Located at 287 Johnson Ave in Westbound median lane, 5 m South of curb.	Asphalt	200	Concrete	450	Clay	0.8	0.9	30							
						Clay	1.1	1.2	30							
						Clay	1.4	1.5	30							
						Silt	1.7	1.8	28							
TH19-27	UTM : 5530684 N, 635634 E Located at 227 Johnson Ave in Westbound median lane, 5 m South of curb.	Asphalt	200	Concrete	300	Sand (Fill)	0.6	0.7	5							
				Wood	100	Clay	0.8	0.9	28							
						Clay	1.1	1.2	30							
						Clay	1.4	1.5	29							
TH19-28	UTM : 5530765 N, 635463 E Located at 179 Johnson Ave in Westbound median lane, 5 m South of curb.	Asphalt	150	Concrete	450	Clay	0.6	0.8	31							
						Silt	0.9	1.1	25	20	75	5	0	18	33	14
						Silt	1.2	1.4	24							
						Silt	1.4	1.5	23							
TH19-29	UTM : 5530720 N, 635548 E Located at 204 Johnson Ave in Eastbound median lane, 5 m North of curb.	Asphalt	200	Concrete	400	Clay	0.8	0.9	28							
						Silt	1.1	1.2	27							
						Silt and Clay	1.4	1.5	27							
						Silt and Clay	1.5	1.7	30							
						Silt and Clay	1.7	1.8	32							

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Moisture Content Report
ASTM D2216-10

Project No. 0395-010-00
Client WSP Group Canada Ltd.
Project Johnson Avenue Pavement Renewals

Sample Date 05-Nov-19
Test Date 14-Nov-19
Technician HS

Test Hole	TH19-21	TH19-21	TH19-21	TH19-21	TH19-22	TH19-22
Depth (m)	0.7 - 0.9	1.0 - 1.2	1.3 - 1.5	1.5 - 1.7	0.7 - 0.9	1.0 - 1.2
Sample #	G97	G98	G99	G100	G101	G102
Tare ID	Z43	C8	P03	A102	A27	K22
Mass of tare	8.4	8.4	8.8	8.4	8.4	8.4
Mass wet + tare	234.2	304.0	163.8	194.8	164.0	197.0
Mass dry + tare	179.2	230.5	124.9	149.4	143.5	154.3
Mass water	55.0	73.5	38.9	45.4	20.5	42.7
Mass dry soil	170.8	222.1	116.1	141.0	135.1	145.9
Moisture %	32.2%	33.1%	33.5%	32.2%	15.2%	29.3%

Test Hole	TH19-22	TH19-22	TH19-23	TH19-23	TH19-23	TH19-23
Depth (m)	1.2 - 1.4	1.4 - 1.5	0.7 - 0.8	0.9 - 1.1	1.1 - 1.2	1.5 - 1.7
Sample #	G103	G104	G105	G106	G107	G108
Tare ID	N49	AB27	H24	K12	F133	K2
Mass of tare	8.4	6.6	8.6	8.6	8.4	8.6
Mass wet + tare	128.6	141.4	215.0	240.2	279.8	293.8
Mass dry + tare	96.3	99.9	166.3	184.9	224.5	244.1
Mass water	32.3	41.5	48.7	55.3	55.3	49.7
Mass dry soil	87.9	93.3	157.7	176.3	216.1	235.5
Moisture %	36.7%	44.5%	30.9%	31.4%	25.6%	21.1%

Test Hole	TH19-24	TH19-24	TH19-24	TH19-24	TH19-25	TH19-25
Depth (m)	0.6 - 0.8	0.9 - 1.1	1.2 - 1.4	1.5 - 1.7	0.6 - 0.8	0.9 - 1.1
Sample #	G109	G110	G111	G112	G113	G114
Tare ID	Z12	AB01	N114	H65	K9	K28
Mass of tare	8.6	6.6	8.8	8.6	8.4	8.6
Mass wet + tare	236.8	333.4	179.6	180.6	194.0	282.6
Mass dry + tare	179.9	250.5	136.0	144.3	150.1	231.2
Mass water	56.9	82.9	43.6	36.3	43.9	51.4
Mass dry soil	171.3	243.9	127.2	135.7	141.7	222.6
Moisture %	33.2%	34.0%	34.3%	26.8%	31.0%	23.1%

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Moisture Content Report
ASTM D2216-10

Project No. 0395-010-00
Client WSP Group Canada Ltd.
Project Johnson Avenue Pavement Renewals

Sample Date 05-Nov-19
Test Date 14-Nov-19
Technician HS

Test Hole	TH19-25	TH19-25	TH19-26	TH19-26	TH19-26	TH19-26
Depth (m)	1.2 - 1.4	1.5 - 1.7	0.8 - 0.9	1.1 - 1.2	1.4 - 1.5	1.7 - 1.8
Sample #	G115	G116	G117	G118	G119	G120
Tare ID	F49	A37	F142	E55	E94	E78
Mass of tare	8.4	8.2	8.8	8.8	8.4	8.6
Mass wet + tare	236.8	180.8	170.4	193.4	132.8	153.8
Mass dry + tare	187.6	149.3	132.9	151.1	104.2	122.3
Mass water	49.2	31.5	37.5	42.3	28.6	31.5
Mass dry soil	179.2	141.1	124.1	142.3	95.8	113.7
Moisture %	27.5%	22.3%	30.2%	29.7%	29.9%	27.7%

Test Hole	TH19-27	TH19-27	TH19-27	TH19-27	TH19-28	TH19-28
Depth (m)	0.6 - 0.7	0.8 - 0.9	1.1 - 1.2	1.4 - 1.5	0.6 - 0.8	0.9 - 1.1
Sample #	G121	G122	G123	G124	G125	G126
Tare ID	W08	W09	N85	AA14	AB26	D35
Mass of tare	8.4	8.8	8.4	6.8	6.6	8.6
Mass wet + tare	220.8	206.4	177.0	136.8	180.6	341.4
Mass dry + tare	210.8	163.4	138.3	107.4	139.0	273.9
Mass water	10.0	43.0	38.7	29.4	41.6	67.5
Mass dry soil	202.4	154.6	129.9	100.6	132.4	265.3
Moisture %	4.9%	27.8%	29.8%	29.2%	31.4%	25.4%

Test Hole	TH19-28	TH19-28	TH19-29	TH19-29	TH19-29	TH19-29
Depth (m)	1.2 - 1.4	1.4 - 1.5	0.8 - 0.9	1.1 - 1.2	1.4 - 1.5	1.5 - 1.7
Sample #	G127	G128	G129	G130	G131	G132
Tare ID	W15	OO1	A19	W10	P34	Z81
Mass of tare	8.4	8.4	8.6	8.4	8.4	8.4
Mass wet + tare	233.0	233.8	180.6	328.8	208.0	287.6
Mass dry + tare	190.0	191.4	143.4	260.1	165.9	223.9
Mass water	43.0	42.4	37.2	68.7	42.1	63.7
Mass dry soil	181.6	183.0	134.8	251.7	157.5	215.5
Moisture %	23.7%	23.2%	27.6%	27.3%	26.7%	29.6%

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Moisture Content Report
ASTM D2216-10

Project No. 0395-010-00
Client WSP Group Canada Ltd.
Project Johnson Avenue Pavement Renewals

Sample Date 05-Nov-19
Test Date 14-Nov-19
Technician HS

Test Hole	TH19-29					
Depth (m)	1.7 - 1.8					
Sample #	G133					
Tare ID	E56					
Mass of tare	8.6					
Mass wet + tare	198.8					
Mass dry + tare	152.5					
Mass water	46.3					
Mass dry soil	143.9					
Moisture %	32.2%					

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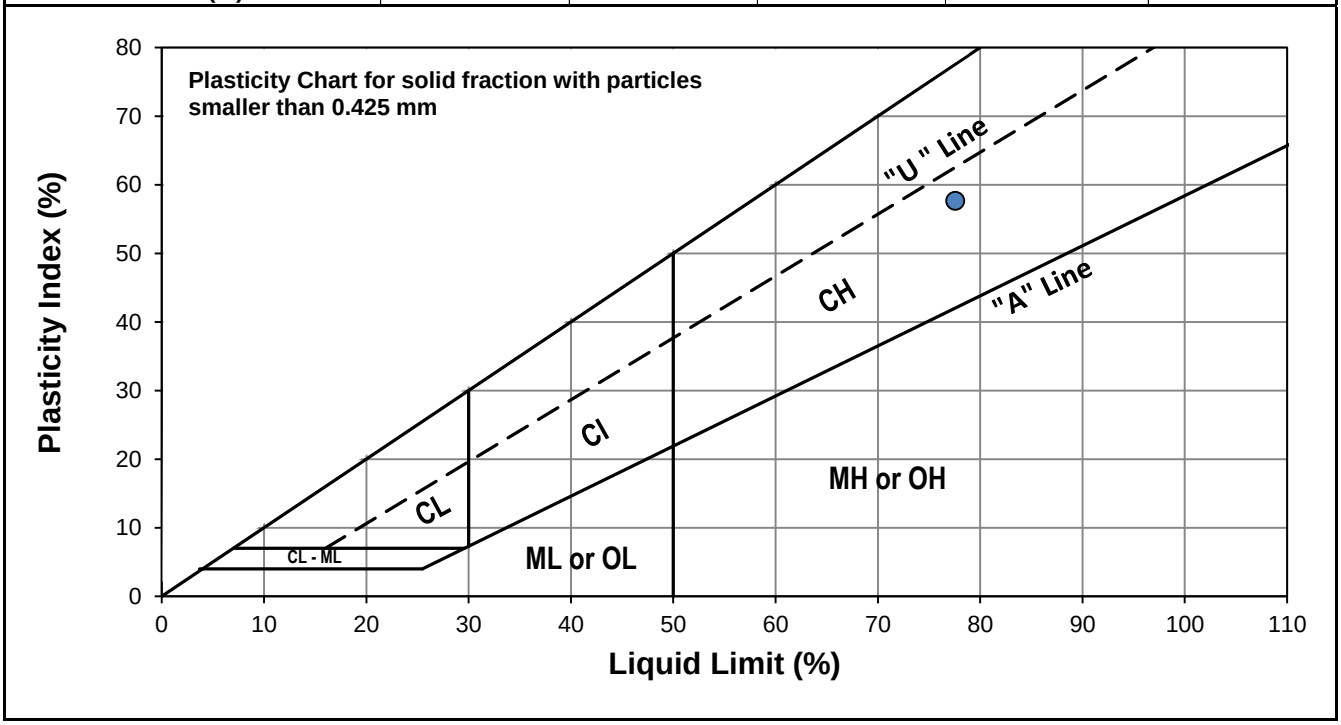
Atterberg Limits
ASTM D4318-10e1

Project No.	0395-010-00
Client	WSP Group Canada Ltd.
Project	19-C-09 Johnson Avenue Pavement Renewals
Test Hole	TH19-21
Sample #	G98
Depth (m)	1.0 - 1.2
Sample Date	05-Nov-19
Test Date	19-Nov-19
Technician	AD

Liquid Limit	78
Plastic Limit	20
Plasticity Index	58

Liquid Limit

Trial #	1	2	3		
Number of Blows (N)	17	23	35		
Mass Wet Soil + Tare (g)	26.621	24.362	25.061		
Mass Dry Soil + Tare (g)	21.081	19.874	20.290		
Mass Tare (g)	14.154	14.121	13.972		
Mass Water (g)	5.540	4.488	4.771		
Mass Dry Soil (g)	6.927	5.753	6.318		
Moisture Content (%)	79.977	78.011	75.514		



Plastic Limit

Trial #	1	2	3	4	5
Mass Tare (g)	13.986	14.100			
Mass Wet Soil + Tare (g)	20.637	21.610			
Mass Dry Soil + Tare (g)	19.554	20.338			
Mass Water (g)	1.083	1.272			
Mass Dry Soil (g)	5.568	6.238			
Moisture Content (%)	19.450	20.391			

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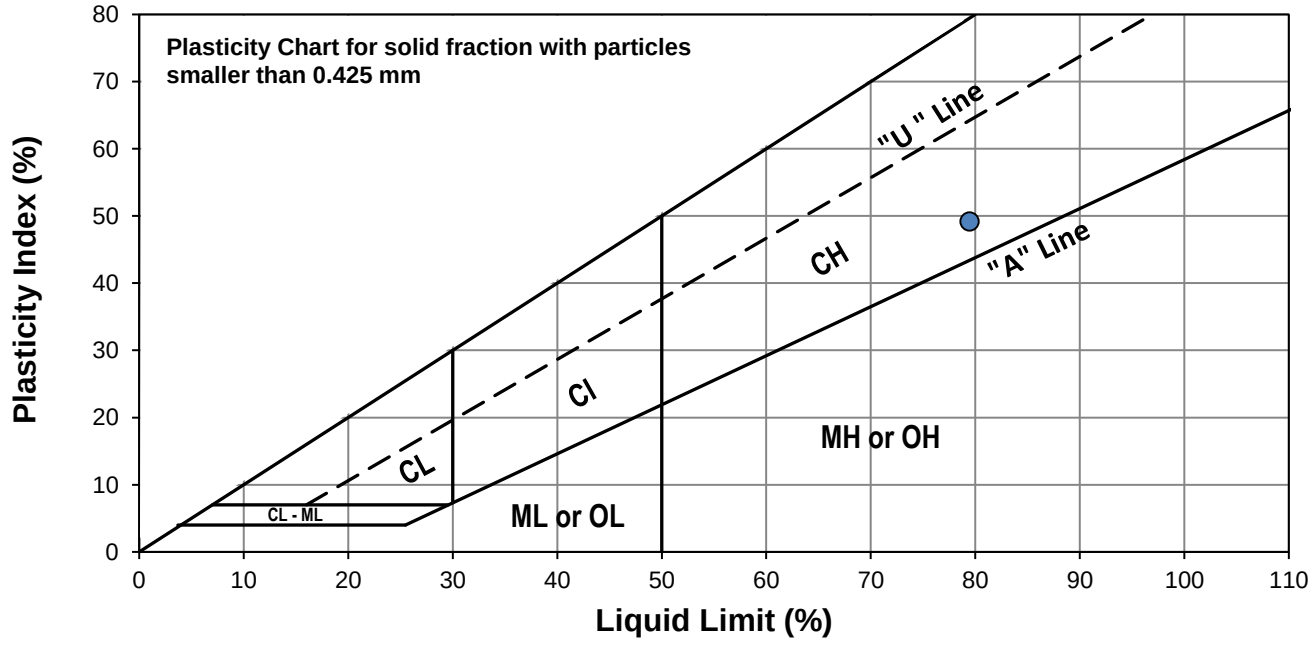
Atterberg Limits
ASTM D4318-10e1

Project No.	0395-010-00
Client	WSP Group Canada Ltd.
Project	19-C-09 Johnson Avenue Pavement Renewals
Test Hole	TH19-24
Sample #	G110
Depth (m)	0.9 - 1.1
Sample Date	5-Nov-19
Test Date	21-Nov-19
Technician	HS

Liquid Limit	79
Plastic Limit	30
Plasticity Index	49

Liquid Limit

Trial #	1	2	3		
Number of Blows (N)	17	23	28		
Mass Wet Soil + Tare (g)	29.332	26.255	27.720		
Mass Dry Soil + Tare (g)	22.270	20.824	21.762		
Mass Tare (g)	13.870	14.081	14.128		
Mass Water (g)	7.062	5.431	5.958		
Mass Dry Soil (g)	8.400	6.743	7.634		
Moisture Content (%)	84.071	80.543	78.046		



Plastic Limit

Trial #	1	2	3	4	5
Mass Tare (g)	13.890	14.177			
Mass Wet Soil + Tare (g)	20.468	20.611			
Mass Dry Soil + Tare (g)	18.948	19.106			
Mass Water (g)	1.520	1.505			
Mass Dry Soil (g)	5.058	4.929			
Moisture Content (%)	30.051	30.534			

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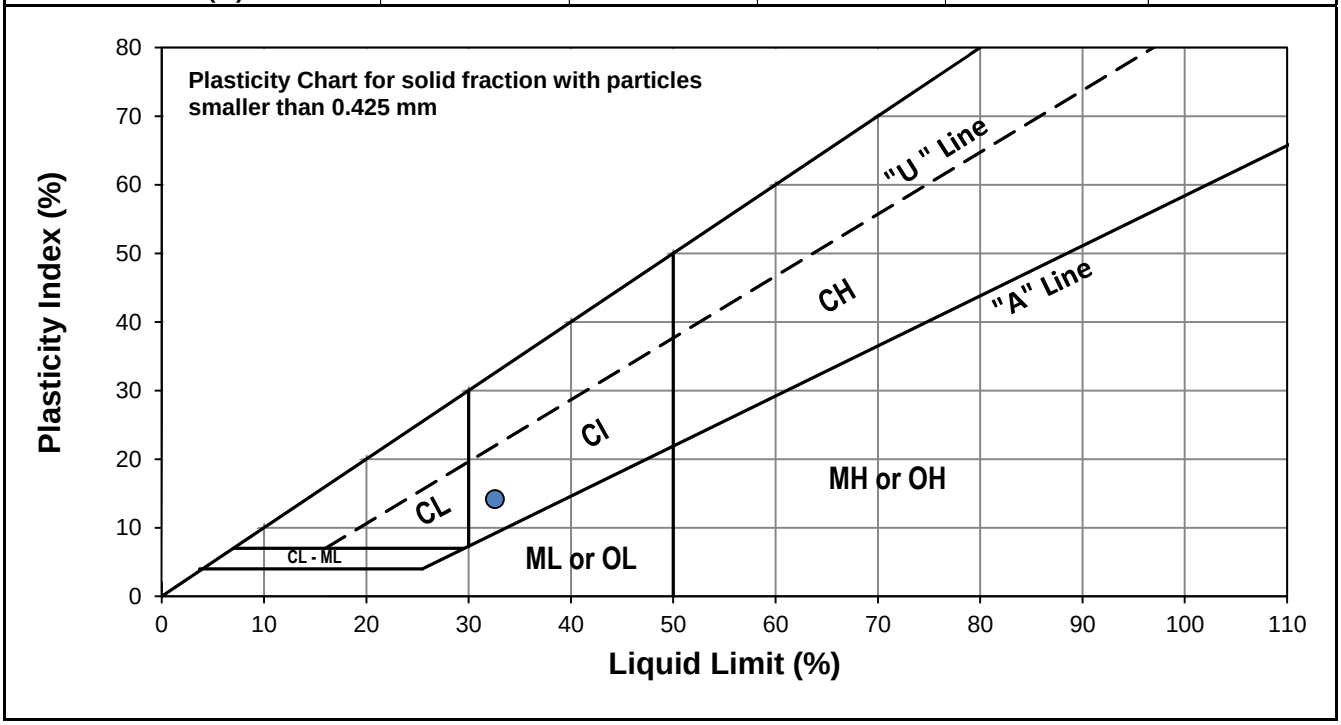
Atterberg Limits
ASTM D4318-10e1

Project No.	0395-010-00
Client	WSP Group Canada Ltd.
Project	19-C-09 Johnson Avenue Pavement Renewals
Test Hole	TH19-28
Sample #	G126
Depth (m)	0.9 - 1.1
Sample Date	05-Nov-19
Test Date	20-Nov-19
Technician	HS

Liquid Limit	33
Plastic Limit	18
Plasticity Index	14

Liquid Limit

Trial #	1	2	3		
Number of Blows (N)	16	21	28		
Mass Wet Soil + Tare (g)	24.214	22.566	22.565		
Mass Dry Soil + Tare (g)	21.684	20.442	20.502		
Mass Tare (g)	14.195	14.036	14.100		
Mass Water (g)	2.530	2.124	2.063		
Mass Dry Soil (g)	7.489	6.406	6.402		
Moisture Content (%)	33.783	33.156	32.224		



Plastic Limit

Trial #	1	2	3	4	5
Mass Tare (g)	14.202	14.123			
Mass Wet Soil + Tare (g)	21.931	20.708			
Mass Dry Soil + Tare (g)	20.714	19.696			
Mass Water (g)	1.217	1.012			
Mass Dry Soil (g)	6.512	5.573			
Moisture Content (%)	18.689	18.159			

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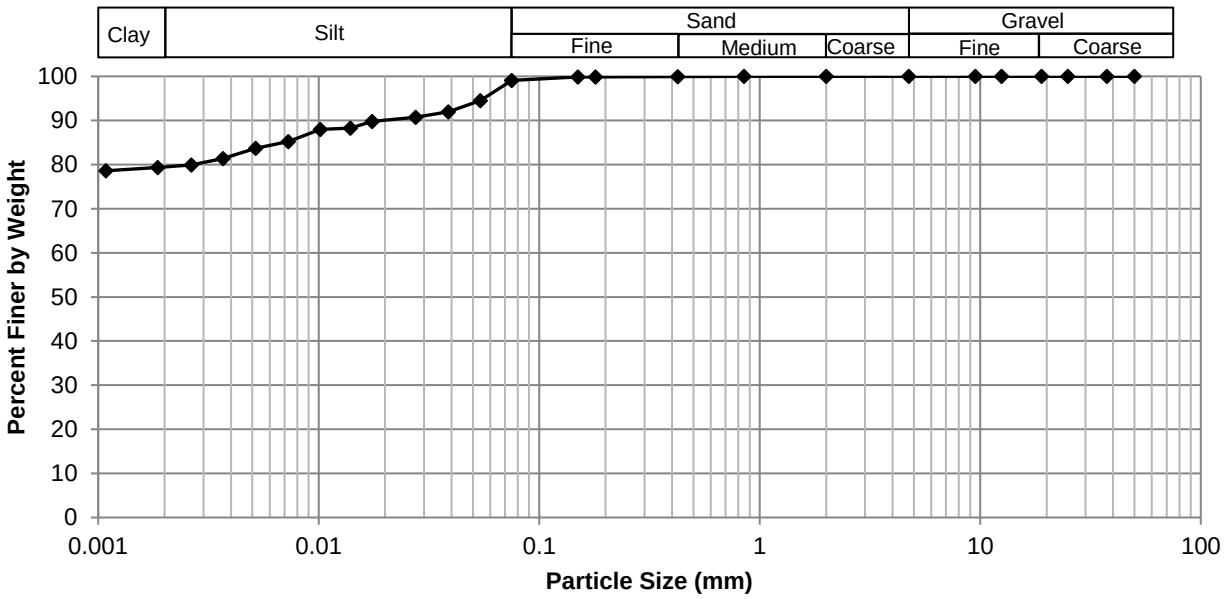
Grain Size Analysis (Hydrometer Method)
ASTM D7928

Project No.	0395 010 00
Client	WSP Group Canada Ltd.
Project	Johnson Ave Pavement Renewals
Test Hole	TH19-21
Sample #	G98
Depth (m)	1.0 - 1.2
Sample Date	5-Nov-19
Test Date	20-Nov-19
Technician	HS/AD

Gravel	0.0%
Sand	0.9%
Silt	19.6%
Clay	79.5%

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	0.0540	94.47
25.0	100.00	0.850	100.00	0.0387	91.97
19.0	100.00	0.425	99.97	0.0275	90.72
12.5	100.00	0.180	99.86	0.0175	89.79
9.50	100.00	0.150	99.86	0.0139	88.29
4.75	100.00	0.075	99.11	0.0102	87.98
				0.0073	85.23
				0.0052	83.73
				0.0037	81.36
				0.0026	79.93
				0.0019	79.37
				0.0011	78.59

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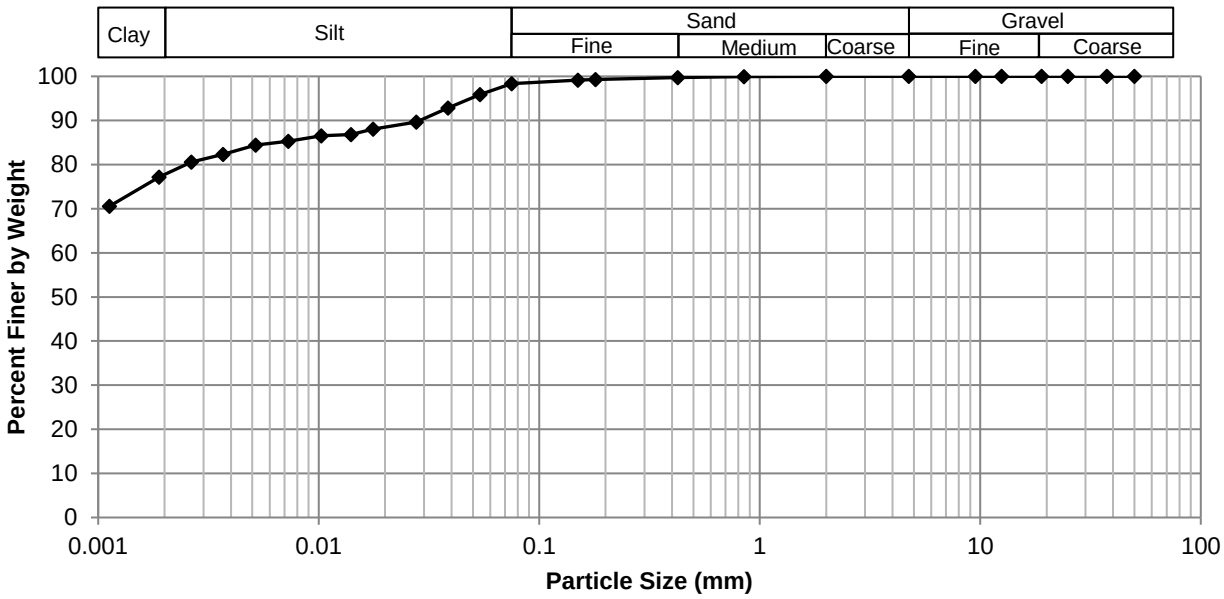
Grain Size Analysis (Hydrometer Method)
ASTM D7928

Project No.	0395 010 00
Client	WSP Group Canada Ltd.
Project	Johnson Ave Pavement Renewals
Test Hole	TH19-24
Sample #	G110
Depth (m)	0.9 - 1.1
Sample Date	5-Nov-19
Test Date	20-Nov-19
Technician	HS/AD

Gravel	0.0%
Sand	1.6%
Silt	20.7%
Clay	77.7%

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	98.35
37.5	100.00	2.00	100.00	0.0538	95.89
25.0	100.00	0.850	99.92	0.0386	92.80
19.0	100.00	0.425	99.72	0.0277	89.66
12.5	100.00	0.180	99.27	0.0177	88.08
9.50	100.00	0.150	99.18	0.0140	86.83
4.75	100.00	0.075	98.35	0.0103	86.51
				0.0073	85.31
				0.0052	84.42
				0.0037	82.33
				0.0026	80.55
				0.0019	77.15
				0.0011	70.56

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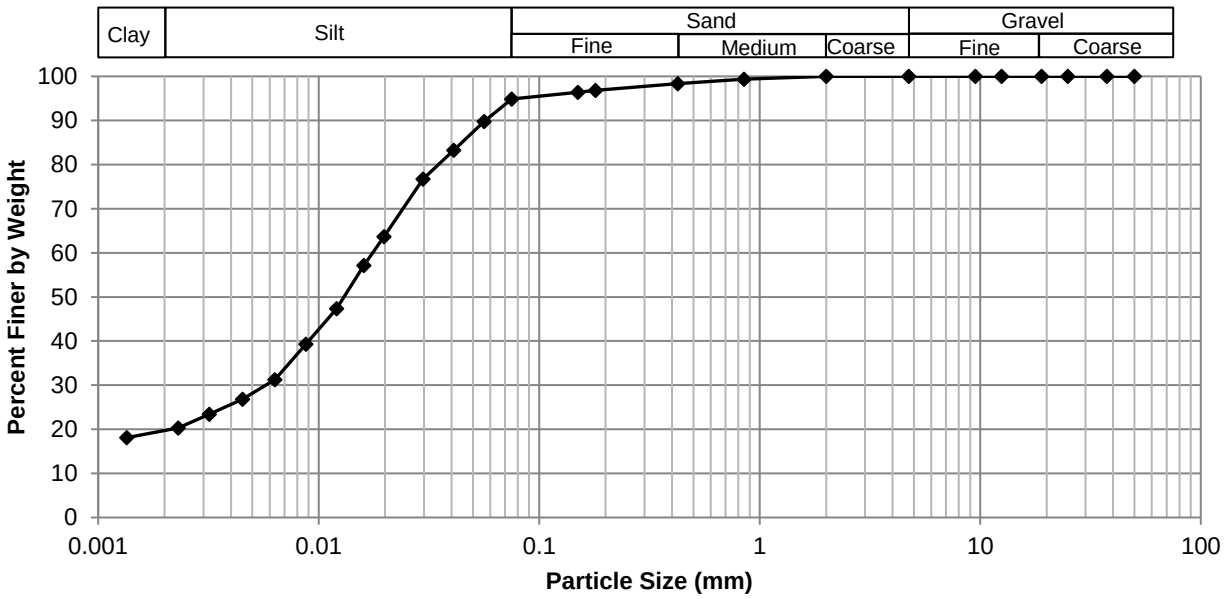
Grain Size Analysis (Hydrometer Method)
ASTM D7928

Project No.	0395 010 00
Client	WSP Group Canada Ltd.
Project	Johnson Ave Pavement Renewals
Test Hole	TH19-28
Sample #	G126
Depth (m)	0.9 - 1.1
Sample Date	5-Nov-19
Test Date	18-Nov-19
Technician	HS

Gravel	0.0%
Sand	5.1%
Silt	75.3%
Clay	19.6%

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	100.00	0.0750	94.87
37.5	100.00	2.00	100.00	0.0563	89.81
25.0	100.00	0.850	99.39	0.0410	83.27
19.0	100.00	0.425	98.36	0.0298	76.74
12.5	100.00	0.180	96.79	0.0198	63.67
9.50	100.00	0.150	96.41	0.0160	57.13
4.75	100.00	0.075	94.87	0.0121	47.39
				0.0087	39.28
				0.0063	31.23
				0.0045	26.82
				0.0032	23.40
				0.0023	20.31
				0.0013	18.10

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Standard Proctor Compaction Test

ASTM D698-12e2

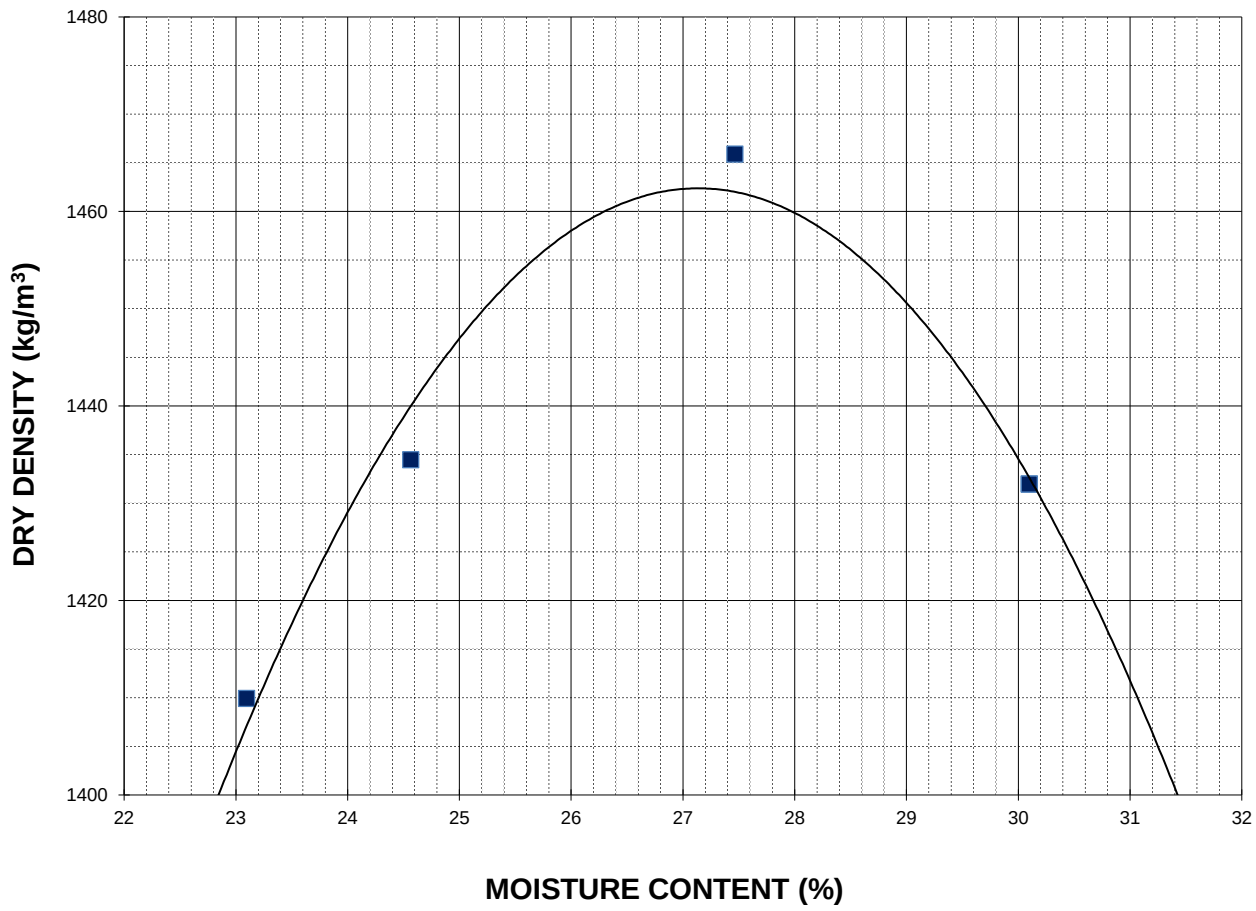
CERTIFIED BY CCIL Canadian Council of Independent Laboratories For specific tests as listed on www.ccil.com

Project No.	0395-010-00
Client	WSP Group
Project	19-C-09 Johnson Ave Pavement Renewals

Sample #	Bulk 1
Source	TH19-22,27
Material	Clay
Sample Date	05-Nov-19
Test Date	20-Nov-19
Technician	AD

Maximum Dry Density (kg/m3)	1462
Optimum Moisture (%)	27.1

Trial Number	1	2	3	4	
Wet Density (kg/m^3)	1736	1787	1869	1863	
Dry Density (kg/m^3)	1410	1434	1466	1432	
Moisture Content (%)	23.1	24.6	27.5	30.1	



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Standard Proctor Compaction Test

ASTM D698-12e2

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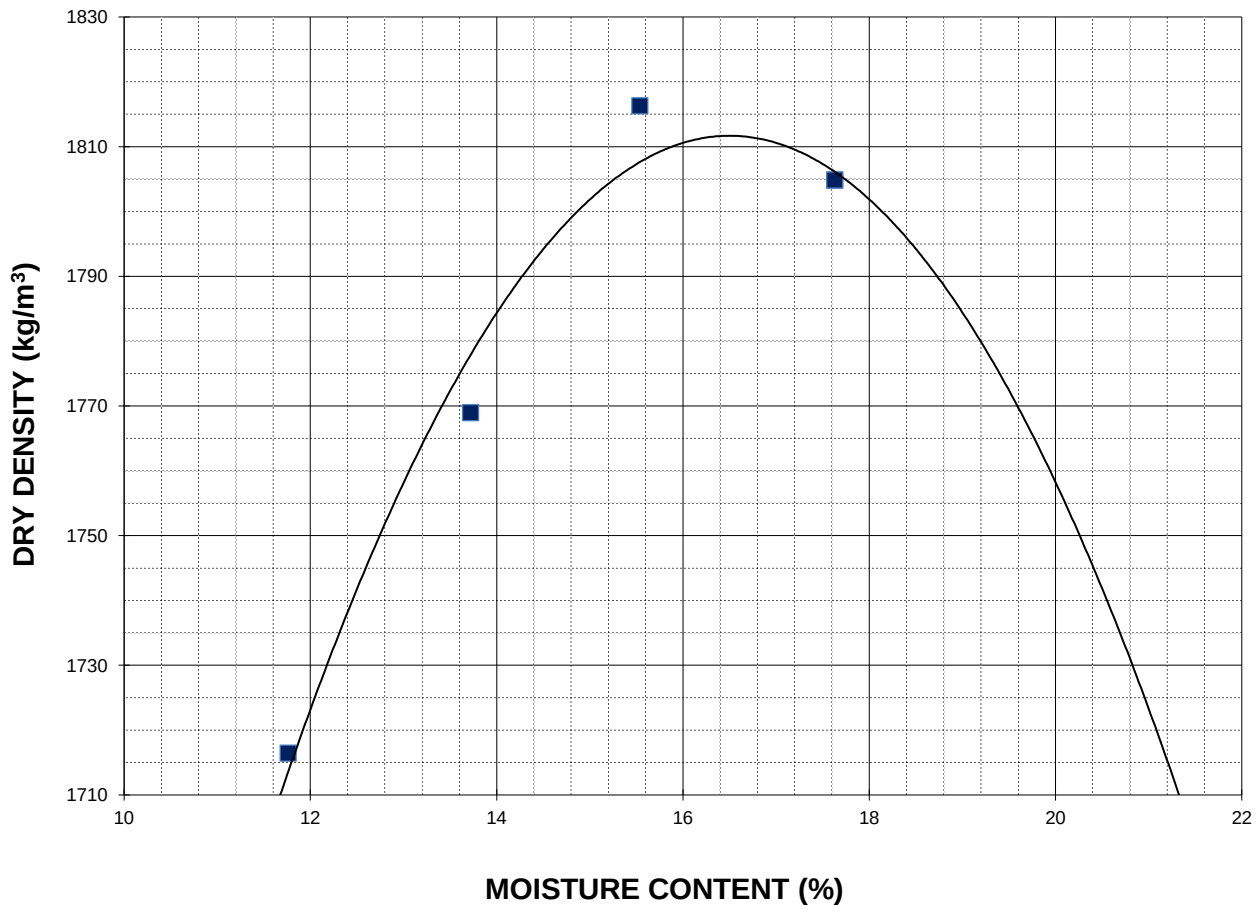
Project No.	0395-010-00
Client	WSP Group
Project	19-C-09 Johnson Ave Pavement Renewals

Sample #	Bulk 2
Source	TH19-23,24,25,29
Material	Silt
Sample Date	01-Nov-19
Test Date	20-Nov-19
Technician	AD

Maximum Dry Density (kg/m3)	1812
Optimum Moisture (%)	16.5

Trial Number	1	2	3	4	
Wet Density (kg/m^3)	1918	2012	2099	2123	
Dry Density (kg/m^3)	1716	1769	1816	1805	
Moisture Content (%)	11.8	13.7	15.5	17.6	



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Standard Proctor Compaction Test

ASTM D698-12e2

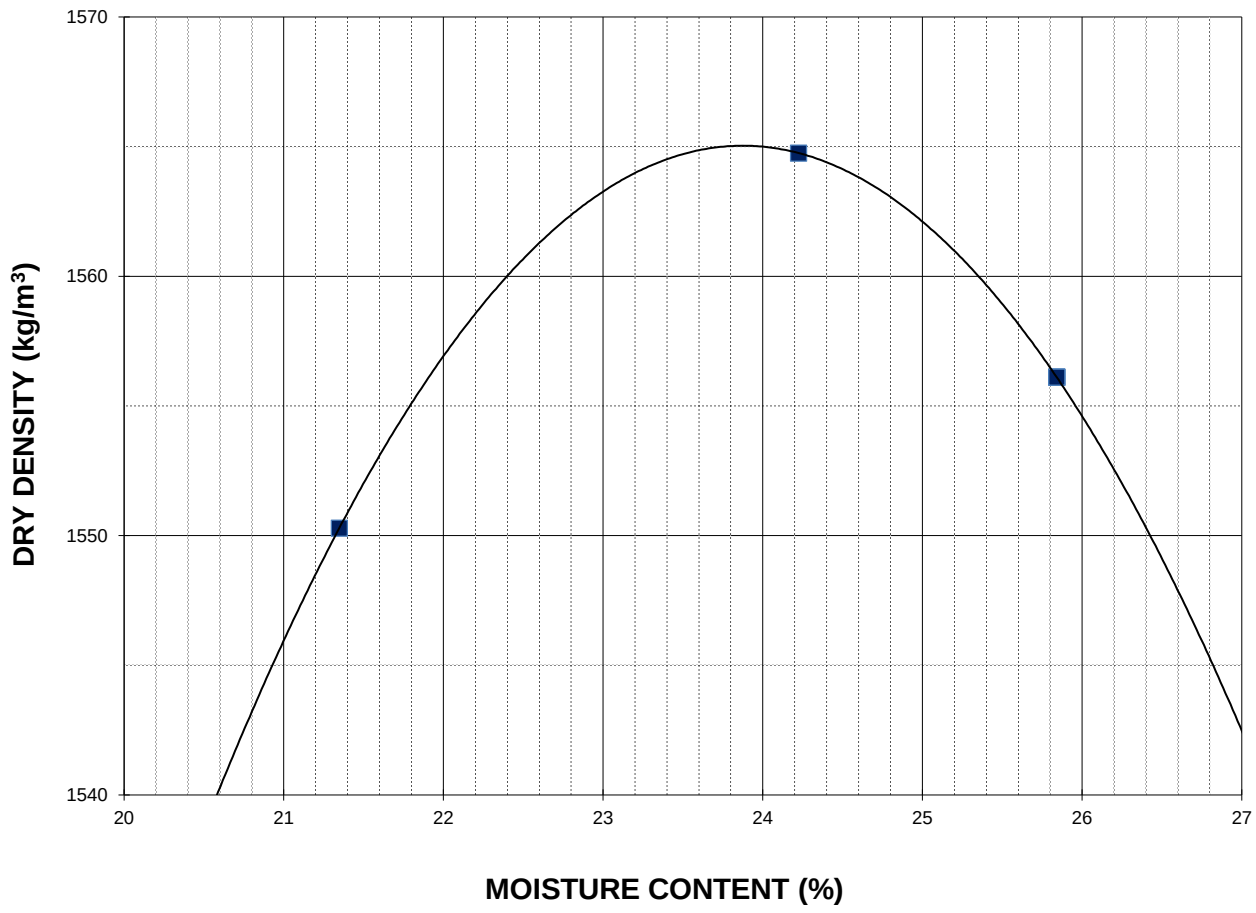
CERTIFIED BY CCIL Canadian Council of Independent Laboratories For specific tests as listed on www.ccil.com

Project No.	0395-010-00
Client	WSP Group
Project	19-C-09 Johnson Ave Pavement Renewals

Sample #	Bulk 3
Source	TH19-26
Material	Clay
Sample Date	01-Nov-19
Test Date	22-Nov-19
Technician	AD

Maximum Dry Density (kg/m3)	1565
Optimum Moisture (%)	23.9

Trial Number	1	2	3		
Wet Density (kg/m^3)	1881	1944	1958		
Dry Density (kg/m^3)	1550	1565	1556		
Moisture Content (%)	21.3	24.2	25.8		



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1712 St. James Street
Winnipeg, MB R3H 0L3
Tel: 204.975.9433 Fax: 204.975.9435

California Bearing Ratio Test Data Sheet

ASTM D1883-16

Project No.	0395-010-00	**Source**	TH19-22 & TH19-27
Client	WSP Group Canada Ltd.	**Material**	Clay
Project	19-C-09 Pavement Renewals - Johns	**Sample Date**	05/11/2019
Sample #	Bulk 1	**Test Date**	26/11/2019
		Technician	BMH/AD

Proctor Results (ASTM D698)

Maximum Dry Density	1462	kg/m3
Optimum Moisture Content	27.1	%
Material Retained on 19 mm Sieve	0.0	%

CBR Sample Compaction

Dry Density	1393	kg/m3
Initial Moisture Content	31.7	%
Relative Density	95.3	% SPMDD

Soaking Results

Surcharge	4.54	kg
Swell	0.6	%
Moisture Content in top 25 mm	36.2	%
Immersion Period	95	h

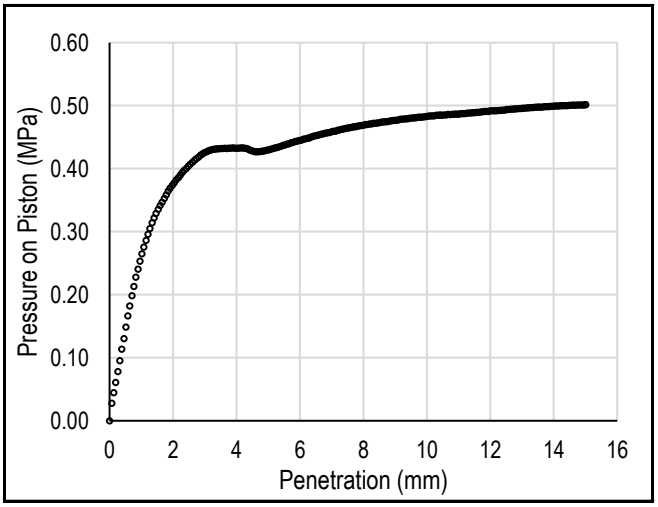
CBR Results

CBR at 2.54 mm	5.9	%
CBR at 5.08 mm	4.2	%
Zero Correction	0	mm

Test Data

Penetration (mm)	Measured Pressure (MPa)	Corrected Pressure (MPa)
0.64	0.18	0.18
1.27	0.31	0.31
1.91	0.37	0.37
2.54	0.41	0.41
3.18	0.43	0.43
3.81	0.43	0.43
4.45	0.43	0.43
5.08	0.43	0.43
7.62	0.47	0.47
10.16	0.48	0.48
12.70	0.49	0.49

Load/Penetration Curve



Comments:

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Tel: 204.975.9433 Fax: 204.975.9435

California Bearing Ratio Test Data Sheet

ASTM D1883-16

Project No.	0395-010-00	**Source**	TH19-23, TH19-24, TH19-25 & TH19-29
Client	WSP Group Canada Ltd.	**Material**	Silt
Project	19-C-09 Pavement Renewals - Johnson Ave	**Sample Date**	05/11/2019
Sample #	Bulk 2	**Test Date**	26/11/2019
		Technician	AD

Proctor Results (ASTM D698)

Maximum Dry Density	1812	kg/m3
Optimum Moisture Content	16.5	%
Material Retained on 19 mm Sieve	0.0	%

CBR Sample Compaction

Dry Density	1740	kg/m3
Initial Moisture Content	19.3	%
Relative Density	96.1	% SPMDD

Soaking Results

Surcharge	4.54	kg
Swell	0.0	%
Moisture Content in top 25 mm	19.8	%
Immersion Period	73	h

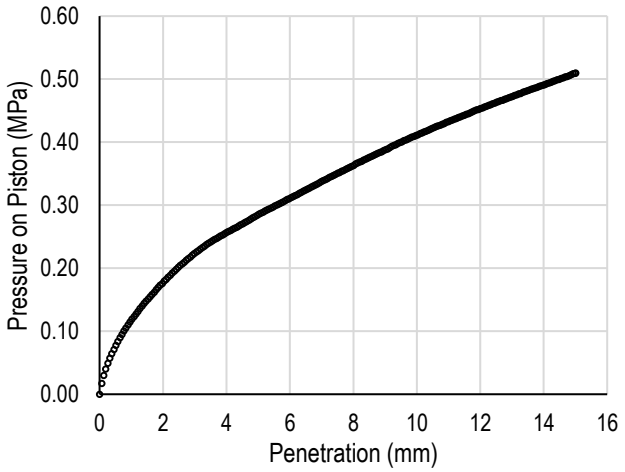
CBR Results

CBR at 2.54 mm	3.0	%
CBR at 5.08 mm	2.8	%
Zero Correction	0	mm

Test Data

Penetration (mm)	Measured Pressure (MPa)	Corrected Pressure (MPa)
0.64	0.09	0.09
1.27	0.14	0.14
1.91	0.17	0.17
2.54	0.20	0.20
3.18	0.23	0.23
3.81	0.25	0.25
4.45	0.27	0.27
5.08	0.29	0.29
7.62	0.35	0.35
10.16	0.42	0.42
12.70	0.47	0.47

Load/Penetration Curve



Comments:

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Tel: 204.975.9433 Fax: 204.975.9435

California Bearing Ratio Test Data Sheet

ASTM D1883-16

Project No.	0395-010-00	**Source**	TH19-26
Client	WSP Group Canada Ltd.	**Material**	Clay
Project	19-C-09 Pavement Renewals - Johnson Ave	**Sample Date**	05/11/2019
Sample #	Bulk 3	**Test Date**	27/11/2019
		Technician	AD

Proctor Results (ASTM D698)

Maximum Dry Density	1565	kg/m3
Optimum Moisture Content	23.9	%
Material Retained on 19 mm Sieve	0.0	%

CBR Sample Compaction

Dry Density	1480	kg/m3
Initial Moisture Content	27.5	%
Relative Density	94.6	% SPMDD

Soaking Results

Surcharge	4.54	kg
Swell	0.5	%
Moisture Content in top 25 mm	35.8	%
Immersion Period	50	h

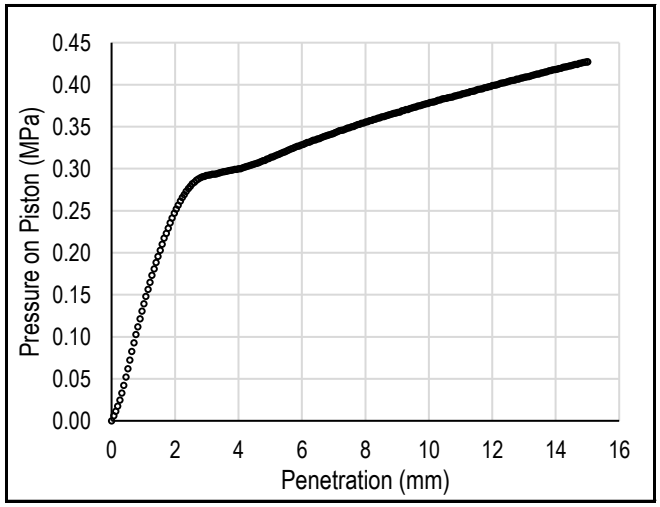
CBR Results

CBR at 2.54 mm	4.1	%
CBR at 5.08 mm	3.1	%
Zero Correction	0	mm

Test Data

Penetration (mm)	Measured Pressure (MPa)	Corrected Pressure (MPa)
0.64	0.08	0.08
1.27	0.17	0.17
1.91	0.24	0.24
2.54	0.28	0.28
3.18	0.29	0.29
3.81	0.30	0.30
4.45	0.31	0.31
5.08	0.31	0.31
7.62	0.35	0.35
10.16	0.38	0.38
12.70	0.41	0.41

Load/Penetration Curve



Comments:

Photo 21: Pavement Core Sample at Test Hole TH19-21

Photo 22: Recovered Pavement Core Sample at Test Hole TH19-22A (1.5 m West of TH19-22)

Photo 23: Pavement Core Measurement at Test Hole TH19-23

Photo 24: Pavement Core Measurement at Test Hole TH19-24

Photo 25: Pavement Core Measurement at Test Hole TH19-25

Photo 26: Pavement Core Measurement at Test Hole TH19-26

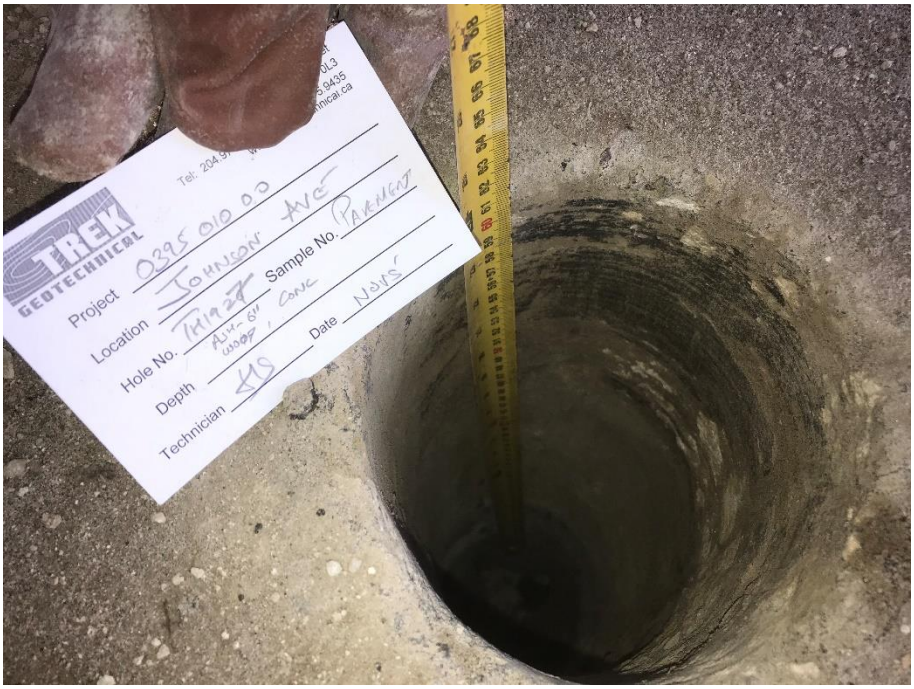


Photo 27: Pavement Core Measurement at Test Hole TH19-27

Photo 28: Pavement Core Measurement at Test Hole TH19-28

Photo 29: Pavement Core Measurement at Test Hole TH19-29

Quality Engineering | Valued Relationships

WSP Canada Group Ltd

19-C-09 Watt Street Pavement Renewal

Prepared for:

WSP Canada Group Ltd.
111-93 Lombard Ave.
Winnipeg, MB R3B
Attention: Kelly Groff. P. Eng.

Project Number:
0395 010 00 401

Date:
November 21, 2019
Final Report

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TREK GEOTECHNICAL Quality Engineering | Valued Relationships

November 21, 2019 Our File No. 0395 010 00

Kelly Groff, P.Eng.
WSP Canada Group Ltd.
111-93 Lombard Avenue
Winnipeg, Manitoba, R3B 3B1

RE: Sub-Surface Investigation Report for
19-C-09 Watt Street Pavement Renewal

TREK Geotechnical Inc. is pleased to submit our report for the sub-surface investigations for the 19-C-09 Watt Street Pavement Renewal.

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	November 21, 2019	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: Nov. 21, 2019

Reviewed By:

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

Table of Contents

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1.0 Introduction

This report summarizes the results of the road investigation completed for the 19-C-09 Watt Street Pavement Renewal project. The test holes were completed along Watt Street between Chalmers Ave and Munroe Ave. The information collected describes the pavement structure of the existing road as well as the soil stratigraphy beneath the pavement structure at the test hole locations.

2.0 Road Investigation and Laboratory Program

The investigation included coring of pavement followed by drilling of test holes at 9 locations. WSP selected the investigation locations as shown on Figure 01. The road investigation was conducted between September 24, 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. Eight test holes were drilled to a depth of 2.1 m below road surface by Paddock 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 distance 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. 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^3)	Opt. Moisture (%)	Percent Proctor (%)	Moisture Content (%)	CBR Value at 2.54 mm	CBR Value at 5.08 mm
Silt and Sand	TH19-03	0.5-1.5	1895	12.9	96.2	15.2	6.0%	4.6%
Clay	TH19-04	0.3-1.5	1529	25.6	94.7	28.4	5.9%	4.4%
Clay	TH19-05	0.3-1.5	1498	26.7	94.5	30.5	4.5%	3.4%

* 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.

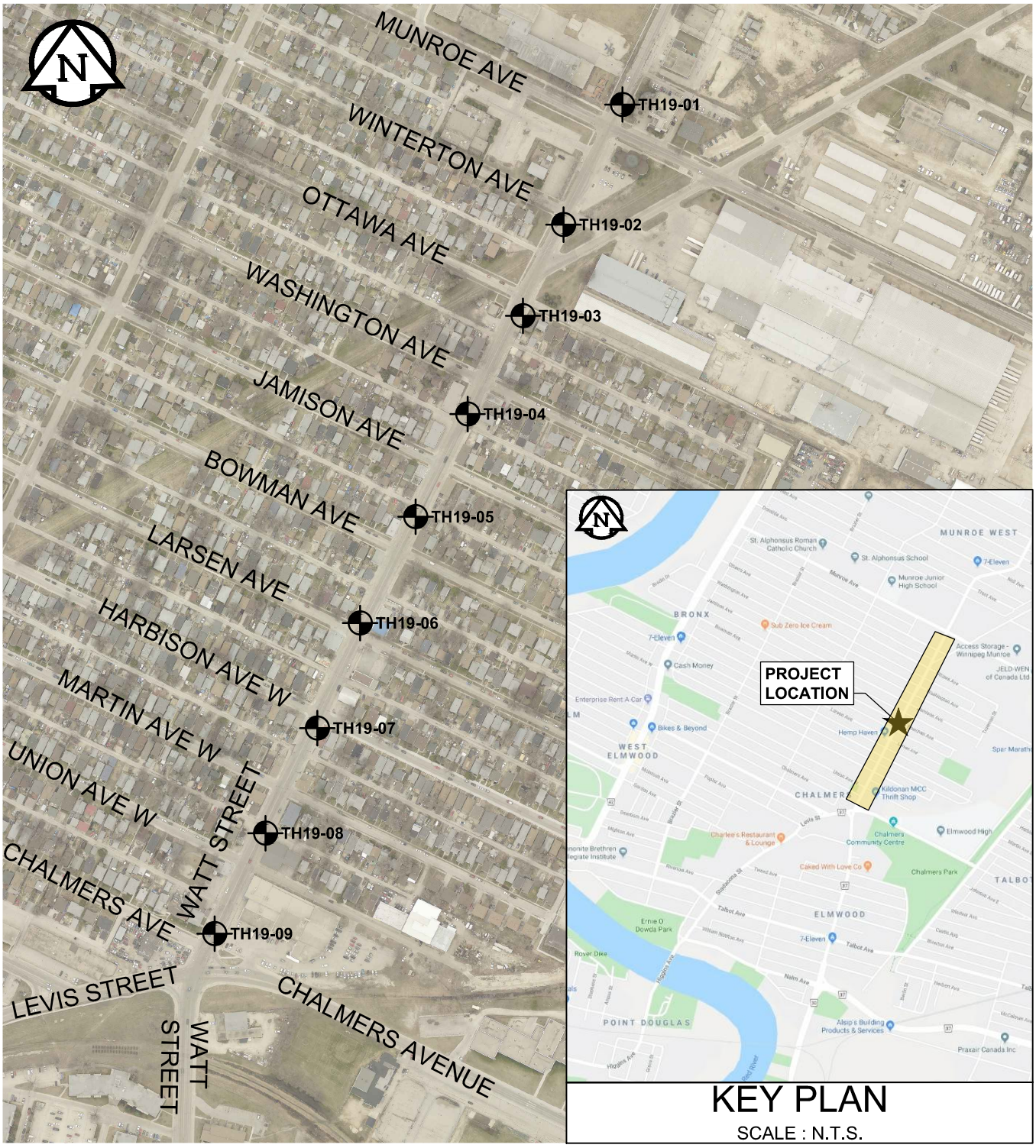
All information provided in this report is subject to our standard terms and conditions for engineering services, a copy of which is provided to each of our clients with the original scope of work, or a mutually executed standard engineering services agreement. If these conditions are not attached, and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

TREK GEOTECHNICAL

0395 010 00
WSP GROUP CANADA LTD.
19-C-09 Watt Street Pavement Renewals



KEY PLAN
SCALE : N.T.S.

LEGEND:

TEST HOLE (TREK, NOVEMBER 2019)

NOTES:

1. AERIAL PHOTOGRAPH FROM CITY of WINNIPEG 2016
2. GPS COORDINATES FROM HAND HELD DEVICE

0 50 100 150 200 250 m
SCALE = 1 : 5 000 (216 mm x 279 mm)

FIGURE 01
TEST HOLE LOCATION PLAN

Appendix A

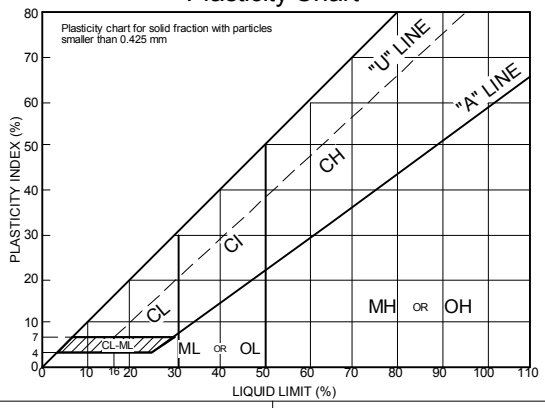
Test Hole Logs

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 TH19-01
1 of 1

Client:	WSP Group Canada Inc.	**Project Number:**	0395-010-00
Project Name:	19-C-09 Pavement Renewals - Watt Street	**Location:**	N-5531236, E-636561
Contractor:	Paddock Drilling Ltd.	**Ground Elevation:**	Top of Pavement
Method:	125 mm Solid Stem Auger, CME55 Truck Mount	**Date Drilled:**	October 17, 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/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 - 150 mm thick				
		CONCRETE - 160 mm thick				
		CLAY - silty, trace sand - grey - moist, firm - high plasticity - AASHTO: A-7-6(54)		G01		
0.5		- stiff below 0.6 m		G02		
1.0				G03		
		- very stiff below 1.2 m		G04		
1.5		- stiff below 1.5 m		G05		
		- firm below 1.8 m				
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 in Northbound curb lane, 1.3 m North and 3.5 m West of fire hydrant near 505 Munroe Ave.

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

SUB-SURFACE LOG LOGS 2019-10-31_WATT STREET _0395-010-00_0_A_BMH.GPJ TREK GEOTECHNICAL.GDT 11/20/19

Sub-Surface Log

Test Hole TH19-02
1 of 1

Client:	WSP Group Canada Inc.	**Project Number:**	0395-010-00
Project Name:	19-C-09 Pavement Renewals - Watt Street	**Location:**	N-5531132, E-636510
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/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
		ASPHALT - 150 mm thick						
		CONCRETE - 200 mm thick						
0.5		CLAY - silty, trace sand - dark grey - moist, firm to stiff - high plasticity - AASHTO: A-7-6		G50				
				G51				
1.0				G52				
				G53				
1.5		SILT - trace clay, trace sand - light brown - moist to wet, soft - low plasticity - AASHTO: A-5		G54				
2.0				G55				

END OF TEST HOLE AT 2.1 m IN SILT
1) Seepage from silt layer observed between 1.8 to 2.1 m depth.
2) No sloughing observed.
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 Northbound curb lane, 3.5 m South and 12 m East of fire hydrant near 496 Winterton Ave.

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

SUB-SURFACE LOG LOGS 2019-10-31_WATT STREET_0395-010-00_0_A_BMH.GPJ TREK GEOTECHNICAL.GDT 11/20/19

Sub-Surface Log

Test Hole TH19-03
1 of 1

Client:	WSP Group Canada Inc.	**Project Number:**	0395-010-00
Project Name:	19-C-09 Pavement Renewals - Watt Street	**Location:**	N-5531053, E-636475
Contractor:	Paddock Drilling Ltd.	**Ground Elevation:**	Top of Pavement
Method:	125 mm Solid Stem Auger, CME55 Truck Mount	**Date Drilled:**	October 17, 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/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 - 260 mm thick				
		CONCRETE - 180 mm thick				
0.5		SAND AND GRAVEL - some silt, trace clay - light brown - moist, compact - well graded sand and gravel (<25 mm diam.) - sub-rounded to angular "pitrun" - AASHTO: A-1b(0)		G37	●	
				G38	●	
1.0		TRANSITION: from SAND AND GRAVEL to CLAY AND SILT		G39	●	
				G40	●	
1.5		CLAY - silty, trace sand, trace organics - mottled black and brown - moist, firm to stiff - intermediate to high plasticity - AASHTO: A-7-6		G41	●	△✤
2.0				G42	●	✤

END OF TEST HOLE AT 2.1 m IN CLAY
1) No seepage observed.
2) Sloughing from sand and gravel 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 Northbound curb lane, 8 m North and 14 m West of fire hydrant near 504 Ottawa Ave.

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

SUB-SURFACE LOG LOGS 2019-10-31_WATT STREET_0395-010-00_0_A_BMH.GPJ TREK GEOTECHNICAL.GDT 11/20/19

Sub-Surface Log

Test Hole TH19-04
1 of 1

Client:	WSP Group Canada Inc.	**Project Number:**	0395-010-00
Project Name:	19-C-09 Pavement Renewals - Watt Street	**Location:**	N-5530968, E-636427
Contractor:	Paddock Drilling Ltd.	**Ground Elevation:**	Top of Pavement
Method:	125 mm Solid Stem Auger, CME55 Truck Mount	**Date Drilled:**	October 17, 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/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 - 75 mm thick				
		CONCRETE - 205 mm thick				
		CLAY - silty, trace sand - grey - moist, stiff to very stiff - high plasticity - AASHTO: A-7-6		G43	●	△ ✤
0.5				G44	●	△ ✤
1.0				G45	●	△ ✤
				G46	●	△ ✤
		- brown below 1.3 m				
1.5				G47	●	△ ✤
		SILT - trace to some clay, trace sand - light brown, moist to wet, soft - low to intermediate plasticity - AASHTO: A-5		G48	●	
2.0				G49	●	

END OF TEST HOLE AT 2.1 m IN SILT
1) No seepage observed.
2) Sloughing from silt layer observed between 1.8 to 2.1 m depth.
3) Test hole open to 1.9 m immediately after drilling.
4) Test hole backfilled with auger cuttings, granular fill and cold patch asphalt.
5) Test hole located Northbound median lane, 5 m South and 8 m West of 445 Watt St.

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

SUB-SURFACE LOG LOGS 2019-10-31_WATT STREET_0395-010-00_0_A_BMH.GPJ TREK GEOTECHNICAL.GDT 11/20/19

Sub-Surface Log

Test Hole TH19-05
1 of 1

Client:	WSP Group Canada Inc.	**Project Number:**	0395-010-00
Project Name:	19-C-09 Pavement Renewals - Watt Street	**Location:**	N-5530879, E-636382
Contractor:	Paddock Drilling Ltd.	**Ground Elevation:**	Top of Pavement
Method:	125 mm Solid Stem Auger, CME55 Truck Mount	**Date Drilled:**	October 17, 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/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 - 50 mm thick				
		CONCRETE - 180 mm thick				
		CLAY - silty, trace sand, trace organics - mottled black and blue - moist, firm to stiff - high plasticity, strong chemical-like odour - AASHTO: A-7-6(60)		G07		
0.5				G08		
1.0				G09		
		- brown, no organics, stiff to very stiff below 1.2 m		G10		
1.5				G11		
		SILT - trace clay, trace sand - light brown - wet, soft - low plasticity - AASHTO: A-5				
2.0				G12		

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 in Southbound median lane, 24 m North and 8 m West of fire hydrant near 501 Bowman Ave.

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

SUB-SURFACE LOG LOGS 2019-10-31_WATT STREET_0395-010-00_0_A_BMH.GPJ TREK GEOTECHNICAL.GDT 11/20/19

Sub-Surface Log

Test Hole TH19-06
1 of 1

Client:	WSP Group Canada Inc.	**Project Number:**	0395-010-00
Project Name:	19-C-09 Pavement Renewals - Watt Street	**Location:**	N-5530787, E-636334
Contractor:	Paddock Drilling Ltd.	**Ground Elevation:**	Top of Pavement
Method:	125 mm Solid Stem Auger, CME55 Truck Mount	**Date Drilled:**	October 17, 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/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 - 70 mm thick				
		CONCRETE - 230 mm thick				
		CLAY - silty, trace sand - grey - moist, stiff - high plasticity - AASHTO: A-7-6		G13		
0.5				G14		
		- very stiff below 0.9 m		G15		
1.0		SILT - trace clay, trace sand - light brown - moist to wet, soft - low plasticity - AASHTO: A-5		G16		
1.5				G17		
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 in Southbound median lane, 4 m North and 8.3 m West of fire hydrant near the intersection of Larsen Ave and Watt St.

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

SUB-SURFACE LOG LOGS 2019-10-31_WATT STREET_0395-010-00_0_A_BMH.GPJ TREK GEOTECHNICAL.GDT 11/20/19

Sub-Surface Log

Test Hole TH19-07
1 of 1

Client:	WSP Group Canada Inc.	**Project Number:**	0395-010-00
Project Name:	19-C-09 Pavement Renewals - Watt Street	**Location:**	N-5530696, E-636297
Contractor:	Paddock Drilling Ltd.	**Ground Elevation:**	Top of Pavement
Method:	125 mm Solid Stem Auger, CME55 Truck Mount	**Date Drilled:**	October 17, 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/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 - 150 mm thick				
		CONCRETE - 350 mm thick				
0.5		CLAY - silty, trace sand - dark grey - moist, stiff - high plasticity - AASHTO: A-7-6(55)		G31		
				G32		
1.0		SILT - trace clay, trace sand - light brown, moist to wet, soft - low plasticity - AASHTO: A-5		G33		
1.5		CLAY - silty - brown - moist, very stiff - high plasticity - AASHTO: A-7-6		G34		
		- firm to stiff below 1.8 m		G35		
2.0				G36		

END OF TEST HOLE AT 2.1 m IN CLAY
1) No seepage observed.
2) Sloughing from silt layer observed between 1.1 to 1.4 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 Southbound median lane, 6 m South and 8 m West of 430 Harbison Ave.

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

SUB-SURFACE LOG LOGS 2019-10-31_WATT STREET_0395-010-00_0_A_BMH.GPJ TREK GEOTECHNICAL.GDT 11/20/19

Sub-Surface Log

Test Hole TH19-08
1 of 1

Client:	WSP Group Canada Inc.	**Project Number:**	0395-010-00
Project Name:	19-C-09 Pavement Renewals - Watt Street	**Location:**	N-5530605, E-636252
Contractor:	Paddock Drilling Ltd.	**Ground Elevation:**	Top of Pavement
Method:	125 mm Solid Stem Auger, CME55 Truck Mount	**Date Drilled:**	October 17, 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/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 - 110 mm thick				
		CONCRETE - 490 mm thick (420 mm recovered)				
0.5		CLAY - silty, trace sand - brown - moist, stiff to very stiff - high plasticity - AASHTO: A-7-6(51)		G25		
1.0				G26		
		SILT - trace clay, trace sand - light brown - moist to wet, soft - low plasticity - AASHTO: A-5		G27		
1.5				G28		
				G29		
2.0				G30		

END OF TEST HOLE AT 2.1 m IN SILT
1) No seepage observed.
2) Sloughing from silt layer observed between 1.2 to 2.1 m depth.
3) Test hole open to 1.8 m immediately after drilling.
4) Test hole backfilled with auger cuttings, granular fill and cold patch asphalt.
5) Test hole located in Northbound median lane, 4 m North and 7.5 m West of 229 Watt St.

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

SUB-SURFACE LOG LOGS 2019-10-31_WATT STREET_0395-010-00_0_A_BMH.GPJ TREK GEOTECHNICAL.GDT 11/20/19

Sub-Surface Log

Test Hole TH19-09
1 of 1

Client:	WSP Group Canada Inc.	**Project Number:**	0395-010-00
Project Name:	19-C-09 Pavement Renewals - Watt Street	**Location:**	N-5530518, E-636208
Contractor:	Paddock Drilling Ltd.	**Ground Elevation:**	Top of Pavement
Method:	125 mm Solid Stem Auger, CME55 Truck Mount	**Date Drilled:**	October 17, 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/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 - 90 mm thick				
		CONCRETE - 210 mm thick				
		CLAY - silty, trace sand, trace gravel (<20 mm diam.) - grey - moist, stiff - high plasticity - AASHTO: A-7-6		G19	●	✤
0.5				G20	●	✤
		SILT - trace clay, trace sand - light brown - wet, soft - low plasticity - AASHTO: A-5		G21	●	
				G22	●	
1.5				G23	●	
2.0				G24	●	

END OF TEST HOLE AT 2.1 m IN SILT
1) No seepage observed.
2) Sloughing from silt layer observed between 1.2 to 2.1 m depth.
3) Test hole open to 1.6 m immediately after drilling.
4) Test hole backfilled with auger cuttings, granular fill and cold patch asphalt.
5) Test hole located in Northbound median lane, 63 m South and 9.3 m East of fire hydrant near the intersecton of Union Ave and Watt St.

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

SUB-SURFACE LOG LOGS 2019-10-31_WATT STREET_0395-010-00_0_A_BMH.GPJ TREK GEOTECHNICAL.GDT 11/20/19

Appendix B

Summary Table & Lab Testing Results

Watt Street Pavement Renewals
Sub-Surface Investigation
Watt Street

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 : 5531236 N, 636561 E Located in Northbound, curb lane, 1.3 m North and 3.5 m West of fire hydrant near 505 Munroe Avenue	Asphalt	150	Concrete	160	Clay and Silt	0.3	0.5	28							
						Clay and Silt	0.6	0.8	32	60	32	9	0	18	72	54
						Clay and Silt	0.9	1.1	34							
						Clay and Silt	1.2	1.4	35							
						Clay and Silt	1.5	1.7	30							
						Clay and Silt	2.0	2.1	38							
TH19-02	UTM : 5531132 N, 636510 E Located in Northbound, curb lane, 3.5 m South and 12 m East of fire hydrant near 496 Winterton Ave.	Asphalt	150	Concrete	200	Clay and Silt	0.5	0.6	33							
						Clay and Silt	0.8	0.9	32							
						Clay and Silt	1.1	1.2	33							
						Clay and Silt	1.4	1.5	33							
						Silt	1.7	1.8	24							
						Silt	2.0	2.1	29							
TH19-03	UTM : 5531053 N, 636475 E Located in Northbound, curb lane, 8.0 North and 14.0 m West of fire hydrant near 504 Ottawa Ave.	Asphalt	260	Concrete	180						%Fines	Sand	Gravel			
						Sand and Gravel (Fill)	0.5	0.6	7							
						Sand and Gravel (Fill)	0.8	0.9	8		23	38	39			
						Transition from Sand and Gravel to Clay and Silt	1.1	1.2	11							
						Transition from Sand and Gravel to Clay and Silt	1.4	1.5	22							
						Clay and Silt	1.7	1.8	24							
						Clay and Silt	2.0	2.1	34							
TH19-04	UTM : 5530968 N, 636427 E Located in Northbound, median lane, 5.0 m South and 8.0 m West of 445 Watt St.	Asphalt	75	Concrete	205	Clay and Silt	0.3	0.5	31							
						Clay and Silt	0.6	0.8	29							
						Clay and Silt	0.9	1.1	29							
						Clay and Silt	1.2	1.4	29							
						Clay and Silt	1.5	1.7	31							
						Silt	1.8	2.0	24							
						Silt	2.0	2.1	27							

Watt Street Pavement Renewals
Sub-Surface Investigation
Watt Street

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
TH19-05	UTM : 5531236 N, 636561 E Located in Northbound, curb lane, 1.3 m North and 3.5 m West of fire hydrant near 505 Munroe Avenue	Asphalt	50	Concrete	180	Clay and Silt	0.4	0.5	18							
						Clay and Silt	0.6	0.8	32	47	46	7	0	21	79	58
						Clay and Silt	0.9	1.1	31							
						Clay and Silt	1.2	1.4	29							
						Clay and Silt	1.5	1.7	28							
						Silt	2.0	2.1	25							
TH19-06	UTM : 5530787 N, 636334 E Located in Southbound, median lane, 4.0 m North and 8.3 m West of fire hydrant near the intersection of Larsen Ave and Watt St.	Asphalt	70	Concrete	230	Clay and Silt	0.3	0.5	31							
						Clay and Silt	0.6	0.8	31							
						Clay and Silt	0.9	1.1	30							
						Silt	1.2	1.4	22							
						Silt	1.5	1.7	22							
						Silt	2.0	2.1	23							
TH19-07	UTM : 5530696 N, 636297 E Located in Southbound, median lane, 6.0 m South and 8.0 m West of 430 Harbison Ave.	Asphalt	150	Concrete	350	Clay and Silt	0.5	0.7	33	58	36	5	0	22	73	52
						Clay and Silt	0.8	1.0	27							
						Silt	1.1	1.3	23							
						Clay	1.4	1.6	30							
						Clay	1.7	1.9	43							
						Clay	2.0	2.1	40							
TH19-08	UTM : 5530605 N, 636252 E Located in Northbound, median lane, 4.0 m North and 7.5 m West of 229 Watt St.	Asphalt	110	Concrete	470	Clay and Silt	0.6	0.8	30	69	26	5	0	21	70	48
						Clay and Silt	0.9	1.1	30							
						Silt	1.2	1.4	23							
						Silt	1.5	1.7	24							
						Silt	1.8	2.0	24							
						Silt	2.0	2.1	24							

Watt Street Pavement Renewals
Sub-Surface Investigation
Watt Street

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
TH19-09	UTM : 5530518 N, 636208 E Located in Northbound, median lane, 63 m South and 9.3 m East of fire hydrant near the intersection of Union Ave and Watt St.	Asphalt	90	Concrete	210	Clay and Silt	0.3	0.5	32							
						Clay and Silt	0.6	0.8	31							
						Silt	0.9	1.1	26							
						Silt	1.2	1.4	27							
						Silt	1.5	1.7	23							
						Silt	2.0	2.1	25							

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Moisture Content Report
ASTM D2216-10

Project No. 0395-010-00
Client WSP Group Canada Ltd.
Project 19-C-09 Watt Street Pavement Renewals

Sample Date 17-Oct-19
Test Date 01-Nov-19
Technician SB

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	2.0 - 2.1
Sample #	G01	G02	G03	G04	G05	G06
Tare ID	W47	AB96	AB62	H20	F32	E9
Mass of tare	8.6	6.7	6.6	8.5	8.3	8.6
Mass wet + tare	175.1	386.3	140.9	161.6	144.0	149.3
Mass dry + tare	138.3	293.6	107.0	121.8	112.8	110.7
Mass water	36.8	92.7	33.9	39.8	31.2	38.6
Mass dry soil	129.7	286.9	100.4	113.3	104.5	102.1
Moisture %	28.4%	32.3%	33.8%	35.1%	29.9%	37.8%

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	2.0 - 2.1
Sample #	G50	G51	G52	G53	G54	G55
Tare ID	AA19	AB07	Z26	E52	N22	AC10
Mass of tare	6.8	6.8	8.5	8.5	8.5	6.6
Mass wet + tare	166.8	183.8	143.7	156.8	228.0	222.0
Mass dry + tare	127.4	140.6	110.3	120.2	185.0	174.0
Mass water	39.4	43.2	33.4	36.6	43.0	48.0
Mass dry soil	120.6	133.8	101.8	111.7	176.5	167.4
Moisture %	32.7%	32.3%	32.8%	32.8%	24.4%	28.7%

Test Hole	TH19-03	TH19-03	TH19-03	TH19-03	TH19-03	TH19-03
Depth (m)	0.5 - 0.6	0.8 - 0.9	1.1 - 1.2	1.4 - 1.5	1.7 - 1.8	2.0 - 2.1
Sample #	G37	G38	G39	G40	G41	G42
Tare ID	A32	J33	N32	D21	N59	P28
Mass of tare	9.1	367.9	8.3	8.6	8.5	8.6
Mass wet + tare	201.3	1073.3	173.8	192.2	176.6	182.2
Mass dry + tare	189.2	1020.0	157.1	159.4	143.8	138.3
Mass water	12.1	53.3	16.7	32.8	32.8	43.9
Mass dry soil	180.1	652.1	148.8	150.8	135.3	129.7
Moisture %	6.7%	8.2%	11.2%	21.8%	24.2%	33.8%

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Moisture Content Report
ASTM D2216-10

Project No. 0395-010-00
Client WSP Group Canada Ltd.
Project 19-C-09 Watt Street Pavement Renewals

Sample Date 17-Oct-19
Test Date 01-Nov-19
Technician SB

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	1.8 - 2.0
Sample #	G43	G44	G45	G46	G47	G48
Tare ID	C2	F132	E41	AA01	E44	A30
Mass of tare	8.6	8.7	8.5	6.7	8.6	8.2
Mass wet + tare	150.1	150.2	167.7	175.9	178.7	184.3
Mass dry + tare	116.7	118.3	131.8	138.1	138.9	150.7
Mass water	33.4	31.9	35.9	37.8	39.8	33.6
Mass dry soil	108.1	109.6	123.3	131.4	130.3	142.5
Moisture %	30.9%	29.1%	29.1%	28.8%	30.5%	23.6%

Test Hole	TH19-04	TH19-05	TH19-05	TH19-05	TH19-05	TH19-05
Depth (m)	2.0 - 2.1	0.4 - 0.5	0.6 - 0.8	0.9 - 1.1	1.2 - 1.4	1.5 - 1.7
Sample #	G49	G07	G08	G09	G10	G11
Tare ID	AA22	Z73	F1	Z09	C17	E138
Mass of tare	6.9	8.6	8.6	8.4	8.7	8.8
Mass wet + tare	151.5	216.0	347.8	173.4	174.1	168.6
Mass dry + tare	121.2	184.7	264.8	134.7	136.9	133.7
Mass water	30.3	31.3	83.0	38.7	37.2	34.9
Mass dry soil	114.3	176.1	256.2	126.3	128.2	124.9
Moisture %	26.5%	17.8%	32.4%	30.6%	29.0%	27.9%

Test Hole	TH19-05	TH19-06	TH19-06	TH19-06	TH19-06	TH19-06
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 #	G12	G13	G14	G15	G16	G17
Tare ID	N42	E121	AB90	Z45	Z07	H53
Mass of tare	8.6	8.4	6.7	8.7	8.6	8.4
Mass wet + tare	203.6	152.1	190.2	165.6	187.6	252.7
Mass dry + tare	164.1	118.2	146.7	129.0	154.9	208.4
Mass water	39.5	33.9	43.5	36.6	32.7	44.3
Mass dry soil	155.5	109.8	140.0	120.3	146.3	200.0
Moisture %	25.4%	30.9%	31.1%	30.4%	22.4%	22.2%

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Moisture Content Report
ASTM D2216-10

Project No. 0395-010-00
Client WSP Group Canada Ltd.
Project 19-C-09 Watt Street Pavement Renewals

Sample Date 17-Oct-19
Test Date 01-Nov-19
Technician SB

Test Hole	TH19-06	TH19-07	TH19-07	TH19-07	TH19-07	TH19-07
Depth (m)	2.0 - 2.1	0.5 - 0.7	0.8 - 1.0	1.1 - 1.3	1.4 - 1.6	1.7 - 1.9
Sample #	G18	G31	G32	G33	G34	G35
Tare ID	F55	K20	H70	E85	AA15	K29
Mass of tare	8.6	8.4	8.8	8.6	6.7	8.2
Mass wet + tare	194.2	378.5	161.9	146.0	170.3	169.9
Mass dry + tare	159.2	287.2	129.6	120.0	132.6	121.1
Mass water	35.0	91.3	32.3	26.0	37.7	48.8
Mass dry soil	150.6	278.8	120.8	111.4	125.9	112.9
Moisture %	23.2%	32.7%	26.7%	23.3%	29.9%	43.2%

Test Hole	TH19-07	TH19-08	TH19-08	TH19-08	TH19-08	TH19-08
Depth (m)	2.0 - 2.1	0.6 - 0.8	0.9 - 1.1	1.2 - 1.4	1.5 - 1.7	1.8 - 2.0
Sample #	G36	G25	G26	G27	G28	G29
Tare ID	C20	Z109	W76	W22	N92	W19
Mass of tare	8.4	8.5	8.5	8.4	8.5	8.7
Mass wet + tare	169.1	346.5	176.5	212.8	188.7	178.9
Mass dry + tare	123.4	268.2	137.4	174.1	154.2	145.6
Mass water	45.7	78.3	39.1	38.7	34.5	33.3
Mass dry soil	115.0	259.7	128.9	165.7	145.7	136.9
Moisture %	39.7%	30.2%	30.3%	23.4%	23.7%	24.3%

Test Hole	TH19-08	TH19-09	TH19-09	TH19-09	TH19-09	TH19-09
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 #	G30	G19	G20	G21	G22	G23
Tare ID	AB71	W80	H56	H59	Z23	Z21
Mass of tare	6.7	8.7	8.7	8.7	8.5	9.2
Mass wet + tare	191.3	161.9	158.3	167.4	150.4	215.1
Mass dry + tare	155.9	124.9	122.6	135.1	120.5	176.2
Mass water	35.4	37.0	35.7	32.3	29.9	38.9
Mass dry soil	149.2	116.2	113.9	126.4	112.0	167.0
Moisture %	23.7%	31.8%	31.3%	25.6%	26.7%	23.3%

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Moisture Content Report
ASTM D2216-10

Project No. 0395-010-00
Client WSP Group Canada Ltd.
Project 19-C-09 Watt Street Pavement Renewals

Sample Date 17-Oct-19
Test Date 01-Nov-19
Technician SB

Test Hole	TH19-09					
Depth (m)	2.0 - 2.1					
Sample #	G24					
Tare ID	E83					
Mass of tare	8.7					
Mass wet + tare	156.6					
Mass dry + tare	127.1					
Mass water	29.5					
Mass dry soil	118.4					
Moisture %	24.9%					

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Atterberg Limits
ASTM D4318-10e1

Project No.	0395-001-00
Client	WSP Group Canada Ltd.
Project	19-C-09 Watt Street Pavement Renewals
Test Hole	TH19-01
Sample #	G02
Depth (m)	0.6 - 0.8
Sample Date	17-Oct-19
Test Date	05-Nov-19
Technician	SB

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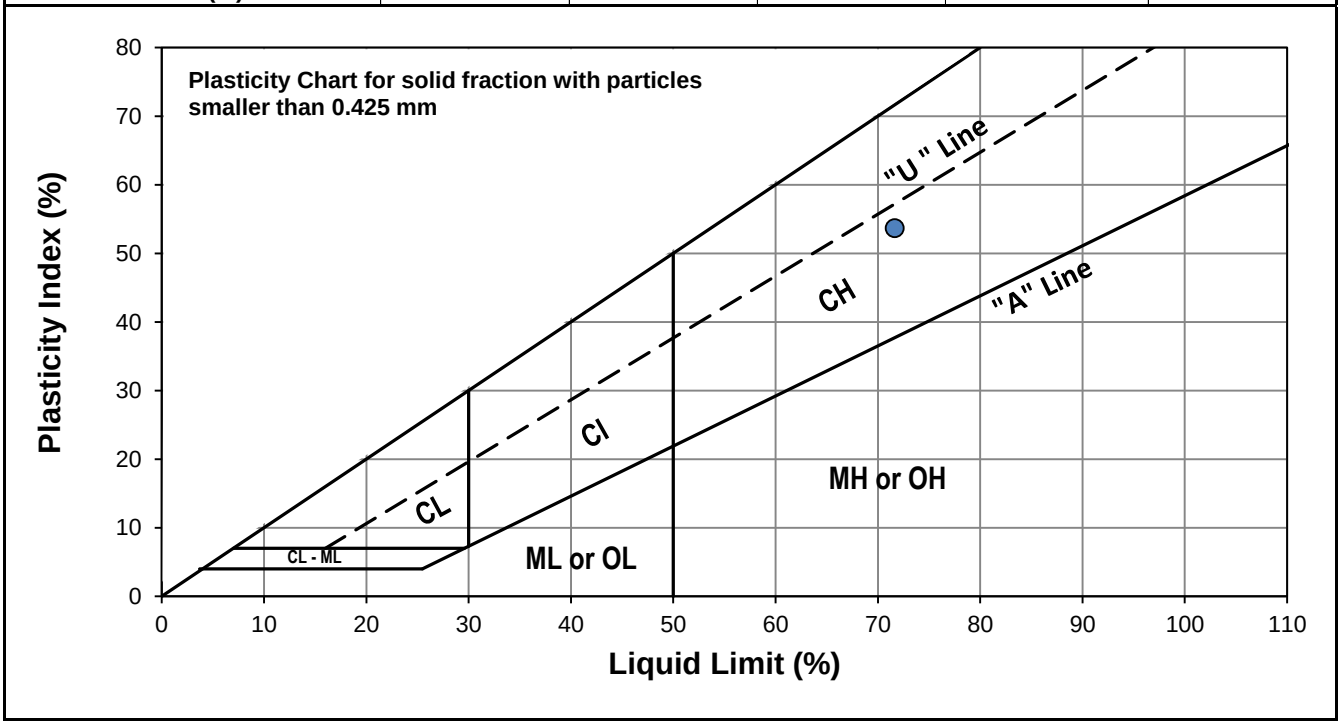
Liquid Limit	72
Plastic Limit	18
Plasticity Index	54

Liquid Limit

Trial #	1	2	3		
Number of Blows (N)	17	22	31		
Mass Wet Soil + Tare (g)	22.069	21.141	21.039		
Mass Dry Soil + Tare (g)	18.661	18.142	18.220		
Mass Tare (g)	14.062	14.023	14.196		
Mass Water (g)	3.408	2.999	2.819		
Mass Dry Soil (g)	4.599	4.119	4.024		
Moisture Content (%)	74.103	72.809	70.055		



Plastic Limit

Trial #	1	2	3	4	5
Mass Tare (g)	14.012	14.161			
Mass Wet Soil + Tare (g)	21.341	21.953			
Mass Dry Soil + Tare (g)	20.207	20.781			
Mass Water (g)	1.134	1.172			
Mass Dry Soil (g)	6.195	6.620			
Moisture Content (%)	18.305	17.704			

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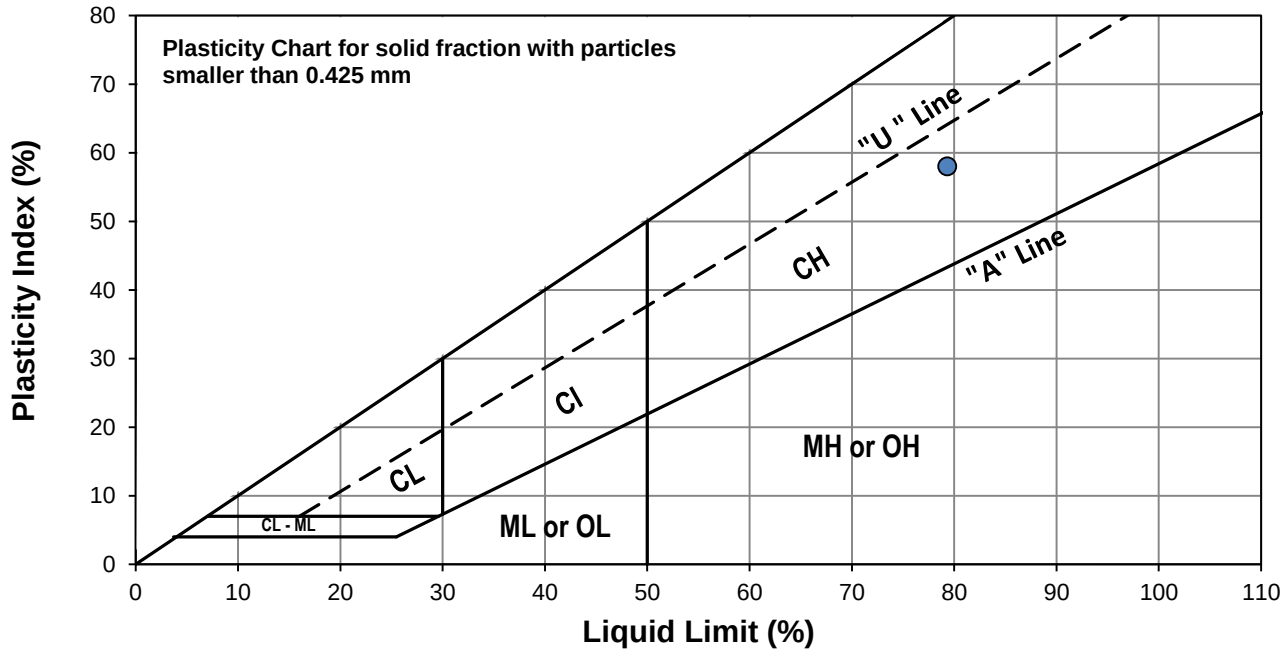
Atterberg Limits
ASTM D4318-10e1

Project No.	0395-001-00
Client	WSP Group Canada Ltd.
Project	19-C-09 Watt Street Pavement Renewals
Test Hole	TH19-05
Sample #	G08
Depth (m)	0.6 - 0.8
Sample Date	18-Oct-19
Test Date	06-Nov-19
Technician	SB

Liquid Limit	79
Plastic Limit	21
Plasticity Index	58

Liquid Limit

Trial #	1	2	3		
Number of Blows (N)	21	27	30		
Mass Wet Soil + Tare (g)	20.710	20.762	21.005		
Mass Dry Soil + Tare (g)	17.660	17.888	18.012		
Mass Tare (g)	13.855	14.249	14.198		
Mass Water (g)	3.050	2.874	2.993		
Mass Dry Soil (g)	3.805	3.639	3.814		
Moisture Content (%)	80.158	78.978	78.474		



Plastic Limit

Trial #	1	2	3	4	5
Mass Tare (g)	13.937	14.178			
Mass Wet Soil + Tare (g)	22.036	21.931			
Mass Dry Soil + Tare (g)	20.596	20.582			
Mass Water (g)	1.440	1.349			
Mass Dry Soil (g)	6.659	6.404			
Moisture Content (%)	21.625	21.065			

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Atterberg Limits
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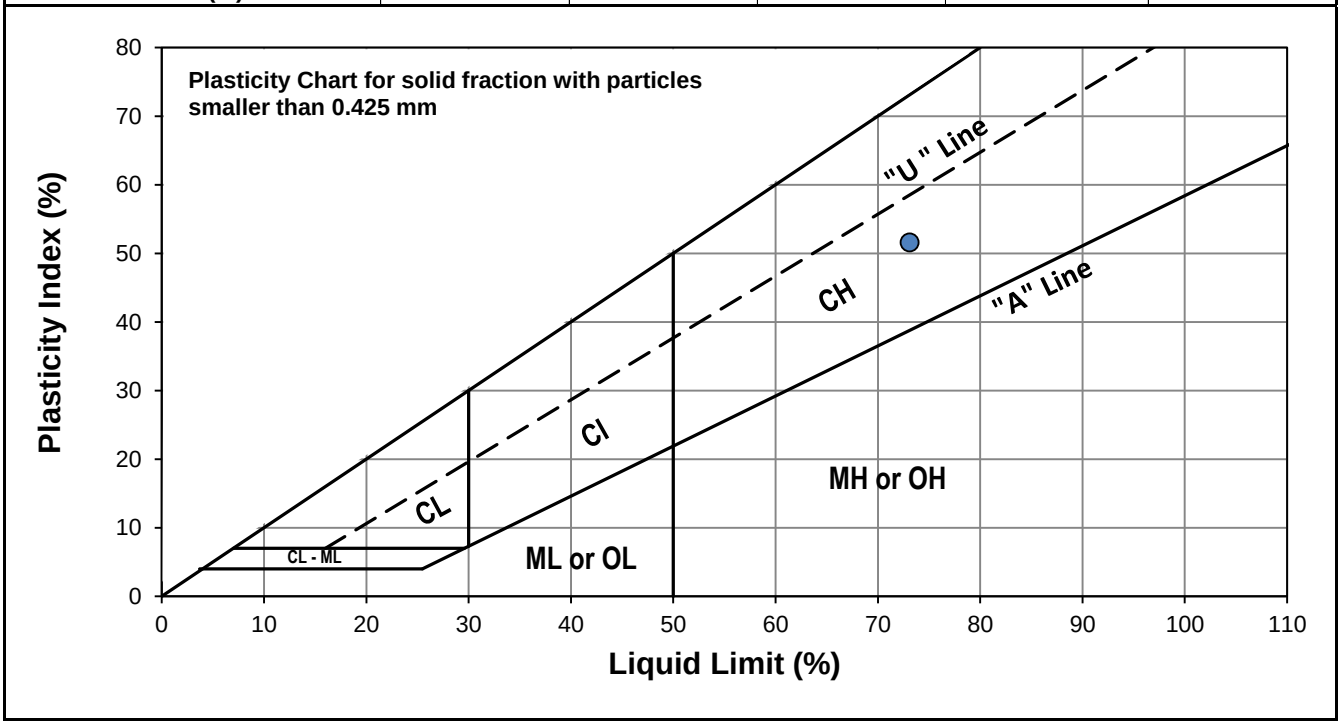
Project No.	0395-001-00
Client	WSP Group Canada Ltd.
Project	19-C-09 Watt Street Pavement Renewals
Test Hole	TH19-07
Sample #	G31
Depth (m)	0.5 - 0.7
Sample Date	17-Oct-19
Test Date	06-Nov-19
Technician	SB/AD

Liquid Limit	73
Plastic Limit	22
Plasticity Index	52

Liquid Limit

Trial #	1	2	3		
Number of Blows (N)	19	22	28		
Mass Wet Soil + Tare (g)	20.206	21.613	21.200		
Mass Dry Soil + Tare (g)	17.581	18.383	18.283		
Mass Tare (g)	14.110	14.037	14.234		
Mass Water (g)	2.625	3.230	2.917		
Mass Dry Soil (g)	3.471	4.346	4.049		
Moisture Content (%)	75.627	74.321	72.042		



Plastic Limit

Trial #	1	2	3	4	5
Mass Tare (g)	14.011	14.153			
Mass Wet Soil + Tare (g)	21.117	21.496			
Mass Dry Soil + Tare (g)	19.881	20.171			
Mass Water (g)	1.236	1.325			
Mass Dry Soil (g)	5.870	6.018			
Moisture Content (%)	21.056	22.017			

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Atterberg Limits
ASTM D4318-10e1

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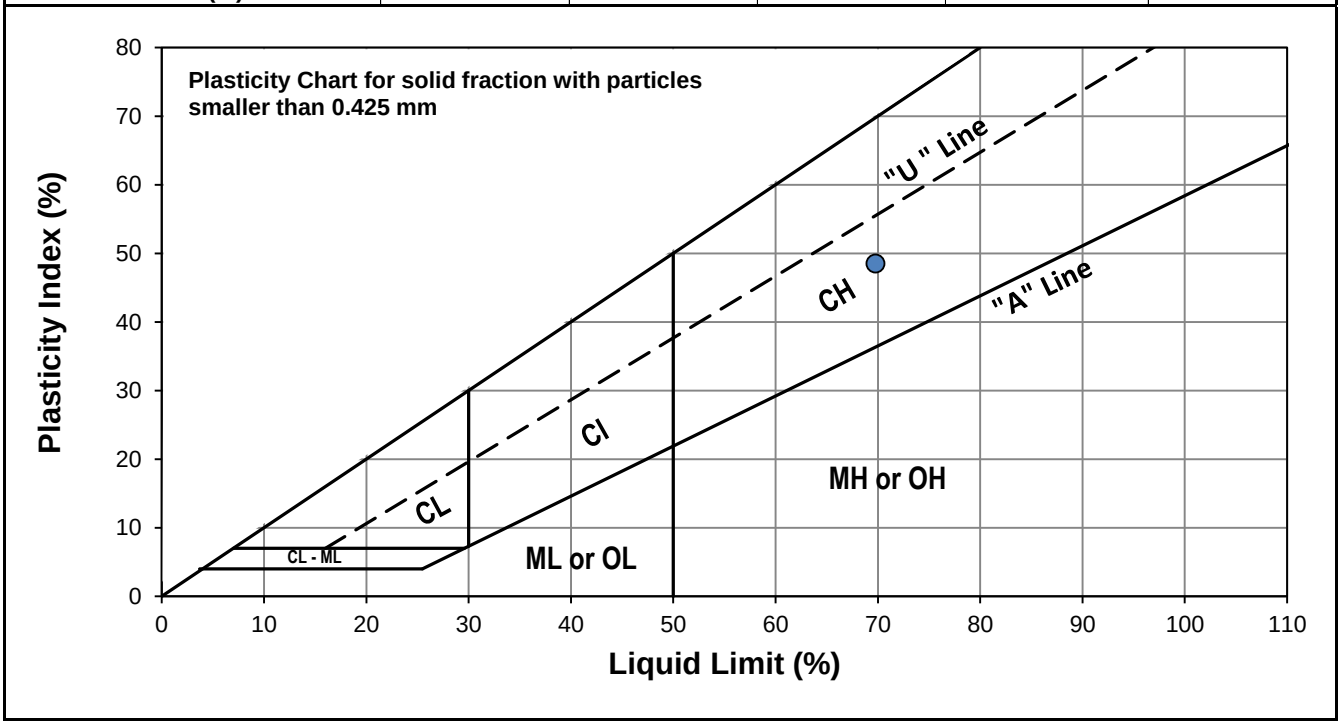
Project No.	0395-001-00
Client	WSP Group Canada Ltd.
Project	19-C-09 Watt Street Pavement Renewals
Test Hole	TH19-08
Sample #	G25
Depth (m)	0.6 - 0.8
Sample Date	17-Oct-19
Test Date	06-Nov-19
Technician	SB

Liquid Limit	70
Plastic Limit	21
Plasticity Index	48

Liquid Limit

Trial #	1	2	3		
Number of Blows (N)	16	25	28		
Mass Wet Soil + Tare (g)	20.283	21.887	21.422		
Mass Dry Soil + Tare (g)	17.570	18.726	18.388		
Mass Tare (g)	13.988	14.152	13.977		
Mass Water (g)	2.713	3.161	3.034		
Mass Dry Soil (g)	3.582	4.574	4.411		
Moisture Content (%)	75.740	69.108	68.783		



Plastic Limit

Trial #	1	2	3	4	5
Mass Tare (g)	13.716	14.347			
Mass Wet Soil + Tare (g)	22.406	23.031			
Mass Dry Soil + Tare (g)	20.867	21.521			
Mass Water (g)	1.539	1.510			
Mass Dry Soil (g)	7.151	7.174			
Moisture Content (%)	21.521	21.048			

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Grain Size Analysis (Hydrometer Method)
AASHTO T 88

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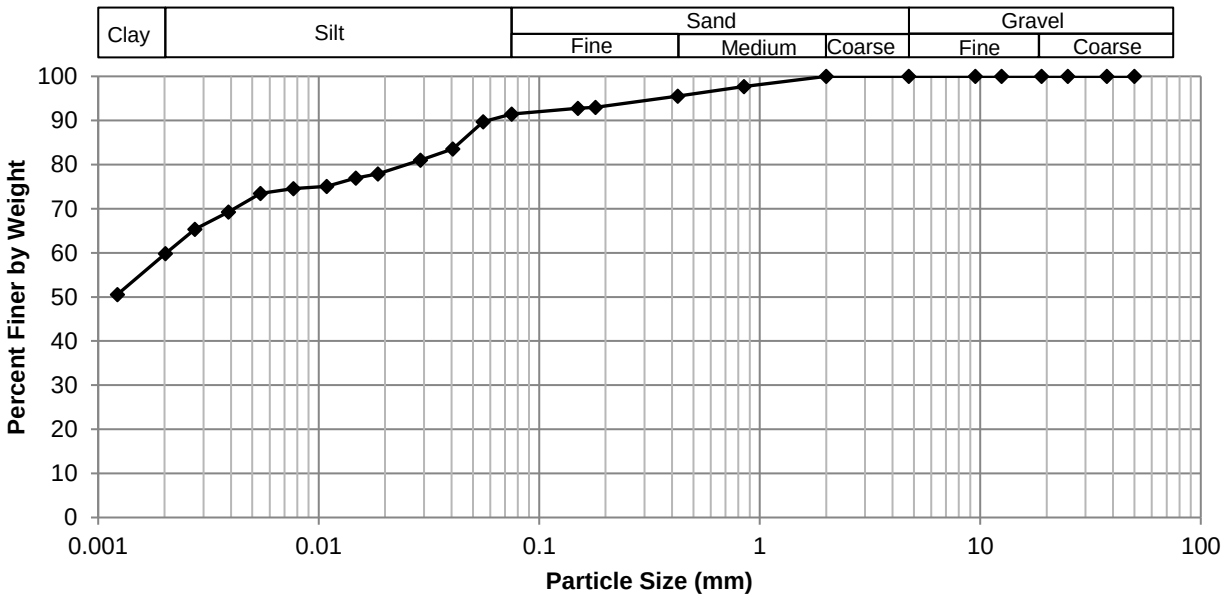
Project No.	0395-010-00-400
Client	WSP Group Canada Ltd.
Project	19-C-09 Watt Street Pavement Renewals
Test Hole	TH19-01
Sample #	G02
Depth (m)	0.6 - 0.8
Sample Date	17-Oct-19
Test Date	5-Nov-19
Technician	JSB

Gravel	0.0%
Sand	8.5%
Silt	31.9%
Clay	59.6%

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	100.00	0.0750	91.49
37.5	100.00	2.00	100.00	0.0557	89.71
25.0	100.00	0.850	97.72	0.0405	83.53
19.0	100.00	0.425	95.49	0.0290	81.03
12.5	100.00	0.180	93.01	0.0186	77.91
9.50	100.00	0.150	92.74	0.0148	76.97
4.75	100.00	0.075	91.49	0.0109	75.09
				0.0077	74.54
				0.0054	73.44
				0.0039	69.28
				0.0027	65.37
				0.0020	59.81
				0.0012	50.56

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Grain Size Analysis (Hydrometer Method)
AASHTO T 88

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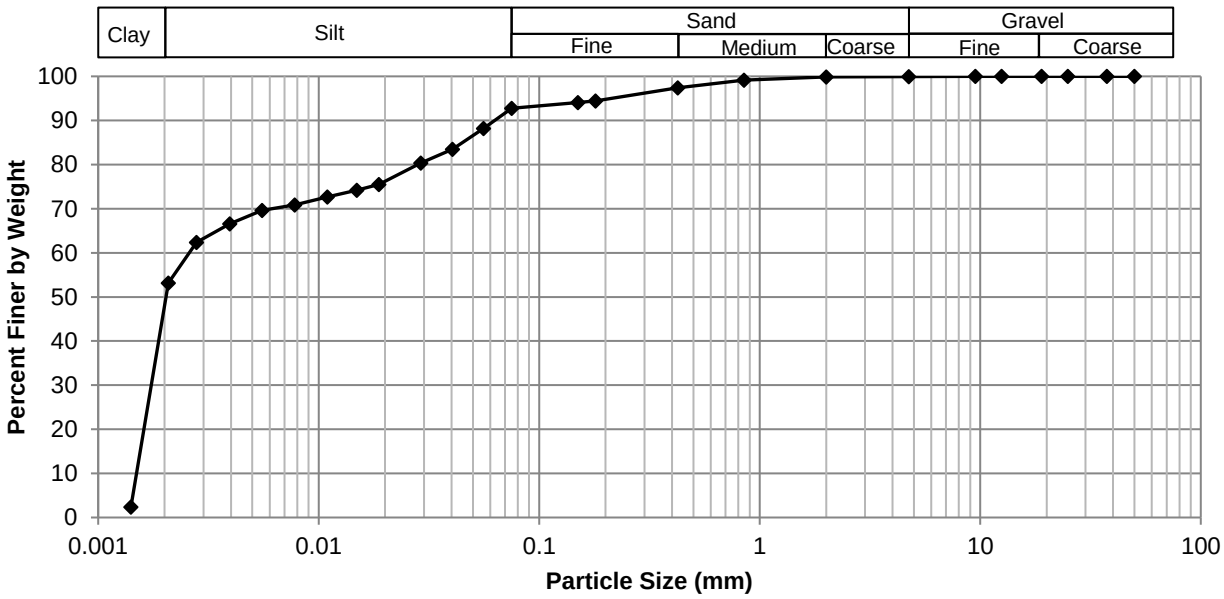
Project No.	0395-010-00-400
Client	WSP Group Canada Ltd.
Project	19-C-09 Watt Street Pavement Renewals
Test Hole	TH19-05
Sample #	G08
Depth (m)	0.6 - 0.8
Sample Date	18-Oct-19
Test Date	6-Nov-19
Technician	JSB

Gravel	0.1%
Sand	7.2%
Silt	45.8%
Clay	47.0%

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	99.94	0.0750	92.78
37.5	100.00	2.00	99.88	0.0560	88.19
25.0	100.00	0.850	99.14	0.0405	83.51
19.0	100.00	0.425	97.43	0.0290	80.39
12.5	100.00	0.180	94.44	0.0187	75.46
9.50	100.00	0.150	94.09	0.0149	74.22
4.75	99.94	0.075	92.78	0.0109	72.65
				0.0078	70.85
				0.0055	69.60
				0.0040	66.56
				0.0028	62.35
				0.0021	53.13
				0.0014	2.39

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Grain Size Analysis (Hydrometer Method)
AASHTO T 88

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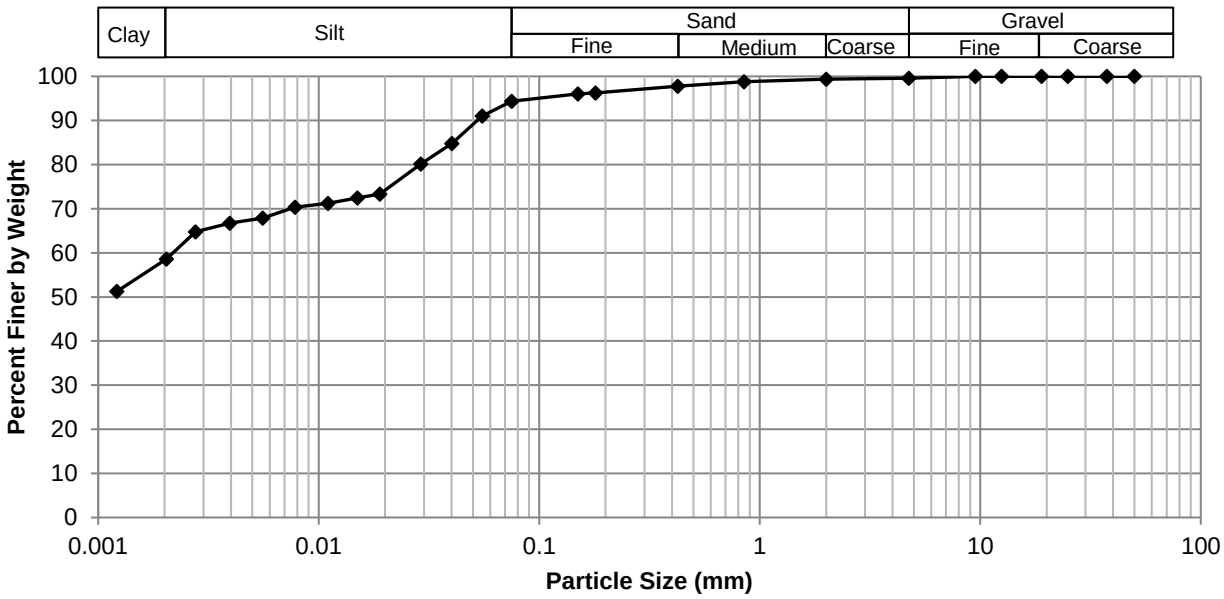
Project No.	0395-010-00-400
Client	WSP Group Canada Ltd.
Project	19-C-09 Watt Street Pavement Renewals
Test Hole	TH19-07
Sample #	G31
Depth (m)	0.5 - 0.7
Sample Date	17-Oct-19
Test Date	6-Nov-19
Technician	JSB

Gravel	0.4%
Sand	5.2%
Silt	36.2%
Clay	58.2%

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	99.57	0.0750	94.38
37.5	100.00	2.00	99.40	0.0552	91.01
25.0	100.00	0.850	98.76	0.0402	84.80
19.0	100.00	0.425	97.80	0.0290	80.14
12.5	100.00	0.180	96.25	0.0189	73.30
9.50	100.00	0.150	96.05	0.0150	72.43
4.75	99.57	0.075	94.38	0.0110	71.19
				0.0078	70.32
				0.0056	67.90
				0.0039	66.72
				0.0028	64.73
				0.0020	58.58
				0.0012	51.24

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Grain Size Analysis (Hydrometer Method)
AASHTO T 88

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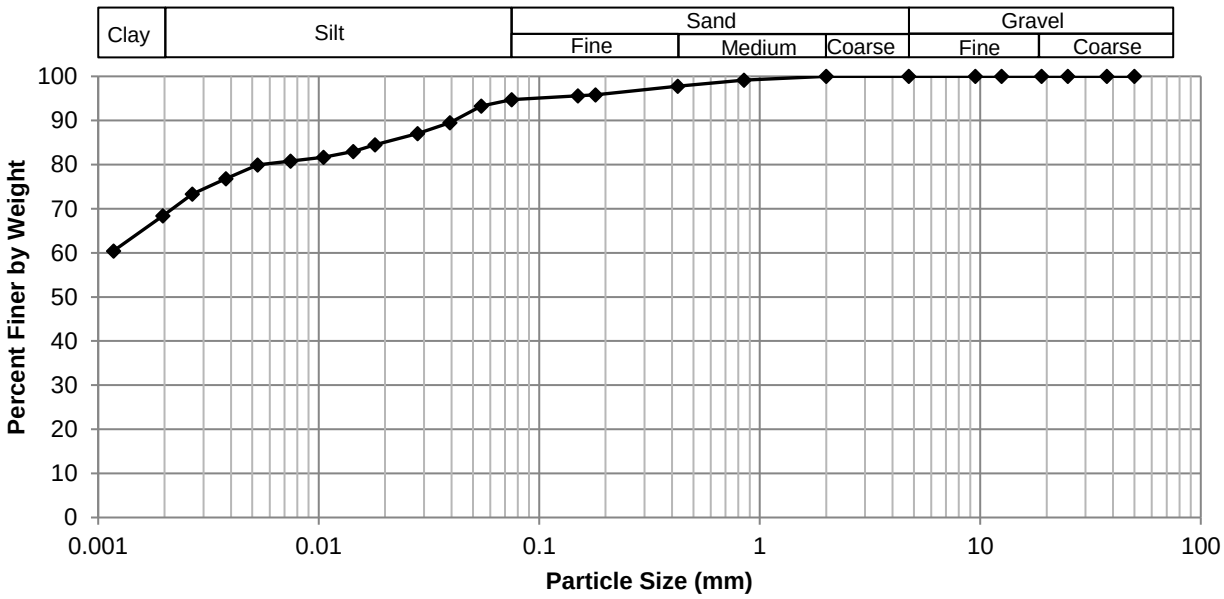
Project No.	0395-010-00-400
Client	WSP Group Canada Ltd.
Project	19-C-09 Watt Street Pavement Renewals
Test Hole	TH19-08
Sample #	G25
Depth (m)	0.6 - 0.8
Sample Date	17-Oct-19
Test Date	6-Nov-19
Technician	JSB

Gravel	0.0%
Sand	5.3%
Silt	26.1%
Clay	68.6%

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	100.00	0.0750	94.71
37.5	100.00	2.00	100.00	0.0546	93.26
25.0	100.00	0.850	99.13	0.0393	89.50
19.0	100.00	0.425	97.78	0.0281	87.00
12.5	100.00	0.180	95.80	0.0180	84.50
9.50	100.00	0.150	95.59	0.0143	82.94
4.75	100.00	0.075	94.71	0.0105	81.69
				0.0075	80.82
				0.0053	79.94
				0.0038	76.82
				0.0027	73.31
				0.0020	68.38
				0.0012	60.43

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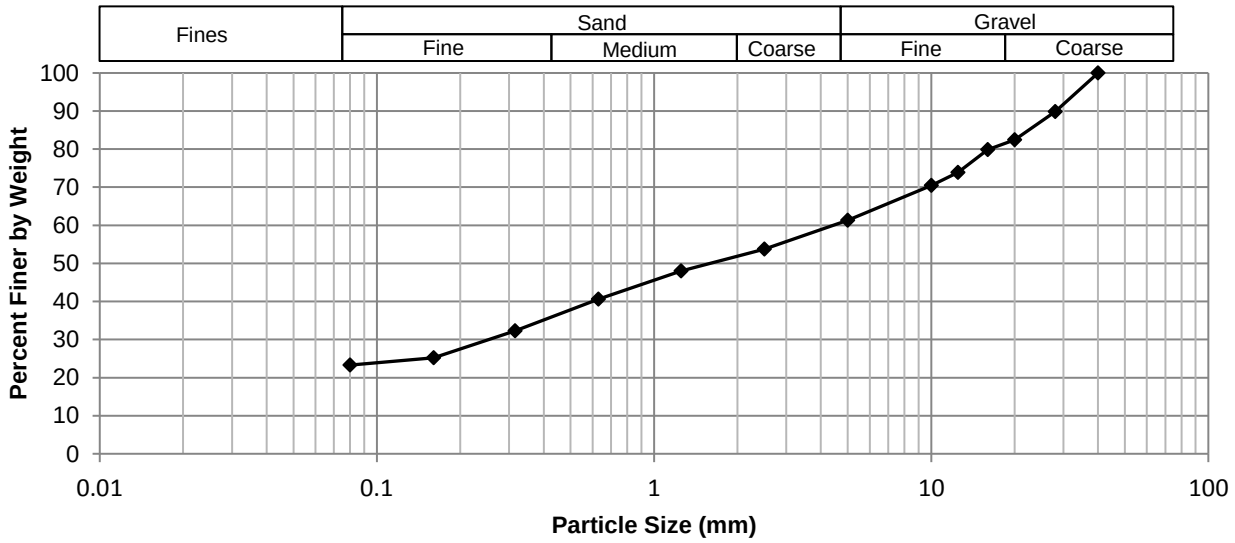
Grain Size Analysis (Sieve Method)
ASTM C136-06

Project No.	0395-010-00-400
Client	WSP Group Canada Ltd.
Project	Watt Street Pavement Renewals

Test Hole	TH19-03
Sample #	G38
Depth	0.8 - 0.9
Date Sampled	17-Oct-19
Date Tested	3-Nov-19
Technician	SB

Total Weight (g)	652.1
Gravel %	38.7
Sand %	38.0
Fines %	23.3

Particle Size Distribution Curve



Sieve Opening (mm)	Percent Passing	Specification (Min-Max)
40.0	100	-
28.0	90	-
20.0	82	-
16.0	80	-
12.5	74	-
10.0	70	-
5.0	61	-
2.50	54	-
1.25	48	-
0.630	41	-
0.315	32	-
0.160	25	-
0.080	23	-

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Standard Proctor Compaction Test

ASTM D698-12e2

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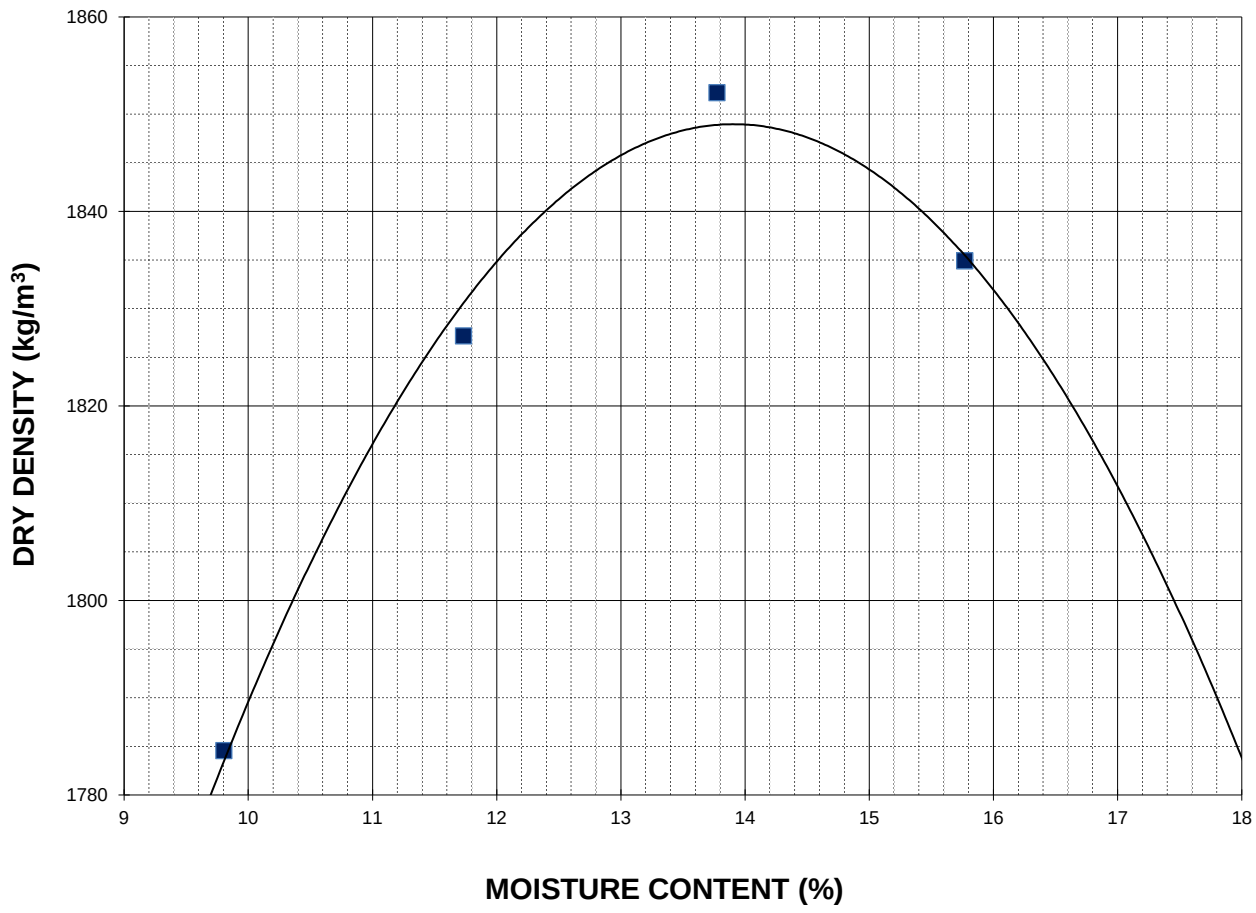
Project No.	0395-010-00
Client	WSP Group
Project	19-C-09 Watt Street Pavement Renewals

Sample #	Bulk 1
Source	TH19-03
Material	Silt and Sand
Sample Date	17-Oct-19
Test Date	05-Nov-19
Technician	BMH

Corrected Max. Dry Density (kg/m3)	1895
Corrected Optimum Moisture (%)	12.9
Oversize Material (%)	8
Maximum Dry Density (kg/m3)	1849
Optimum Moisture (%)	13.9

Trial Number	1	2	3	4	
Wet Density (kg/m^3)	1959	2042	2107	2124	
Dry Density (kg/m^3)	1785	1827	1852	1835	
Moisture Content (%)	9.8	11.7	13.8	15.8	



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Standard Proctor Compaction Test

ASTM D698-12e2

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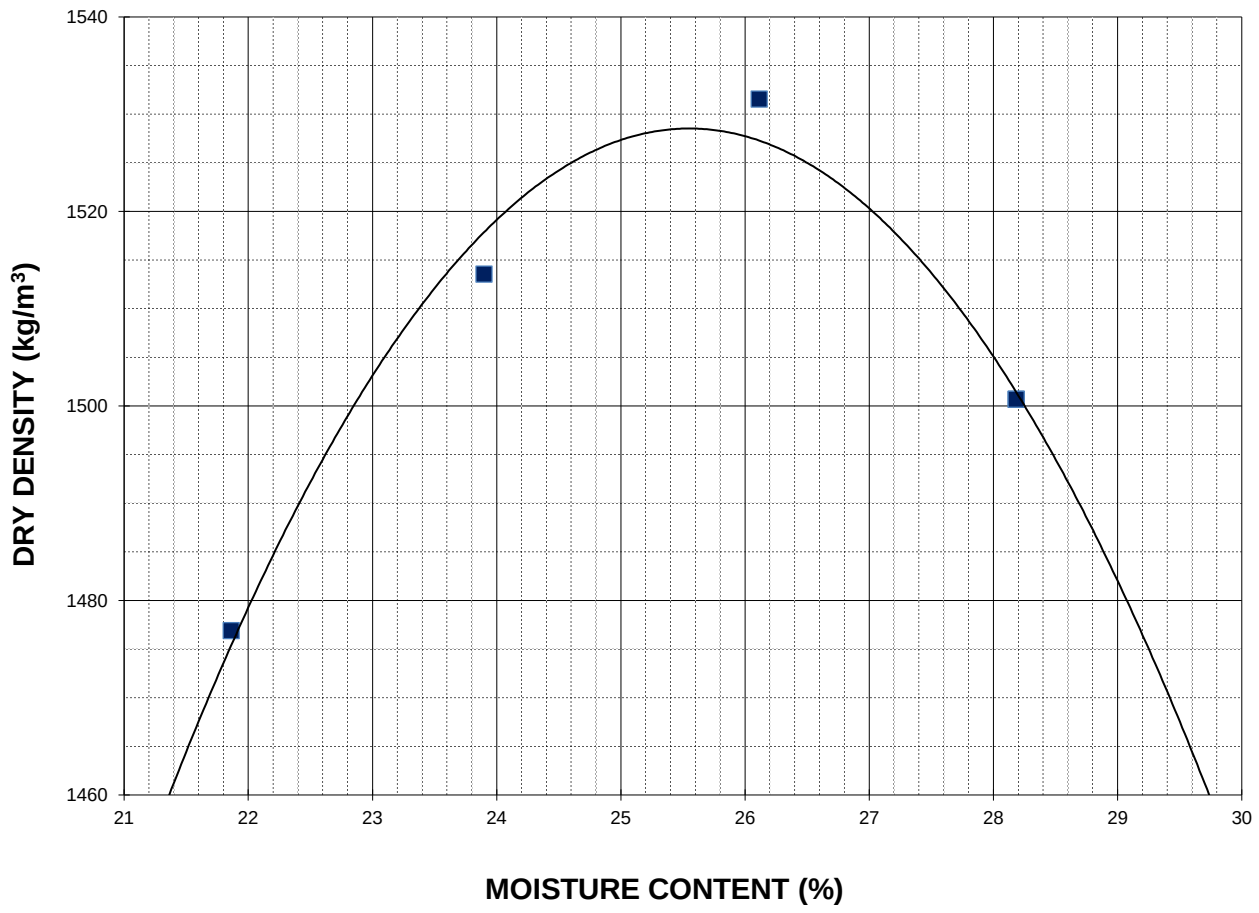
Project No.	0395-010-00
Client	WSP Group
Project	19-C-09 Watt Street Pavement Renewals

Sample #	Bulk 2
Source	TH19-04
Material	Clay
Sample Date	17-Oct-19
Test Date	05-Nov-19
Technician	BMH

Maximum Dry Density (kg/m3)	1529
Optimum Moisture (%)	25.6

Trial Number	1	2	3	4	
Wet Density (kg/m^3)	1800	1875	1931	1924	
Dry Density (kg/m^3)	1477	1514	1532	1501	
Moisture Content (%)	21.9	23.9	26.1	28.2	



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Standard Proctor Compaction Test

ASTM D698-12e2

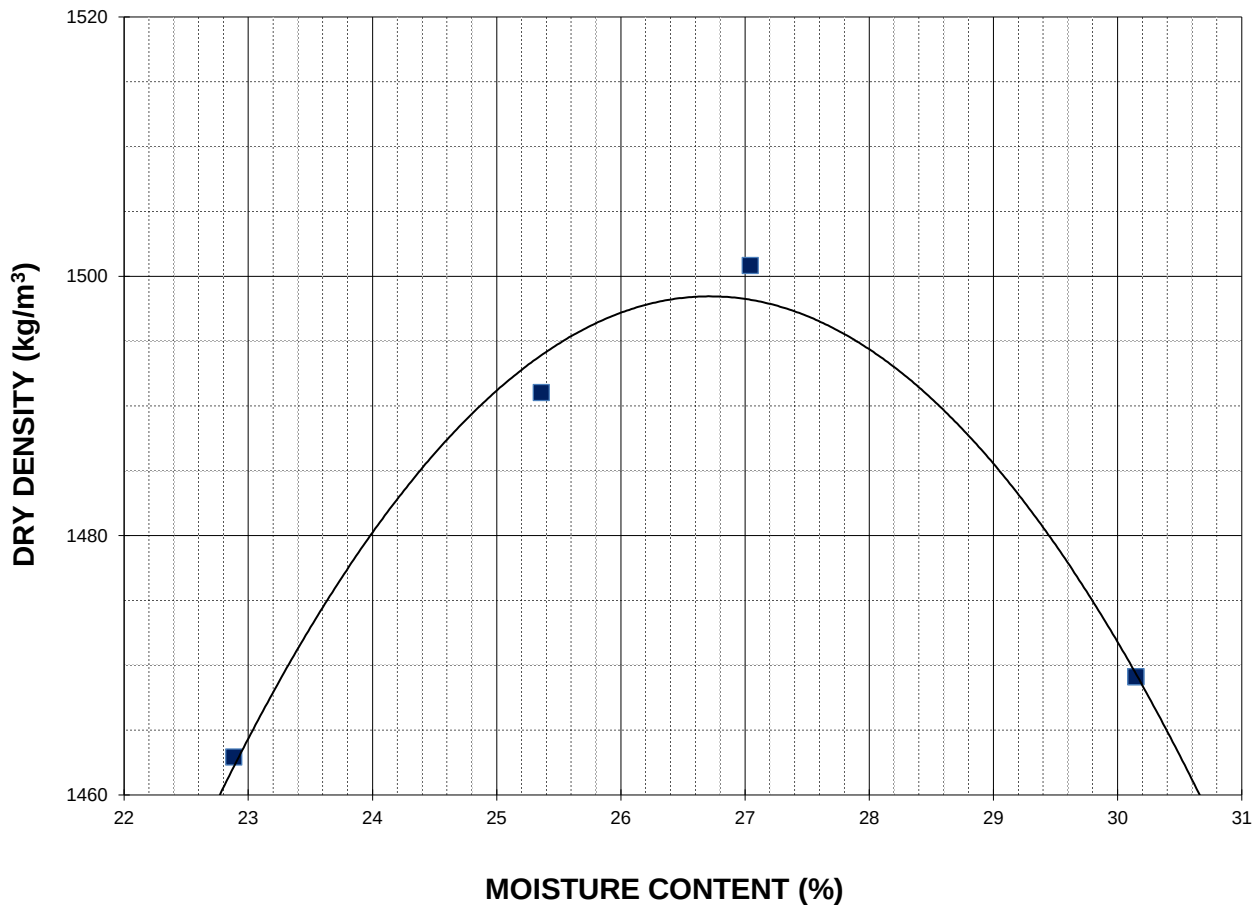
CERTIFIED BY CCIL Canadian Council of Independent Laboratories For specific tests as listed on www.ccil.com

Project No.	0395-010-00
Client	WSP Group
Project	19-C-09 Watt Street Pavement Renewals

Sample #	Bulk 3
Source	TH19-05
Material	Clay Fill
Sample Date	17-Oct-19
Test Date	05-Nov-19
Technician	BMH

Maximum Dry Density (kg/m3)	1498
Optimum Moisture (%)	26.7

Trial Number	1	2	3	4	
Wet Density (kg/m^3)	1798	1869	1907	1912	
Dry Density (kg/m^3)	1463	1491	1501	1469	
Moisture Content (%)	22.9	25.4	27.0	30.1	



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California Bearing Ratio Test Data Sheet

ASTM D1883-16

Project No.	0395-010-00	**Source**	TH19-03
Client	WSP Group	**Material**	Silt and Sand
Project	2019 Pavement Renewals - Watt	**Sample Date**	10/17/2019
Sample #	Bulk 1	**Test Date**	12/11/2019
		Technician	BMH

Proctor Results (ASTM D698)

Maximum Dry Density	1895	kg/m3
Optimum Moisture Content	12.9	%
Material Retained on 19 mm Sieve	0.0	%

CBR Sample Compaction

Dry Density	1822	kg/m3
Initial Moisture Content	15.2	%
Relative Density	96.2	% SPMDD

Soaking Results

Surcharge	4.54	kg
Swell	0.2	%
Moisture Content in top 25 mm	15.9	%
Immersion Period	96	h

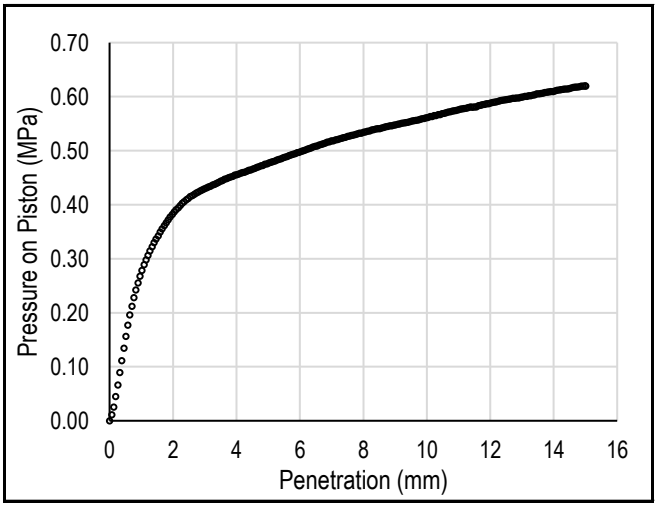
CBR Results

CBR at 2.54 mm	6.0	%
CBR at 5.08 mm	4.6	%
Zero Correction	0	mm

Test Data

Penetration (mm)	Measured Pressure (MPa)	Corrected Pressure (MPa)
0.64	0.20	0.20
1.27	0.31	0.31
1.91	0.38	0.38
2.54	0.41	0.41
3.18	0.43	0.43
3.81	0.45	0.45
4.45	0.46	0.46
5.08	0.48	0.48
7.62	0.53	0.53
10.16	0.56	0.56
12.70	0.60	0.60

Load/Penetration Curve



Comments:

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California Bearing Ratio Test Data Sheet

ASTM D1883-16

Project No.	0395-010-00	**Source**	TH19-04
Client	WSP Group	**Material**	Clay
Project	2019 Pavement Renewals - Watt	**Sample Date**	10/17/2019
Sample #	Bulk 2	**Test Date**	12/11/2019
		Technician	BMH

Proctor Results (ASTM D698)

Maximum Dry Density	1529	kg/m3
Optimum Moisture Content	25.6	%
Material Retained on 19 mm Sieve	0.0	%

CBR Sample Compaction

Dry Density	1447	kg/m3
Initial Moisture Content	28.4	%
Relative Density	94.7	% SPMDD

Soaking Results

Surcharge	4.54	kg
Swell	0.6	%
Moisture Content in top 25 mm	32.7	%
Immersion Period	96	h

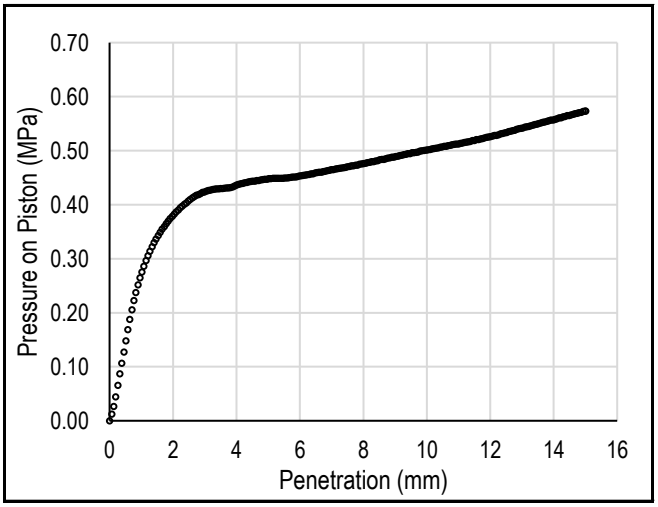
CBR Results

CBR at 2.54 mm	5.9	%
CBR at 5.08 mm	4.4	%
Zero Correction	0	mm

Test Data

Penetration (mm)	Measured Pressure (MPa)	Corrected Pressure (MPa)
0.64	0.19	0.19
1.27	0.31	0.31
1.91	0.37	0.37
2.54	0.41	0.41
3.18	0.43	0.43
3.81	0.43	0.43
4.45	0.44	0.44
5.08	0.45	0.45
7.62	0.47	0.47
10.16	0.50	0.50
12.70	0.54	0.54

Load/Penetration Curve



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California Bearing Ratio Test Data Sheet

ASTM D1883-16

Project No.	0395-010-00	**Source**	TH19-05
Client	WSP Group	**Material**	Clay Fill
Project	2019 Pavement Renewals - Watt	**Sample Date**	10/17/2019
Sample #	Bulk 3	**Test Date**	12/11/2019
		Technician	BMH

Proctor Results (ASTM D698)

Maximum Dry Density	1498	kg/m3
Optimum Moisture Content	26.7	%
Material Retained on 19 mm Sieve	0.0	%

CBR Sample Compaction

Dry Density	1416	kg/m3
Initial Moisture Content	30.5	%
Relative Density	94.5	% SPMDD

Soaking Results

Surcharge	4.54	kg
Swell	0.5	%
Moisture Content in top 25 mm	33.6	%
Immersion Period	96	h

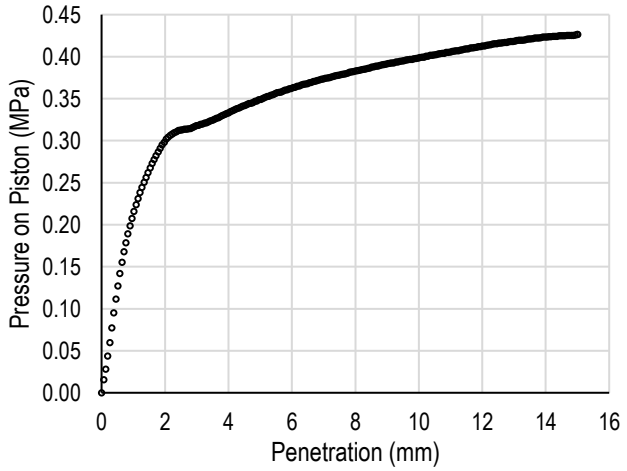
CBR Results

CBR at 2.54 mm	4.5	%
CBR at 5.08 mm	3.4	%
Zero Correction	0	mm

Test Data

Penetration (mm)	Measured Pressure (MPa)	Corrected Pressure (MPa)
0.64	0.16	0.16
1.27	0.24	0.24
1.91	0.30	0.30
2.54	0.31	0.31
3.18	0.32	0.32
3.81	0.33	0.33
4.45	0.34	0.34
5.08	0.35	0.35
7.62	0.38	0.38
10.16	0.40	0.40
12.70	0.42	0.42

Load/Penetration Curve



Comments:

Appendix C

Photographs of Pavement Core Samples

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

Wood

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