

APPENDIX 'A'

GEOTECHNICAL REPORT



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"Engineering and Testing Solutions That Work for You"

January 8, 2020

File No.: 19-035-01

WSP Canada Inc.
111 – 93 Lombard Avenue
Winnipeg, Manitoba
R3B 3B1

ATTENTION: Mark Vogt, M.Sc., P.Eng.

RE: Geotechnical Investigation – Maryland Street Pavement Renewals

1.0 Introduction

ENG-TECH Consulting Limited (ENG-TECH) completed the requested geotechnical investigation (pavement cores and test holes) along Maryland Street between Woodrow Place and Broadway. The pavement cores and test holes were conducted as follows:

- Five (5) test holes on Maryland Street (East and West curb lanes), between Woodrow Place and Sara Avenue.
- Eight (8) pavement cores on Maryland Street (East and West curb lanes) between Woodrow Place and Broadway.

The geotechnical investigation field work and laboratory program were conducted in accordance with the City of Winnipeg Geotechnical Investigation requirements for Public Works Projects (September 2015) and the supplementary information provided by the engineer from the City of Winnipeg.

2.0 Scope of Work

The scope of work for the project was as follows:

- Clear all underground public services at the locations of the test holes.
- Maintain at least one (1) lane of traffic, and adhering to the Manual of Temporary Traffic Control.
- Core a total of eight (8) holes through the existing pavement structure at the location previous mentioned using a 150 mm diameter core barrel, and retain the cores for measurements and photographs.
- Drill five (5) 125 mm diameter test holes to 3.0 m below the surface of the pavement structure, and classify the underlying soils and collect samples from the auger flights at regular intervals, and retain the samples for laboratory testing.

- A laboratory testing program consisting of moisture contents, Atterberg Limits, particle size analyses and California Bearing Ratio (CBR) on select samples.
- A report outlining the work conducted, including pavement core and test hole summary tables, laboratory test results, a site plan showing the test hole and pavement core locations, UTM coordinates, photographs, and test hole summary logs.

3.0 Field Program

ENG-TECH conducted the coring and test hole drilling program on December 3rd and 6th, 2019 at Maryland Street (East and West curb lanes) from Woodrow Place to Broadway. The cores were obtained using a 150 mm diameter core barrel owned and operated by Di-Tech International Inc., whereas the test holes were drilled using a 125 mm diameter solid stem continuous flight augers using a CME 75 truck mounted drill rig owned and operated by Subterranean Manitoba Ltd. The test holes were advanced to 3.0 m below the pavement structure on Maryland Street at the locations as shown on Figure 1.

Soil samples were collected off the auger flights at regular depth intervals of 0.1, 0.4, 0.7, 1.1, 1.5 and 2.0 m, as specified in the supplementary information provided by the engineer from the City of Winnipeg, then the test holes were backfilled with soil auger cuttings and bentonite. Compacted cold mix asphalt was placed upon the completion of drilling. The core thicknesses and stratigraphy at the location of the test holes are outlined on Tables 1 and 2, and the attached test hole summary logs. The pavement core and test hole locations, UTM coordinates and offsets from the curbs are shown on Figure 1. Detailed stratigraphy descriptions are outlined on the test hole summary logs.

4.0 Laboratory Program


The soil samples collected and the pavement structure cores were retained for testing in ENG-TECH'S laboratory. The moisture content of each sample was determined and select samples were tested for particle size, Atterberg Limits and California Bearing Ratio (CBR). The pavement structure core thicknesses were measured and photographed. The moisture content, particle size and Atterberg Limit test results are summarized on Table 1, and the attached test hole summary logs. The CBR and Particle Size Analysis results are shown on separate reports, with the test hole summary logs and photographs of each core attached to this report.

5.0 Closure

ENG-TECH trusts this is all the information required. If you have any questions, please contact the undersigned.

Sincerely,
ENG-TECH Consulting Limited




Paula Filizzola Pinheiro Chagas
B.Sc. (C.E.), B.Sc. (Enviro. E.), C.E.T.
Engineering Department



Clark Hryhoruk, M.Sc., P.Eng.
President, Geotechnical Engineer

CDH/pfpc



Attachments: Table 1 – Summary of Pavement Structure – Maryland Street: From Woodrow Place to Sara Avenue
Table 2 – Summary of Pavement Core Structure – Maryland Street: From Woodrow Place to Broadway
Figure 1 – Pavement Core and Test Hole Location Plan – Maryland St
Modified Unified Classification System for Soils
Test Hole Summary Logs (5)
Atterberg Limits, Plastic Index and Plasticity Index of Soil (7)
Particle Size Analysis (7)
Moisture Density Relationship (1)
California Bearing Ratio Report (1)
Photograph of Cores (8)



Table 1
Summary of Pavement Structure

File No.: 19-035-01

Maryland Street: From Woodrow Place to Sara Avenue

Page 1 of 2

Test Hole	GPS Coordinates		Pavement Surface		Pavement Structure Material		Subgrade Description	Sample Depth (m)	Moisture Content (%)	Hydrometer Analysis				Atterberg Limits					
	UTM	14U	Type	Thickness (mm)	Type	Thickness (mm)				Gravel (%)	Sand (%)	Silt (%)	Clay (%)	Liquid Limit	Plastic Limit	Plasticity Index			
1	5526876	0632110	Asphalt	203	Sand Fill (20 mm)	300	Sand Fill	0.1	18.4										
								0.4	16.2										
								0.7	36.5										
								1.1	28.6										
								1.5	28.4										
2	5526989	0632120	Asphalt	100	Clay Fill	1360	Clay Fill	0.1	24.0										
								0.4	35.5										
								0.7	35.3	2.5	9.9	29.7	57.9	74	27	47			
								1.1	33.2										
								1.5	26.4										
			Concrete	178			Clay	2.0	32.0	0.0	3.4	49.6	47.0	42	16	26			

Note: No water seepage was encountered in the test holes.

Test Hole	Test Hole Location		Pavement Surface		Pavement Structure Material		Subgrade Description	Sample Depth (m)	Moisture Content (%)	Hydrometer Analysis				Atterberg Limits					
	UTM	14U	Type	Thickness (mm)	Type	Thickness (mm)				Gravel (%)	Sand (%)	Silt (%)	Clay (%)	Liquid Limit	Plastic Limit	Plasticity Index			
3	5527100	0632114	Asphalt	127	Silty Sand Fill (20 mm)	400	Silty Sand Fill	0.1	11.2	5.9	62.0	24.8	7.3	0	19	-19			
								0.4	28.2										
			Concrete	300	Clay Fill		0.7	32.2											
							1.1	33.2											
4	05527196	0632122	Asphalt	100	Clay Fill	1450	Clay	0.1	9.9										
								0.4	28.8										
			Concrete (Fractured/Powder)	76	Silty Sand Fill		0.7	23.2	0.3	4.7	54.4	40.6	48	16	32				
							1.1	25.1											
			5	5527313	0632129	Asphalt	114	Silty Sand Fill (20 mm)	460	Clay	1.5	23.2	0.0	3.3	77.3	19.4	25	18	7
											2.0	39.9							
Concrete	229	Clay					0.1	9.6	29.5	47.8	13.5	9.1	28	4	7				
							0.4	21.3											
								0.7	30.5										
								1.1	30.2										
								1.5	39.6	0.2	3.3	25.4	71.1	66	20	46			
								2.0	43.4										

Note: No water seepage was encountered in the test holes.



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Table 2
Summary of Pavement Core Structure

File No.: 19-035-01

Maryland Street: From Woodrow Place to Broadway

Page 1 of 1

Core ID	Core Location	GPS Coordinates		Pavement Surface	
		14U	UTM	Type	Thickness (mm)
PC#1	76.04 m south of core PC#2 and 2.4 m east of West curb	5527398	0632120	Asphalt	76
PC#2	72.55 m south of core PC#3 and 1.6 m west of East curb	5527473	0632129	Concrete	229
PC#3	7.30 m south of Southwest corner of Broadway/Maryland and 2.1 m east of West curb	5527545	0632123	Asphalt	76
TH1	11.80 m south of Woodrow Place and 2.4 m east of West curb.	5526876	0632110	Concrete	178
TH2	110.70 m north of test hole TH1 and 2.1 m west of East curb	5526989	0632120	Asphalt	100
TH3	109.40 m north of test hole TH2 and 2.6 m east of West curb	5527100	0632114	Concrete	178
TH4	71.05 m north of Westminster Avenue and 2.0 m west of East curb	5527196	0632122	Asphalt	127
TH5	115.05 m north of test hole TH4 and 2.6 m east of West curb	5527313	0632129	Concrete	300
				Asphalt	100
				Concrete (fracture/powder)	76
				Asphalt	114
				Concrete	229



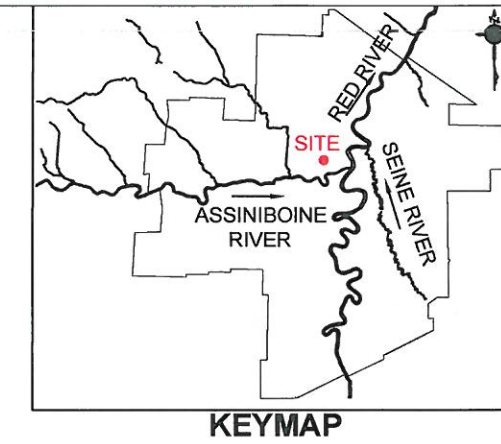
(TH1 TO TH3) MARYLAND ST - BETWEEN WOODROW PLACE & WESTMINSTER AVE



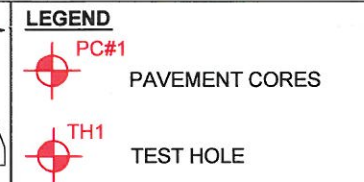
(TH4 & TH5) MARYLAND ST - BETWEEN WESTMINSTER AVE & SARA AVE



(PC#1 TO PC#3) MARYLAND ST - BETWEEN SARA AVE & BROADWAY



KEYMAP



TEST HOLE & PAVEMENT CORE LOCATION TABLE		
HOLE #	GPS COORDINATES DECEMBER 3 & 6, 2019	
	UTM	14U
TH1	5526876	0632110
TH2	5526989	0632120
TH3	5527100	0632114
TH4	5527196	0632122
TH5	5527313	0632129
PC#1	5527398	0632120
PC#2	5527473	0632129
PC#3	5527545	0632123

TEST HOLE & PAVEMENT CORE LOCATION TABLE	
HOLE #	OFFSET FROM CURB
TH1	2.4 m FROM WEST CURB
TH2	2.1 m FROM EAST CURB
TH3	2.6 m FROM WEST CURB
TH4	2.0 m FROM EAST CURB
TH5	2.6 m FROM WEST CURB
PC#1	2.4 m FROM WEST CURB
PC#2	1.6 m FROM EAST CURB
PC#3	2.1 m FROM WEST CURB

NO.	DATE	ISSUE / REVISION
0	JAN 2020	REPORT

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CONSULTING LIMITED

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ENG. STAMP:

**ENGINEERS
GEOSCIENTISTS
MANITOBA**
Certificate of Authorization
ENG-TECH Consulting Limited
No. 2475

CLIENT:
WSP CANADA GROUP LTD.

PROJECT:
GEOTECHNICAL INVESTIGATION
MARYLAND STREET PAVEMENT
RENEWALS

DWG DESCRIPTION:
PAVEMENT CORE AND TEST HOLE
LOCATION PLAN

SCALE:
NTS

DRAWN BY: PFPC DATE: JANUARY 2020

FILE No.: 19-035-01 CLIENT DWG/FIG. No.:

ENG-TECH DWG/FIG. No.: 1 NO.:

MODIFIED UNIFIED CLASSIFICATION SYSTEM FOR SOILS

MAJOR DIVISION		GROUP SYMBOL	GRAPH SYMBOL	TYPICAL DESCRIPTION	LABORATORY CLASSIFICATION CRITERIA
COARSE GRAINED SOILS (MORE THAN HALF BY WEIGHT LARGER THAN 75 µm)	GRAVELS MORE THAN HALF THE COARSE FRACTION LARGER THAN 4.75 mm	CLEAN GRAVELS (TRACE OR NO FINES)	GW	WELL GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES	$C_u = \frac{D_{60}}{D_{10}} > 4$; $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}} = 1 \text{ TO } 3$
		DIRTY GRAVELS (WITH SOME OR MORE FINES)	GP	POORLY GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES	NOT MEETING ABOVE REQUIREMENTS
			GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES	ATTERBERG LIMITS BELOW "A" LINE OR P.I. LESS THAN 4
			GC	CLAYEY GRAVELS, GRAVEL-SAND-CLAY MIXTURES	ATTERBERG LIMITS ABOVE "A" LINE AND P.I. MORE THAN 7
	SANDS MORE THAN HALF THE COARSE FRACTION SMALLER THAN 4.75 mm	CLEAN SANDS (TRACE OR NO FINES)	SW	WELL GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES	$C_u = \frac{D_{60}}{D_{10}} > 6$; $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}} = 1 \text{ TO } 3$
		DIRTY SANDS (WITH SOME OR MORE FINES)	SP	POORLY GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES	NOT MEETING ABOVE REQUIREMENTS
			SM	SILTY SANDS, SAND-SILT MIXTURES	ATTERBERG LIMITS BELOW "A" LINE OR P.I. LESS THAN 4
			SC	CLAYEY SANDS, SAND-CLAY MIXTURES	ATTERBERG LIMITS ABOVE "A" LINE AND P.I. MORE THAN 7
FINE GRAINED SOILS (MORE THAN HALF BY WEIGHT SMALLER THAN 75 µm)	SILTS BELOW "A" LINE NEGLECTIBLE ORGANIC CONTENT	LL ≤ 50%	ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY SANDS OF SLIGHTY PLASTICITY	CLASSIFICATION IS BASED UPON PLASTICITY CHART (SEE BELOW)
		LL > 50%	MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS, FINE SANDY OR SILTY SOILS	
	CLAYS ABOVE "A" LINE NEGLECTIBLE ORGANIC CONTENT	LL ≤ 30%	CL	INORGANIC CLAYS OF LOW PLASTICITY, GRAVELLY, SANDY OR SILTY CLAYS, LEAN CLAYS	
		30% < LL ≤ 50%	CI	INORGANIC CLAYS OF MEDIUM PLASTICITY, SILTY CLAYS	
		LL > 50%	CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS	
	ORGANIC SILTS & CLAYS BELOW "A" LINE	LL < 50%	OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY	
		LL > 50%	OH	ORGANIC CLAYS OF HIGH PLASTICITY	
	HIGHLY ORGANIC SOILS		PT	PEAT AND OTHER HIGHLY ORGANIC SOILS	

ADDITIONAL SYMBOLS

TILL		SANDSTONE	
FILL		GRANITE	
TOPSOIL			
CONCRETE			
SHALE			
LIMESTONE			

PLASTIC SOILS

MOISTURE	PLASTICITY	INTRUSIONS	CONSISTENCY	POCKET PEN (TSF)	(N)
DRY	LOW	ROOTLETS	VERY SOFT		< 2
DAMP	MEDIUM	OXIDES	SOFT	0 - 0.5	2 - 4
MOIST	HIGH	MICA	FIRM	0.5 - 1.0	4 - 8
WET		GYPSUM ETC.	STIFF VERY STIFF	1.0 - 2.0 2.0 - 4.0	8 - 15 15 - 30
			HARD	> 4.0	> 30

TSF x 95.8 = kPa (q_u) S_u = 1/2 x q_u

SOIL DESCRIPTIONS

TRACE:	0 - 10%	BOULDERS:	> 200 mm	COARSE SAND:	2 - 4.75 mm
SOME:	10 - 20%	COBBLES:	75 - 200 mm	MEDIUM SAND:	0.425 - 2 mm
WITH:	20 - 35%	COURSE GRAVEL:	19 - 75 mm	FINE SAND:	0.075 - 0.425 mm
AND:	35 - 50%	FINE GRAVEL:	4.75 - 19 mm	FINES:	< 0.075 mm

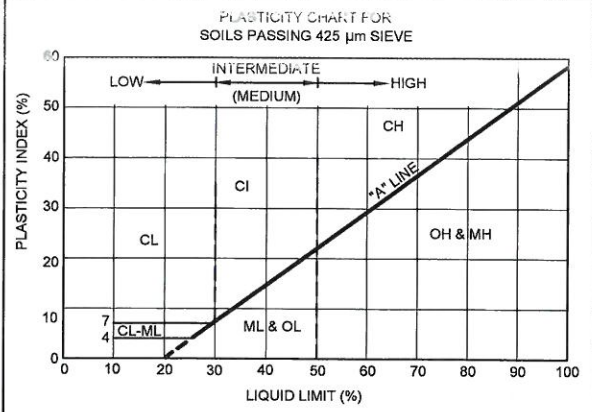
GRANULAR SOILS

MOISTURE	DENSITY	GRADATION	INTRUSIONS	SPT (N)
DRY	VERY LOOSE	POORLY	ROOTLETS	0 - 4
DAMP	LOOSE	WELL	OXIDES	4 - 10
MOIST	MED. DENSE		MICA	10 - 30
WET	DENSE		FINES	30 - 50
	VERY DENSE		ETC.	> 50

DEFINITIONS
 LL = LIQUID LIMIT C_c = COMPRESSION INDEX
 P.I. = PLASTICITY INDEX PL = PLASTIC LIMIT
 C_u = COEFFICIENT OF UNIFORMITY
 q_u = UNCONFINED COMPRESSIVE STRENGTH
 S_u = UNDRAINED SHEAR STRENGTH



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Test Hole #: TH1
Client: WSP Canada Group Ltd.
Site: See Figure 1
Location: Winnipeg, MB
Project: Geotechnical Investigation - Maryland Street Pavement Renewals

File No.: 19-035-01
Date Drilled: December 6, 2019
Grade Elevation: 100.0 m
Water Elevation: - -

SUBSURFACE PROFILE			SAMPLE DATA				SHEAR STRENGTH (kPa)				
Depth (m)	Soil Symbol	Description	Elevation (m)	Sample No.	Sample Type	Moisture Content (%)	Blows/300 mm	Moisture Content (%)			
								PL	X	LL	P. Pen
0.0		Ground Surface	100.0								
		Asphalt (203 mm)									
		Sand Fill (SM) - medium to light brown, wet, and fine sand, some gravel, trace clay & silt. - concrete rubble from 0.4 to 0.5 m.		S1	S	18.4					
		Clay Fill (CH) - dark brown to black, moist, firm, highly plastic, trace silt, gravel & sand.		S2	S	16.2					
1.0			99.0	S3	S	36.5			36		
		Clay (CH) - medium brown, moist, stiff, highly plastic, trace silt & gravel. - at 1.2 m, thin silt seam.		S4	S	28.6			72		
				S5	S	28.4			120		
2.0			98.0	S6	S	36.4			84		
3.0		End of Test Hole - end of test hole at 3.0 m below grade. - no seepage or sloughing observed during or immediately after drilling. - test hole backfilled with soil auger cuttings and bentonite. - pavement was patched with asphalt cold mix upon completion of drilling.	97.0								
4.0			96.0								

ENG-TECH Consulting Limited

Logged by: AH

Reviewed by: *[Signature]*

Drilled By: Subterranean (Manitoba) Ltd.

Drill Rig: Truck Mounted - CME 75

Auger Size: 125 mm Solid Stem

Completion Depth: 3.0 m

Completion Elevation: 97.0 m

Sheet: 1 of 1

SAMPLE TYPE



SPLIT BARREL



SHELBY TUBE



AUGER CUTTINGS



SPLIT SPOON



**Engineering And Testing
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Test Hole #: TH2
Client: WSP Canada Group Ltd.
Site: See Figure 1
Location: Winnipeg, MB
Project: Geotechnical Investigation - Maryland Street Pavement Renewals

File No.: 19-035-01
Date Drilled: December 3, 2019
Grade Elevation: 100.0 m
Water Elevation: - -

SUBSURFACE PROFILE				SAMPLE DATA				SHEAR STRENGTH (kPa)				
Depth (m)	Soil Symbol	Description	Elevation (m)	Sample No.	Sample Type	Moisture Content (%)	Blows/300 mm	Moisture Content (%)				
								PL	X	LL	P. Pen	Torvane
0.0		Ground Surface	100.0									
		Asphalt (100 mm)										
		Granular Fill (50 mm) - thin layer of granular (+/- 50 mm) between asphalt and concrete.										
		Concrete (178 mm)										
		Clay Fill (CH) - dark brown to black, moist, stiff, highly plastic, some silt, trace sand & gravel. - below 0.9 m, firm, some silt, dark to medium brown.	99.0	S1	SHELBY TUBE	24.0						
				S2	SHELBY TUBE	35.5				96		
				S3	SHELBY TUBE	35.3				108		
				S4	SHELBY TUBE	33.2				48		
		Silt (ML) - light brown, moist to wet, soft, low plastic, some clay.	98.0	S5	SHELBY TUBE	26.4				12		
		Clay (Cl) - medium to light brown, moist, firm, medium plastic, and silt, trace sand.		S6	SHELBY TUBE	32.0				48		
3.0		End of Test Hole - end of test hole at 3.0 m below grade. - no seepage or sloughing observed during or immediately after drilling. - test hole backfilled with soil auger cuttings and bentonite. - pavement was patched with asphalt cold mix upon completion of drilling.	97.0									
4.0			96.0									

ENG-TECH Consulting Limited

Logged by: PFPC

Reviewed by:

Drilled By: Subterranean (Manitoba) Ltd.

Drill Rig: Truck Mounted - CME 75

Auger Size: 125 mm Solid Stem

Completion Depth: 3.0 m

Completion Elevation: 97.0 m

Sheet: 1 of 1

SAMPLE TYPE



SPLIT BARREL



SHELBY TUBE



AUGER CUTTINGS



SPLIT SPOON



**Engineering And Testing
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Test Hole #: TH3
Client: WSP Canada Group Ltd.
Site: See Figure 1
Location: Winnipeg, MB
Project: Geotechnical Investigation - Maryland Street Pavement Renewals

File No.: 19-035-01
Date Drilled: December 3, 2019
Grade Elevation: 100.0 m
Water Elevation: - -

SUBSURFACE PROFILE				SAMPLE DATA				SHEAR STRENGTH (kPa)			
Depth (m)	Soil Symbol	Description	Elevation (m)	Sample No.	Sample Type	Moisture Content (%)	Blows/300 mm	Moisture Content (%)			
								PL	X	LL	P. Pen
0.0		Ground Surface	100.0								
		Asphalt (127 mm)									
		Concrete (300 mm)									
		Silty Sand Fill (SM) - medium to light brown, dry to moist, and fine sand, some silt, trace clay & gravel.		S1		11.2					
1.0		Clay Fill (CH) - dark to medium brown, moist, stiff, highly plastic, trace to some silt, trace sand & gravel.	99.0	S2		28.2				72	
				S3		32.2				72	
				S4		33.2				84	
2.0		Silt (ML) - light brown, moist, firm to soft, low plastic, with clay.	98.0	S5		28.4				24	
		Clay (CH) - medium brown, moist, stiff, highly plastic, trace silt.		S6		37.5				72	
3.0		End of Test Hole - end of test hole at 3.0 m below grade. - no seepage or sloughing observed during or immediately after drilling. - test hole backfilled with soil auger cuttings and bentonite. - pavement was patched with asphalt cold mix upon completion of drilling.	97.0								
4.0			96.0								

ENG-TECH Consulting Limited

Logged by: PFPC

Reviewed by:

Drilled By: Subterranean (Manitoba) Ltd.

Drill Rig: Truck Mounted - CME 75

Auger Size: 125 mm Solid Stem

Completion Depth: 3.0 m

Completion Elevation: 97.0 m

Sheet: 1 of 1

SAMPLE TYPE



SPLIT BARREL



SHELBY TUBE



AUGER CUTTINGS



SPLIT SPOON



**Engineering And Testing
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Test Hole #: TH4
Client: WSP Canada Group Ltd.
Site: See Figure 1
Location: Winnipeg, MB
Project: Geotechnical Investigation - Maryland Street Pavement Renewals

File No.: 19-035-01
Date Drilled: December 3, 2019
Grade Elevation: 100.0 m
Water Elevation: - -

SUBSURFACE PROFILE				SAMPLE DATA				SHEAR STRENGTH (kPa)		
Depth (m)	Soil Symbol	Description	Elevation (m)	Sample No.	Sample Type	Moisture Content (%)	Blows/300 mm	Moisture Content (%)		
								PL	LL	UC
0.0		Ground Surface Asphalt (100 mm) Concrete Powder/Fractured (76 mm) - thin layer of concrete mixture/ rubble between asphalt and clay fill. - tan, dry, cement, sand & gravel. Clay Fill (CI) - dark brown to black, moist, stiff, medium plastic, with silt, sand & gravel. - below 0.9 m, medium brown, and silt.	100.0							
				S1		9.9				
				S2		28.8				60
1.0			99.0	S3		23.2				48
				S4		25.1				72
		Silt (ML) - light brown, moist to wet, soft, low plastic, some clay, trace sand.		S5		23.2				
2.0			98.0							
		Clay (CH) - medium brown, moist, stiff, highly plastic, trace silt.		S6		39.9				60
3.0		End of Test Hole - end of test hole at 3.0 m below grade. - no seepage or sloughing observed during or immediately after drilling. - test hole backfilled with soil auger cuttings and bentonite. - pavement was patched with asphalt cold mix upon completion of drilling.	97.0							
4.0			96.0							

ENG- TECH Consulting Limited

Logged by: PFPC

Reviewed by:

Drilled By: Subterranean (Manitoba) Ltd.

Drill Rig: Truck Mounted - CME 75

Auger Size: 125 mm Solid Stem

Completion Depth: 3.0 m

Completion Elevation: 97.0 m

Sheet: 1 of 1

SAMPLE TYPE



SPLIT BARREL



SHELBY TUBE



AUGER CUTTINGS



SPLIT SPOON



**Engineering And Testing
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Test Hole #: TH5
Client: WSP Canada Group Ltd.
Site: See Figure 1
Location: Winnipeg, MB
Project: Geotechnical Investigation - Maryland Street Pavement Renewals

File No.: 19-035-01
Date Drilled: December 3, 2019
Grade Elevation: 100.0 m
Water Elevation: - -

SUBSURFACE PROFILE				SAMPLE DATA				SHEAR STRENGTH (kPa)				
Depth (m)	Soil Symbol	Description	Elevation (m)	Sample No.	Sample Type	Moisture Content (%)	Blows/300 mm	Moisture Content (%)				
								PL	X	LL	P. Pen	Torvane
0.0		Ground Surface	100.0									
		Asphalt (114 mm)										
		Concrete (229 mm)										
		Silty Sand Fill (SM) - medium brown, moist to dry, and silt, with gravel, trace to some clay.		S1		9.6						
		Clay Fill (CH) - dark brown, moist, stiff, highly plastic, trace to some silt, trace sand & gravel.	99.0	S2		21.3						
1.0		Clay (CH) - medium brown, moist, stiff, highly plastic, some silt, trace sand.		S3		30.5				72		
		Clay (CH) - medium brown, moist, stiff, highly plastic, some silt, trace sand.		S4		30.2				96		
2.0		- below 2.0 m, silt intrusions.	98.0	S5		39.6				108		
				S6		43.4				96		
3.0		End of Test Hole - end of test hole at 3.0 m below grade. - no seepage or sloughing observed during or immediately after drilling. - test hole backfilled with soil auger cuttings and bentonite. - pavement was patched with asphalt cold mix upon completion of drilling.	97.0									
4.0			96.0									

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Logged by: PFPC

Reviewed by:

Drilled By: Subterranean (Manitoba) Ltd.

Drill Rig: Truck Mounted - CME 75

Auger Size: 125 mm Solid Stem

Completion Depth: 3.0 m

Completion Elevation: 97.0 m

Sheet: 1 of 1

SAMPLE TYPE



SPLIT BARREL



SHELBY TUBE



AUGER CUTTINGS



SPLIT SPOON



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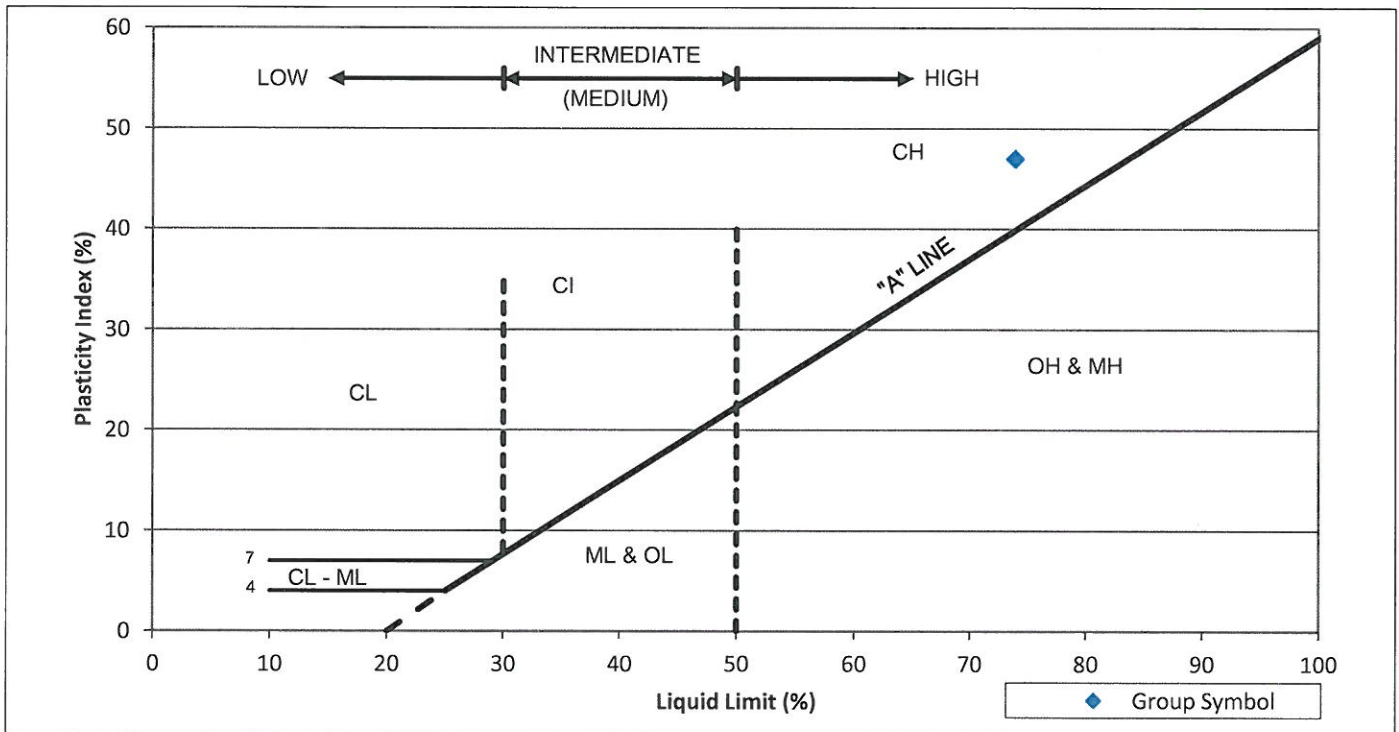
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File No.: 19-035-01
 Ref. No.: 19-35-1-2

Attention: Mark Vogt, M.Sc., P.Eng.

Project: MARYLAND STREET PAVEMENT RENEWALS, WINNIPEG, MANITOBA

Test Hole No.: 2	Sample No.: 3	Depth: 0.7 m
Sampled By: ENG-TECH (Paula Chagas)	Sampling Method: Auger cutting	Source: Project site
Date Sampled: Dec 2/19	Date Received: Dec 2/19	Date Tested: Dec 19/19
Method: <input checked="" type="checkbox"/> A (Multipoint) <input type="checkbox"/> B (Single Point)	Drying Method: <input checked="" type="checkbox"/> Air <input type="checkbox"/> Oven	



Liquid Limit (%): 74 Plastic Limit (%): 27 Plasticity Index (%): 47


Estimated Percentage of sand/gravel particles retained on 0.425mm sieve: 8.5

Classification:
 ASTM D2487: CH, fat clay; ASTM D3282: A-7-6 (47)

Comments:
 As received moisture content: 35.3%.

Email: mark.vogt@wsp.com

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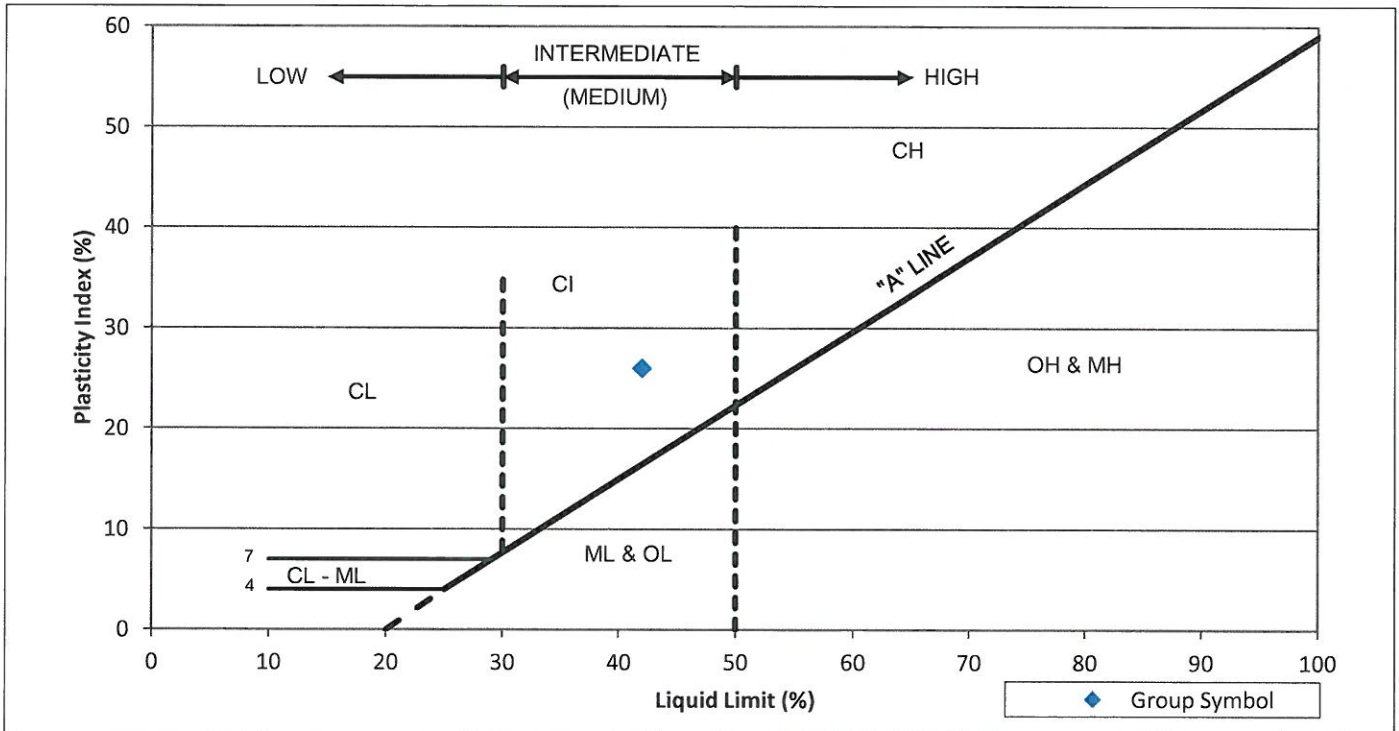
File No.: 19-035-01

Ref. No.: 19-35-1-4

Attention: Mark Vogt, M.Sc., P.Eng.

Project: MARYLAND STREET PAVEMENT RENEWALS, WINNIPEG, MANITOBA

Test Hole No.:	2	Sample No.:	6	Depth:	2.0 m
Sampled By:	ENG-TECH (Paula Chagas)	Sampling Method:	Auger cutting	Source:	Project site
Date Sampled:	Dec 2/19	Date Received:	Dec 2/19	Date Tested:	Dec 19/19
Method:	<input checked="" type="checkbox"/> A (Multipoint)	<input type="checkbox"/> B (Single Point)	Drying Method: <input checked="" type="checkbox"/> Air <input type="checkbox"/> Oven		



Liquid Limit (%): 42 Plastic Limit (%): 16 Plasticity Index (%): 26

Estimated Percentage of sand/gravel particles retained on 0.425mm sieve: 0.6

Classification:


ASTM D2487: CL, lean clay; ASTM D3282: A-7-6 (26)

Comments:

As received moisture content: 32.0%.

Email: mark.vogt@wsp.com

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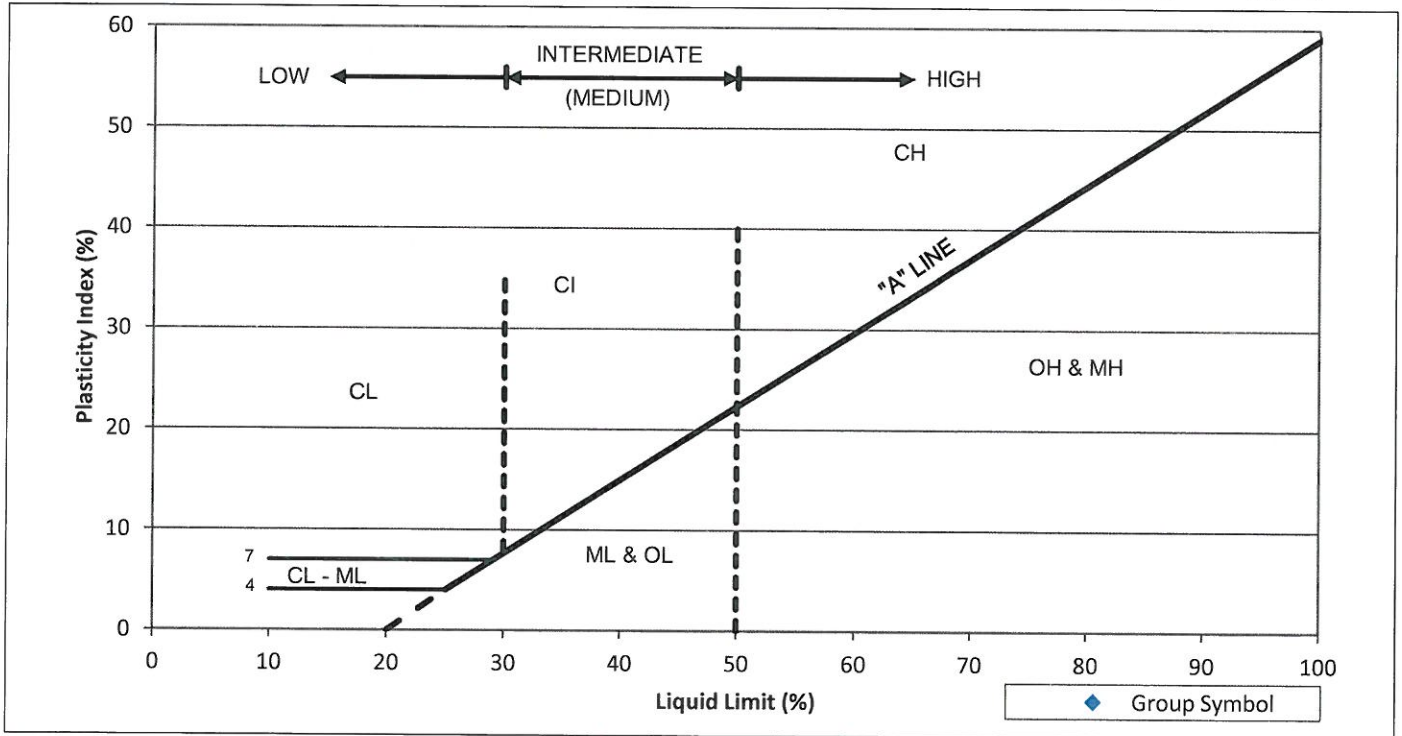
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File No.: 19-035-01
Ref. No.: 19-35-1-6

Attention: Mark Vogt, M.Sc., P.Eng.

Project: MARYLAND STREET PAVEMENT RENEWALS, WINNIPEG, MANITOBA

Test Hole No.:	3	Sample No.:	1	Depth:	0.1 m
Sampled By:	ENG-TECH (Paula Chagas)	Sampling Method:	Auger cutting	Source:	Project site
Date Sampled:	Dec 2/19	Date Received:	Dec 2/19	Date Tested:	-
Method:	<input checked="" type="checkbox"/> A (Multipoint)	<input type="checkbox"/> B (Single Point)	Drying Method: <input checked="" type="checkbox"/> Air <input type="checkbox"/> Oven		



Liquid Limit (%): 0.0 Plastic Limit (%): 19.0 Plasticity Index (%): -19.0

Estimated Percentage of sand/gravel particles retained on 0.425mm sieve: 41.2

Classification:


ASTM D2487: ML sandy silt, ASTM D3282: A-2-4 (0)

Comments:

Non-plastic. As received moisture content: 11.2%.

Email: mark.vogt@wsp.com

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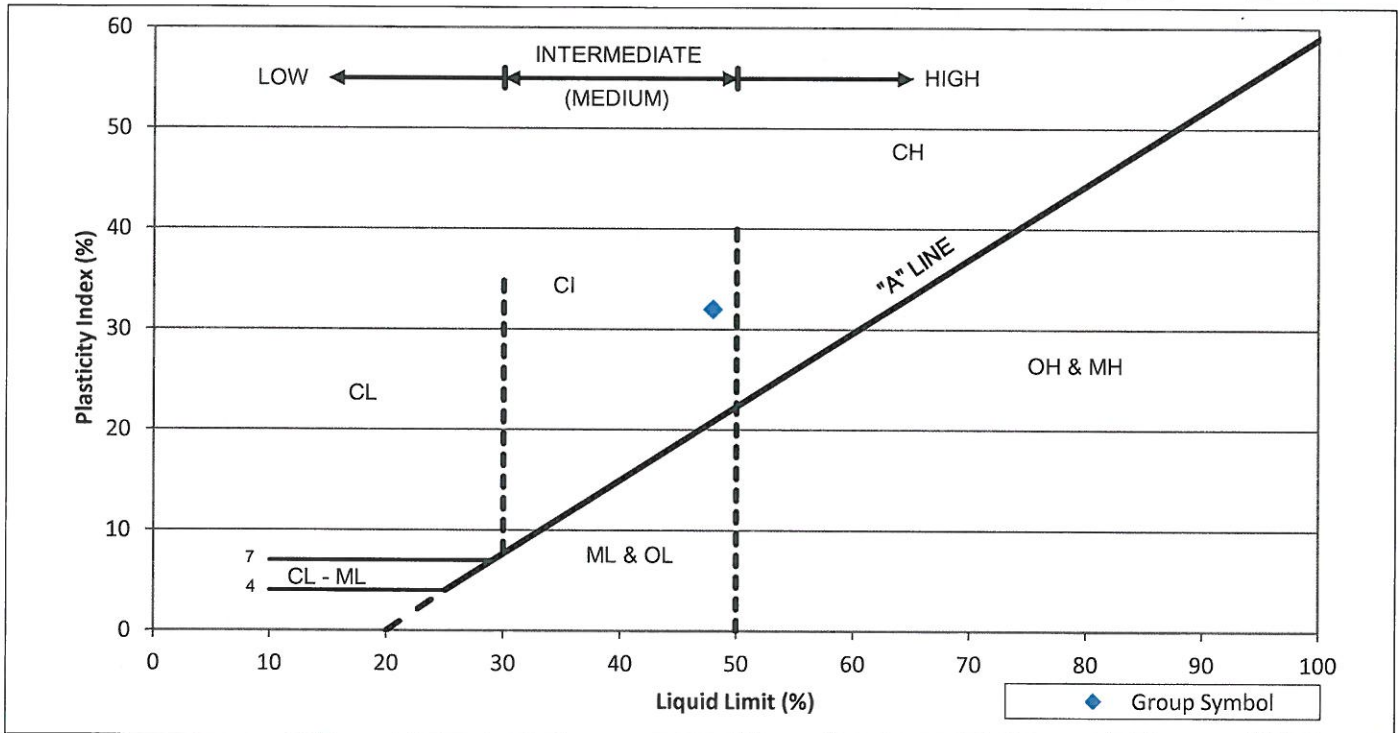
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File No.: 19-035-01
 Ref. No.: 19-35-1-8

Attention: Mark Vogt, M.Sc., P.Eng.

Project: MARYLAND STREET PAVEMENT RENEWALS, WINNIPEG, MANITOBA

Test Hole No.:	4	Sample No.:	3	Depth:	0.7 m
Sampled By:	ENG-TECH (Paula Chagas)	Sampling Method:	Auger cutting	Source:	Project site
Date Sampled:	Dec 2/19	Date Received:	Dec 2/19	Date Tested:	Dec 19/19
Method:	<input checked="" type="checkbox"/> A (Multipoint)	<input type="checkbox"/> B (Single Point)	Drying Method: <input checked="" type="checkbox"/> Air <input type="checkbox"/> Oven		



Liquid Limit (%): 48 Plastic Limit (%): 16 Plasticity Index (%): 32

Estimated Percentage of sand/gravel particles retained on 0.425mm sieve: 1.5

Classification:
 ASTM D2487: CL, lean clay; ASTM D3282: A-7-6 (32)

Comments:
 As received moisture content: 23.2%.

Email: mark.vogt@wsp.com

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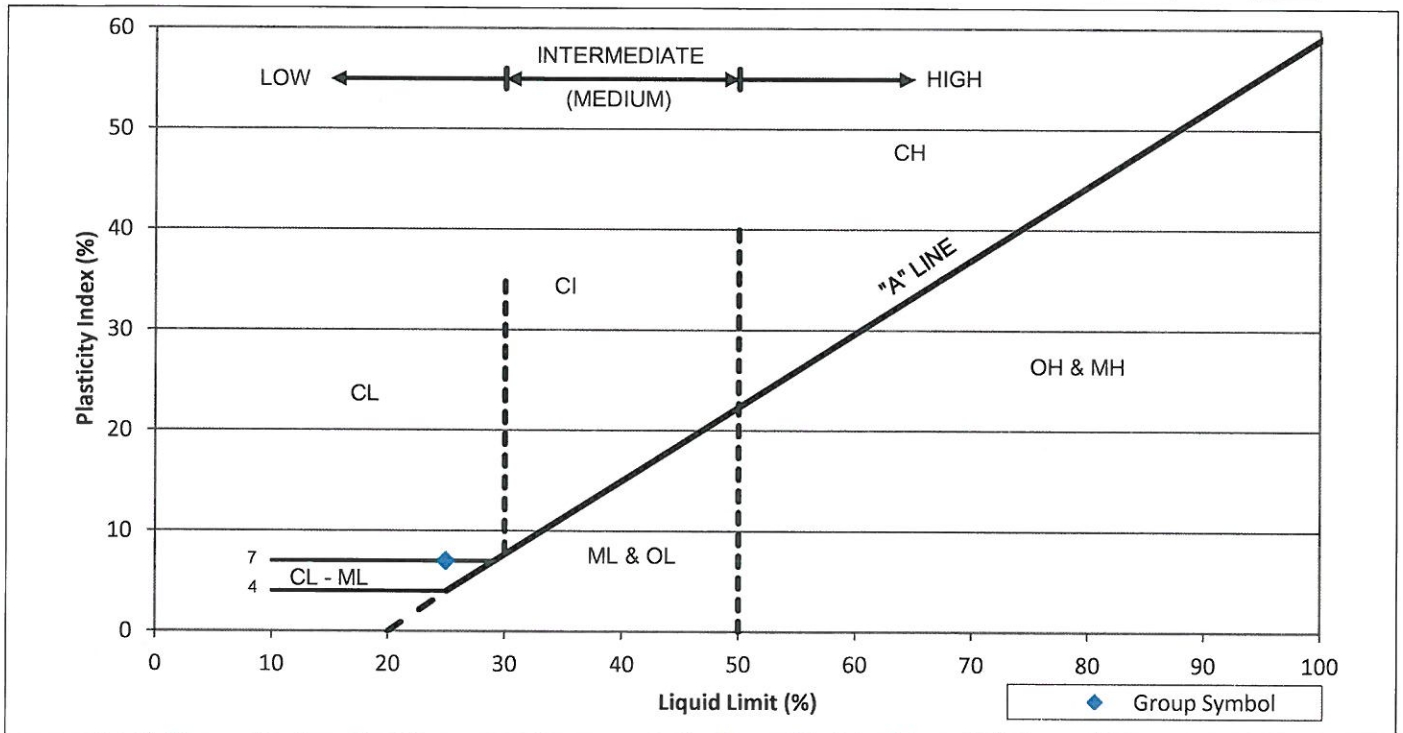
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File No.: 19-035-01
Ref. No.: 19-35-1-10

Attention: Mark Vogt, M.Sc., P.Eng.

Project: MARYLAND STREET PAVEMENT RENEWALS, WINNIPEG, MANITOBA

Test Hole No.: 4	Sample No.: 5	Depth: 1.5 m
Sampled By: ENG-TECH (Paula Chagas)	Sampling Method: Auger cutting	Source: Project site
Date Sampled: Dec 2/19	Date Received: Dec 2/19	Date Tested: Dec 19/19
Method: <input checked="" type="checkbox"/> A (Multipoint) <input type="checkbox"/> B (Single Point)	Drying Method: <input checked="" type="checkbox"/> Air <input type="checkbox"/> Oven	



Liquid Limit (%): 25 Plastic Limit (%): 18 Plasticity Index (%): 7

Estimated Percentage of sand/gravel particles retained on 0.425mm sieve: 0.9

Classification:


ASTM D2487: CL-ML, silty clay; ASTM D3282: A-4 (5)

Comments:

As received moisture content: 23.2%.

Email: mark.vogt@wsp.com

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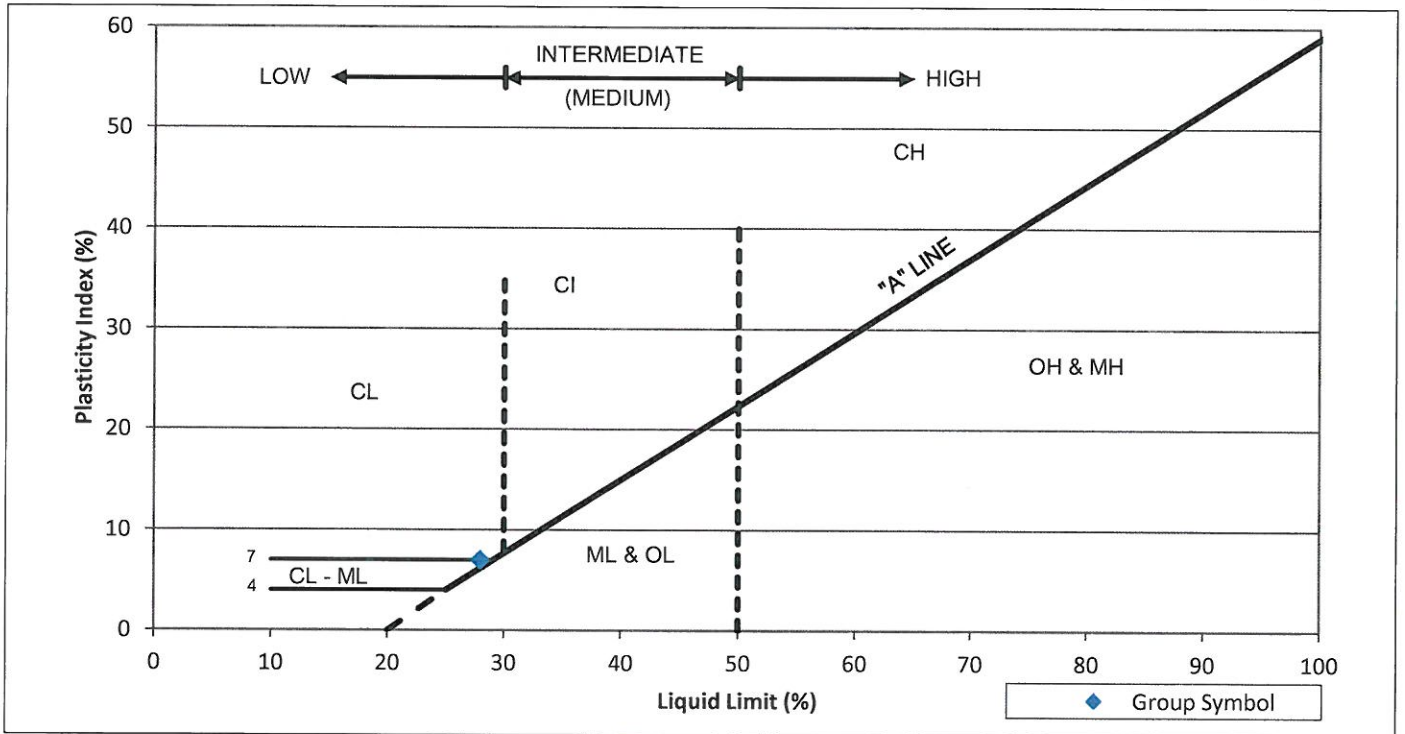
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File No.: 19-035-01
Ref. No.: 19-35-1-12

Attention: Mark Vogt, M.Sc., P.Eng.

Project: MARYLAND STREET PAVEMENT RENEWALS, WINNIPEG, MANITOBA

Test Hole No.:	5	Sample No.:	1	Depth:	0.1 m
Sampled By:	ENG-TECH (Paula Chagas)	Sampling Method:	Auger cutting	Source:	Project site
Date Sampled:	Dec 2/19	Date Received:	Dec 2/19	Date Tested:	Dec 19/19
Method:	<input checked="" type="checkbox"/> A (Multipoint)	<input type="checkbox"/> B (Single Point)	Drying Method: <input checked="" type="checkbox"/> Air <input type="checkbox"/> Oven		



Liquid Limit (%): 28 Plastic Limit (%): 21 Plasticity Index (%): 7

Estimated Percentage of sand/gravel particles retained on 0.425mm sieve: 61.9

Classification:


ASTM D2487: SC, clayey sand with gravel; ASTM 3282: A-4 (0)

Comments:

As received moisture content: 9.6%.

Email: mark.vogt@wsp.com

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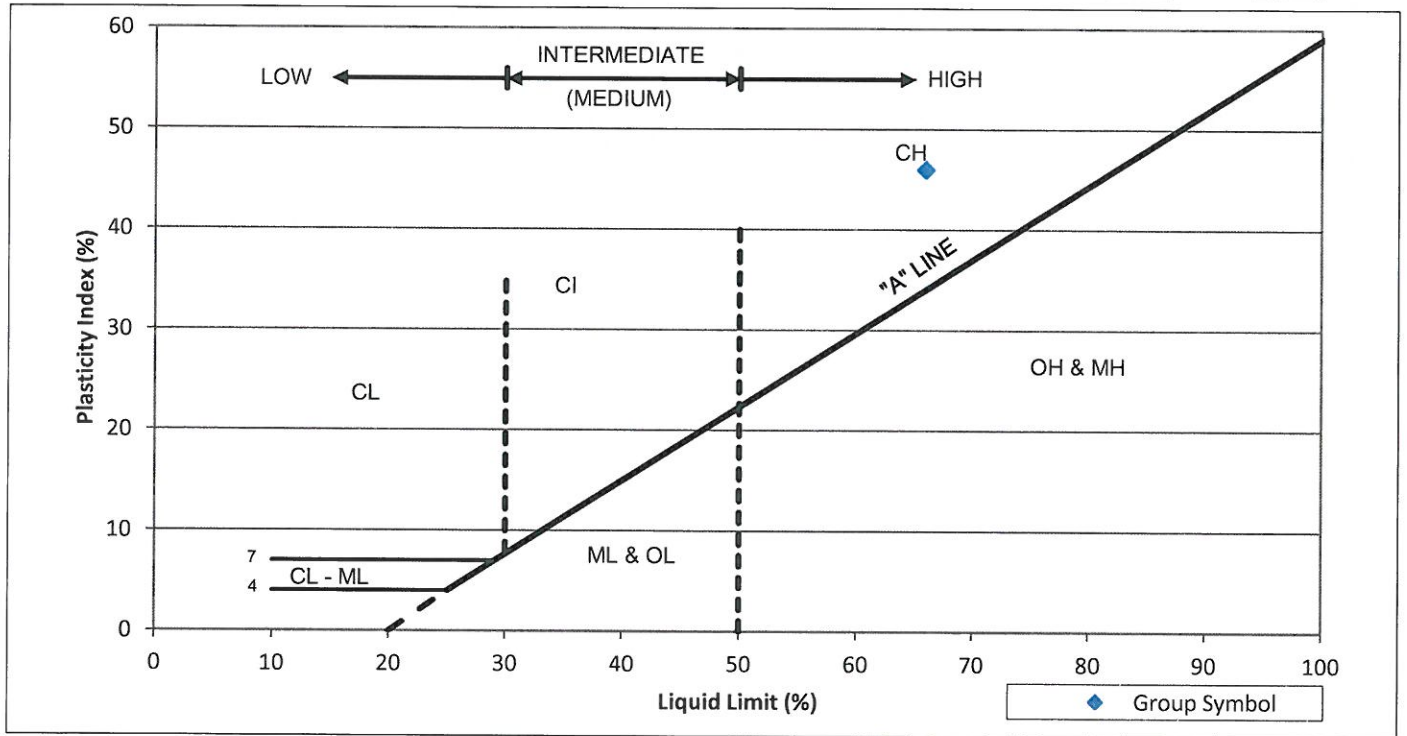
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File No.: 19-035-01
Ref. No.: 19-35-1-14

Attention: Mark Vogt, M.Sc., P.Eng.

Project: MARYLAND AVENUE PAVEMENT RENEWALS, WINNIPEG, MANITOBA

Test Hole No.: 5	Sample No.: 4	Depth: 1.1 m
Sampled By: ENG-TECH (Paula Chagas)	Sampling Method: Auger cutting	Source: Project site
Date Sampled: Dec 2/19	Date Received: Dec 2/19	Date Tested: Dec 19/19
Method: <input checked="" type="checkbox"/> A (Multipoint) <input type="checkbox"/> B (Single Point)	Drying Method: <input checked="" type="checkbox"/> Air <input type="checkbox"/> Oven	



Liquid Limit (%): 66 Plastic Limit (%): 20 Plasticity Index (%): 46

Estimated Percentage of sand/gravel particles retained on 0.425mm sieve: -

Classification:


ASTM D2487: CH, fat clay, ASTM D3282: A-7-6 (49)

Comments:

As received moisture content: 30.2%.

Email: mark.vogt@wsp.com

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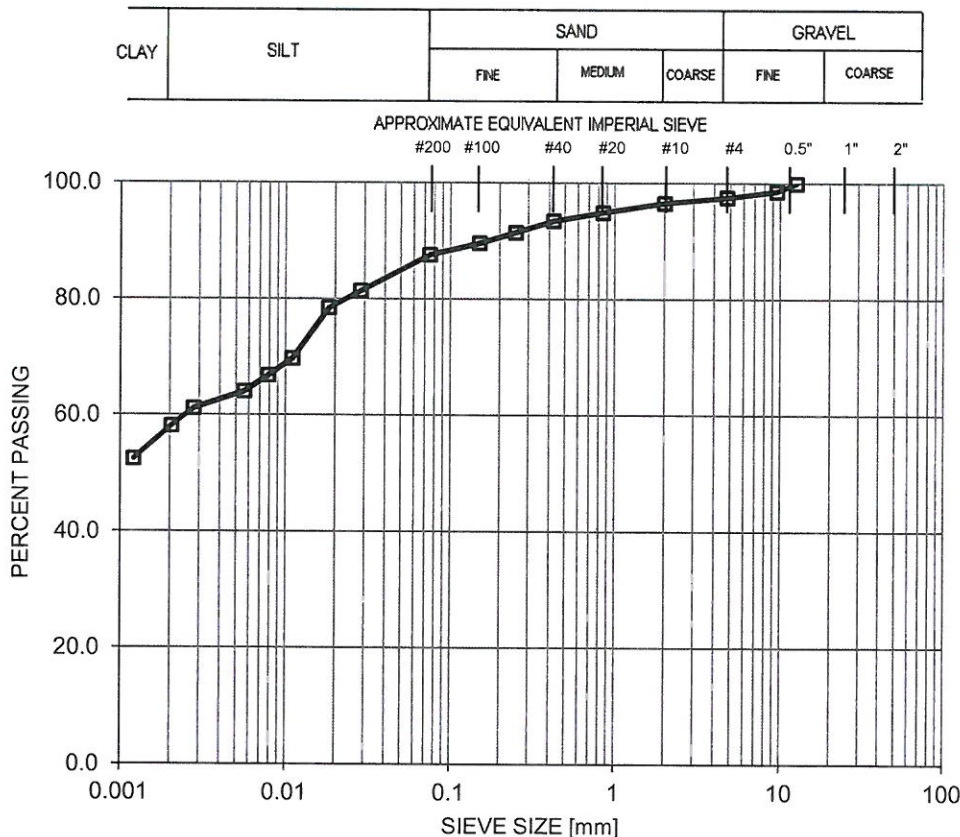
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Ref. No.: 19-35-1-3

Attention: Mark Vogt, M.Sc., P. Eng.

Project: MARYLAND STREET PAVEMENT RENEWALS, WINNIPEG, MANITOBA

Test Hole No.: 2 Sample No.: 3 Depth: 0.7 m
 Sampled By: ENG-TECH (Paula Chagas) Sampling Method: Grab Source: Project site
 Date Sampled: Dec 2/19 Date Received: Dec 2/19 Date Tested: Dec 18/19
 Dispersion Device: Apparatus A: Humboldt Mechanical Analysis Stirrer Dispersion Time (min.): 1



SIEVE SIZE (mm)	PERCENT PASSING
12.5	100.0
9.5	98.6
4.75	97.5
2.0	96.6
0.850	94.9
0.425	93.5
0.250	91.5
0.150	89.6
0.075	87.6
0.028	81.4
0.018	78.5
0.011	69.7
0.008	66.8
0.006	64.1
0.003	61.2
0.002	58.1
0.001	52.5

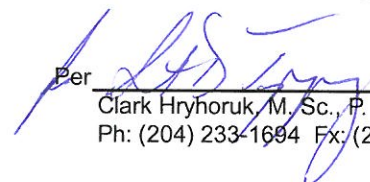
Percent of: GRAVEL (2.5 %), SAND (9.9 %), SILT (29.7 %), CLAY (57.9 %)

Sample Description: ASTM D2487: CH, fat clay
ASTM D3282: A-7-6 (47)

Comments: Insitu Moisture content is 35.3%.

Email: mark.vogt@wsp.com

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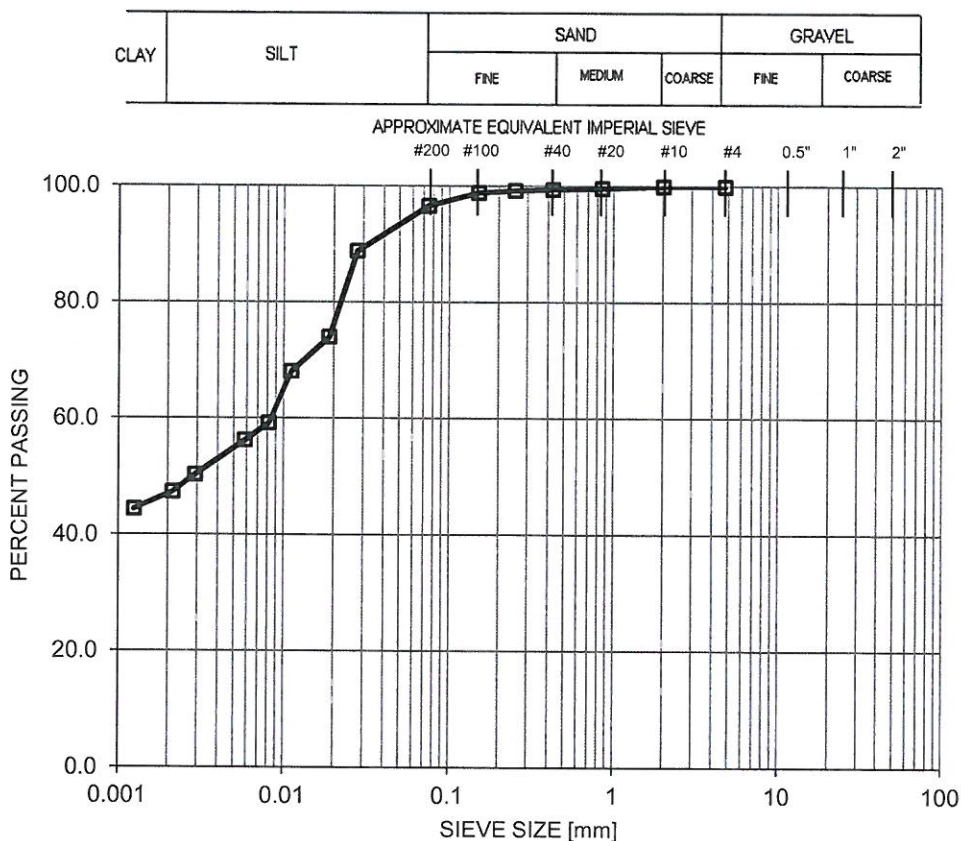
File No.: 19-035-01

Ref. No.: 19-35-1-5

Attention: Mark Vogt, M.Sc., P. Eng.

Project: MARYLAND STREET PAVEMENT RENEWALS, WINNIPEG, MANITOBA

Test Hole No.: 2 Sample No.: 6 Depth: 2.0 m
 Sampled By: ENG-TECH (Paula Chagas) Sampling Method: Grab Source: Project site
 Date Sampled: Dec 2/19 Date Received: Dec 2/19 Date Tested: Dec 18/19
 Dispersion Device: Apparatus A: Humboldt Mechanical Analysis Stirrer Dispersion Time (min.): 1



SIEVE SIZE (mm)	PERCENT PASSING
4.75	100.0
2.0	100.0
0.850	99.6
0.425	99.4
0.250	99.3
0.150	98.9
0.075	96.6
0.028	88.8
0.019	74.0
0.011	68.1
0.008	59.2
0.006	56.2
0.003	50.3
0.002	47.4
0.001	44.4

Percent of: GRAVEL (0.0 %), SAND (3.4 %), SILT (49.6 %), CLAY (47.0 %)

Sample Description: ASTM D2487: CL, lean clay
 ASTM D3282: A-7-6 (26)

Comments: Insitu Moisture content is 32.0%.

Email: mark.vogt@wsp.com

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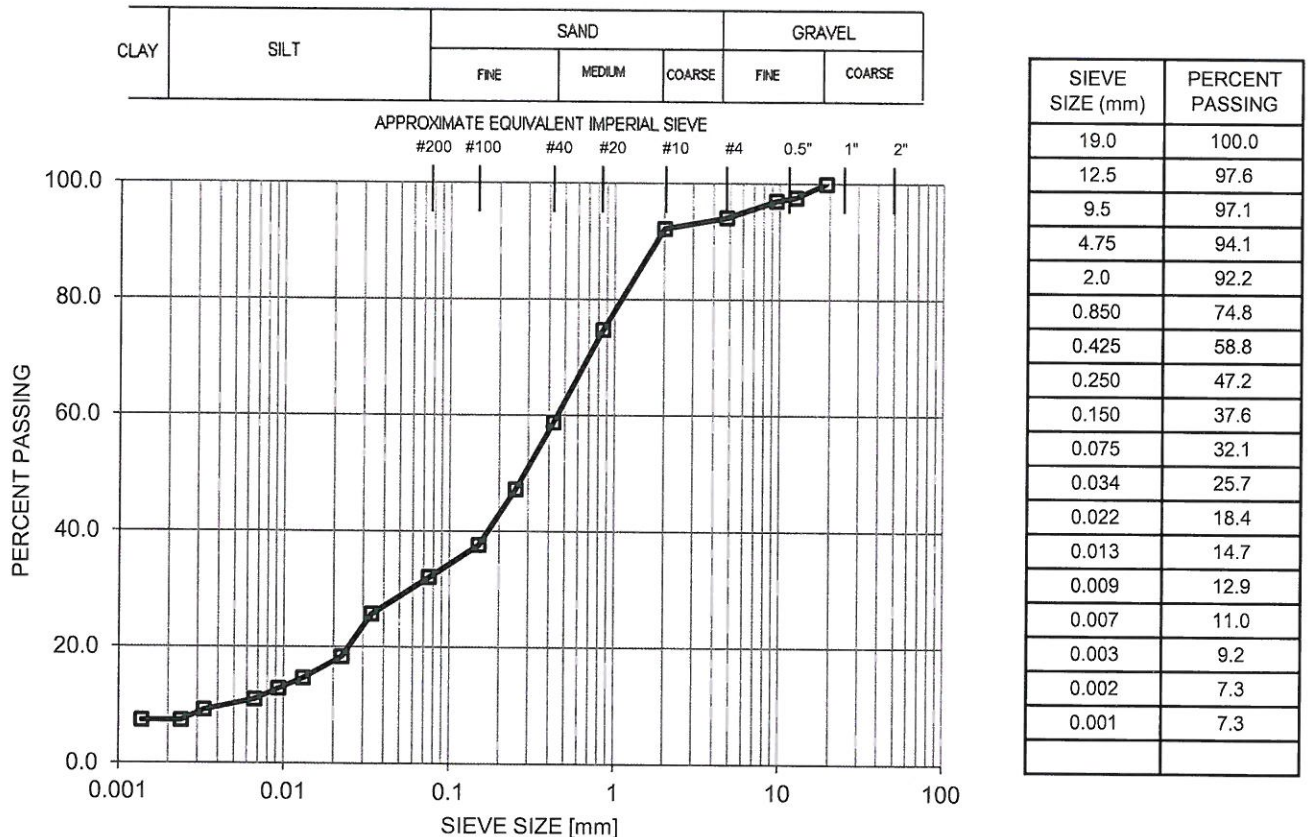
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Ref. No.: 19-35-1-7

Attention: Mark Vogt, M.Sc., P. Eng.

Project: MARYLAND STREET PAVEMENT RENEWALS, WINNIPEG, MANITOBA

Test Hole No. 3 **Sample No.** 1 **Depth:** 0.1 m
Sample By: ENG-TECH (Paula Chagas) **Sampling Method:** Grab **Source:** Project site
Date Sampled: Dec 2/19 **Date Received:** Dec 2/19 **Date Tested:** Dec 18/19
Dispersion Device: Apparatus A: Humboldt Mechanical Analysis Stirrer **Dispersion Time (min.):** 1




Percent of: GRAVEL (5.9 %), SAND (62.0 %), SILT (24.8 %), CLAY (7.3 %)

Sample Description: ASTM D247: ML sandy silt
 ASTM D3282: A-2-4 (0)

Comments: Insitu Moisture content is 11.2%.

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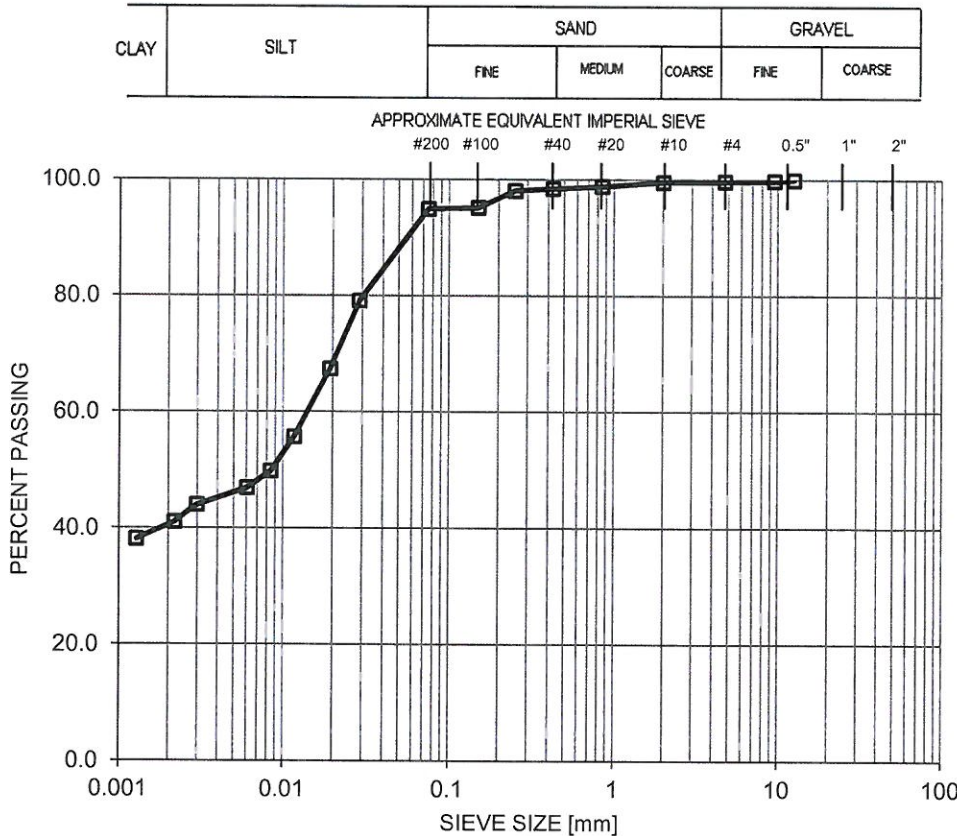
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Ref. No.: 19-35-1-9

Attention: Mark Vogt, M.Sc., P. Eng.

Project: MARYLAND STREET PAVEMENT RENEWALS, WINNIPEG, MANITOBA

Test Hole No.: 4 Sample No.: 3 Depth: 0.7 m
 Sampled By: ENG-TECH (Paula Chagas) Sampling Method: Grab Source: Project site
 Date Sampled: Dec 2/19 Date Received: Dec 2/19 Date Tested: Dec 17/19
 Dispersion Device: Apparatus A: Humboldt Mechanical Analysis Stirrer Dispersion Time (min.): 1



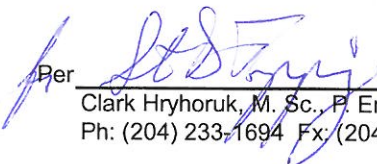
Percent of: GRAVEL (0.3 %), SAND (4.7 %), SILT (54.4 %), CLAY (40.6 %)

Sample Description: ASTM D2487: CL, lean clay
 ASTM D3282: A-7-6 (32)

Comments: Insitu Moisture content is 23.2%.

Email: mark.vogt@wsp.com

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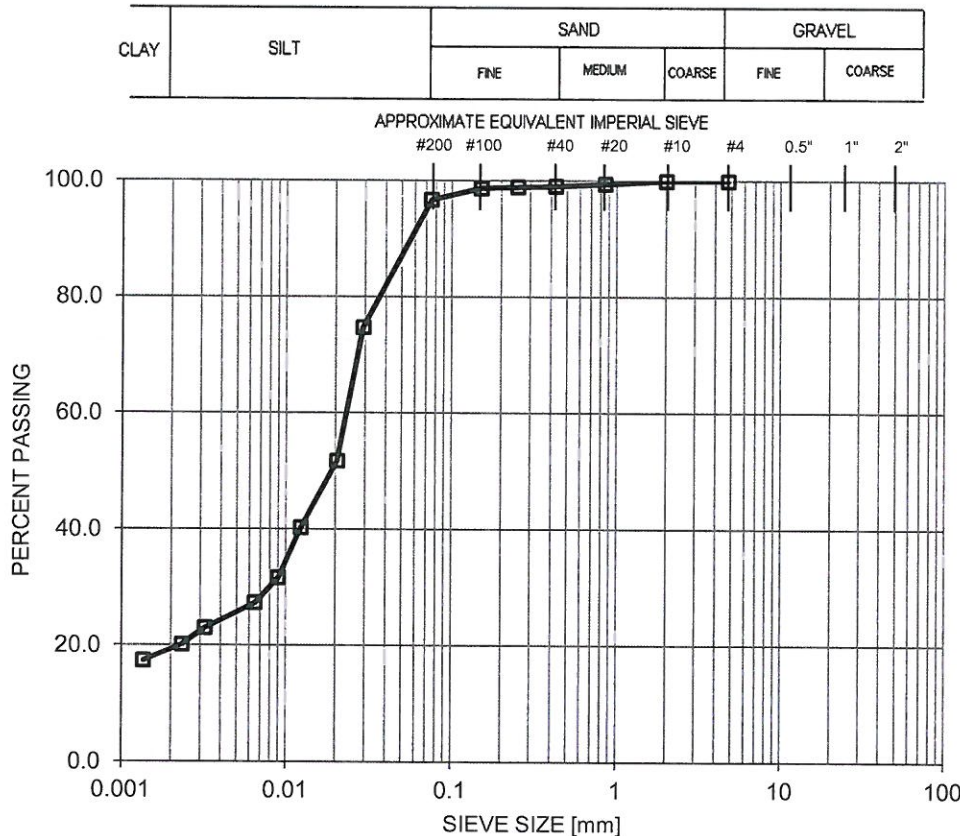
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Ref. No.: 19-35-1-11

Attention: Mark Vogt, M.Sc., P. Eng.

Project: MARYLAND STREET PAVEMENT RENEWALS, WINNIPEG, MANITOBA

Test Hole No.: 4 Sample No.: 5 Depth: 1.5 m
 Sampled By: ENG-TECH (Paula Chagas) Sampling Method: Grab Source: Project site
 Date Sampled: Dec 2/19 Date Received: Dec 2/19 Date Tested: Dec 18/19
 Dispersion Device: Apparatus A: Humboldt Mechanical Analysis Stirrer Dispersion Time (min.): 1



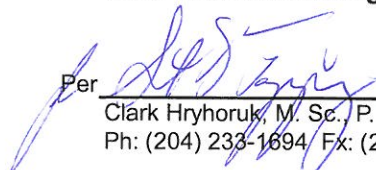
Percent of: GRAVEL (0.0 %), SAND (3.3 %), SILT (77.3 %), CLAY (19.4 %)

Sample Description: ASTM D2487: CL-ML, silty clay
 ASTM D3282: A-4 (0)

Comments: Insitu Moisture content is 23.2%.

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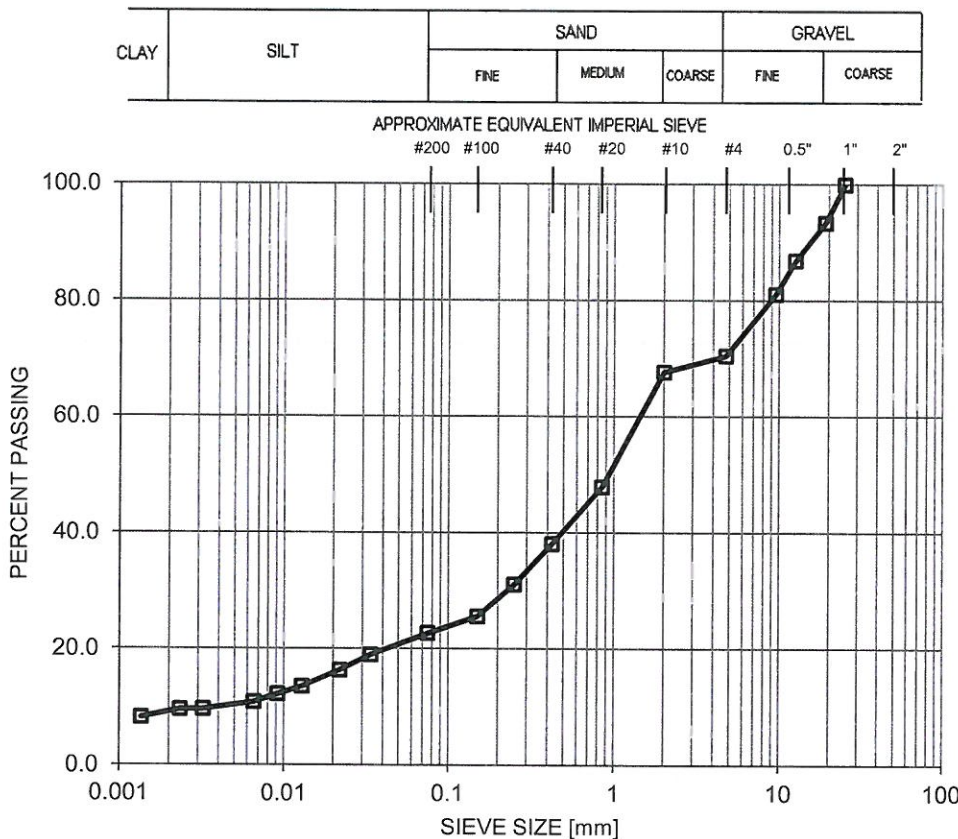
File No.: 19-035-01

Ref. No.: 19-35-1-13

Attention: Mark Vogt, M.Sc., P. Eng.

Project: MARYLAND STREET PAVEMENT RENEWALS, WINNIPEG, MANITOBA

Test Hole No.: 5 Sample No.: 1 Depth: 0.1 m
 Sampled By: ENG-TECH (Paula Chagas) Sampling Method: Grab Source: Project site
 Date Sampled: Dec 2/19 Date Received: Dec 2/19 Date Tested: Dec 18/19
 Dispersion Device: Apparatus A: Humboldt Mechanical Analysis Stirrer Dispersion Time (min.): 1



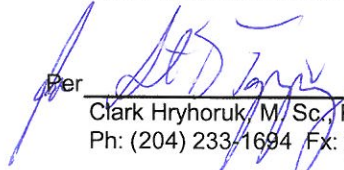
Percent of: GRAVEL (29.5 %), SAND (47.8 %), SILT (13.5 %), CLAY (9.2 %)

Sample Description: ASTM D2487: SC, clayey sand with gravel
 ASTM D3282: A-4 (0)

Comments: Insitu Moisture content is 9.6%.

Email: mark.vogt@wsp.com

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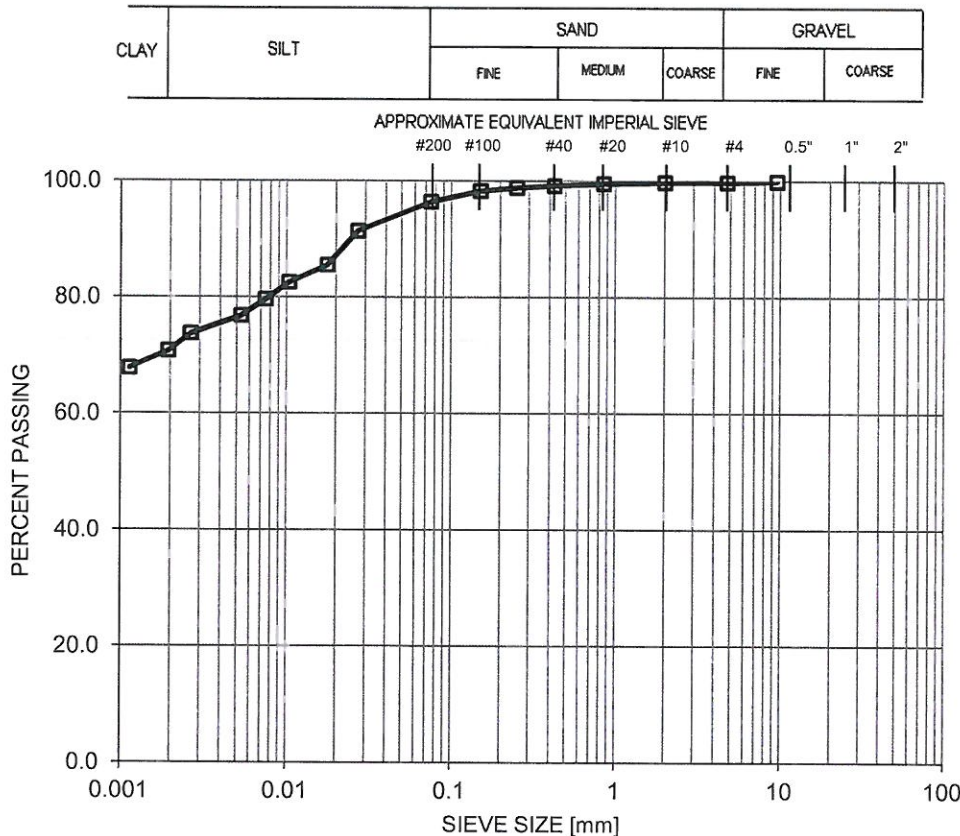
File No.: 19-035-01

Ref. No.: 19-35-1-15

Attention: Mark Vogt, M.Sc., P. Eng.

Project: MARYLAND STREET PAVEMENT RENEWALS, WINNIPEG, MANITOBA

Test Hole No.: 5 Sample No.: 4 Depth: 1.1 m
 Sampled By: ENG-TECH (Paula Chagas) Sampling Method: Grab Source: Project site
 Date Sampled: Dec 2/19 Date Received: Dec 2/19 Date Tested: Dec 19/19
 Dispersion Device: Apparatus A: Humboldt Mechanical Analysis Stirrer Dispersion Time (min.): 1



Percent of: GRAVEL (0.2 %), SAND (3.3 %), SILT (25.4 %), CLAY (71.1 %)
 Sample Description: ASTM D2487: CH, fat clay
 ASTM D3282: A-7-6 (49)
 Comments: Insitu Moisture content is 30.2%.

Email: mark.vogt@wsp.com

ENG-TECH Consulting Limited

Per Clark Hryhoruk, M. Sc., P. Eng. President
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File No.: 19-035-01
 Ref. No.: 19-35-1-16

Attention: Mark Vogt, M.Sc., P.Eng.

Project: GEOTECHNICAL INVESTIGATION - MARYLAND STREET PAVEMENT RENEWALS

Compaction Standard Method ASTM D698 ASTM D1557

Preparation Method: Moist

Dry Density kg/m ³	1463	1542	1529	1465	
Moisture Content (%)	24.0	26.1	27.9	30.0	

Compaction Method: Manual

Maximum Dry Density = 1546 kg/m³ Corrected = - kg/m
 Optimum Moisture = 26.6 % Corrected = - %

Date Sampled: Dec 2/19

Sampled By: ENG-TECH (Paula Chagas)

Date Received: Dec 2/19

Date Tested: Dec 16/19

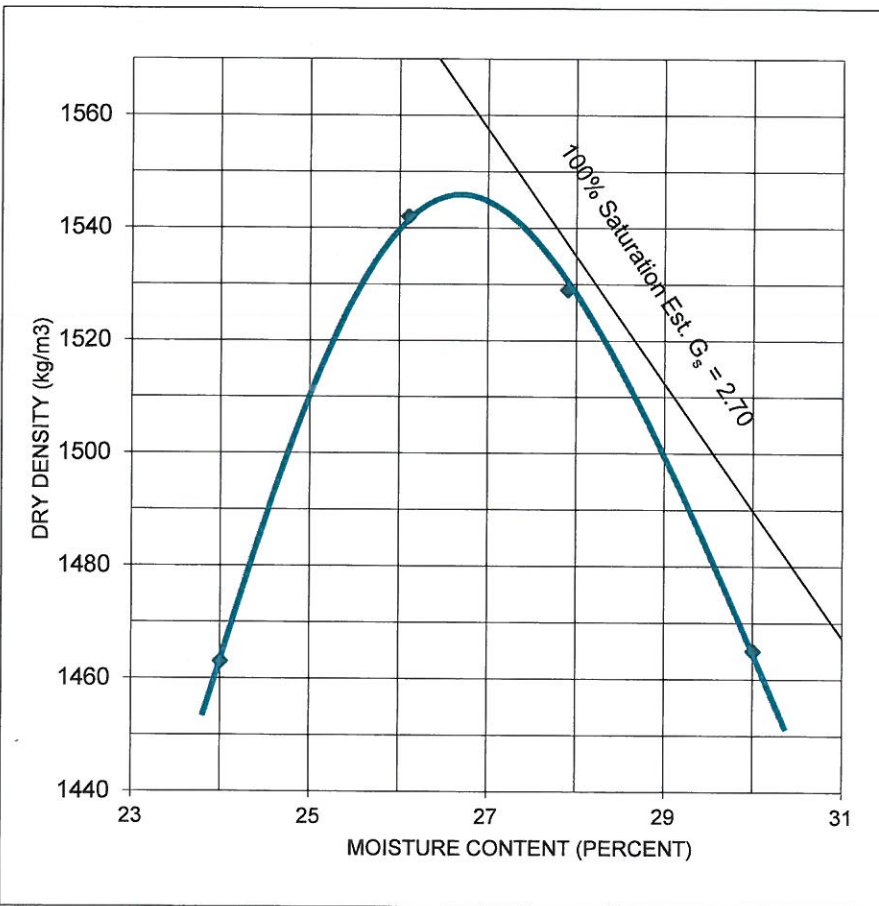
As Received Moisture Content (%): 18.8

Test Method: A

Material Oversize
 4.75 mm = 1.9 %
 19.0 mm = - %

Source:
 Composite sample from TH1 to TH5, between 1.0m and 1.5m depths

Soil Description:
 CI, clay, medium plastic, silt sizes, trace sand, trace gravel



Comments:

ENG-TECH Consulting Limited

Per

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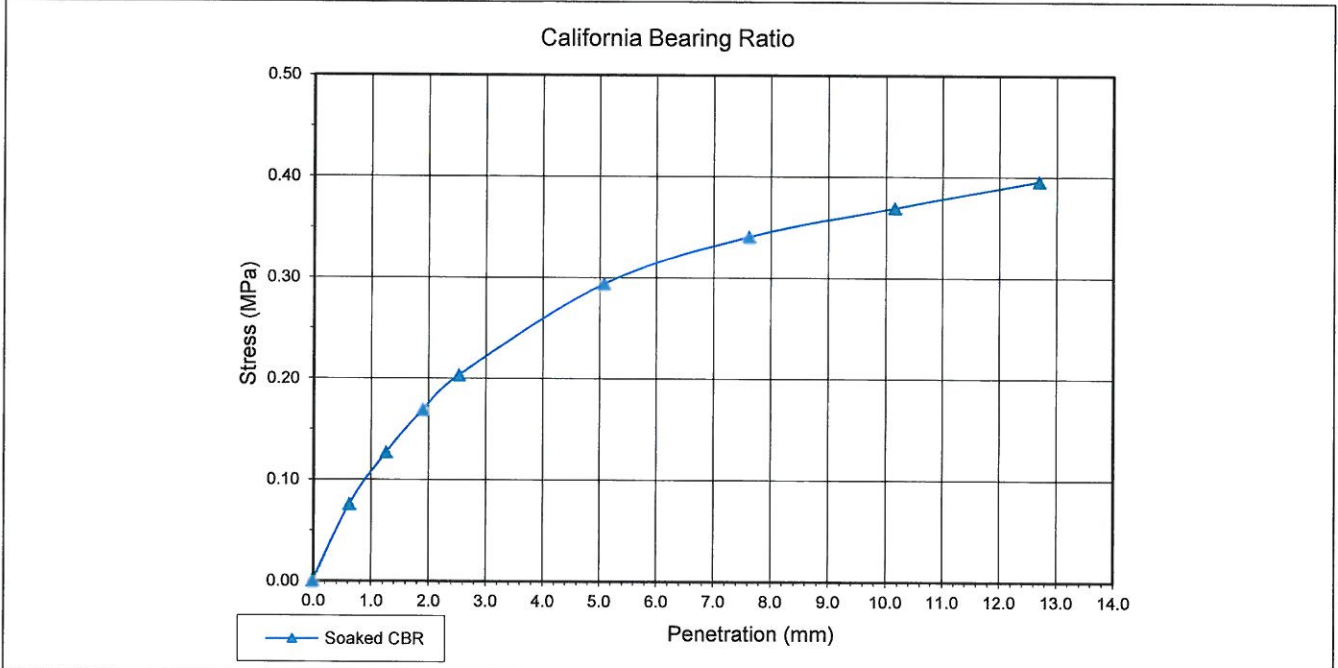
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File No.: 19-035-01
 Ref. No.: 19-35-1-17

Attention: Mark Vogt, M.Sc., P. Eng.
Project: GEOTECHNICAL INVESTIGATION - MARYLAND STREET RENEWALS, WINNIPEG, MANITOBA

Source:	Composite sample from TH1 to TH5, between 1.0 and 1.5 meter depths	Date Sampled:	Dec 2/19
Sample Type:	Cl, clay, medium plastic, silt sizes, trace sand, trace gravel	Date Received:	Dec 2/19
Sampled By:	ENG-TECH (Paula Chagas)	Date Tested:	Dec 20/19



Test Data			
Compaction Standard Method:	<input checked="" type="checkbox"/> ASTM D698	<input type="checkbox"/> ASTM D1557	
Dry Density; Unsoaked:	- kg/m ³	Soaked:	1546 kg/m ³
As Compacted Moisture Content; Unsoaked:	- %	Soaked:	26.0 %
Moisture Content; Top 25 mm Soaked:	31.4 %		
CBR Values:	- % @ 2.54mm (0.1in)		- % @ 5.08mm (0.2in)
CBR Values after 96 Hours Soaking:	2.95 % @ 2.54mm (0.1in)		2.85 % @ 5.08mm (0.2in)
Sample Expansion:	2.7 % of Initial Height	Oversize Correction:	-- % Surcharge Mass: 4.55 kg

Comments: The test was conducted at 100% standard compactive effort. Test was not corrected for oversize present in the original sample

Email: mark.vogt@wsp.com

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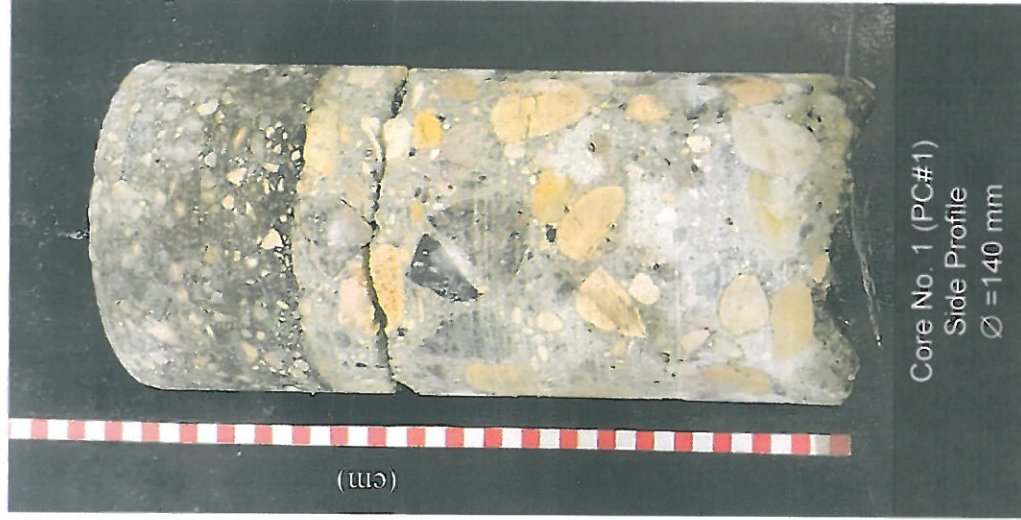
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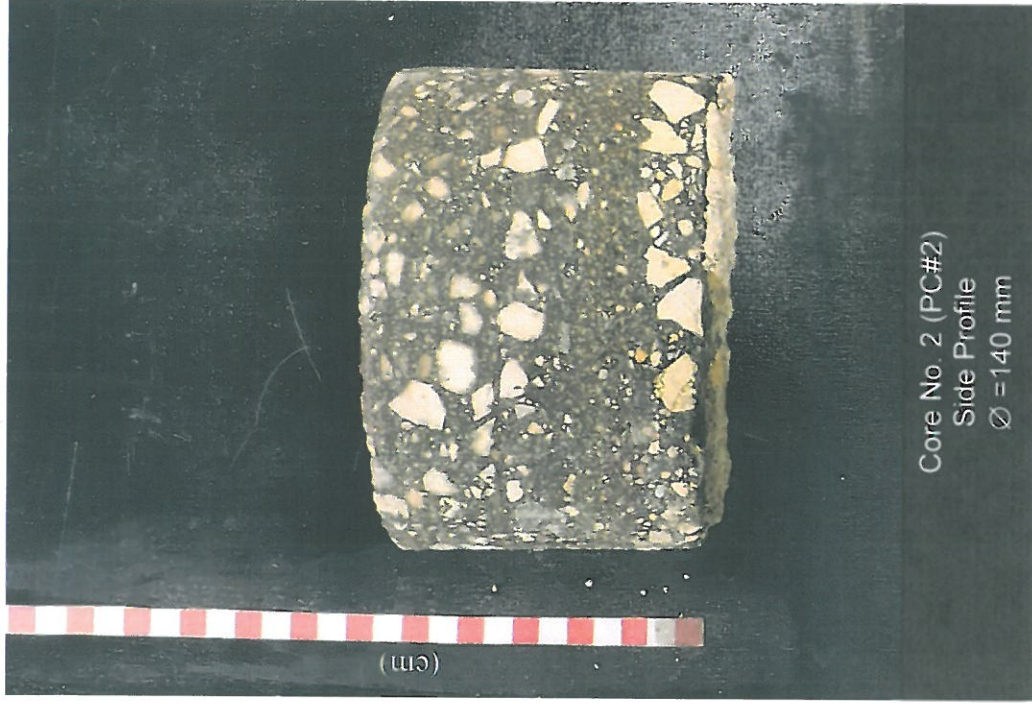
Enclosure: Moisture –Density Relationship Ref. No. 19-35-1-16



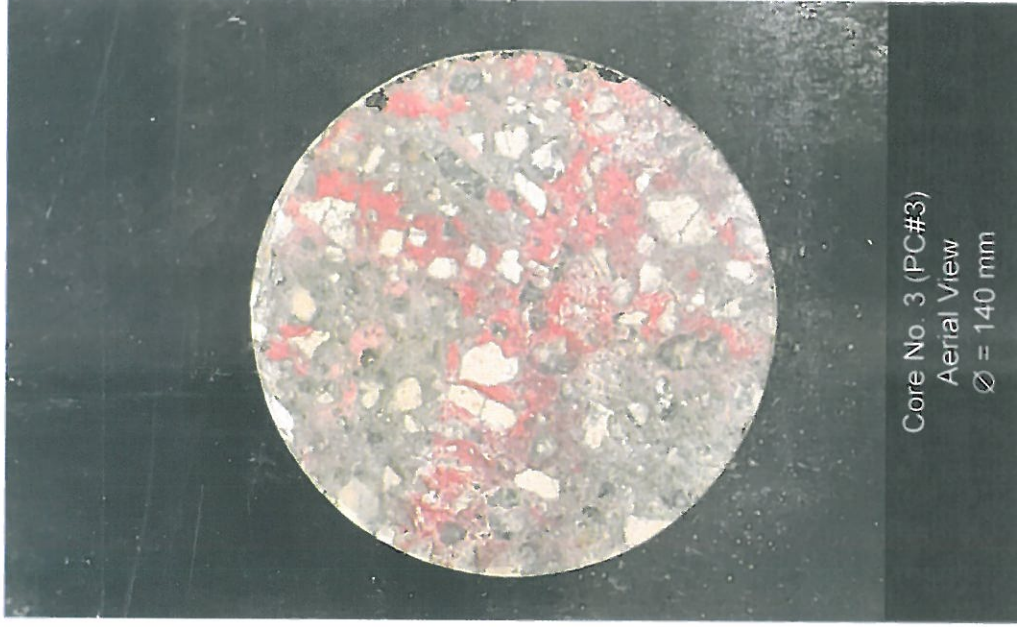
Photograph 1: Intact specimens from Maryland Street



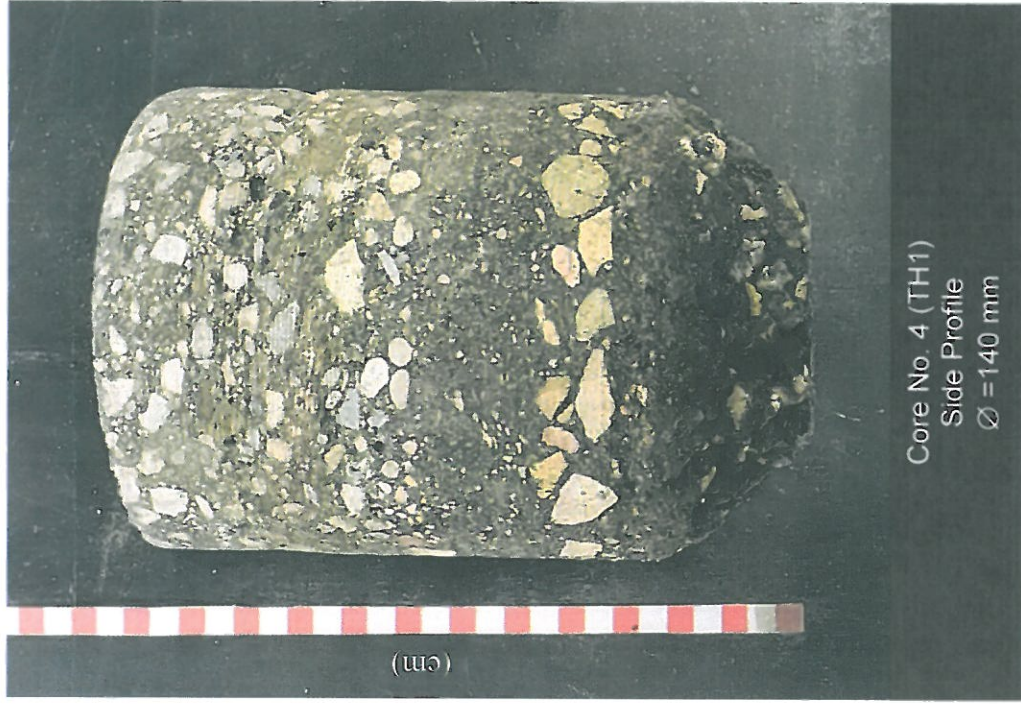
Photograph 2: Intact specimens from Maryland Street



Photograph 3: Intact specimens from Maryland Street



Photograph 4: Intact specimens from Maryland Street



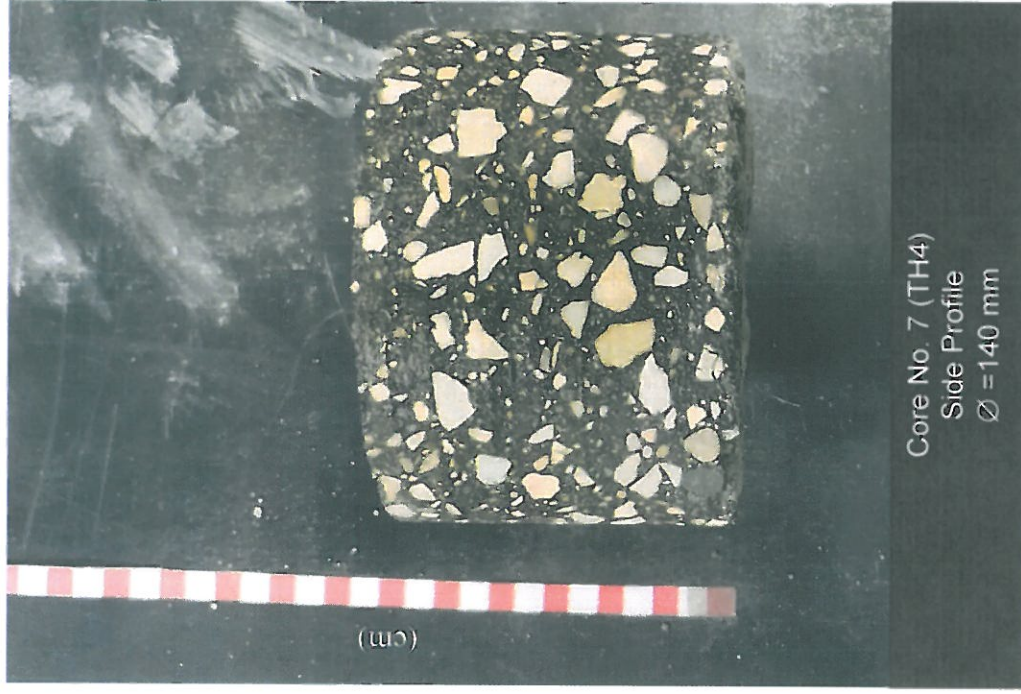
Photograph 5: Intact specimens from Maryland Street



Photograph 6: Intact specimens from Maryland Street



Photograph 7: Intact specimens from Maryland Street



Photograph 8: Intact specimens from Maryland Street

