APPENDIX 'A'

GEOTECHNICAL REPORT

Quality Engineering | Valued Relationships

WSP Canada Group Ltd

2018 Regional Street Package (PW File #: C-05)

Prepared for:

WSP Canada Group Ltd.
111-93 Lombard Ave.
Winnipeg, MB R3B
Attention: Marcus Wong

Project Number:
0395 004 00

Date:
March 14, 2018
Final Report

www.trekgeotechnical.ca
1712 St. James Street | Winnipeg, Manitoba R3H 0L3 | Tel 1.204.975.9433 | Fax 1.204.975.9435

TREK GEOTECHNICAL Quality Engineering | Valued Relationships

March 14, 2018 Our File No. 0395 004 00

Marcus Wong, B.Sc. (C.E.), P.Eng.
WSP Canada Group Ltd.
111-93 Lombard Ave.
Winnipeg, MB R3B

RE: Sub-Surface Investigation Report for
2018 Regional Street Package (PW File #: C-05)

TREK Geotechnical Inc. is pleased to submit our report for the sub-surface investigations for the 2018 Regional Street Package (PW File #: C-05).

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

Sincerely,

TREK Geotechnical Inc.
Per:

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

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

Revision History

Revision No.	Author	Issue Date	Description
0	AFK	March 14, 2018	Final Report

Authorization Signatures

Prepared By:

Angela Fidler-Kliewer C.Tech.

PROVINCE OF MANITOBA
N. J. FERREIRA
Member
22884
REGISTERED PROFESSIONAL ENGINEER
Mar. 14, 2018

ENGINEERS GEOSCIENTISTS MANITOBA
Certificate of Authorization
TREK GEOTECHNICAL INC.
No. 4877 Date: Mar. 14, 2018

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 2018 Regional Street Package C-05 project. The streets included York Avenue, Memorial Blvd. and Colony Street. The information collected describes the pavement structure of the existing road as well as the soil stratigraphy beneath the pavement structure at select locations.

2.0 Road Investigation and Laboratory Program

The investigation included coring of pavement or a combination of coring and drilling of test holes. WSP selected the investigation locations as shown on Figure 01 to Figure 04 (attached) and the table below summarizes the investigation program per street.

Road Investigation Program

Street	# of Locations	Investigation
York Avenue – Memorial Blvd to Osbourne Street.	2	Pavement Cores and Test Holes
Memorial Blvd – St. Mary Avenue to Broadway Avenue	8	Pavement Cores and Test Holes
Memorial Blvd – Portage Avenue to St. Mary Avenue	6	Pavement Cores Only
Colony Street – Ellice Avenue to Portage Avenue	6	Pavement Cores Only

The road investigation was conducted between February 12, 2018 and February 15, 2018. The pavement structure (asphalt or concrete) was cored by Harsimran Singh of TREK Geotechnical Inc. (TREK) using a portable coring press equipped with a hollow 150 mm diameter diamond core drill bit. The test holes were drilled to a depth of 3.0 m below road surface by Paddock 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 retrieved during the sub-surface investigation were transported to TREK's material testing laboratory for further testing. Core samples were also retrieved and logged at TREK's material testing laboratory.

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

Core and test hole locations noted on the summary tables and test hole logs are based on their location relative to the nearest address, and measured distances from the edge of pavement or other permanent features.

3.0 Closure

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

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

This report has been prepared by TREK Geotechnical Inc. (the Consultant) for the exclusive use of WSP Canada Group Inc. (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 004 00
WSP GROUP CANADA LTD.
Regional Streets C-05 York Avenue

0 25 50 75 100 m
SCALE = 1 : 2 000 (216 mm x 279 mm)

LEGEND: TEST HOLE (TREK, 2018)

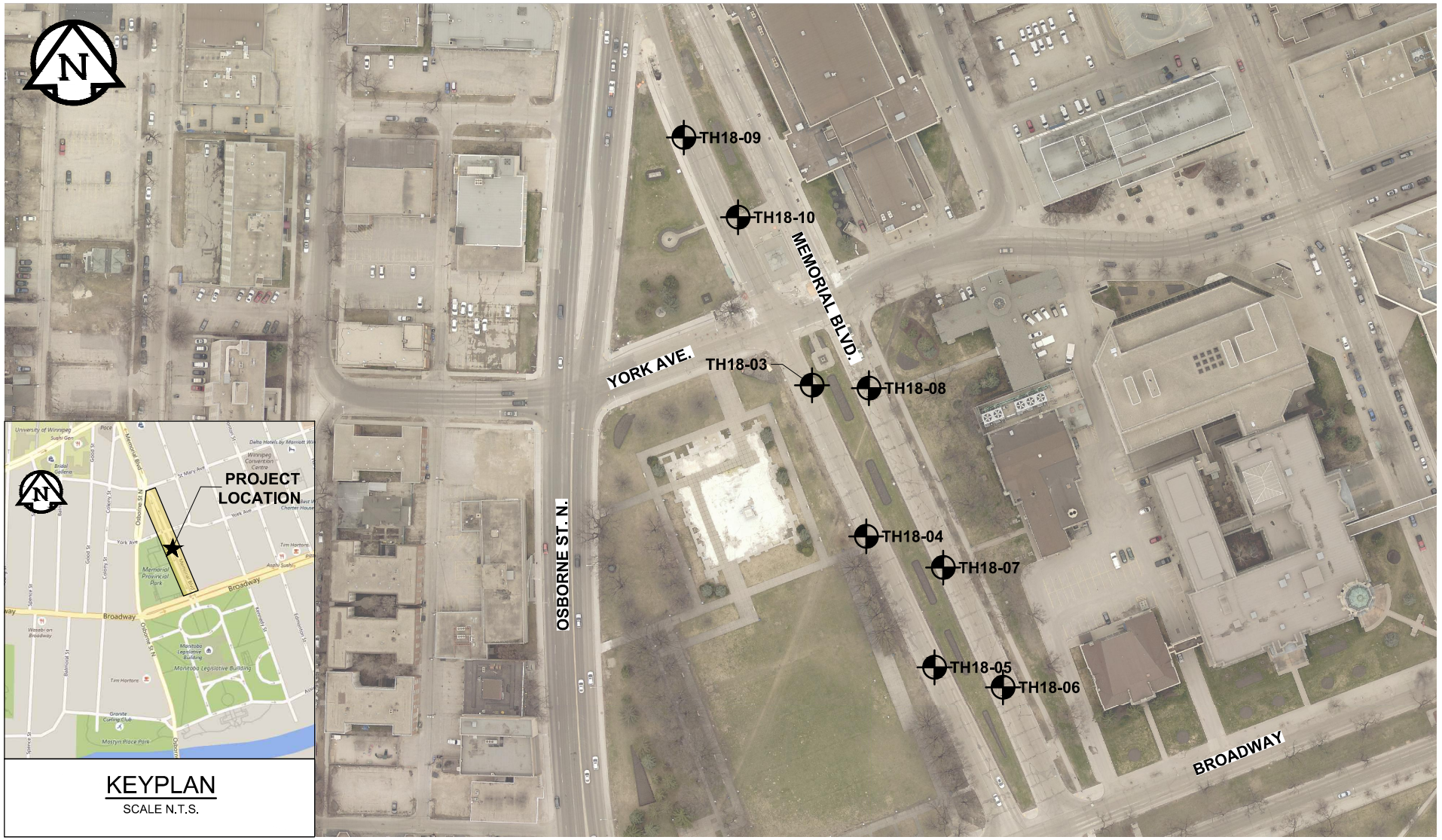
NOTES: 1. AERIAL IMAGE FROM CITY OF WINNIPEG 2016

Figure 01
Test Hole Plan

ANSI full bleed A (11.00 x 8.50 Inches)
FIG.001 2018-03-07 Test □ole Plan 0_A_SL 0395 004 00 (Yor□Ave.).dwg, 3/13/2018 11:35:40 AM

TREK GEOTECHNICAL

0395 004 00
WSP GROUP CANADA LTD.
Regional Streets C-05 Memorial Boulevard



0 25 50 75 100 m
SCALE = 1 : 2 000 (216 mm x 279 mm)

LEGEND: TEST HOLE (TREK, 2018)

NOTES: 1. AERIAL IMAGE FROM CITY OF WINNIPEG 2016

Figure 02
Test Hole Plan

ANSI full bleed A (11.00 x 8.50 Inches)

FIG.002 2018-03-07 Test Hole Plan 0_A_SL 0395 004 00 (Memorial Blvd.).dwg, 3/13/2018 11:38:29 AM

TREK GEOTECHNICAL

0395 004 00
WSP GROUP CANADA LTD.
Regional Streets C-05 _ Memorial Boulevard

ANSI full bleed A (11.00 x 8.50 Inches)

FIG.003 2018-03-07 Pavement Core 0 A SL 0395 004 00 (Memorial Blvd.).dwg, 3/9/2018 9:48:57 AM

0 25 50 75 100 m
SCALE = 1 : 2 000 (216 mm x 279 mm)

LEGEND: PAVEMENT CORES (TREK, 2018)

NOTES: 1. AERIAL IMAGE FROM CITY OF WINNIPEG 2016

Figure 03
Pavement Core Plan

TREK GEOTECHNICAL

0395 004 00
WSP GROUP CANADA LTD.
Regional Streets C-05 _ Colony Street

ANSI full bleed A (11.00 x 8.50 Inches)

FIG.004 2018-03-07 Pavement Core 0 A SL 0395 004 00 (Colony St.).dwg, 3/8/2018 11:46:58 AM

0 25 50 75 100 m
SCALE = 1 : 2 000 (216 mm x 279 mm)

LEGEND: PAVEMENT CORES (TREK, 2018)

NOTES: 1. AERIAL IMAGE FROM CITY OF WINNIPEG 2016

Figure 04
Pavement Core Plan

Appendix A

York Avenue, between Osbourne St. North and Memorial Blvd.

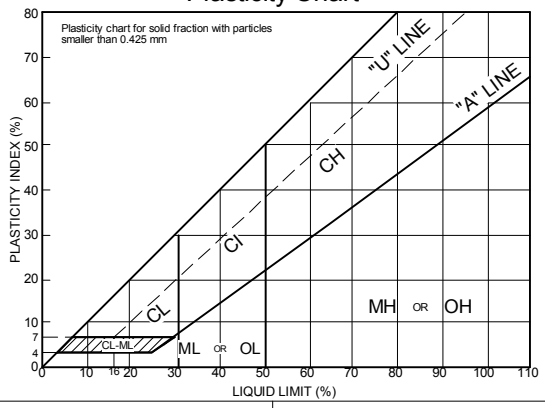
Test Hole Logs, Summary Table, Lab Data and Photographs of Pavement Core Samples

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
	Sand		
	Coarse	#10 to #4	2.00 to 4.75
	Medium	#40 to #10	0.425 to 2.00
	Fine	#200 to #40	0.075 to 0.425
	Silt or Clay	< #200	< 0.075

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

* 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 TH18-01
1 of 1

Client:	WSP Canada Goup Ltd.	**Project Number:**	0395-004-00
Project Name:	2018 Regional Streets C-05 (York Ave)	**Location:**	UTM N-5527770, E-632917
Contractor:	Paddock Drilling Ltd.	**Ground Elevation:**	Top of Pavement
Method:	125mm Solid Stem Auger, Acker MP8 Truck Mount	**Date Drilled:**	2018 February 14

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

Particle Size Legend: Fines | Clay | Silt | Sand | Gravel | Cobbles | Boulders

Depth (m)	Soil Symbol	MATERIAL DESCRIPTION	Sample Type	Sample Number	Bulk Unit Wt (kN/m³) 16 17 18 19 20 21 / Particle Size (%) 0 20 40 60 80 100 / PL MC LL	Undrained Shear Strength (kPa) Test Type: △ Torvane △ ✤ Pocket Pen. ✤ ☒ Qu ☒ ○ Field Vane ○ 0 50 100 150 200 250
		CONCRETE - 205 mm thick				
		CLAY (FILL) - silty, sandy, some gravel - brown, frozen, moist and soft when thawed, high plasticity		G01		
0.5		SILT AND CLAY - trace sand - brown - frozen, moist and soft when thawed - intermediate plasticity		G02		
1.0				G03		
				G04		
1.5		CLAY - silty, trace sand to 2.7 m - grey - frozen to 1.5 m, moist and stiff when thawed - high plasticity		G05		
		- trace silt inclusions (< 5 mm diam.), trace oxidation, very stiff below 1.8 m		G06		
2.0						
2.5						
		- stiff below 2.7 m		G07		
3.0						

END OF TEST HOLE AT 3.0 m IN CLAY
1) No seepage or sloughing.
2) Test hole backfilled with auger cuttings, bentonite chips, sand and cold patch asphalt.
3) Test hole located at 17 m East of York Ave and Osborne Street intersection, 3.5 m South of North curb.

Logged By: Harsimran Singh **Reviewed By:** N.J Ferreira **Project Engineer:** Nelson Ferreira

Sub-Surface Log

Test Hole TH18-02
1 of 1

Client:	WSP Canada Goup Ltd.	**Project Number:**	0395-004-00
Project Name:	2018 Regional Streets C-05 (York Ave)	**Location:**	UTM N-5527774, E-632935
Contractor:	Paddock Drilling Ltd.	**Ground Elevation:**	Top of Pavement
Method:	125mm Solid Stem Auger, Acker MP8 Truck Mount	**Date Drilled:**	2018 February 14

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

Particle Size Legend: Fines | Clay | Silt | Sand | Gravel | Cobbles | Boulders

Depth (m)	Soil Symbol	MATERIAL DESCRIPTION	Sample Type	Sample Number	Bulk Unit Wt (kN/m³) 16 17 18 19 20 21 / Particle Size (%) 0 20 40 60 80 100 / PL MC LL	Undrained Shear Strength (kPa) Test Type: △ Torvane △ ✤ Pocket Pen. ✤ ☒ Qu ☒ ○ Field Vane ○ 0 50 100 150 200 250
		CONCRETE - 210 mm thick				
		CLAY (FILL) - silty, sandy, some gravel - brown, frozen, moist and soft when thawed, high plasticity		G08		
0.5		SILT AND CLAY - trace sand - brown - frozen to 1.5 m, moist and soft to firm when thawed - intermediate plasticity		G09		
1.0				G10		
				G11		
1.5		CLAY - silty, trace sand to 2.7 m - grey - moist, stiff - high plasticity - trace silt inclusions (< 5 mm diam.) below 1.8 m		G12		
2.0				G13		
2.5						
		- firm below 2.7 m		G14		
3.0		END OF TEST HOLE AT 3.0 m IN CLAY				

1) No seepage or sloughing.
2) Test hole backfilled with auger cuttings, bentonite chips, sand and cold patch asphalt.
3) Test hole located at 23 m West of York Ave and Memorial Boulevard intersection, 1 m North of South curb.

Logged By: Harsimran Singh **Reviewed By:** N.J Ferreira **Project Engineer:** Nelson Ferreira

PTH 83 TH LOGS MIT FONT LOGS 2018-03-08_LOCAL STREETS C-05 YORK AVE_0395-004-00_0_A_HS.GPJ TREK GEOTECHNICAL.GDT 18-3-13

TREK GEOTECHNICAL

Regional Street Package C-05
Sub-Surface Investigation
York Avenue

Test Hole No.	Test Hole Location	Pavement Surface		Pavement Structure Material		Subgrade Description	Sample Depth (m)		Moisture Content (%)	Grain Size Analysis				Atterberg Limits		
		Type	Thickness (mm)	Type	Thickness (mm)		Top (m)	Bottom (m)		Gravel (%)	Sand (%)	Silt (%)	Clay (%)	Plastic	Liquid	Plasticity Index
TH18-01	UTM: 5527770 N, 632917 E Located 17 m East of York Ave. and Osborne St. intersection, 3.5 m South of North curb.	Asphalt	N/A	Concrete	203											
						CLAY (FILL)	0.2	0.3	19	16	34	27	24	18	57	39
						SILT AND CLAY	0.6	0.8	34							
						SILT AND CLAY	0.9	1.1	26							
						SILT AND CLAY	1.2	1.3	25							
						CLAY	1.5	1.6	28							
						CLAY	1.8	2.0	33							
						CLAY	2.7	2.9	47							
TH18-02	UTM: 5527774 N, 632935 E Located 23 M West of York Ave. and Memorial Blvd. intersection, 1.0 m North of South curb.	Asphalt	N/A	Concrete	254											
						CLAY (FILL)	0.2	0.4	22							
						SILT AND CLAY	0.7	0.8	25	0	7	60	32	14	35	21
						SILT AND CLAY	1.0	1.1	28							
						SILT AND CLAY	1.2	1.4	36							
						CLAY	1.6	1.7	42							
						CLAY	1.9	2.0	34							
						CLAY	2.7	2.9	54							

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Moisture Content Report
ASTM D2216-10

Project No. 0395-004-00
Client WSP Canada Group Ltd.
Project 2018 Regional Streets C-05 (York Ave)

Sample Date 14-Feb-18
Test Date 2-Mar-18
Technician HS

Test Pit	TH18-01	TH18-01	TH18-01	TH18-01	TH18-01	TH18-01
Depth (m)	0.2 - 0.3	0.6 - 0.8	0.9 - 1.1	1.2 - 1.3	1.5 - 1.6	1.8 - 2.0
Sample #	G01	G02	G03	G04	G05	G06
Tare ID	H46	P40	E59	W88	F35	N26
Mass of tare	8.5	8.6	8.6	8.5	8.7	8.7
Mass wet + tare	570.5	475.7	271.8	189.4	305.7	300.9
Mass dry + tare	479.5	358.1	217.7	153.6	240.2	227.9
Mass water	91.0	117.6	54.1	35.8	65.5	73.0
Mass dry soil	471.0	349.5	209.1	145.1	231.5	219.2
Moisture %	19.3%	33.6%	25.9%	24.7%	28.3%	33.3%

Test Pit	TH18-01	TH18-02	TH18-02	TH18-02	TH18-02	TH18-02
Depth (m)	2.7 - 2.9	0.2 - 0.4	0.7 - 0.8	1.0 - 1.1	1.2 - 1.4	1.6 - 1.7
Sample #	G07	G08	G09	G10	G11	G12
Tare ID	E70	Z43	W79	H66	F44	AB71
Mass of tare	8.8	8.4	8.5	8.4	8.6	6.7
Mass wet + tare	274.5	555.4	412.4	304.6	199.7	280.3
Mass dry + tare	189.4	456.3	330.8	239.7	160.0	200.1
Mass water	85.1	99.1	81.6	64.9	39.7	80.2
Mass dry soil	180.6	447.9	322.3	231.3	151.4	193.4
Moisture %	47.1%	22.1%	25.3%	28.1%	26.2%	41.5%

Test Pit	TH18-02	TH18-02				
Depth (m)	1.9 - 2.0	2.7 - 2.9				
Sample #	G13	G14				
Tare ID	H90	F149				
Mass of tare	8.6	8.4				
Mass wet + tare	372.3	228.4				
Mass dry + tare	279.7	151.1				
Mass water	92.6	77.3				
Mass dry soil	271.1	142.7				
Moisture %	34.2%	54.2%				

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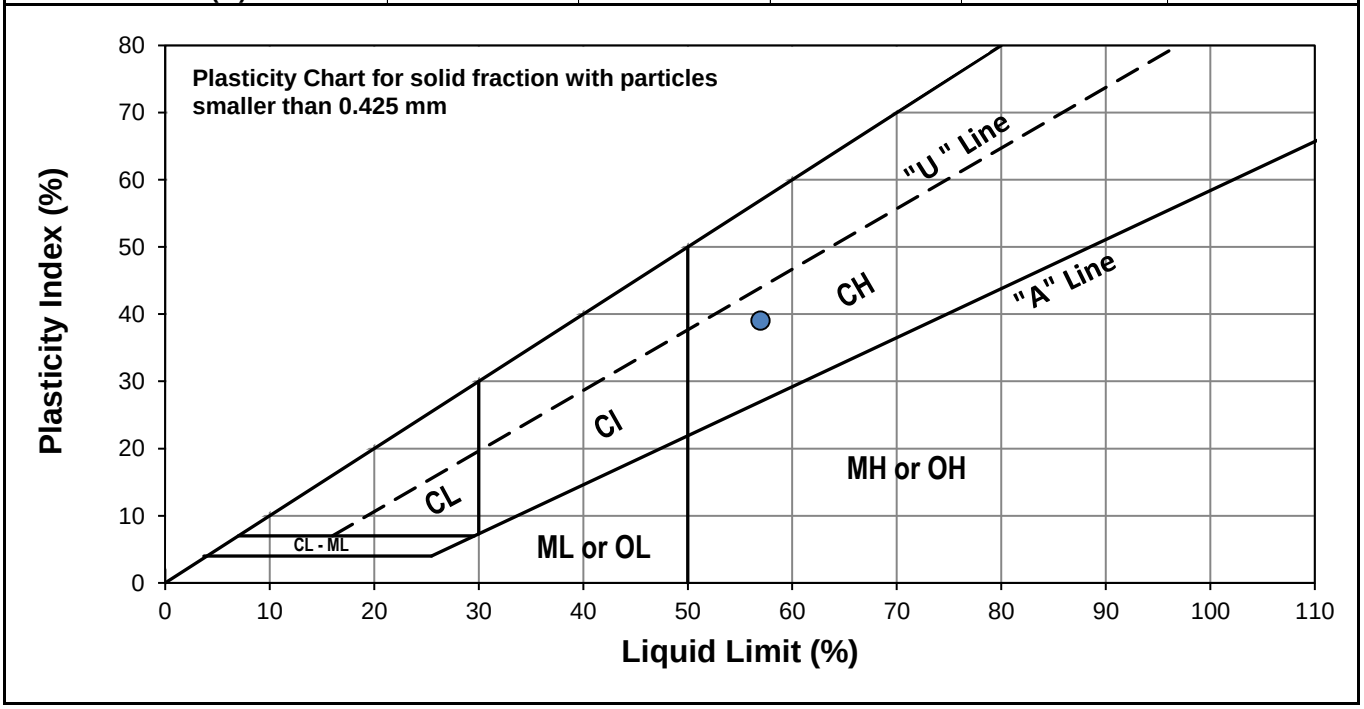
Atterberg Limits
ASTM D4318-10e1

Project No.	0395-004-00
Client	WSP
Project	2018 Regional Streets C-05 (York Ave)
Test Hole	TH18-01
Sample #	G01
Depth (m)	0.2-0.3
Sample Date	14-Feb-18
Test Date	6-Mar-18
Technician	HS

Liquid Limit	57
Plastic Limit	18
Plasticity Index	39

Liquid Limit

Trial #	1	2	3		
Number of Blows (N)	17	29	33		
Mass Wet Soil + Tare (g)	24.073	27.976	23.071		
Mass Dry Soil + Tare (g)	20.358	23.020	19.860		
Mass Tare (g)	14.092	14.183	14.047		
Mass Water (g)	3.715	4.956	3.211		
Mass Dry Soil (g)	6.266	8.837	5.813		
Moisture Content (%)	59.288	56.082	55.238		



Plastic Limit

Trial #	1	2	3	4	5
Mass Tare (g)	20.777	22.192			
Mass Wet Soil + Tare (g)	19.807	20.989			
Mass Dry Soil + Tare (g)	14.445	14.225			
Mass Water (g)	0.970	1.203			
Mass Dry Soil (g)	5.362	6.764			
Moisture Content (%)	18.090	17.785			

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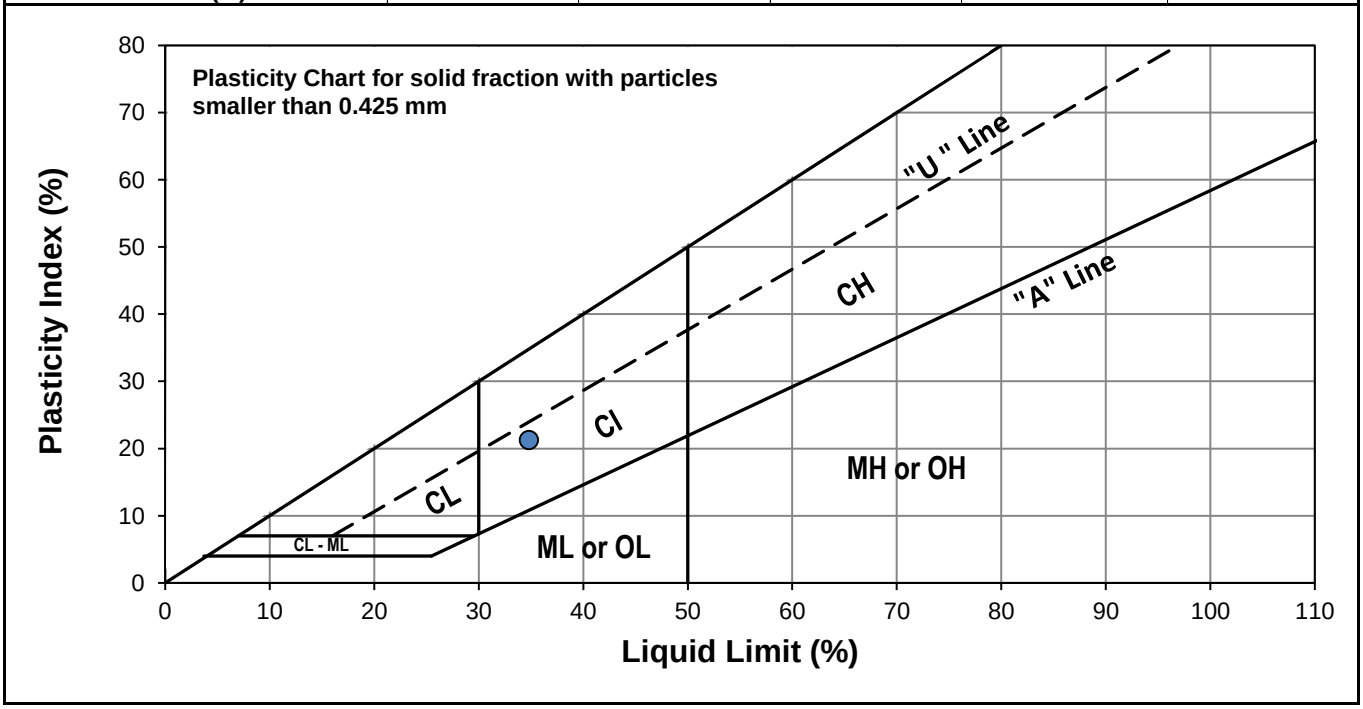
Atterberg Limits
ASTM D4318-10e1

Project No.	0395-004-00
Client	WSP
Project	2018 Regional Streets C-05 (York Ave)
Test Hole	TH18-02
Sample #	G09
Depth (m)	0.7-0.8
Sample Date	14-Feb-18
Test Date	6-Mar-18
Technician	HS

Liquid Limit	35
Plastic Limit	14
Plasticity Index	21

Liquid Limit

Trial #	1	2	3		
Number of Blows (N)	17	21	30		
Mass Wet Soil + Tare (g)	21.514	21.254	23.566		
Mass Dry Soil + Tare (g)	19.551	19.390	21.181		
Mass Tare (g)	14.225	14.233	14.082		
Mass Water (g)	1.963	1.864	2.385		
Mass Dry Soil (g)	5.326	5.157	7.099		
Moisture Content (%)	36.857	36.145	33.596		



Plastic Limit

Trial #	1	2	3	4	5
Mass Tare (g)	22.020	20.435			
Mass Wet Soil + Tare (g)	21.096	19.716			
Mass Dry Soil + Tare (g)	14.228	14.457			
Mass Water (g)	0.924	0.719			
Mass Dry Soil (g)	6.868	5.259			
Moisture Content (%)	13.454	13.672			

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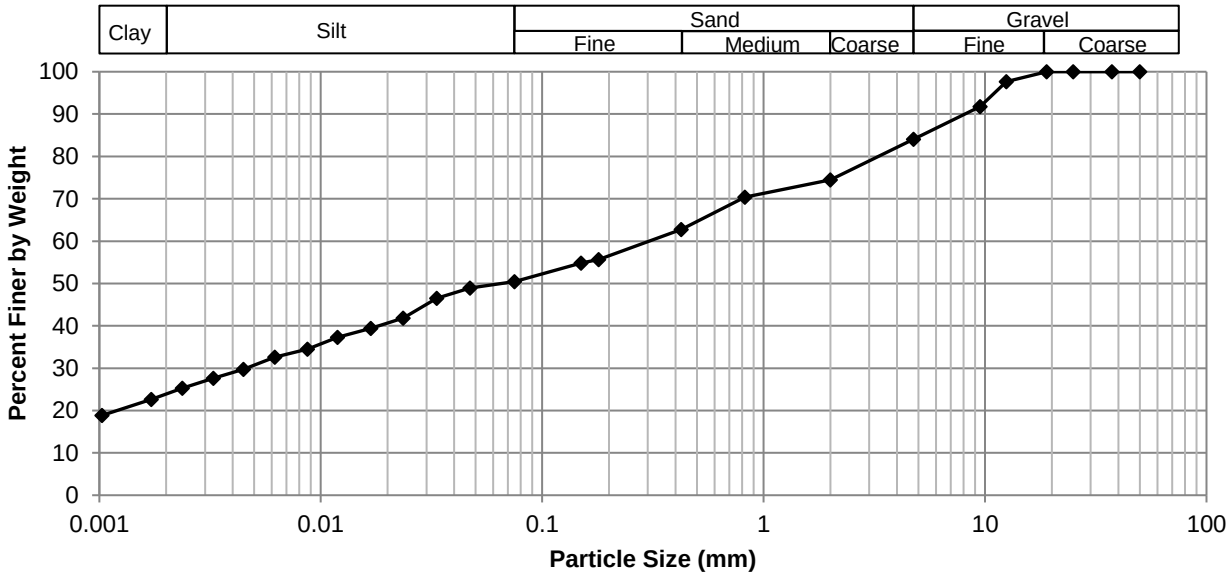
Grain Size Analysis (Hydrometer Method)
ASTM D422

Project No.	0395-004-00
Client	WSP Canada Group Ltd.
Project	2018 Regional Streets C-05 (York Ave)
Test Hole	TH18-01
Sample #	G01
Depth (m)	0.2 - 0.3
Sample Date	14-Feb-18
Test Date	6-Mar-18
Technician	HS

Gravel	15.9%
Sand	33.7%
Silt	26.7%
Clay	23.8%

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	84.10	0.0750	50.43
37.5	100.00	2.00	74.48	0.0472	48.90
25.0	100.00	0.825	70.40	0.0334	46.54
19.0	100.00	0.425	62.75	0.0236	41.81
12.5	97.64	0.180	55.67	0.0168	39.44
9.50	91.78	0.150	54.83	0.0119	37.31
4.75	84.10	0.075	50.43	0.0087	34.47
				0.0062	32.58
				0.0045	29.74
				0.0033	27.61
				0.0024	25.25
				0.0017	22.64
				0.0010	18.86

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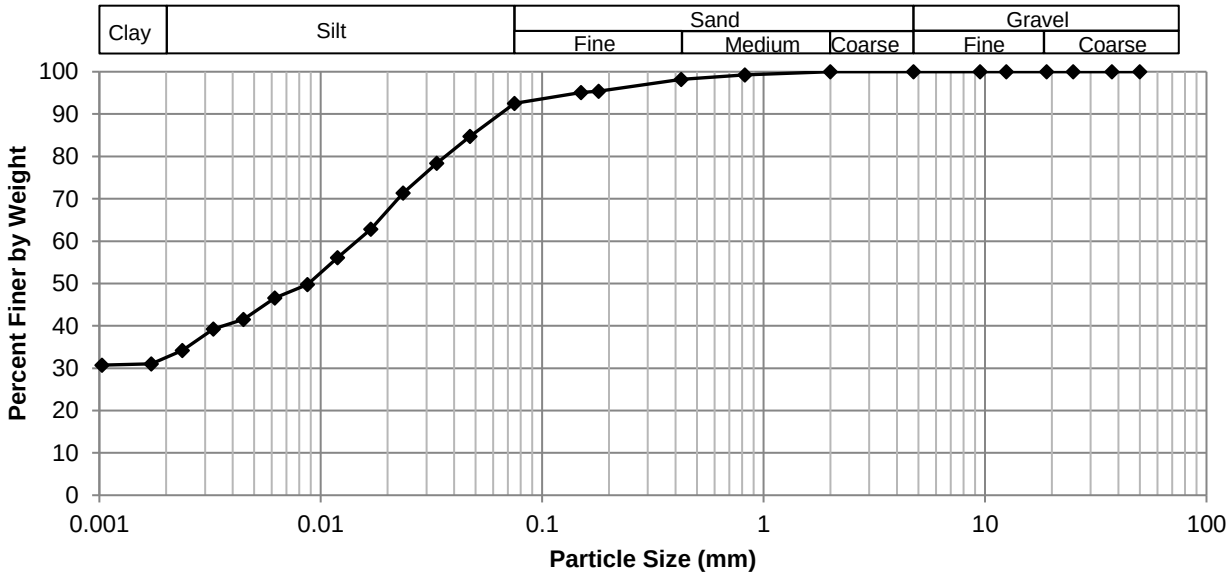
Grain Size Analysis (Hydrometer Method)
ASTM D422

Project No.	0395-004-00
Client	WSP Canada Group Ltd.
Project	2018 Regional Streets C-05 (York Ave)
Test Hole	TH18-02
Sample #	G09
Depth (m)	0.7 - 0.8
Sample Date	14-Feb-18
Test Date	6-Mar-18
Technician	HS

Gravel	0.0%
Sand	7.4%
Silt	60.2%
Clay	32.4%

Particle Size Distribution Curve



Gravel		Sand		Silt and Clay	
Particle Size (mm)	**Percent Passing**	**Particle Size (mm)**	**Percent Passing**	**Particle Size (mm)**	**Percent Passing**
50.0	100.00	4.75	100.00	0.0750	92.56
37.5	100.00	2.00	100.00	0.0472	84.72
25.0	100.00	0.825	99.27	0.0334	78.37
19.0	100.00	0.425	98.19	0.0236	71.38
12.5	100.00	0.180	95.40	0.0168	62.80
9.50	100.00	0.150	95.09	0.0119	56.13
4.75	100.00	0.075	92.56	0.0087	49.78
				0.0062	46.60
				0.0045	41.52
				0.0033	39.30
				0.0024	34.21
				0.0017	31.04
				0.0010	30.72

Photo 1: Pavement Core Sample at Test Hole TH18-01

Photo 2: Pavement Core Sample at Test Hole TH18-02

Appendix B

Memorial Blvd, between St Mary Ave. and Broadway Ave.

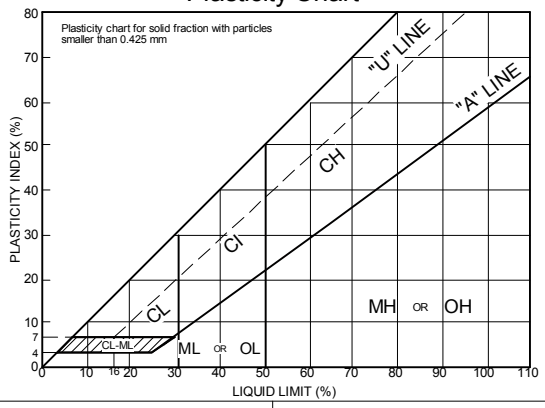
Test Hole Logs, Summary Table, Lab Data and Photographs of Pavement Core Samples

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
	Sand		
	Coarse	#10 to #4	2.00 to 4.75
	Medium	#40 to #10	0.425 to 2.00
	Fine	#200 to #40	0.075 to 0.425
	Silt or Clay	< #200	< 0.075

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

* 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 TH18-03
1 of 1

Client:	WSP Canada Goup Ltd.	**Project Number:**	0395-004-00
Project Name:	2018 Regional Streets C-05 (Memorial Boulevard)	**Location:**	UTM N-5527762, E-632979
Contractor:	Paddock Drilling Ltd.	**Ground Elevation:**	Top of Pavement
Method:	125mm Solid Stem Auger, Acker MP8 Truck Mount	**Date Drilled:**	2018 February 14

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

Particle Size Legend: Fines | Clay | Silt | Sand | Gravel | Cobbles | Boulders

Depth (m)	Soil Symbol	MATERIAL DESCRIPTION	Sample Type	Sample Number	Bulk Unit Wt (kN/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
		CONCRETE - 200 mm thick				
		CLAY (FILL) - silty, some sand, trace gravel - brown, frozen, moist and soft when thawed, intermediate plasticity				
0.5				G15	●	
		SILT AND CLAY - trace sand - brown - frozen to 1.5 m, moist and soft when thawed - intermediate plasticity - stiff below 0.9 m		G16	●	
1.0				G17	●	✤
				G18	●	
1.5				G19	●	
		CLAY - silty, trace silt inclusions (< 10 mm diam.) - grey - moist, stiff - high plasticity		G20	●	△✤
2.5		- firm below 2.7 m		G21	●	✤
3.0						

END OF TEST HOLE AT 3.0 m IN CLAY
1) No seepage or sloughing.
2) Test hole backfilled with auger cuttings, bentonite chips, sand and cold patch asphalt.
3) Test hole located at 42 m South of Memorial Boulevard and York Avenue intersection, 1.2 m West of East curb.

Logged By: Harsimran Singh **Reviewed By:** N.J Ferreira **Project Engineer:** Nelson Ferreira

PTH 83 TH LOGS MIT FONT LOGS 2018-03-08_LOCAL STREETS C-05 MEMORIAL BLVD_0395-004-00_0_A_HS.GPJ TREK GEOTECHNICAL.GDT 18-3-13

Sub-Surface Log

Test Hole TH18-04
1 of 1

Client:	WSP Canada Goup Ltd.	**Project Number:**	0395-004-00
Project Name:	2018 Regional Streets C-05 (Memorial Boulevard)	**Location:**	UTM N-5527709, E-632998
Contractor:	Paddock Drilling Ltd.	**Ground Elevation:**	Top of Pavement
Method:	125mm Solid Stem Auger, Acker MP8 Truck Mount	**Date Drilled:**	2018 February 14

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

Particle Size Legend: Fines | Clay | Silt | Sand | Gravel | Cobbles | Boulders

Depth (m)	Soil Symbol	MATERIAL DESCRIPTION	Sample Type	Sample Number
		CONCRETE - 200 mm thick		
		CLAY (FILL) - silty, some sand, trace gravel - brown, frozen, moist and soft when thawed, intermediate plasticity		
0.5		SILT AND CLAY - trace sand - brown - frozen to 1.5 m, moist and soft when thawed - intermediate plasticity		G22
				G23
1.0				G24
				G25
1.5		- trace silt inclusions (< 10 mm diam.), firm below 1.5 m		G26
		- stiff below 1.8 m		G27
2.0				
		CLAY - silty, trace silt inclusions (< 10 mm diam.) - grey - moist, firm - high plasticity		
2.5				
				G28
3.0		END OF TEST HOLE AT 3.0 m IN CLAY		

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

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

PL MC LL: 0 20 40 60 80 100

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

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

1) No seepage or sloughing.
2) Test hole backfilled with auger cuttings, bentonite chips, sand and cold patch asphalt.
3) Test hole located at building #219 (Southbound lane), 3 m East of West curb.

Logged By: Harsimran Singh **Reviewed By:** N.J Ferreira **Project Engineer:** Nelson Ferreira

Sub-Surface Log

Test Hole TH18-05
1 of 1

Client:	WSP Canada Goup Ltd.	**Project Number:**	0395-004-00
Project Name:	2018 Regional Streets C-05 (Memorial Boulevard)	**Location:**	UTM N-5527663, E-633022
Contractor:	Paddock Drilling Ltd.	**Ground Elevation:**	Top of Pavement
Method:	125mm Solid Stem Auger, Acker MP8 Truck Mount	**Date Drilled:**	2018 February 14

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

Particle Size Legend: Fines | Clay | Silt | Sand | Gravel | Cobbles | Boulders

Depth (m)	Soil Symbol	MATERIAL DESCRIPTION	Sample Type	Sample Number	Bulk Unit Wt (kN/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
		CONCRETE - 205 mm thick				
		CLAY (FILL) - silty, some sand, trace gravel - black, frozen, moist and soft when thawed, intermediate plasticity		G29		
0.5		CLAY - silty, trace sand - black, frozen - moist - high plasticity		G30		
1.0				G31		
		SILT AND CLAY - trace sand - brown - frozen to 1.5 m, moist and soft when thawed - intermediate plasticity		G32		
1.5		SILT - some clay, trace sand - brown - moist, soft - low plasticity		G33		
		SILT AND CLAY - trace sand - brown - moist, firm - intermediate plasticity		G34		
2.5		- stiff below 2.7 m		G35		
3.0		END OF TEST HOLE AT 3.0 m IN SILT AND CLAY				

1) No seepage or sloughing.
2) Test hole backfilled with auger cuttings, bentonite chips, sand and cold patch asphalt.
3) Test hole located at 50 m North of Memorial Boulevard and Broadway intersection, 4 m East of West curb.

Logged By: Harsimran Singh **Reviewed By:** N.J Ferreira **Project Engineer:** Nelson Ferreira

PTH 83 TH LOGS MIT FONT LOGS 2018-03-08_LOCAL STREETS C-05 MEMORIAL BLVD_0395-004-00_0_A_HS.GPJ TREK GEOTECHNICAL.GDT 18-3-13

Sub-Surface Log

Test Hole TH18-06

Client:	WSP Canada Goup Ltd.	**Project Number:**	0395-004-00
Project Name:	2018 Regional Streets C-05 (Memorial Boulevard)	**Location:**	UTM N-5527656, E-633046
Contractor:	Paddock Drilling Ltd.	**Ground Elevation:**	Top of Pavement
Method:	125mm Solid Stem Auger, Acker MP8 Truck Mount	**Date Drilled:**	2018 February 14

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

Particle Size Legend: Fines | Clay | Silt | Sand | Gravel | Cobbles | Boulders

Depth (m)	Soil Symbol	MATERIAL DESCRIPTION	Sample Type	Sample Number
0		CONCRETE - 225 mm thick		
		CLAY (FILL) - silty, some sand, trace gravel - brown, frozen, moist and soft when thawed, intermediate plasticity	G	G36
0.5		SILT AND CLAY - trace sand - brown - frozen to 1.5 m, moist when thawed - intermediate to high plasticity	G	G37
1.0			G	G38
			G	G39
1.5		- firm below 1.5 m	G	G40
		- stiff below 1.9 m	G	G41
2.0				
2.5		CLAY - silty, trace silt inclusions (< 10 mm diam.) - grey - moist, stiff - high plasticity	G	G42
3.0		END OF TEST HOLE AT 3.0 m IN CLAY		

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

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

PL MC LL: 0 20 40 60 80 100

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

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

1) No seepage or sloughing.
2) Test hole backfilled with auger cuttings, bentonite chips, sand and cold patch asphalt.
3) Test hole located at 30 m North of Memorial Boulevard and Broadway intersection, 4.5 m East of West curb.

Logged By: Harsimran Singh **Reviewed By:** N.J Ferreira **Project Engineer:** Nelson Ferreira

Sub-Surface Log

Test Hole TH18-07
1 of 1

Client:	WSP Canada Goup Ltd.	**Project Number:**	0395-004-00
Project Name:	2018 Regional Streets C-05 (Memorial Boulevard)	**Location:**	UTM N-5527698, E-633025
Contractor:	Paddock Drilling Ltd.	**Ground Elevation:**	Top of Pavement
Method:	125mm Solid Stem Auger, Acker MP8 Truck Mount	**Date Drilled:**	2018 February 14

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

Particle Size Legend: Fines | Clay | Silt | Sand | Gravel | Cobbles | Boulders

Depth (m)	Soil Symbol	MATERIAL DESCRIPTION	Sample Type	Sample Number	Bulk Unit Wt (kN/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
		CONCRETE - 215 mm thick				
		CLAY (FILL) - silty, some sand, trace gravel - black, frozen, moist and soft when thawed - intermediate plasticity		G43		
0.5		CLAY - silty, trace silt inclusions (< 10 mm diam.) - grey - frozen, moist and stiff when thawed - high plasticity		G44		
1.0				G45		
		- brown below 1.2 m		G46		
1.5		SILT - clayey, trace sand - brown - moist, soft - low plasticity		G47		
				G48		
2.0		CLAY - silty, trace silt inclusions (< 10 mm diam.), trace oxidation - grey - moist, stiff - high plasticity				
2.5				G49		
3.0		END OF TEST HOLE AT 3.0 m IN CLAY				

1) No seepage or sloughing.
2) Test hole backfilled with auger cuttings, bentonite chips, sand and cold patch asphalt.
3) Test hole located at building #219 (Northbound lane), 4 m East of West curb.

Logged By: Harsimran Singh **Reviewed By:** N.J Ferreira **Project Engineer:** Nelson Ferreira

PTH 83 TH LOGS MIT FONT LOGS 2018-03-08_LOCAL STREETS C-05 MEMORIAL BLVD_0395-004-00_0_A_HS.GPJ TREK GEOTECHNICAL.GDT 18-3-13

Sub-Surface Log

Test Hole TH18-08
1 of 1

Client:	WSP Canada Goup Ltd.	**Project Number:**	0395-004-00
Project Name:	2018 Regional Streets C-05 (Memorial Boulevard)	**Location:**	UTM N-5527761, E-632999
Contractor:	Paddock Drilling Ltd.	**Ground Elevation:**	Top of Pavement
Method:	125mm Solid Stem Auger, Acker MP8 Truck Mount	**Date Drilled:**	2018 February 14

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

Particle Size Legend: Fines | Clay | Silt | Sand | Gravel | Cobbles | Boulders

Depth (m)	Soil Symbol	MATERIAL DESCRIPTION	Sample Type	Sample Number	Bulk Unit Wt (kN/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		CONCRETE - 205 mm thick				
		SILT AND CLAY - trace sand - brown - frozen to 1.5 m, moist and soft when thawed - intermediate plasticity		G50		
0.5				G51		
1.0				G52		
		- grey below 1.2 m		G53		
1.5		- stiff, trace silt inclusions (< 5 mm diam.) below 1.5 m		G54		
				G55		
2.0						
2.5		CLAY - silty, trace silt inclusions (< 10 mm diam.) - grey - moist, stiff - high plasticity		G56		
3.0		END OF TEST HOLE AT 3.0 m IN CLAY				

1) No seepage or sloughing.
2) Test hole backfilled with auger cuttings, bentonite chips, sand and cold patch asphalt.
3) Test hole located at 35 m South of Memorial Boulevard and York Avenue intersection, 2 m West of East curb.

Logged By: Harsimran Singh **Reviewed By:** N.J Ferreira **Project Engineer:** Nelson Ferreira

PTH 83 TH LOGS MIT FONT LOGS 2018-03-08_LOCAL STREETS C-05 MEMORIAL BLVD_0395-004-00_0_A_HS.GPJ TREK GEOTECHNICAL.GDT 18-3-13

Sub-Surface Log

Test Hole TH18-09

Client:	WSP Canada Goup Ltd.	**Project Number:**	0395-004-00
Project Name:	2018 Regional Streets C-05 (Memorial Boulevard)	**Location:**	UTM N-5527849, E-632934
Contractor:	Paddock Drilling Ltd.	**Ground Elevation:**	Top of Pavement
Method:	125mm Solid Stem Auger, Acker MP8 Truck Mount	**Date Drilled:**	2018 February 14

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

Particle Size Legend: Fines | Clay | Silt | Sand | Gravel | Cobbles | Boulders

Depth (m)	Soil Symbol	MATERIAL DESCRIPTION	Sample Type	Sample Number
		ASPHALT - 75 mm thick		
		CONCRETE - 215 mm		
		CLAY (FILL) - silty, some sand, some gravel, trace organics - grey - frozen to 1.5 m, moist and soft when thawed - intermediate plasticity		G57
0.5				G58
1.0				G59
		- stiff below 1.2 m		G60
1.5				G61
2.0				G62
2.5				G63
3.0		END OF TEST HOLE AT 3.0 m IN CLAY FILL		

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

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

PL MC LL: 0 20 40 60 80 100

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

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

1) No seepage or sloughing.
2) Test hole backfilled with auger cuttings, bentonite chips, sand and cold patch asphalt.
3) Test hole located at 75 m North of Memorial Boulevard and York Avenue intersection, 1.4 m East of West curb.

Logged By: Harsimran Singh **Reviewed By:** N.J Ferreira **Project Engineer:** Nelson Ferreira

Sub-Surface Log

Test Hole TH18-10
1 of 1

Client:	WSP Canada Goup Ltd.	**Project Number:**	0395-004-00
Project Name:	2018 Regional Streets C-05 (Memorial Boulevard)	**Location:**	UTM N-5527821, E-632953
Contractor:	Paddock Drilling Ltd.	**Ground Elevation:**	Top of Pavement
Method:	125mm Solid Stem Auger, Acker MP8 Truck Mount	**Date Drilled:**	2018 February 14

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

Particle Size Legend: Fines | Clay | Silt | Sand | Gravel | Cobbles | Boulders

Depth (m)	Soil Symbol	MATERIAL DESCRIPTION	Sample Type	Sample Number
		ASPHALT - 55 mm thick		
		CONCRETE - 190 mm		
0.5		CLAY (FILL) - silty, some sand, some gravel, trace organics - grey - frozen, moist and soft when thawed - intermediate plasticity		G64
1.0				G65
				G66
		- stiff below 1.2 m		G67
1.5		ORGANIC CLAY (TOPSOIL) - silty, trace sand - black - moist, stiff - high plasticity		G68
2.0				G69
2.5		CLAY - silty - grey - moist, firm - high plasticity		G70
3.0				

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

END OF TEST HOLE AT 3.0 m IN CLAY
1) No seepage or sloughing.
2) Test hole backfilled with auger cuttings, bentonite chips, sand and cold patch asphalt.
3) Test hole locanted at 35 m North of Memorial Boulevard and York Avenue intersection, 1 m West of East curb.

Logged By: Harsimran Singh **Reviewed By:** N.J Ferreira **Project Engineer:** Nelson Ferreira

Regional Street Package C-05
Sub-Surface Investigation
Memorial Blvd.

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)		Gravel (%)	Sand (%)	Silt (%)	Clay (%)	Plastic	Liquid	Plasticity Index
TH18-03	UTM: 5527762 N, 632979 E Located 42 m South of Memorial Blvd. and York Ave. intersection, 1.2 m Wet of East curb.	Asphalt	N/A	Concrete	254											
						CLAY (FILL)	0.4	0.5	14							
						SILT AND CLAY	0.7	0.8	28							
						SILT AND CLAY	1.0	1.1	38							
						SILT AND CLAY	1.2	1.4	27							
						SILT AND CLAY	1.6	1.7	36							
						CLAY	1.9	2.0	41							
						CLAY	2.7	2.9	48							
TH18-04	UTM: 5527709 N, 632998 E Located at Building #219 (Southbound Lane), 3.0 m East of West curb.	Asphalt	N/A	Concrete	203	CLAY (FILL)	-	-	-							
						SILT AND CLAY	0.3	0.5	42							
						SILT AND CLAY	0.6	0.8	35							
						SILT AND CLAY	0.9	1.1	35							
						SILT AND CLAY	1.2	1.3	29							
						SILT AND CLAY	1.5	1.6	27							
						SILT AND CLAY	1.8	2.0	27							
						CLAY	2.7	2.9	49							
TH18-05	UTM: 5527663 N, 633022 E Located 50 m North of Memorial Blvd and Broadway intersection, 4.0 m East of West curb.	Asphalt	N/A	Concrete	203											
						CLAY (FILL)	0.2	0.4	31							
						CLAY	0.6	0.8	35							
						SILT AND CLAY	0.9	1.1	29							
						SILT AND CLAY	1.2	1.3	34							
						SILT	1.5	1.6	22							
						SILT AND CLAY	1.8	2.0	39							
						SILT AND CLAY	2.7	2.9	40							
TH18-06	UTM: 5527656 N, 633046 E Located 30 m North of Memorial Blvd. and Broadway intersection, 4.5 m East of West curb.	Asphalt	N/A	Concrete	227											
						CLAY (FILL)	0.2	0.3	13							
						SILT AND CLAY	0.7	0.8	29							
						SILT AND CLAY	1.0	1.1	28							
						SILT AND CLAY	1.2	1.4	29							
						SILT AND CLAY	1.6	1.7	24							
						SILT AND CLAY	1.9	2.0	23							
						CLAY	2.7	2.9	49							

Regional Street Package C-05
Sub-Surface Investigation
Memorial Blvd.

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)		Gravel (%)	Sand (%)	Silt (%)	Clay (%)	Plastic	Liquid	Plasticity Index
TH18-07	UTM: 5527698 N, 633025 E Located at Building #219 (Northbound lane), 4.0 m East of West curb.	Asphalt	N/A	Concrete	203											
						CLAY (FILL)	0.2	0.3	13							
						CLAY	0.7	0.8	29	0	2	24	75	21	74	53
						CLAY	1.0	1.1	28							
						CLAY	1.2	1.4	29							
						SILT	1.6	1.7	24							
						SILT	1.9	2.0	23							
						CLAY	2.7	2.9	49							
TH18-08	UTM: 5527761 N, 632999 E Located 35 m South of Memorial Blvd. and York Ave. intersection, 2.0 m West of East curb.	Asphalt	N/A	Concrete	227											
						CLAY (FILL)	0.4	0.5	30	2	12	32	54	14	37	23
						SILT AND CLAY	0.7	0.8	32	0	4	57	39	15	37	23
						SILT AND CLAY	1.0	1.1	37							
						SILT AND CLAY	1.2	1.4	38							
						SILT AND CLAY	1.6	1.7	32							
						SILT AND CLAY	1.9	2.0	44							
						CLAY	2.7	2.9	52							
TH18-09	UTM: 5527849 N, 632934 E Located 75 m North of Memorial Blvd and York Ave. intersection, 1.4 m East of West curb.	Asphalt	N/A	Concrete	229											
						CLAY (FILL)	0.3	0.5	26							
						CLAY (FILL)	0.7	0.9	32							
						CLAY (FILL)	1.0	1.2	35							
						CLAY (FILL)	1.3	1.5	35							
						CLAY (FILL)	1.6	1.8	42							
						CLAY (FILL)	1.9	2.1	41							
						CLAY (FILL)	2.7	2.9	43							
TH18-10	UTM: 5527821 N, 632953 E Located 35 m North of Memorial Blvd. and York Ave. intersection, 1.0 m West of East curb.	Asphalt	55	Concrete	249											
						CLAY (FILL)	0.3	0.5	23							
						CLAY (FILL)	0.7	0.8	28							
						CLAY (FILL)	1.0	1.1	35							
						CLAY (FILL)	1.3	1.5	37							
						ORGANIC CLAY (TOPSOIL)	1.6	1.7	63							
						CLAY	1.9	2.1	49							
						CLAY	2.7	2.9	44							

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Moisture Content Report
ASTM D2216-10

Project No. 0395-004-00
Client WSP Canada Group Ltd.
Project 2018 Regional Streets C-05 (Memorial Blvd.)

Sample Date 14-Feb-18
Test Date 2-Mar-18
Technician HS

Test Pit	TH18-03	TH18-03	TH18-03	TH18-03	TH18-03	TH18-03
Depth (m)	0.4 - 0.5	0.7 - 0.8	1.0 - 1.1	1.2 - 1.4	1.6 - 1.7	1.9 - 2.0
Sample #	G15	G16	G17	G18	G19	G20
Tare ID	F100	E75	Z139	Z24	AB60	W54
Mass of tare	8.4	8.7	8.6	8.5	6.6	8.3
Mass wet + tare	488.4	303.8	279.8	212.4	298.8	228.0
Mass dry + tare	430.1	238.5	204.5	169.7	221.7	164.6
Mass water	58.3	65.3	75.3	42.7	77.1	63.4
Mass dry soil	421.7	229.8	195.9	161.2	215.1	156.3
Moisture %	13.8%	28.4%	38.4%	26.5%	35.8%	40.6%

Test Pit	TH18-03	TH18-04	TH18-04	TH18-04	TH18-04	TH18-04
Depth (m)	2.7 - 2.9	0.3 - 0.5	0.6 - 0.8	0.9 - 1.1	1.2 - 1.3	1.5 - 1.6
Sample #	G21	G22	G23	G24	G25	G26
Tare ID	F13	W12	AA18	F130	A6	W85
Mass of tare	8.5	8.4	7.0	8.9	8.3	8.6
Mass wet + tare	341	275.5	422.4	286.5	269	371
Mass dry + tare	232.6	196.3	314.1	215.1	210.5	293.0
Mass water	108.4	79.2	108.3	71.4	58.5	78.0
Mass dry soil	224.1	187.9	307.1	206.2	202.2	284.4
Moisture %	48.4%	42.2%	35.3%	34.6%	28.9%	27.4%

Test Pit	TH18-04	TH18-04	TH18-05	TH18-05	TH18-05	TH18-05
Depth (m)	1.8 - 2.0	2.7 - 2.9	0.2 - 0.4	0.6 - 0.8	0.9 - 1.1	1.2 - 1.3
Sample #	G27	G28	G29	G30	G31	G32
Tare ID	Z103	E111	H25	F58	Z09	C26
Mass of tare	8.1	8.6	8.3	8.6	8.5	8.7
Mass wet + tare	308.7	308.5	378.7	250.2	327.1	317.2
Mass dry + tare	245.6	210.3	290.9	187.0	255.2	238.3
Mass water	63.1	98.2	87.8	63.2	71.9	78.9
Mass dry soil	237.5	201.7	282.6	178.4	246.7	229.6
Moisture %	26.6%	48.7%	31.1%	35.4%	29.1%	34.4%

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Moisture Content Report
ASTM D2216-10

Project No. 0395-004-00
Client WSP Canada Group Ltd.
Project 2018 Regional Streets C-05 (Memorial Blvd.)

Sample Date 14-Feb-18
Test Date 2-Mar-18
Technician HS

Test Pit	TH18-05	TH18-05	TH18-05	TH18-06	TH18-06	TH18-06
Depth (m)	1.5 - 1.6	1.8 - 2.0	2.7 - 2.9	0.2 - 0.3	0.7 - 0.8	1.0 - 1.1
Sample #	G33	G34	G35	G36	G37	G38
Tare ID	N42	AC05	H79	C12	C18	F152
Mass of tare	8.6	6.9	8.0	8.6	8.7	8.5
Mass wet + tare	294.4	370.1	324.5	267.2	210.8	184.7
Mass dry + tare	242.3	268.7	233.9	237.0	165.2	146.4
Mass water	52.1	101.4	90.6	30.2	45.6	38.3
Mass dry soil	233.7	261.8	225.9	228.4	156.5	137.9
Moisture %	22.3%	38.7%	40.1%	13.2%	29.1%	27.8%

Test Pit	TH18-06	TH18-06	TH18-06	TH18-06	TH18-07	TH18-07
Depth (m)	1.2 - 1.4	1.6 - 1.7	1.9 - 2.0	2.7 - 2.9	0.3 - 0.5	0.6 - 0.8
Sample #	G39	G40	G41	G42	G43	G44
Tare ID	AB43	K9	P10	N97	N14	Z126
Mass of tare	6.8	8.8	8.4	8.6	8.5	8.7
Mass wet + tare	267.5	294.8	265.5	411.4	222.3	385.6
Mass dry + tare	208.7	239.3	217.0	278.9	159.7	290.2
Mass water	58.8	55.5	48.5	132.5	62.6	95.4
Mass dry soil	201.9	230.5	208.6	270.3	151.2	281.5
Moisture %	29.1%	24.1%	23.3%	49.0%	41.4%	33.9%

Test Pit	TH18-07	TH18-07	TH18-07	TH18-07	TH18-07	TH18-08
Depth (m)	0.9 - 1.1	1.2 - 1.3	1.5 - 1.6	1.7 - 1.8	2.7 - 2.9	0.4 - 0.5
Sample #	G45	G46	G47	G48	G49	G50
Tare ID	W70	E24	Z84	N12	A32	F52
Mass of tare	8.4	8.6	8.5	8.4	8.7	8.5
Mass wet + tare	282.6	290.1	328.6	321.6	301.8	455.1
Mass dry + tare	215.1	226.1	268.8	260.0	214.5	352.6
Mass water	67.5	64.0	59.8	61.6	87.3	102.5
Mass dry soil	206.7	217.5	260.3	251.6	205.8	344.1
Moisture %	32.7%	29.4%	23.0%	24.5%	42.4%	29.8%

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Moisture Content Report
ASTM D2216-10

Project No. 0395-004-00
Client WSP Canada Group Ltd.
Project 2018 Regional Streets C-05 (Memorial Blvd.)

Sample Date 14-Feb-18
Test Date 2-Mar-18
Technician HS

Test Pit	TH18-08	TH18-08	TH18-08	TH18-08	TH18-08	TH18-08
Depth (m)	0.7 - 0.8	1.0 - 1.1	1.2 - 1.4	1.6 - 1.7	1.9 - 2.0	2.7 - 2.9
Sample #	G51	G52	G53	G54	G55	G56
Tare ID	Z74	F55	E11	H17	W24	W28
Mass of tare	8.6	8.5	8.6	8.8	8.4	8.5
Mass wet + tare	420.8	317.9	217.8	246.0	250.0	269.7
Mass dry + tare	320.9	234.9	160.2	188.7	176.3	180.1
Mass water	99.9	83.0	57.6	57.3	73.7	89.6
Mass dry soil	312.3	226.4	151.6	179.9	167.9	171.6
Moisture %	32.0%	36.7%	38.0%	31.9%	43.9%	52.2%

Test Pit	TH18-09	TH18-09	TH18-09	TH18-09	TH18-09	TH18-09
Depth (m)	0.3 - 0.5	0.7 - 0.9	1.0 - 1.2	1.3 - 1.5	1.6 - 1.8	1.9 - 2.1
Sample #	G57	G58	G59	G60	G61	G62
Tare ID	H36	Z106	AB56	A102	E69	D11
Mass of tare	8.8	8.4	6.7	8.4	8.4	9.0
Mass wet + tare	369.8	290.7	254.3	290.6	378.3	357.0
Mass dry + tare	294.3	222.3	190.4	217.2	268.6	256.6
Mass water	75.5	68.4	63.9	73.4	109.7	100.4
Mass dry soil	285.5	213.9	183.7	208.8	260.2	247.6
Moisture %	26.4%	32.0%	34.8%	35.2%	42.2%	40.5%

Test Pit	TH18-09	TH18-10	TH18-10	TH18-10	TH18-10	TH18-10
Depth (m)	2.7 - 2.9	0.3 - 0.5	0.7 - 0.9	1.0 - 1.2	1.3 - 1.5	1.6 - 1.8
Sample #	G63	G64	G65	G66	G67	G68
Tare ID	F89	F9	N02	F79	N69	F151
Mass of tare	8.3	9.1	8.4	8.9	8.9	8.5
Mass wet + tare	247.2	463.2	290.9	281.3	225.1	228.8
Mass dry + tare	175.5	378.9	229.4	210.3	166.2	144.0
Mass water	71.7	84.3	61.5	71.0	58.9	84.8
Mass dry soil	167.2	369.8	221.0	201.4	157.3	135.5
Moisture %	42.9%	22.8%	27.8%	35.3%	37.4%	62.6%

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Moisture Content Report
ASTM D2216-10

Project No. 0395-004-00
Client WSP Canada Group Ltd.
Project 2018 Regional Streets C-05 (Memorial Blvd.)

Sample Date 14-Feb-18
Test Date 2-Mar-18
Technician HS

Test Pit	TH18-10	TH18-10				
Depth (m)	1.9 - 2.1	2.7 - 2.9				
Sample #	G69	G70				
Tare ID	Z77	Z102				
Mass of tare	8.4	8.4				
Mass wet + tare	252.2	295.4				
Mass dry + tare	172.4	207.9				
Mass water	79.8	87.5				
Mass dry soil	164.0	199.5				
Moisture %	48.7%	43.9%				

Test Pit						
Depth (m)						
Sample #						
Tare ID						
Mass of tare						
Mass wet + tare						
Mass dry + tare						
Mass water						
Mass dry soil						
Moisture %						

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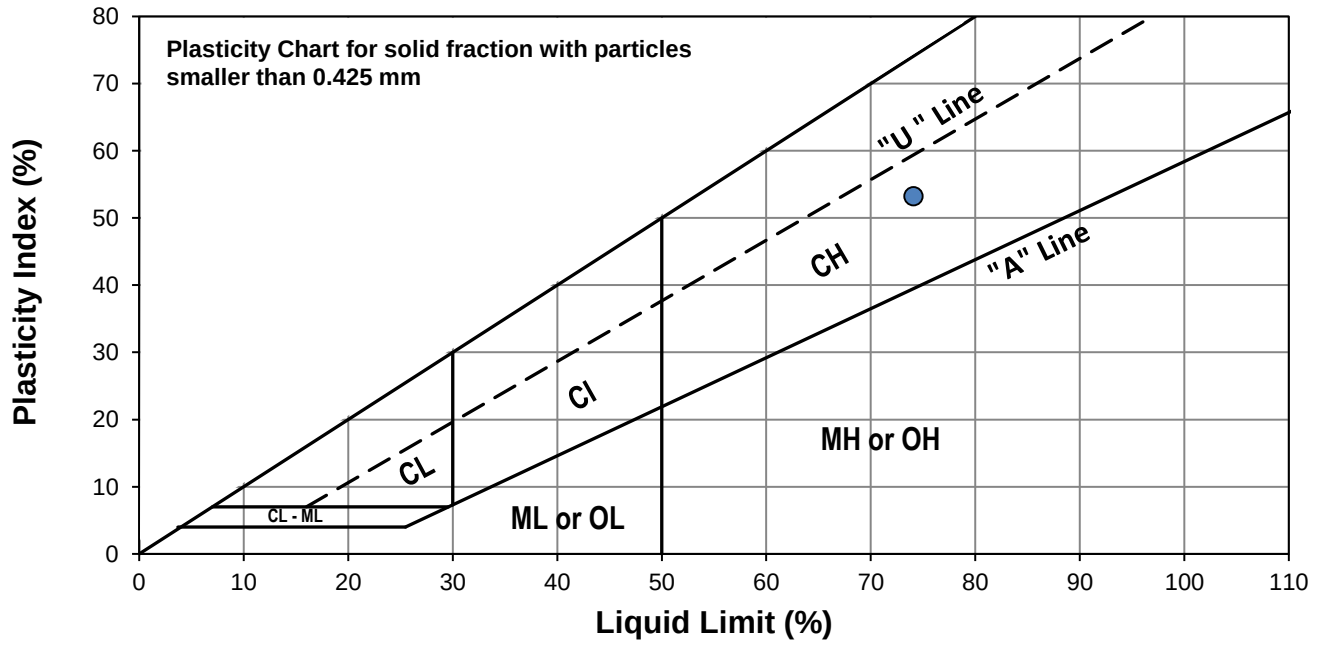
Atterberg Limits
ASTM D4318-10e1

Project No.	0395-004-00
Client	WSP
Project	2018 Regional Streets C-05 (Memorial Blvd.)
Test Hole	TH18-08
Sample #	G44
Depth (m)	0.6-0.8
Sample Date	14-Feb-18
Test Date	6-Mar-18
Technician	DS

Liquid Limit	74
Plastic Limit	21
Plasticity Index	53

Liquid Limit

Trial #	1	2	3		
Number of Blows (N)	17	23	33		
Mass Wet Soil + Tare (g)	20.864	19.799	20.249		
Mass Dry Soil + Tare (g)	17.992	17.362	17.681		
Mass Tare (g)	14.238	14.077	14.147		
Mass Water (g)	2.872	2.437	2.568		
Mass Dry Soil (g)	3.754	3.285	3.534		
Moisture Content (%)	76.505	74.186	72.666		



Plastic Limit

Trial #	1	2	3	4	5
Mass Tare (g)	20.488	20.214			
Mass Wet Soil + Tare (g)	19.402	19.183			
Mass Dry Soil + Tare (g)	14.231	14.204			
Mass Water (g)	1.086	1.031			
Mass Dry Soil (g)	5.171	4.979			
Moisture Content (%)	21.002	20.707			

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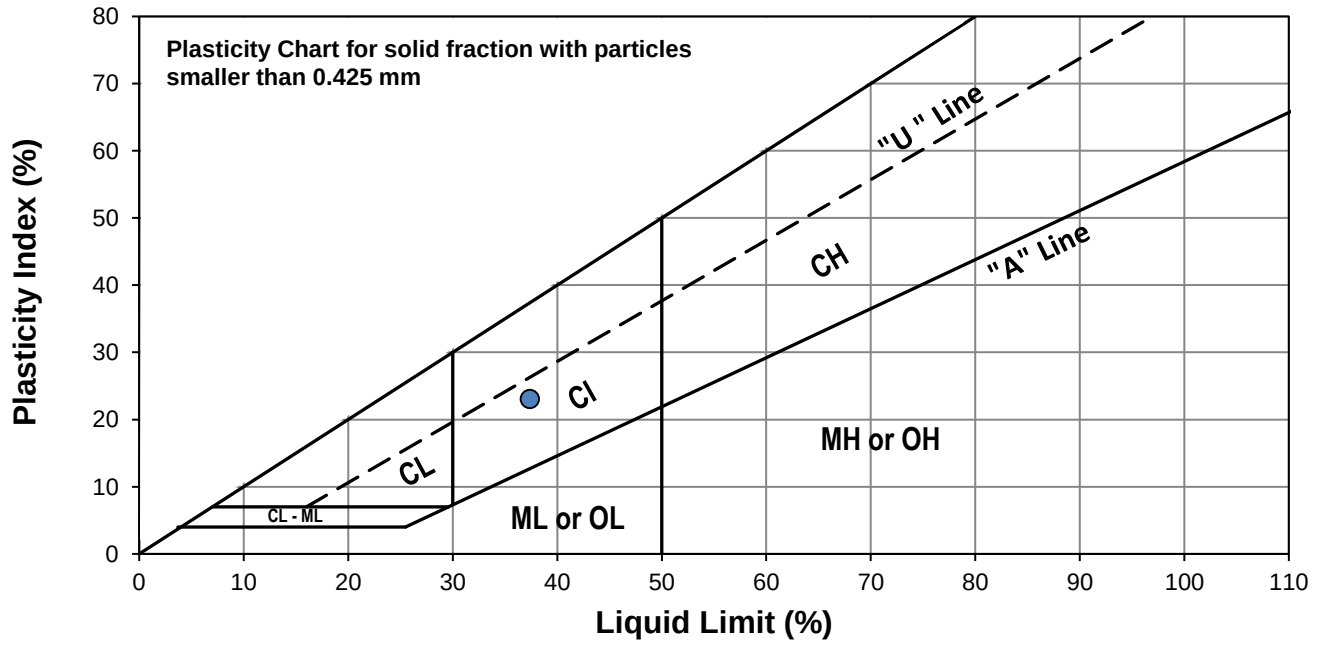
Atterberg Limits
ASTM D4318-10e1

Project No.	0395-004-00
Client	WSP
Project	2018 Regional Streets C-05 (Memorial Blvd.)
Test Hole	TH18-08
Sample #	G50
Depth (m)	0.4-0.5
Sample Date	14-Feb-18
Test Date	6-Mar-18
Technician	HS

Liquid Limit	37
Plastic Limit	14
Plasticity Index	23

Liquid Limit

Trial #	1	2	3		
Number of Blows (N)	15	23	33		
Mass Wet Soil + Tare (g)	23.334	27.807	24.646		
Mass Dry Soil + Tare (g)	20.747	24.065	21.895		
Mass Tare (g)	14.230	14.145	14.282		
Mass Water (g)	2.587	3.742	2.751		
Mass Dry Soil (g)	6.517	9.920	7.613		
Moisture Content (%)	39.696	37.722	36.136		



Plastic Limit

Trial #	1	2	3	4	5
Mass Tare (g)	22.548	24.210			
Mass Wet Soil + Tare (g)	21.500	22.999			
Mass Dry Soil + Tare (g)	14.376	14.308			
Mass Water (g)	1.048	1.211			
Mass Dry Soil (g)	7.124	8.691			
Moisture Content (%)	14.711	13.934			

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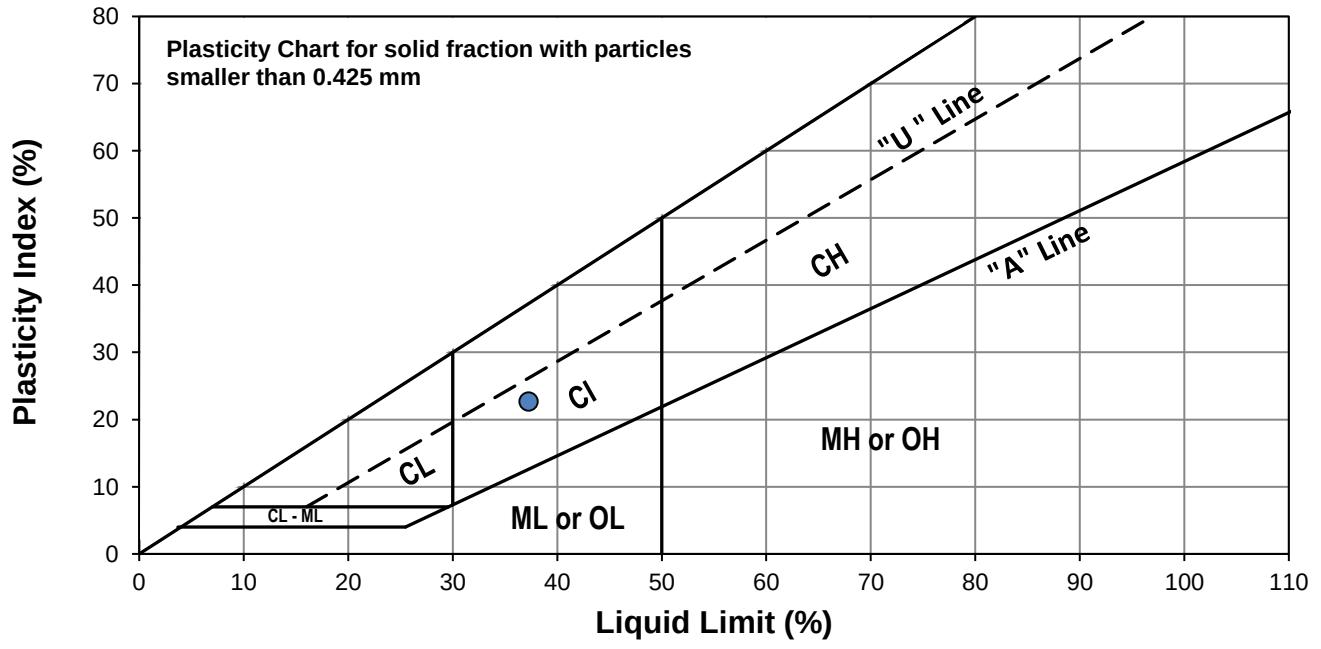
Atterberg Limits
ASTM D4318-10e1

Project No.	0395-004-00
Client	WSP
Project	2018 Regional Streets C-05 (Memorial Blvd.)
Test Hole	TH18-08
Sample #	G51
Depth (m)	0.7-0.8
Sample Date	14-Feb-18
Test Date	6-Mar-18
Technician	HS

Liquid Limit	37
Plastic Limit	15
Plasticity Index	23

Liquid Limit

Trial #	1	2	3		
Number of Blows (N)	15	22	31		
Mass Wet Soil + Tare (g)	24.098	24.349	27.998		
Mass Dry Soil + Tare (g)	21.362	21.543	24.326		
Mass Tare (g)	14.275	14.098	14.306		
Mass Water (g)	2.736	2.806	3.672		
Mass Dry Soil (g)	7.087	7.445	10.020		
Moisture Content (%)	38.606	37.690	36.647		



Plastic Limit

Trial #	1	2	3	4	5
Mass Tare (g)	21.335	20.991			
Mass Wet Soil + Tare (g)	20.377	20.143			
Mass Dry Soil + Tare (g)	14.024	14.148			
Mass Water (g)	0.958	0.848			
Mass Dry Soil (g)	6.353	5.995			
Moisture Content (%)	15.079	14.145			

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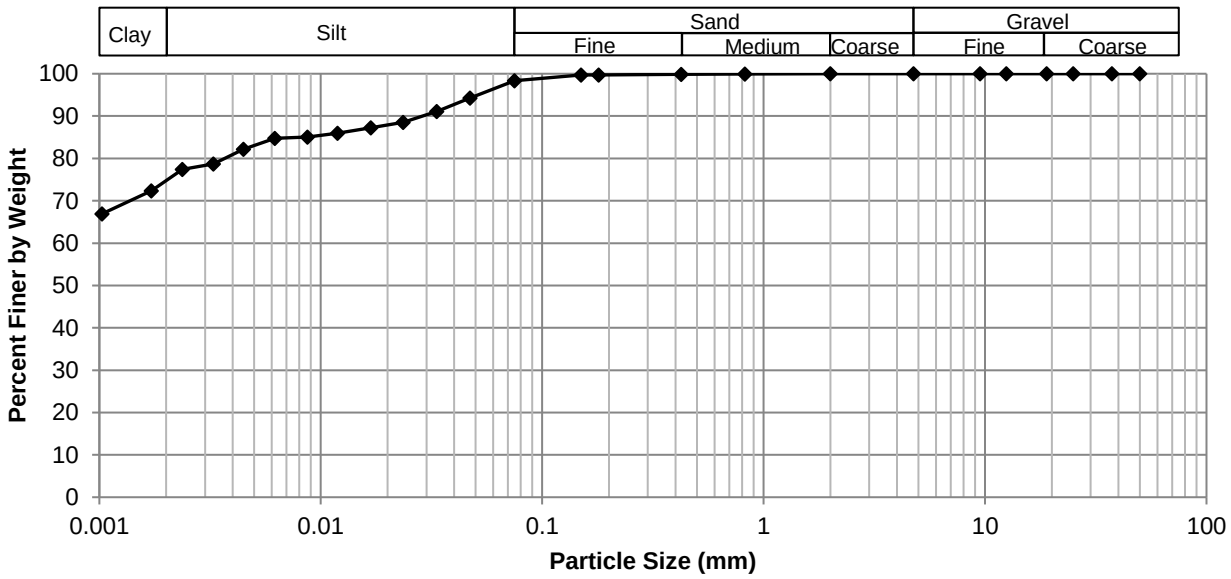
Grain Size Analysis (Hydrometer Method)
ASTM D422

Project No.	0395-004-00
Client	WSP Canada Group Ltd.
Project	2018 Regional Streets C-05 (Memorial Blvd.)
Test Hole	TH18-07
Sample #	G44
Depth (m)	0.6 - 0.8
Sample Date	14-Feb-18
Test Date	6-Mar-18
Technician	HS

Gravel	0.0%
Sand	1.7%
Silt	23.8%
Clay	74.5%

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	98.32
37.5	100.00	2.00	100.00	0.0472	94.25
25.0	100.00	0.825	99.93	0.0334	91.07
19.0	100.00	0.425	99.87	0.0236	88.53
12.5	100.00	0.180	99.70	0.0168	87.26
9.50	100.00	0.150	99.69	0.0119	85.99
4.75	100.00	0.075	98.32	0.0087	85.04
				0.0062	84.72
				0.0045	82.18
				0.0033	78.68
				0.0024	77.41
				0.0017	72.33
				0.0010	66.93

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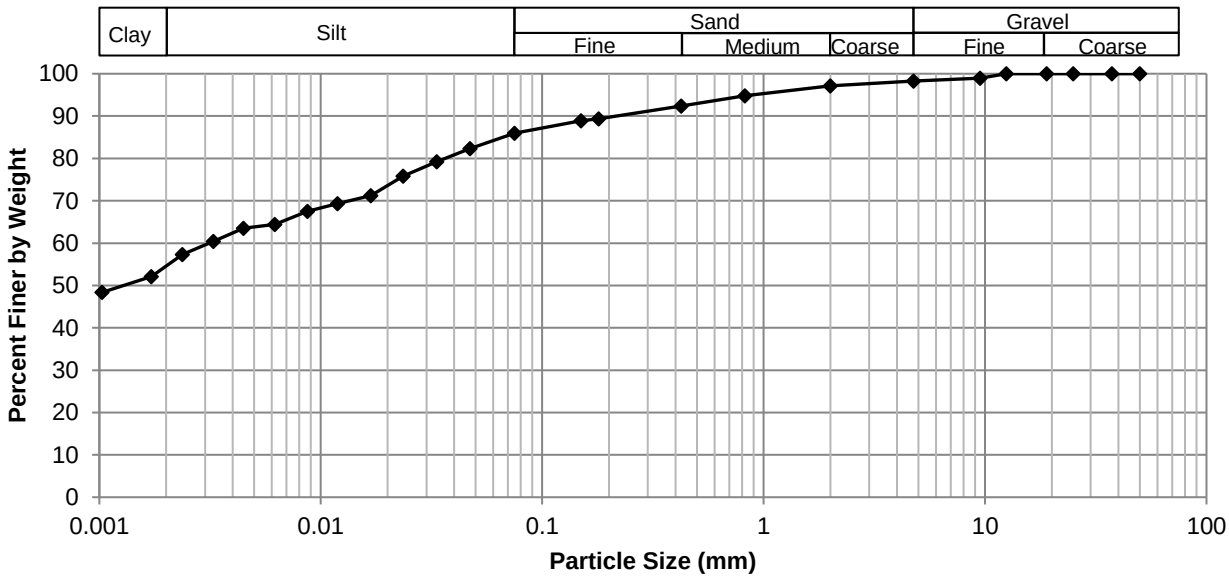
Winnipeg, MB R3H 0L3
Tel: 204.975.9433 Fax: 204.975.9435

Grain Size Analysis (Hydrometer Method)
ASTM D422

Project No.	0395-004-00
Client	WSP Canada Group Ltd.
Project	2018 Regional Streets C-05 (Memorial Blvd.)
Test Hole	TH18-08
Sample #	G50
Depth (m)	0.4 - 0.5
Sample Date	14-Feb-18
Test Date	6-Mar-18
Technician	HS

Gravel	1.7%
Sand	12.3%
Silt	31.7%
Clay	54.3%

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	98.30	0.0750	85.99
37.5	100.00	2.00	97.17	0.0472	82.32
25.0	100.00	0.825	94.76	0.0334	79.24
19.0	100.00	0.425	92.40	0.0236	75.84
12.5	100.00	0.180	89.35	0.0168	71.21
9.50	98.98	0.150	88.93	0.0119	69.36
4.75	98.30	0.075	85.99	0.0087	67.51
				0.0062	64.42
				0.0045	63.49
				0.0033	60.41
				0.0024	57.32
				0.0017	52.07
				0.0010	48.37

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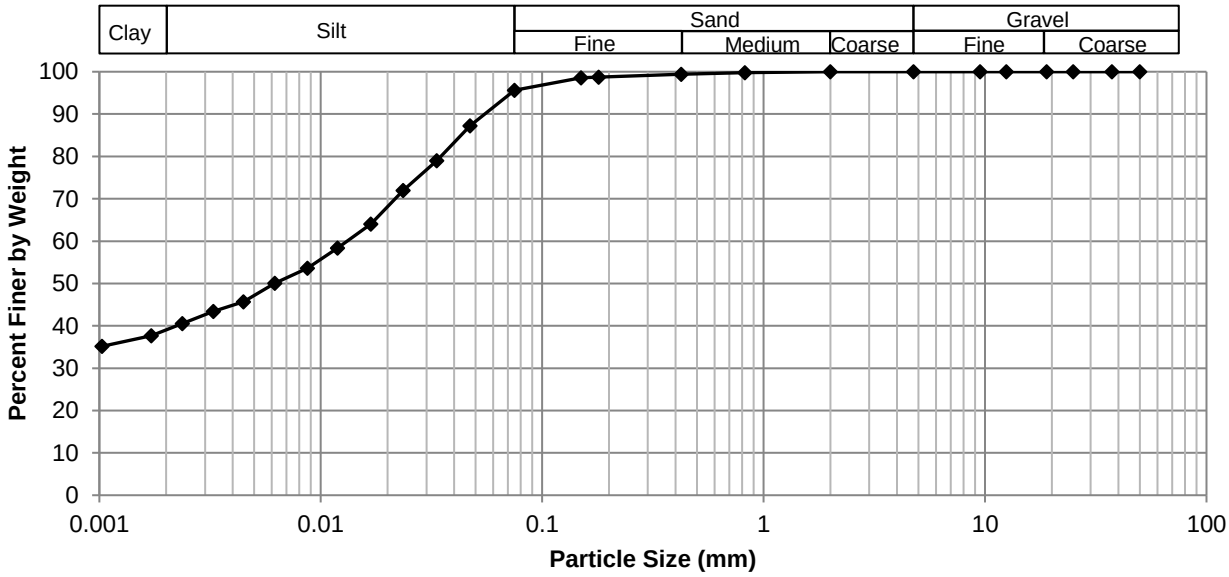
Grain Size Analysis (Hydrometer Method)
ASTM D422

Project No.	0395-004-00
Client	WSP Canada Group Ltd.
Project	2018 Regional Streets C-05 (Memorial Blvd.)
Test Hole	TH18-08
Sample #	G51
Depth (m)	0.7 - 0.8
Sample Date	14-Feb-18
Test Date	6-Mar-18
Technician	HS

Gravel	0.0%
Sand	4.3%
Silt	56.7%
Clay	38.9%

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	95.65
37.5	100.00	2.00	100.00	0.0472	87.26
25.0	100.00	0.825	99.77	0.0334	79.00
19.0	100.00	0.425	99.44	0.0236	72.01
12.5	100.00	0.180	98.76	0.0168	64.07
9.50	100.00	0.150	98.61	0.0119	58.35
4.75	100.00	0.075	95.65	0.0087	53.59
				0.0062	50.10
				0.0045	45.65
				0.0033	43.43
				0.0024	40.57
				0.0017	37.71
				0.0010	35.17

Photo 1: Pavement Core Sample at Test Hole TH18-03

Photo 2: Pavement Core Sample at Test Hole TH18-04

Photo 3: Pavement Core Sample at Test Hole TH18-05

Photo 4: Pavement Core Sample at Test Hole TH18-06

Photo 5: Pavement Core Sample at Test Hole TH18-07

Photo 6: Pavement Core Sample at Test Hole TH18-08

Photo 7: Pavement Core Sample at Test Hole TH18-09

Photo 8: Pavement Core Sample at Test Hole TH18-10

Appendix C

Memorial Blvd, between Portage Ave. and St. Mary's Ave.

Summary Table & Photographs of Pavement Core Samples

Regional Streets Package C-05
Road Investigation
Memorial Blvd.

Pavement Core No.	Pavement Core Location	Pavement Surface		Pavement Structure Material	
		Type	Thickness (mm)	Type	Thickness (mm)
PC18-01	16 m South of 450 Portage Ave (Impark parking), 2 m East of West Curb	Asphalt	95	Concrete	N/A
PC18-02	0.5 South of fire hydrant at Hudson Bay Company, 1.8 West of East curb	Asphalt	140	Concrete	N/A
PC18-03	90 m North of fire hydrant infront of Hudson Bay Company, 1 m West of East curb	Asphalt	N/A	Concrete	320
PC18-04	78 m North of fire hydrant at Winnipeg Art Gallery, 1.2 m West of East curb	Asphalt	145	Concrete	N/A
PC18-05	36 m South of fire hydrant at Winnipeg Art Gallery, 1.2 m East of West curb	Asphalt	65	Concrete	245
PC18-06	104 m South of fire hydrant at Winnipeg Art Gallery, 1.2 East of West curb	Asphalt	160	Concrete	160
PC18-13	33 m North of York Ave and Memorial Boulevard intersection, 0.8 m East of West curb	Asphalt	85	Concrete	135
PC18-14	15 m South of 277 Memorial Boulevard emergency exit door, 3.8 m West of East curb	Asphalt	85	Concrete	195

Photo 1: Pavement Core Sample at Pavement Hole PC18-01

Photo 2: Pavement Core Sample at Pavement Hole PC18-02

Photo 3: Pavement Core Sample at Pavement Hole PC18-03

Photo 4: Pavement Core Sample at Pavement Hole PC18-04

Photo 5: Pavement Core Sample at Pavement Hole PC18-05

Photo 6: Pavement Core Sample at Pavement Hole PC18-06

Photo 7: Pavement Core Sample at Pavement Hole PC18-13

Photo 8: Pavement Core Sample at Pavement Hole PC18-14

Appendix D

Colony Street, between Ellice Ave. and Portage Ave.

Summary Table & Photographs of Pavement Core Samples

Regional Streets Package C-05
Road Investigation
Colony Street

Pavement Core No.	Pavement Core Location	Pavement Surface		Pavement Structure Material	
		Type	Thickness (mm)	Type	Thickness (mm)
PC18-07	72 m North of fire hydrant located at the corner of Portage Ave and Colony Street, 1.3 m East of West curb	Asphalt	190	Concrete	N/A
PC18-08	138 m North of fire hydrant located at the corner of Portage Ave and Colony Street, 5 m West of East curb	Asphalt	65	Concrete	225
PC18-09	20 m North of fire hydrant located at the corner of Weibe Place and Colony Street, 1.5 m West of East curb	Asphalt	100	Concrete	200
PC18-10	0.4 m North of fire hydrant located at the corner of Weibe Place and Colony Street, 1.3 m West of East curb	Asphalt	160	Concrete	170
PC18-11	103 m South of fire hydrant located at the corner of Weibe Place and Colony Street, 7 m East of West curb	Asphalt	290	Concrete	N/A
PC18-12	28 m North of fire hydrant located at the corner of Weibe Place and Colony Street, 1.5 m East of West curb	Asphalt	N/A	Concrete	245

Photo 1: Pavement Core Sample at Pavement Hole PC18-07

Photo 2: Pavement Core Sample at Pavement Hole PC18-08

Photo 3: Pavement Core Sample at Pavement Hole PC18-09

Photo 4: Pavement Core Sample at Pavement Hole PC18-10

Photo 5: Pavement Core Sample at Pavement Hole PC18-11

Photo 6: Pavement Core Sample at Pavement Hole PC18-12

Quality Engineering | Valued Relationships

WSP Canada Group Ltd

2018 Regional Street Package (PW File #: C-05) Additional Pavement Investigation

Prepared for:

WSP Canada Group Ltd.
111-93 Lombard Ave.
Winnipeg, MB R3B
Attention: Marcus Wong

Project Number:
0395 004 00

Date:
April 19, 2018
Final Report

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TREK GEOTECHNICAL Quality Engineering | Valued Relationships

April 19, 2018 Our File No. 0395 004 00

Marcus Wong, B.Sc. (C.E.), P.Eng.
WSP Canada Group Ltd.
111-93 Lombard Ave.
Winnipeg, MB R3B

RE: Additional Pavement Investigation Report for 2018 Regional Street Package (PW File #: C-05)

TREK Geotechnical Inc. is pleased to submit our report for the additional pavement investigation for the 2018 Regional Street Package (PW File #: C-05).

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

Sincerely,

TREK Geotechnical Inc.
Per:

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	April 19, 2018	Final Report

Authorization Signatures

Prepared By:

Angela Fidler-Kliewer C.Tech.

PROVINCE OF MANITOBA
FERREIRA
Member
22892
April 19, 2018
REGISTERED PROFESSIONAL ENGINEER

ENGINEERS GEOSCIENTISTS MANITOBA
Certificate of Authorization
TREK GEOTECHNICAL INC.
No. 4877 Date: Apr. 19, 2018

Reviewed By:

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

Table of Contents

List of Figures

List of Appendices

1.0 Introduction

This report summarizes the results of the additional pavement investigation completed for the 2018 Regional Street Package C-05 project on Memorial Blvd. A previous road investigation was completed as part of this package and the results of which were submitted to WSP on April 14, 2018.

2.0 Pavement Investigation

The investigation included coring of the existing road pavement at 7 locations along Memorial Blvd between Portage Avenue and St. Mary Avenue. WSP selected the investigation locations as shown on Figure 01 (attached).

The pavement investigation was conducted between April 10, 2018 and April 11, 2018. The pavement structure (asphalt or concrete) was cored by Harsimran Singh of TREK Geotechnical Inc. (TREK) using a portable coring press equipped with a hollow 150 mm diameter diamond core drill bit. Core samples were also retrieved and logged at TREK's material testing laboratory.

The information provided in Appendix A includes pavement core summary tables and photos of the pavement cores. Pavement core locations noted on the summary tables are based on their location relative to measured distances from the edge of pavement and distance from cross streets.

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,).

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 Inc. (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 004 00
WSP GROUP CANADA LTD.
Regional Streets C-05 Memorial Boulevard

ANSI full bleed A (11.00 x 8.50 Inches)

FIG.006 2018-03-07 Pavement Core 0 A SL 0395 004 00 (Memorial Blvd).dwg, 4/12/2018 2:03:54 PM

0 25 50 75 m
SCALE = 1 : 1 750 (216 mm x 279 mm)

LEGEND: PAVEMENT CORES (TREK, 2018)

NOTES: 1. AERIAL IMAGE FROM CITY OF WINNIPEG 2016

Figure 01
Pavement Core Plan

Appendix A

Memorial Blvd, between Portage Ave. and St. Mary's Ave.

Summary Table & Photographs of Pavement Core Samples

Regional Streets Package C-05
Pavement Investigation
Memorial Blvd.

Pavement Core No.	Pavement Core Location	Pavement Surface		Pavement Structure Material	
		Type	Thickness (mm)	Type	Thickness (mm)
PC18-15	Northbound lane, 32 m North of St. Mary Ave and Memorial Boulevard intersection, 2 m East of Median curb	Asphalt	150	Concrete	200
PC18-16	Northbound lane, 32 m North of St. Mary Ave and Memorial Boulevard intersection, 1.5 West of East curb	Asphalt	160	Concrete	180
PC18-17	Northbound lane, 68 m North of St. Mary Ave and Memorial Boulevard intersection, 5 m East of median curb	Asphalt	160	Concrete	140
PC18-18	Northbound lane, 97 m North of St. Mary Ave and Memorial Boulevard intersection, 8 m East of median curb	Asphalt	140	Concrete	160
PC18-19	Northbound lane, 150 m North of St. Mary Ave and Memorial Boulevard intersection, 1.5 m West of East curb	Asphalt	190	Concrete	120
PC18-20	Northbound lane, 190 m North of St. Mary Ave and Memorial Boulevard intersection, 4.4 m East of median curb	Asphalt	200	Concrete	150
PC18-21	Northbound lane, 210 m North of St. Mary Ave and Memorial Boulevard intersection, 1.3 m East of median curb	Asphalt	180	Concrete	N/A

Photo 1: Pavement Core Sample at Pavement Hole PC18-15

Photo 2: Pavement Core Sample at Pavement Hole PC18-16

Photo 3: Pavement Core Sample at Pavement Hole PC18-17

Photo 4: Pavement Core Sample at Pavement Hole PC18-18

Photo 5: Pavement Core Sample at Pavement Hole PC18-19

Photo 6: Pavement Core Sample at Pavement Hole PC18-20

Photo 7: Pavement Core Sample at Pavement Hole PC18-21