

APPENDIX 'A'

GEOTECHNICAL REPORT



**2012 City of Winnipeg Regional Street
Renewals — PW File #: 12-RL-01
Fort Street Reconstruction**

**Sub-Surface Investigation Report
April 2012**

2012 City of Winnipeg Regional Street Renewals Fort Street Reconstruction – PW File #: 12-RL-01

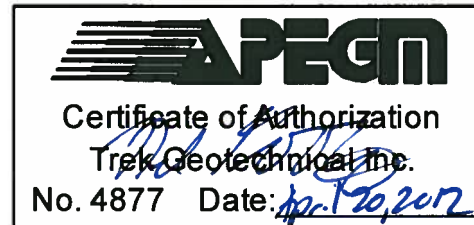
Sub-Surface Investigation Report
April 2012

Our File No. 0035 005 00

Prepared for:

Morrison Hershfield
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Attn: Ron Bruce, P.Eng.



Prepared by:

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Per:

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Geotechnical Engineer, Principal



Table of Contents

1.0	Introduction	1
2.0	Sub-Surface Investigation and Laboratory Program	1

List of Figures

Figure 01 Test Hole Location Plan – Fort Street from Graham Avenue to Portage Avenue.

List of Appendices (Sub-Surface Information)

- Appendix A Test Hole Logs
- Appendix B Lab Testing Summary Tables and Lab Testing Results
- Appendix C Photographs of Pavement Core Samples

1.0 Introduction

This report summarizes the results of the sub-surface investigation completed for the proposed 2012 City of Winnipeg Regional Street Renewal (PW File #: 12-RL-01) of Fort Street between Graham Avenue and Portage Avenue. Information regarding the concrete, asphalt, road base for the existing road, and the soil stratigraphy beneath the pavement structure is provided.

2.0 Sub-Surface Investigation and Laboratory Program

A total of 5 test holes were drilled on Fort Street from Graham Avenue to Portage Avenue at the locations shown on Figure 01. The test holes were drilled in order to determine sub-surface conditions for design and reconstruction of the road segment.

The sub-surface investigation was conducted on March 28, 2012. The test holes were drilled to a depth of 3.1 m below road surface by Paddock Drilling Ltd. using their MP8 truck mounted drill rig equipped with 125 mm diameter solid stem augers. The pavement structure (asphalt or concrete) was cored by Quality Coring using a portable coring press equipped with a hollow 150 mm diameter diamond core drill bit. The sub-surface conditions were observed during drilling and visually classified by Stephen Renner of TREK Geotechnical Inc. (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). The results of the laboratory testing are included on the test hole logs in Appendix A. The laboratory testing results are also summarized and reported separately in Appendix B. Photos of the concrete and asphalt cores are included in Appendix C.

Test hole locations noted on the test hole logs and shown on Figure 01 are based on measured distances from the nearest curb and monument (i.e. light post, fire hydrant, catch basin, etc.).



Figures



0 10 20 30 40m
SCALE 1:1000

Morrison Hershfield
2012 City of Winnipeg Regional Street Renewals - PW File #:12-RL-01
Fort Street Reconstruction - Graham Avenue to Portage Avenue



Figure 01
Test Hole Location Plan



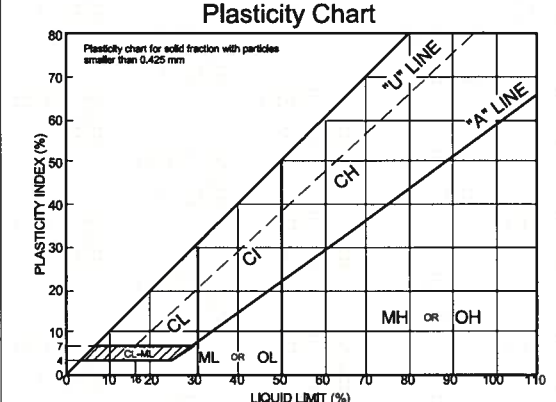
Appendix A

Test Hole Logs

GENERAL NOTES

- 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.
- 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.
- When the following classification terms are used in this report or test hole logs, the primary and secondary soil fractions may be visually estimated.

Major Divisions	USCS Classification	Symbols	Typical Names	Laboratory Classification Criteria		Particle Size	Material	
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)	GW	Well-graded gravels, gravel-sand mixtures, little or no fines	Determine percentages of sand and gravel from grain size curve, depending on percentage of fines (fraction smaller than No. 200 sieve) coarse-grained soils are classified as follows: Less than 5 percent..... GW, GP, SW, SP More than 12 percent..... GM, GC, SM, SC 6 to 12 percent..... Borderline cases requiring dual symbols*	$C_u = \frac{D_{60}}{D_{10}}$ greater than 4; $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ between 1 and 3	mm	ASTM Sieve sizes #10 to #4 #40 to #10 #200 to #40 < #200	
		GP	Poorly-graded gravels, gravel-sand mixtures, little or no fines					Not meeting all gradation requirements for GW
		Gravel with fines (Appreciable amount of fines)	GM		Silty gravels, gravel-sand-silt mixtures	Atterberg limits below "A" line or P.I. less than 4	Above "A" line with P.I. between 4 and 7 are borderline cases requiring use of dual symbols	
			GC		Clayey gravels, gravel-sand-silt mixtures	Atterberg limits above "A" line or P.I. greater than 7		
	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	mm	ASTM Sieve Sizes 2.00 to 4.75 0.425 to 2.00 0.075 to 0.425 < 0.075
			SP		Poorly-graded sands, gravelly sands, little or no fines			
		Sands with fines (Appreciable amount of fines)	SM		Silty sands, sand-silt mixtures		Atterberg limits below "A" line or P.I. less than 4	Above "A" line with P.I. between 4 and 7 are borderline cases requiring use of dual symbols
			SC		Clayey sands, sand-clay mixtures		Atterberg limits above "A" line or P.I. greater than 7	



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

Other Symbol Types

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

LEGEND OF ABBREVIATIONS AND SYMBOLS

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

FRACTION OF SECONDARY SOIL CONSTITUENTS ARE BASED ON THE FOLLOWING TERMINOLOGY

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

TERMS DESCRIBING CONSISTENCY OR COMPACTION CONDITION

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

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

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

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

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

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



Sub-Surface Log

Test Hole TH12-01

1 of 1

Client: Morrison Hershfield Project Number: 0035 005 00
 Project Name: 2012 City of Winnipeg Regional Street Renewals Location: Fort Street From Graham Avenue to Portage Avenue
 Contractor: Paddock Drilling Ltd. Ground Elevation: Not Surveyed
 Method: 125mm Solid Stem Auger, Acker MP8 Truck Mount Date Drilled: March 28, 2012

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

Particle Size Legend: Fines Clay Silt Sand Gravel Cobbles Boulders

Depth (m)	Soil Symbol	MATERIAL DESCRIPTION	Sample Type	Sample Number	Bulk Unit Wt (kN/m ³)		Undrained Shear Strength (kPa)
					16	17	
					Particle Size (%)		Test Type
					0	20	△ Torvane △
					40	60	⊕ Pocket Pen. ⊕
					80	100	⊠ Qu ⊠
					0	20	○ Field Vane ○
					40	60	
					80	100	
					0	50	
					100	150	
					200	250	
0.00		ASPHALT (64 mm thick)					
0.00		CONCRETE (152 mm thick)		C21			
0.00		SAND (Fill) - gravelly, some silt, trace clay, grey, moist, compact, well graded (fine grained sand to fine grained gravel) sub-rounded, "pit run"		G22	●		
0.00		SAND (Fill) - silty, some gravel (<20 mm diam.), trace to some clay		G23	●		
0.00		- light brown					
0.00		- dry, compact					
0.00		- well graded (fine grained sand to fine grained gravel)					
0.00		- carbonate (limestone)					
0.00		SAND (Fill) - some gravel (<20 mm diam.) trace to some clay, trace to some silt		G24	●		
0.00		- grey					
0.00		- moist, compact					
0.00		- well graded (fine grained sand to fine grained gravel)					
0.00		- sub-rounded					
0.00		- "pit run"					
0.00		SAND (Fill) - some gravel (<20 mm diam.) trace to some clay, trace to some silt		G25	●		
0.00		- grey					
0.00		- moist, compact					
0.00		- well graded (fine grained sand to fine grained gravel)					
0.00		- sub-rounded					
0.00		- "pit run"					
0.00		GRAVEL FILL - sandy (coarse grained), some silt, trace asphalt particles (<12.5 mm diam.)		G26	●		
0.00		- dark brown to black					
0.00		- dry, loose to compact					
0.00		- poorly graded (fine grained gravel)					
0.00		GRAVEL FILL - sandy (coarse grained), some silt, trace asphalt particles (<12.5 mm diam.)		G27	●		
0.00		- dark brown to black					
0.00		- dry, loose to compact					
0.00		- poorly graded (fine grained gravel)					
0.00		GRAVEL FILL - sandy (coarse grained), some silt, trace asphalt particles (<12.5 mm diam.)		G28	●		
0.00		- dark brown to black					
0.00		- dry, loose to compact					
0.00		- poorly graded (fine grained gravel)					
0.00		GRAVEL FILL - sandy (coarse grained), some silt, trace asphalt particles (<12.5 mm diam.)		G29	●		
0.00		- dark brown to black					
0.00		- dry, loose to compact					
0.00		- poorly graded (fine grained gravel)					

END OF TEST HOLE AT 2.7 m IN SAND

Notes:

1. Power Auger Refusal (PAR) at 2.7 m.
2. No sloughing or seepage observed.
3. Backfilled test hole with auger cuttings to ~1.0 m below top of pavement, bentonite pellets to 0.2 m below top of pavement, sand to 0.1 m below top of pavement and asphalt cold patch to top of pavement.
4. Test hole location 11.4 m south of cross walk pole at southwest corner of Portage Ave. and Fort St. intersection, 1.9 m east of west curb of Fort Street.

Logged By: Stephen Renner

Reviewed By: Nelson Ferreira

Project Engineer: Nelson Ferreira

SUB-SURFACE LOG 2012 REGIONAL STREET RENEWALS FORT STREET GPJ TREK GEOTECHNICAL GDT 4/20/12



Sub-Surface Log

Test Hole TH12-02

1 of 1

Client: Morrison Hershfield Project Number: 0035 005 00
 Project Name: 2012 City of Winnipeg Regional Street Renewals Location: Fort Street From Graham Avenue to Portage Avenue
 Contractor: Paddock Drilling Ltd. Ground Elevation: Not Surveyed
 Method: 125mm Solid Stem Auger, Acker MP8 Truck Mount Date Drilled: March 28, 2012

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

Particle Size Legend: Fines Clay Silt Sand Gravel Cobbles Boulders

Depth (m)	Soil Symbol	MATERIAL DESCRIPTION	Sample Type	Sample Number	Bulk Unit Wt (kN/m ³)		Undrained Shear Strength (kPa)
					16	17	
					Particle Size (%)		Test Type
					0	20	△ Torvane △
					40	60	⊕ Pocket Pen. ⊕
					80	100	⊠ Qu ⊠
					0	20	○ Field Vane ○
					40	60	
					80	100	
					0	50	
					100	150	
					200	250	
		ASPHALT (25 mm thick)		C11			
		CONCRETE (203 mm thick)		C12			
		SAND (Fill) - gravelly, some silt, trace clay, grey, moist, compact, well graded (fine grained sand to fine grained gravel), sub-rounded, "pit run"		G13	●		
0.5		SAND (Fill) - silty, some gravel (<20 mm diam.), trace to some clay - light brown - dry, compact - well graded (fine grained sand to fine grained gravel) - carbonate (limestone)		G14	●		
				G15	●		
1.0		SILT - some clay, grey, dry to moist, firm, low plasticity					
		CLAY - silty, brown, moist, stiff, high plasticity		G16	●		
		SILT - some clay - grey - moist, very soft to soft - low plasticity		G17	●		
1.5		CLAY - silty, trace silt inclusions (<10 mm diam.) - brown - moist, stiff to very stiff - high plasticity		G18	●		△ ⊕
2.0				G19	●		⊕ △
2.5							
3.0		- firm to stiff below 2.7 m		G20	●		⊕ △

END OF TEST HOLE AT 3.1 m IN CLAY
 Notes:
 1. No sloughing or seepage observed.
 2. Backfilled test hole with auger cuttings to ~1.0 m below top of pavement, bentonite pellets to 0.2 m below top of pavement, sand to 0.1 m below top of pavement and asphalt cold patch to top of pavement.
 3. Test hole location 13.6 m south of MTS manhole on west sidewalk of Fort Street, 4.3 m east of west curb of Fort Street.

SUB-SURFACE LOG 2012 REGIONAL STREET RENEWALS FORT STREET.GPJ TREK GEOTECHNICAL.GDT 4/20/12

Logged By: Stephen Renner Reviewed By: Nelson Ferreira Project Engineer: Nelson Ferreira



Sub-Surface Log

Test Hole TH12-03

1 of 1

Client: Morrison Hershfield Project Number: 0035 005 00
 Project Name: 2012 City of Winnipeg Regional Street Renewals Location: Fort Street From Graham Avenue to Portage Avenue
 Contractor: Paddock Drilling Ltd. Ground Elevation: Not Surveyed
 Method: 125mm Solid Stem Auger, Acker MP8 Truck Mount Date Drilled: March 28, 2012

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

Particle Size Legend: Fines Clay Silt Sand Gravel Cobbles Boulders

Depth (m)	Soil Symbol	MATERIAL DESCRIPTION	Sample Type	Sample Number	Bulk Unit Wt (kN/m ³)					Undrained Shear Strength (kPa)
					16	17	18	19	20	
0.0		ASPHALT (38 mm thick)								
0.0		CONCRETE (203 mm thick)		C39						
0.0		SAND (Fill) - gravelly, some silt, trace clay, grey, moist, compact, well graded (fine grained sand to fine grained gravel), sub-rounded, "pit run"		G40						
0.0		SAND (Fill) - silty, some gravel (<20 mm diam.), trace to some clay - light brown - dry to moist, compact - well graded (fine grained sand to fine grained gravel) - carbonate (limestone)		G41						
0.0				G42						
0.0				G43						
1.5		CLAY - silty - brown - moist, firm to stiff - high plasticity - stiff to very stiff below 1.7 m		G44						△+
1.5				G45						△ +
2.0				G46						△ +
2.5		SILT - trace clay - moist to wet, very soft to soft - low plasticity		G47						

END OF TEST HOLE AT 3.1 m IN CLAY

Notes:

1. No sloughing or seepage observed.
2. Backfilled test hole with auger cuttings to ~1.0 m below top of pavement, bentonite pellets to 0.2 m below top of pavement, sand to 0.1 m below top of pavement and asphalt cold patch to top of pavement.
3. Test hole location 3.4 m south of fire hydrant, 3.9 m west of east curb of Fort Street.

Logged By: Stephen Renner

Reviewed By: Nelson Ferreira

Project Engineer: Nelson Ferreira

SUB-SURFACE LOG 2012 REGIONAL STREET RENEWALS FORT STREET GPJ TREK GEOTECHNICAL GDT 4/2012



Sub-Surface Log

Test Hole TH12-04

1 of 1

Client: Morrison Hershfield Project Number: 0035 005 00
 Project Name: 2012 City of Winnipeg Regional Street Renewals Location: Fort Street From Graham Avenue to Portage Avenue
 Contractor: Paddock Drilling Ltd. Ground Elevation: Not Surveyed
 Method: 125mm Solid Stem Auger, Acker MP8 Truck Mount Date Drilled: March 28, 2012

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

Particle Size Legend: Fines Clay Silt Sand Gravel Cobbles Boulders

Depth (m)	Soil Symbol	MATERIAL DESCRIPTION	Sample Type	Sample Number	Bulk Unit Wt (kN/m ³)					Undrained Shear Strength (kPa)
					16	17	18	19	20	
0.00 - 0.03		ASPHALT (38 mm thick)		C1						
0.03 - 0.06		CONCRETE (184 mm thick)		C2						
0.06 - 0.40		SAND (Fill) - silty, some gravel (<20 mm diam.), trace to some clay - light brown - dry to moist, compact - well graded (fine grained sand to fine grained gravel) - carbonate (limestone)		G3	●					
0.40 - 0.60				G4	●					
0.60 - 1.40		SILT - clayey, sandy - grey, moist, firm to stiff, intermediate plasticity - some clay, light grey, soft, low plasticity below 0.9 m - moist to wet below 1.4 m		G5	●	■	■	■		
1.40 - 1.80				G6	●					
1.80 - 2.00				G7	●					
2.00 - 2.60		CLAY - silty - brown - moist, stiff to very stiff - high plasticity		G8	●					△
2.60 - 3.00		SILT - some clay, light grey, moist, soft, low plasticity		G9	●					
3.00 - 3.10		CLAY - silty, trace sulphates (<2 mm diam.) - brown - moist, stiff to very stiff - high plasticity - firm below 2.6 m		G10	●					△

END OF TEST HOLE AT 3.1 m IN CLAY
 Notes:
 1. No sloughing or seepage observed.
 2. Backfilled test hole with auger cuttings to ~1.0 m below top of pavement, bentonite pellets to 0.2 m below top of pavement, sand to 0.1 m below top of pavement and asphalt cold patch to top of pavement.
 3. Test hole location 6.5 m north of south catch basin on west side of road south of first alley north of Graham Avenue, 3.4 m east of west curb of Fort Street.

SUB-SURFACE LOG 2012 REGIONAL STREET RENEWALS FORT STREET.GPJ TREK GEOTECHNICAL.GDT 4/20/12

Logged By: Stephen Renner Reviewed By: Nelson Ferreira Project Engineer: Nelson Ferreira



Sub-Surface Log

Test Hole TH12-05

1 of 1

Client: Morrison Hershfield Project Number: 0035 005 00
 Project Name: 2012 City of Winnipeg Regional Street Renewals Location: Fort Street From Graham Avenue to Portage Avenue
 Contractor: Paddock Drilling Ltd. Ground Elevation: Not Surveyed
 Method: 125mm Solid Stem Auger, Acker MP8 Truck Mount Date Drilled: March 28, 2012

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

Particle Size Legend: Fines Clay Silt Sand Gravel Cobbles Boulders

Depth (m)	Soil Symbol	MATERIAL DESCRIPTION	Sample Type	Sample Number	Bulk Unit Wt (kN/m ³)		Undrained Shear Strength (kPa)
					16	17	
					Particle Size (%)		Test Type
					0	100	△ Torvane △
					0	100	⊕ Pocket Pen. ⊕
					0	100	⊗ Qu ⊗
					0	100	○ Field Vane ○
0.0		ASPHALT (38 mm thick)					
0.0		CONCRETE (178 mm thick)		C30			
0.0		SAND (Fill) - silty, gravelly (<20 mm diam.), trace clay - light brown - dry to moist, compact - well graded (fine grained sand to fine grained gravel) - carbonate (limestone)		G31	●		
0.5				G32	●		
0.5				G33	●		
1.0				G34	●		
1.5		- trace to some gravel (<50 mm diam.) below 1.4 m		G35	●		
2.0		CLAY - silty - brown - moist, stiff to very stiff - high plasticity		G36	●		△ ⊕
2.5				G37	●		⊕ △
3.0		- firm to stiff below 2.4 m		G38	●		⊕ △

END OF TEST HOLE AT 3.1 m IN CLAY

Notes:

- No sloughing or seepage observed.
- Backfilled test hole with auger cuttings to ~1.0 m below top of pavement, bentonite pellets to 0.2 m below top of pavement, sand to 0.1 m below top of pavement and asphalt cold patch to top of pavement.
- Test hole location 14.2 m north of cross walk pole at northeast corner of Graham Ave. and Fort Street intersection, 3.5 m west of east curb of Fort Street.

SUB-SURFACE LOG 2012 REGIONAL STREET RENEWALS FORT STREET GPJ TREK GEOTECHNICAL GDT 4/20/12

Logged By: Stephen Renner Reviewed By: Nelson Ferreira Project Engineer: Nelson Ferreira



Appendix B
Lab Testing Summary Table and Lab Testing Results



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

**Moisture Content Report
 ASTM D2216-98**

Project No. 0035 005 00
Client Morrison Hershfield
Project 2012 City of Winnipeg Regional Street Renewals - Fort Street
Location Fort Street

Sample Date Mar 28, 2012
Test Date Apr 2, 2012
Technician Lee Boughton

Test Hole	TH12-01	TH12-01	TH12-01	TH12-01	TH12-01	TH12-01
Depth (m)	0.2 - 0.3	0.5 - 0.6	0.8 - 0.9	1.1 - 1.2	1.4 - 1.5	1.7 - 1.8
Sample #	G22	G23	G24	G25	G26	G27
Tare ID	P37	P13	K38	W34	P20	P35
Mass of tare	8.3	8.3	8.3	8.3	8.3	8.3
Mass wet + tare	369.7	424.8	445.2	421.5	537.2	441.9
Mass dry + tare	340.3	391.6	404.7	390.6	499.7	417.7
Mass water	29.4	33.2	40.5	30.9	37.5	24.2
Mass dry soil	332.0	383.3	396.4	382.3	491.4	409.4
Moisture %	8.9%	8.7%	10.2%	8.1%	7.6%	5.9%

Test Hole	TH12-01	TH12-01	TH12-02	TH12-02	TH12-02	TH12-02
Depth (m)	2.0 - 2.1	2.3 - 2.7	0.1 - 0.3	0.5 - 0.6	0.8 - 0.9	1.1 - 1.2
Sample #	G28	G29	G13	G14	G15	G16
Tare ID	Z116	P38	N26	H40	N25	F54
Mass of tare	8.2	8.3	8.3	8.3	8.3	8.3
Mass wet + tare	515	346	375	468.6	418.3	368.7
Mass dry + tare	490	328.6	335.6	423.2	384.3	279.9
Mass water	25.0	17.4	39.4	45.4	34.0	88.8
Mass dry soil	481.8	320.3	327.3	414.9	376.0	271.6
Moisture %	5.2%	5.4%	12.0%	10.9%	9.0%	32.7%

Test Hole	TH12-02	TH12-02	TH12-02	TH12-02	TH12-03	TH12-03
Depth (m)	1.4 - 1.5	1.7 - 1.8	2.0 - 2.1	2.9 - 3.0	0.2 - 0.3	0.5 - 0.6
Sample #	G17	G18	G19	G20	G40	G41
Tare ID	E100	K23	P40	P12	N75	N76
Mass of tare	8.3	8.3	8.4	8.4	8.3	8.3
Mass wet + tare	405.2	383.3	383.5	380.3	582.6	424.7
Mass dry + tare	326.6	288.4	272.6	259.9	519.8	386.8
Mass water	78.6	94.9	110.9	120.4	62.8	37.9
Mass dry soil	318.3	280.1	264.2	251.5	511.5	378.5
Moisture %	24.7%	33.9%	42.0%	47.9%	12.3%	10.0%



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**Moisture Content Report
 ASTM D2216-98**

Project No. 0035 005 00
Client Morrison Hershfield
Project 2012 City of Winnipeg Regional Street Renewals - Fort Street
Location Fort Street

Sample Date Mar 28, 2012
Test Date Apr 2, 2012
Technician Lee Boughton

Test Hole	TH12-03	TH12-03	TH12-03	TH12-03	TH12-03	TH12-03
Depth (m)	0.8 - 0.9	1.1 - 1.2	1.4 - 1.5	1.7 - 1.8	2.0 - 2.1	2.3 - 2.4
Sample #	G42	G43	G44	G45	G46	G47
Tare ID	N80	N87	N81	N88	N82	N103
Mass of tare	8.3	8.3	8.3	8.2	8.3	8.2
Mass wet + tare	388.8	430.7	437.1	470.5	506.2	528
Mass dry + tare	355.1	394.8	340.9	372.1	411.1	431.5
Mass water	33.7	35.9	96.2	98.4	95.1	96.5
Mass dry soil	346.8	386.5	332.6	363.9	402.8	423.3
Moisture %	9.7%	9.3%	28.9%	27.0%	23.6%	22.8%

Test Hole	TH12-04	TH12-04	TH12-04	TH12-04	TH12-04	TH12-04
Depth (m)	0.1 - 0.3	0.5 - 0.6	0.8 - 0.9	1.1 - 1.2	1.4 - 1.5	1.7 - 1.8
Sample #	G3	G4	G5	G6	G7	G8
Tare ID	Z74	H71	F122	F123	N06	K34
Mass of tare	8.3	8.3	8.3	8.3	8.3	8.4
Mass wet + tare	307.2	328.6	352.6	467.8	389.2	390.5
Mass dry + tare	284.5	304.6	297.7	378.7	319.4	299.1
Mass water	22.7	24.0	54.9	89.1	69.8	91.4
Mass dry soil	276.2	296.3	289.4	370.4	311.1	290.7
Moisture %	8.2%	8.1%	19.0%	24.1%	22.4%	31.4%

Test Hole	TH12-04	TH12-04	TH12-05	TH12-05	TH12-05	TH12-05
Depth (m)	2.0 - 2.1	2.9 - 3.0	0.2 - 0.3	0.5 - 0.6	0.8 - 0.9	1.1 - 1.2
Sample #	G9	G10	G31	G32	G33	G34
Tare ID	Z55	E116	N77	N74	N73	N83
Mass of tare	8.3	8.2	8.3	8.3	8.3	8.4
Mass wet + tare	418	383.2	443.7	454.9	435.1	427.7
Mass dry + tare	337.4	263.9	411.3	423.5	402.7	394.9
Mass water	80.6	119.3	32.4	31.4	32.4	32.8
Mass dry soil	329.1	255.7	403.0	415.2	394.4	386.5
Moisture %	24.5%	46.7%	8.0%	7.6%	8.2%	8.5%



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Moisture Content Report ASTM D2216-98

Project No. 0035 005 00
Client Morrison Hershfield
Project 2012 City of Winnipeg Regional Street Renewals - Fort Street
Location Fort Street

Sample Date Mar 28, 2012
Test Date Apr 2, 2012
Technician Lee Boughton

Test Hole	TH12-05	TH12-05	TH12-05	TH12-05		
Depth (m)	1.4 - 1.5	1.7 - 1.8	2.0 - 2.1	2.7 - 2.9		
Sample #	G35	G36	G37	G38		
Tare ID	N78	N85	N79	N86		
Mass of tare	8.3	8.2	8.4	8.3		
Mass wet + tare	554	398	406.6	372		
Mass dry + tare	522.7	318.4	280.2	268.8		
Mass water	31.3	79.6	126.4	103.2		
Mass dry soil	514.4	310.2	271.8	260.5		
Moisture %	6.1%	25.7%	46.5%	39.6%		



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 ASTM D4318**

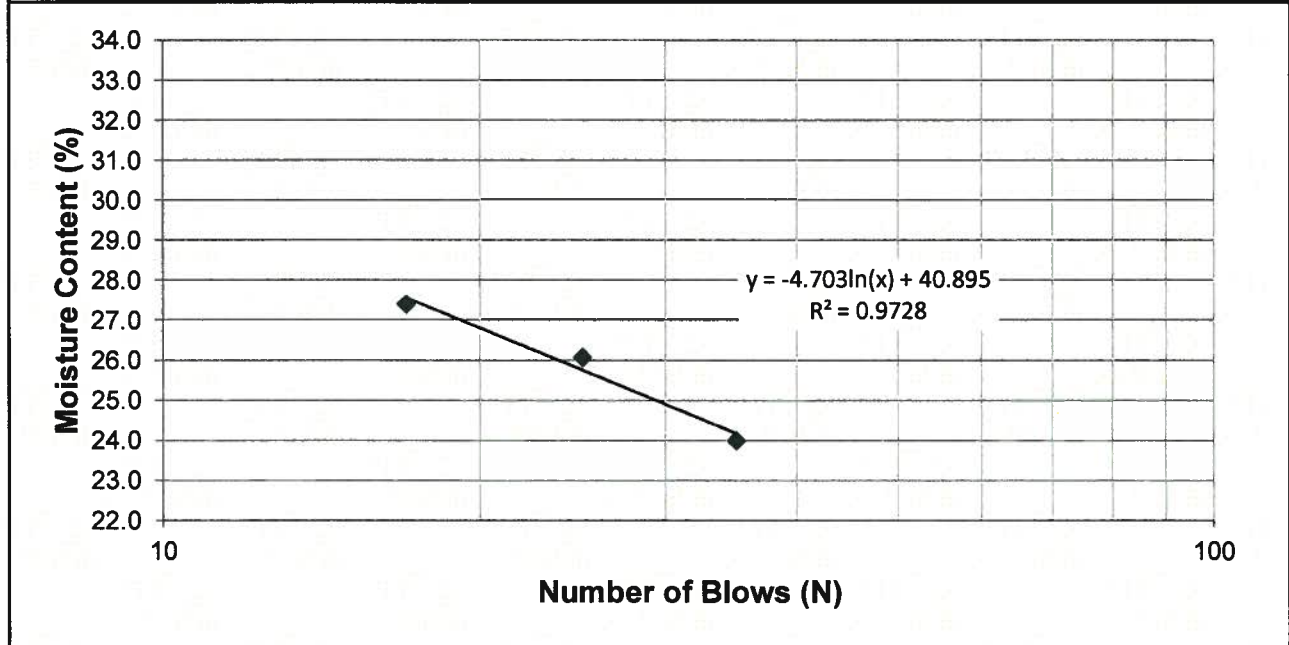
Project No. 0035 005 00
Client Morrison Hershfield
Project 2012 City of Winnipeg Regional Street Renewals - Fort Street

Test Hole TH12-02
Sample # G13
Depth (m) 0.2 - 0.3
Sample Date 28-Mar-12
Test Date 16-Apr-12
Technician Lee Boughton

Liquid Limit	25.8
Plastic Limit	10.9
Plasticity Index	14.8

Liquid Limit

Trial #	1	2	3	4	5
Number of Blows (N)	35	25	17		
Mass Wet Soil + Tare (g)	27.757	29.498	28.488		
Mass Dry Soil + Tare (g)	25.093	26.313	25.388		
Mass Tare (g)	13.992	14.102	14.081		
Mass Water (g)	2.664	3.185	3.100		
Mass Dry Soil (g)	11.101	12.211	11.307		
Moisture Content (%)	23.998	26.083	27.417		



Plastic Limit

Trial #	1	2	3	4	5
Mass Wet Soil + Tare (g)	20.353	20.070			
Mass Dry Soil + Tare (g)	19.724	19.470			
Mass Tare (g)	13.986	13.975			
Mass Water (g)	0.629	0.600			
Mass Dry Soil (g)	5.738	5.495			
Moisture Content (%)	10.962	10.919			



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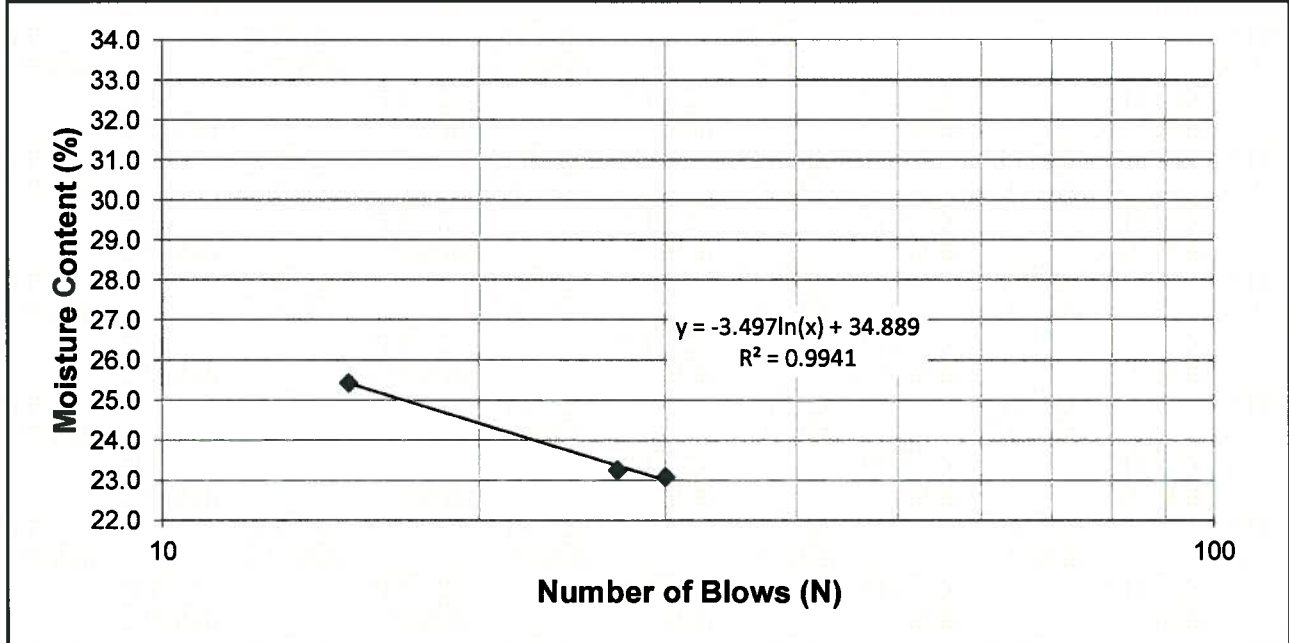
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Client Morrison Hershfield
Project 2012 City of Winnipeg Regional Street Renewals - Fort Street

Test Hole TH12-03
Sample # G40
Depth (m) 0.2 - 0.3
Sample Date 28-Mar-12
Test Date 19-Apr-12
Technician Lee Boughton

Liquid Limit	23.6
Plastic Limit	11.5
Plasticity Index	12.1

Liquid Limit

Trial #	1	2	3	4	5
Number of Blows (N)	30	27	15		
Mass Wet Soil + Tare (g)	28.034	28.097	28.578		
Mass Dry Soil + Tare (g)	25.423	25.444	25.636		
Mass Tare (g)	14.114	14.037	14.070		
Mass Water (g)	2.611	2.653	2.942		
Mass Dry Soil (g)	11.309	11.407	11.566		
Moisture Content (%)	23.088	23.258	25.437		



Plastic Limit

Trial #	1	2	3	4	5
Mass Wet Soil + Tare (g)	20.006	20.118			
Mass Dry Soil + Tare (g)	19.388	19.495			
Mass Tare (g)	14.031	14.092			
Mass Water (g)	0.618	0.623			
Mass Dry Soil (g)	5.357	5.403			
Moisture Content (%)	11.536	11.531			



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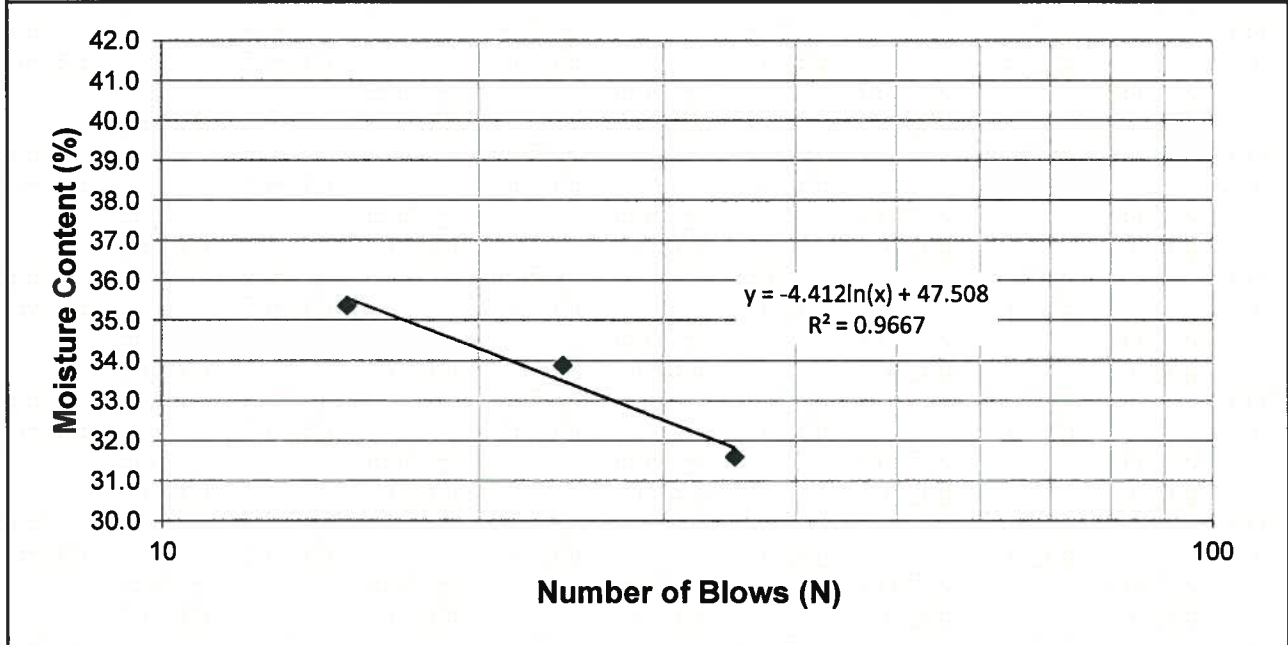
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Client Morrison Hershfield
Project 2012 City of Winnipeg Regional Street Renewals - Fort Street

Test Hole TH12-04
Sample # G5
Depth (m) 0.8 - 0.9
Sample Date 28-Mar-12
Test Date 16-Apr-12
Technician Lee Boughton

Liquid Limit	33.3
Plastic Limit	13.3
Plasticity Index	20.0

Liquid Limit

Trial #	1	2	3	4	5
Number of Blows (N)	35	24	15		
Mass Wet Soil + Tare (g)	30.686	26.995	25.873		
Mass Dry Soil + Tare (g)	26.679	23.674	22.779		
Mass Tare (g)	13.999	13.874	14.035		
Mass Water (g)	4.007	3.321	3.094		
Mass Dry Soil (g)	12.680	9.800	8.744		
Moisture Content (%)	31.601	33.888	35.383		



Plastic Limit

Trial #	1	2	3	4	5
Mass Wet Soil + Tare (g)	20.354	19.814			
Mass Dry Soil + Tare (g)	19.635	19.125			
Mass Tare (g)	14.153	14.014			
Mass Water (g)	0.719	0.689			
Mass Dry Soil (g)	5.482	5.111			
Moisture Content (%)	13.116	13.481			



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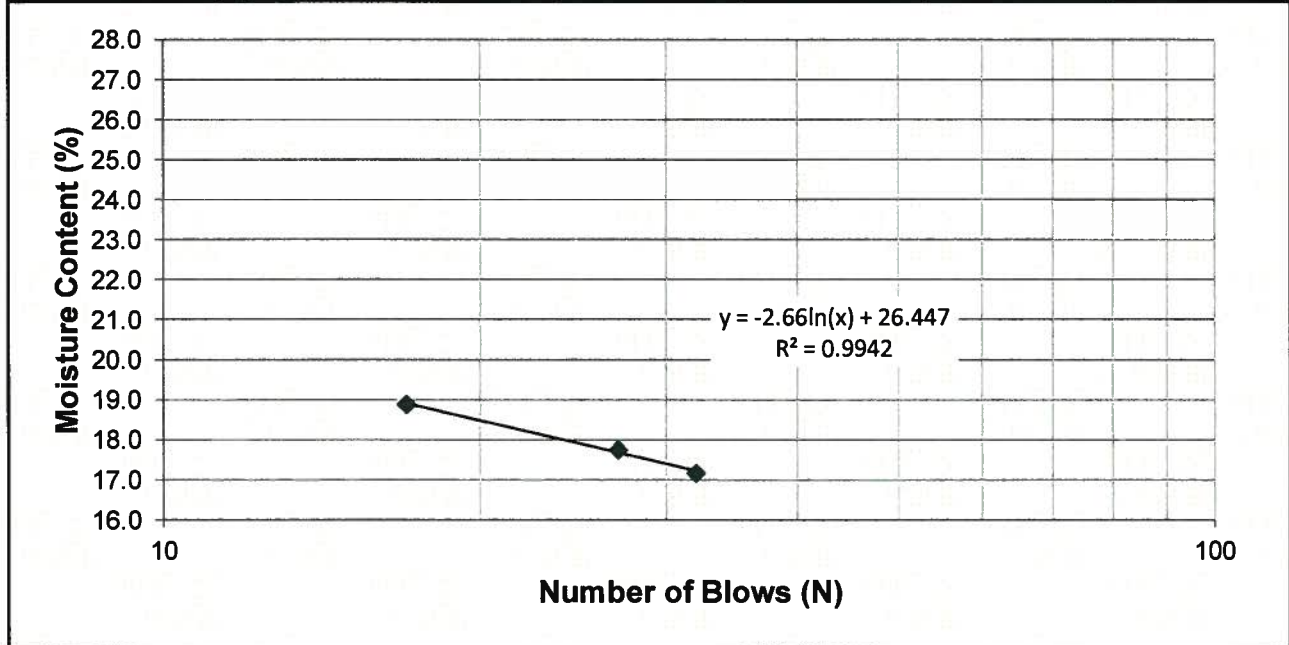
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Test Hole TH12-05
Sample # G33
Depth (m) 0.8 - 0.9
Sample Date 28-Mar-12
Test Date 18-Apr-12
Technician Lee Boughton

Liquid Limit	17.9
Plastic Limit	13.8
Plasticity Index	4.0

Liquid Limit

Trial #	1	2	3	4	5
Number of Blows (N)	32	27	17		
Mass Wet Soil + Tare (g)	27.923	29.310	28.815		
Mass Dry Soil + Tare (g)	25.880	27.019	26.495		
Mass Tare (g)	13.983	14.114	14.213		
Mass Water (g)	2.043	2.291	2.320		
Mass Dry Soil (g)	11.897	12.905	12.282		
Moisture Content (%)	17.172	17.753	18.889		



Plastic Limit

Trial #	1	2	3	4	5
Mass Wet Soil + Tare (g)	19.925	20.245			
Mass Dry Soil + Tare (g)	19.199	19.510			
Mass Tare (g)	14.005	14.149			
Mass Water (g)	0.726	0.735			
Mass Dry Soil (g)	5.194	5.361			
Moisture Content (%)	13.978	13.710			



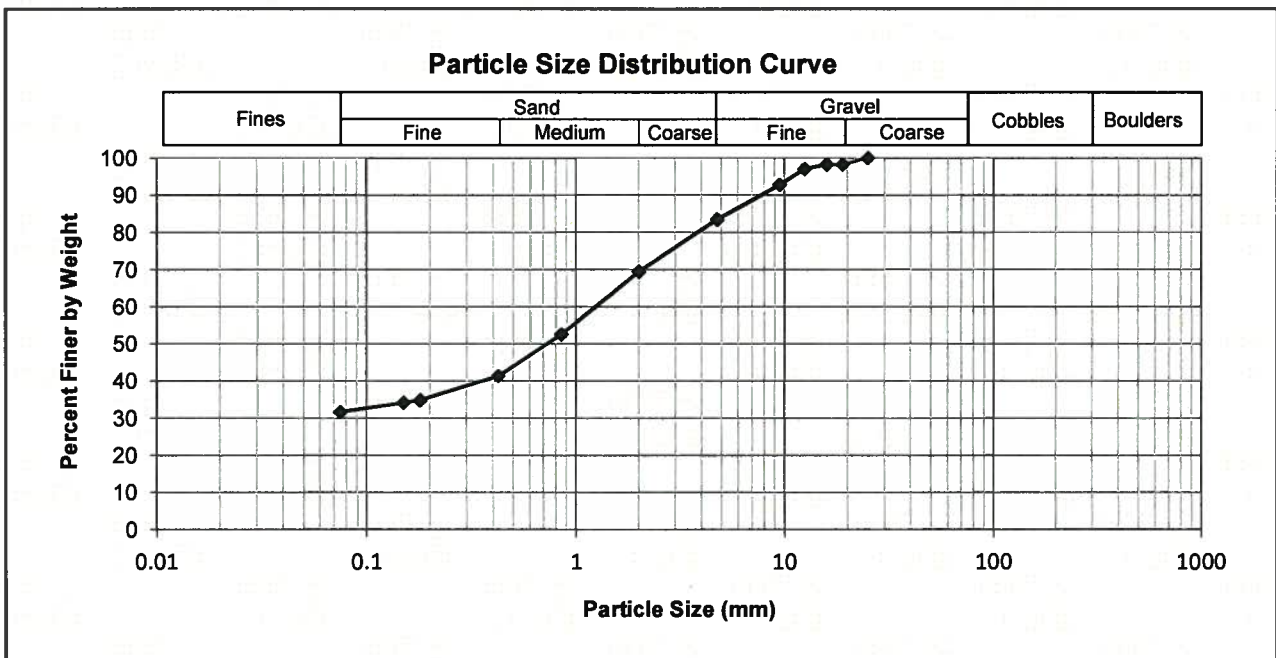
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Grain Size Analysis (Sieve Method)
ASTM C136-06

Project No. 0035 005 00
Client Morrison Hershfield
Project 2012 City of Winnipeg Regional Street Renewals - Fort Street

Test Hole TH12-01
Sample # G26
Depth 1.4-1.5
Date Sampled 28-Mar-12
Date Tested 16-Apr-12
Technician Lee Boughton

Cobbles %	0.0
Gravel %	16.6
Sand %	51.8
Fines %	31.6



Sieve Number	Sieve Opening (mm)	Percent Passing
6"	150	
5"	125	
4"	100	
3"	75.0	
2"	50.0	
1 1/2"	37.5	
1"	25.0	100
3/4"	19.0	98
5/8"	16.0	98
1/2"	12.5	97
3/8"	9.50	93
no. 4	4.75	83
no. 10	2.00	69
no. 20	0.850	53
no. 40	0.425	41
no. 80	0.180	35
no. 100	0.150	34
no. 200	0.075	32



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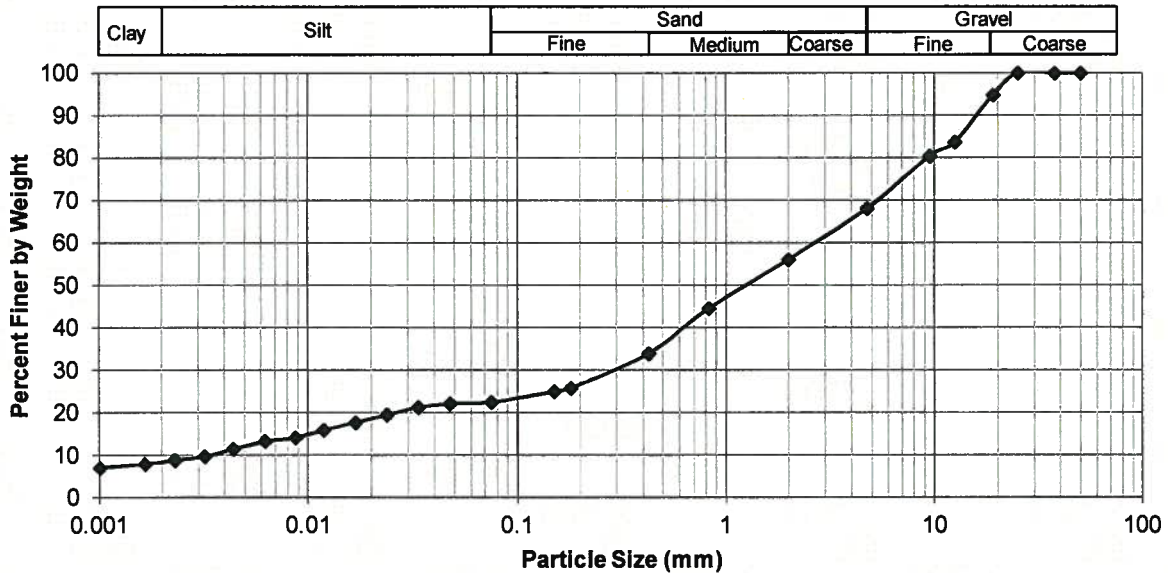
**Grain Size Analysis (Hydrometer Method)
 ASTM D422**

Project No. 0035 005 00
Client Morrison Hershfield
Project 2012 City of Winnipeg Regional Street Renewals - Fort Street

Test Hole TH12-03
Sample # G40
Depth (m) 0.2 - 0.3
Sample Date 27-Mar-12
Test Date 19-Apr-12
Technician Lee Boughton

Gravel	31.9%
Sand	45.7%
Silt	14.0%
Clay	8.4%

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	68.12	0.0750	22.44
37.5	100.00	2.00	56.05	0.0474	22.09
25.0	100.00	0.825	44.52	0.0335	21.20
19.0	94.77	0.425	33.90	0.0237	19.42
12.5	83.69	0.180	25.74	0.0167	17.64
9.50	80.41	0.150	24.94	0.0118	15.86
4.75	68.12	0.075	22.44	0.0087	14.08
				0.0062	13.19
				0.0044	11.41
				0.0032	9.63
				0.0023	8.74
				0.0017	7.85
				0.0010	6.96



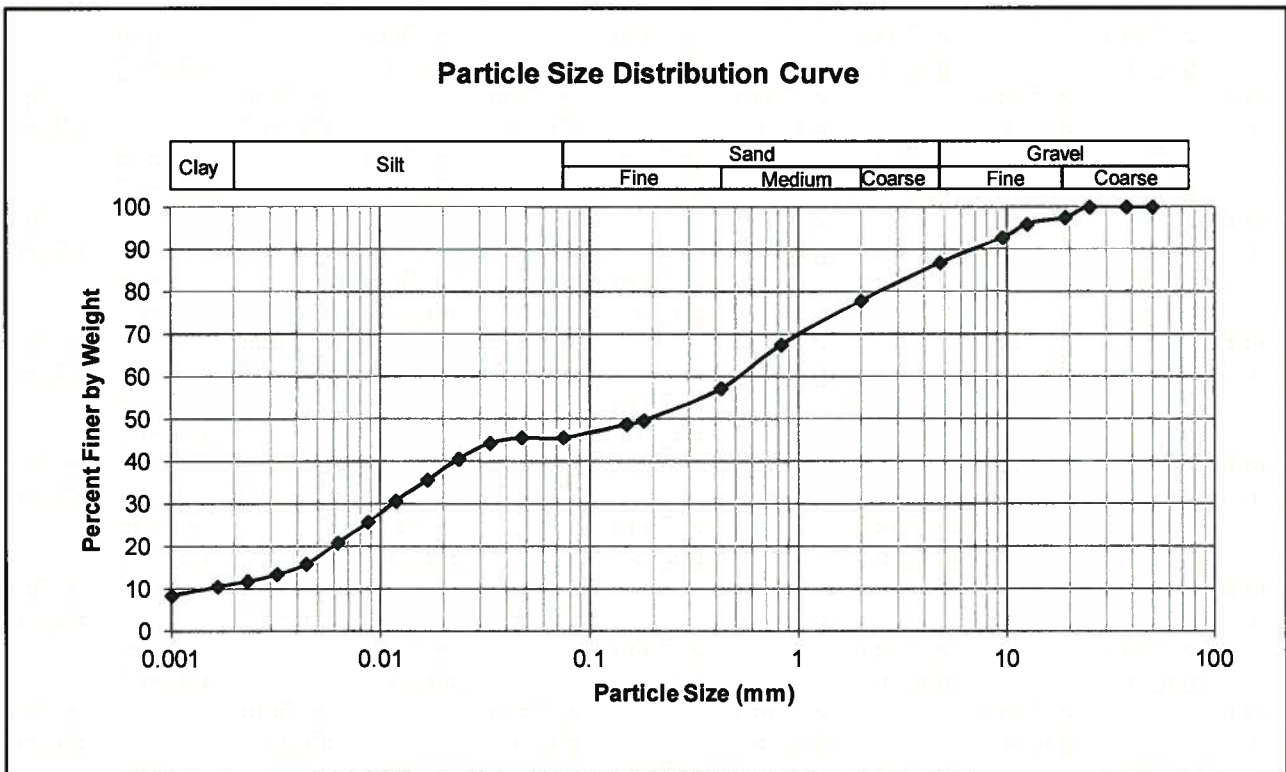
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**Grain Size Analysis (Hydrometer Method)
 ASTM D422**

Project No. 0035 005 00
Client Morrison Hershfield
Project 2012 City of Winnipeg Regional Street Renewals - Fort Street

Test Hole TH12-03
Sample # G42
Depth (m) 0.8 - 0.9
Sample Date 27-Mar-12
Test Date 17-Apr-12
Technician Lee Boughton

Gravel	13.1%
Sand	41.3%
Silt	34.4%
Clay	11.1%



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	86.86	0.0750	45.54
37.5	100.00	2.00	77.84	0.0474	45.52
25.0	100.00	0.825	67.52	0.0335	44.28
19.0	97.49	0.425	57.20	0.0237	40.58
12.5	95.96	0.180	49.64	0.0167	35.63
9.50	92.72	0.150	48.76	0.0118	30.69
4.75	86.86	0.075	45.54	0.0087	25.74
				0.0062	20.80
				0.0044	15.85
				0.0032	13.38
				0.0023	11.75
				0.0017	10.51
				0.0010	8.44



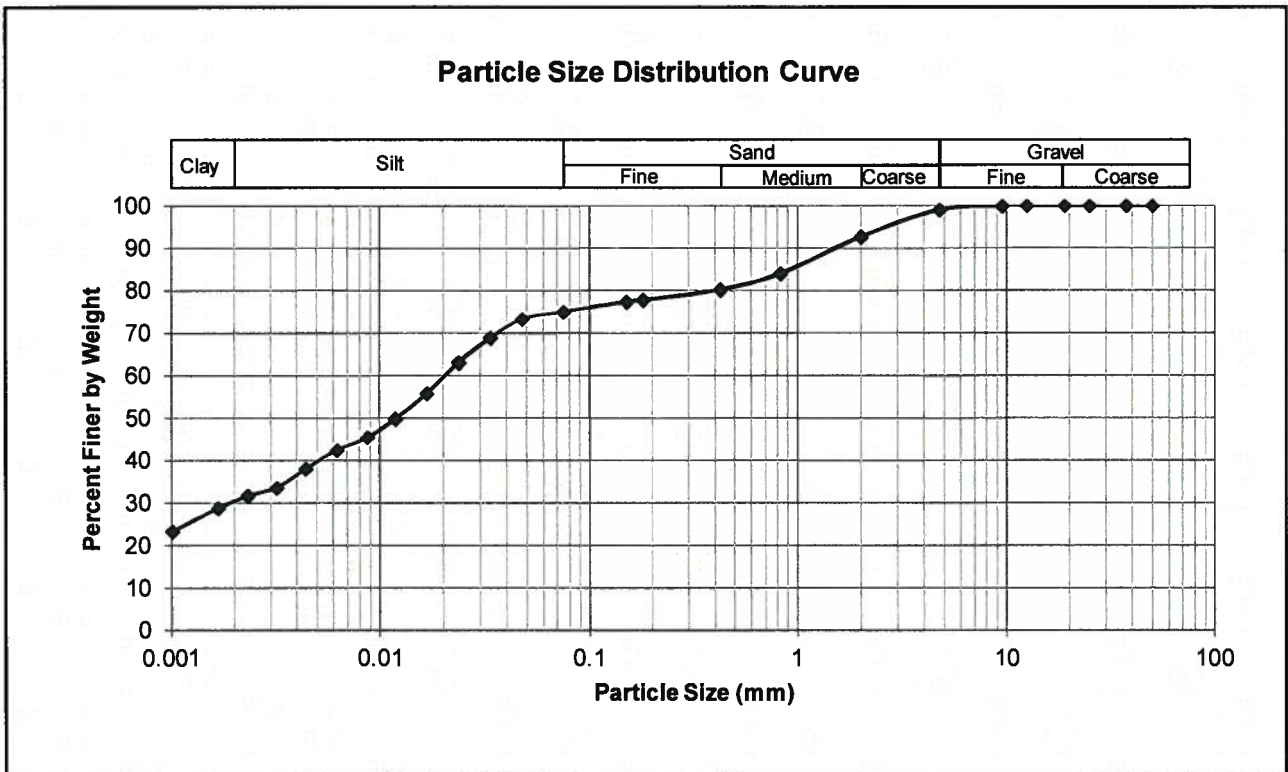
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**Grain Size Analysis (Hydrometer Method)
 ASTM D422**

Project No. 0035 005 00
Client Morrison Hershfield
Project 2012 City of Winnipeg Regional Street Renewals - Fort Street

Test Hole TH12-04
Sample # G5
Depth (m) 0.8 - 0.9
Sample Date 27-Mar-12
Test Date 17-Apr-12
Technician Lee Boughton

Gravel	1.0%
Sand	24.0%
Silt	44.1%
Clay	30.9%



Gravel		Sand		Silt and Clay	
Particle Size (mm)	Percent Passing	Particle Size (mm)	Percent Passing	Particle Size (mm)	Percent Passing
50.0	100.00	4.75	99.05	0.0750	75.00
37.5	100.00	2.00	92.68	0.0474	73.34
25.0	100.00	0.825	84.04	0.0335	68.92
19.0	100.00	0.425	80.28	0.0237	63.03
12.5	100.00	0.180	77.82	0.0167	55.67
9.50	100.00	0.150	77.39	0.0118	49.79
4.75	99.05	0.075	75.00	0.0087	45.37
				0.0062	42.43
				0.0044	38.01
				0.0032	33.60
				0.0023	31.66
				0.0017	28.71
				0.0010	23.29



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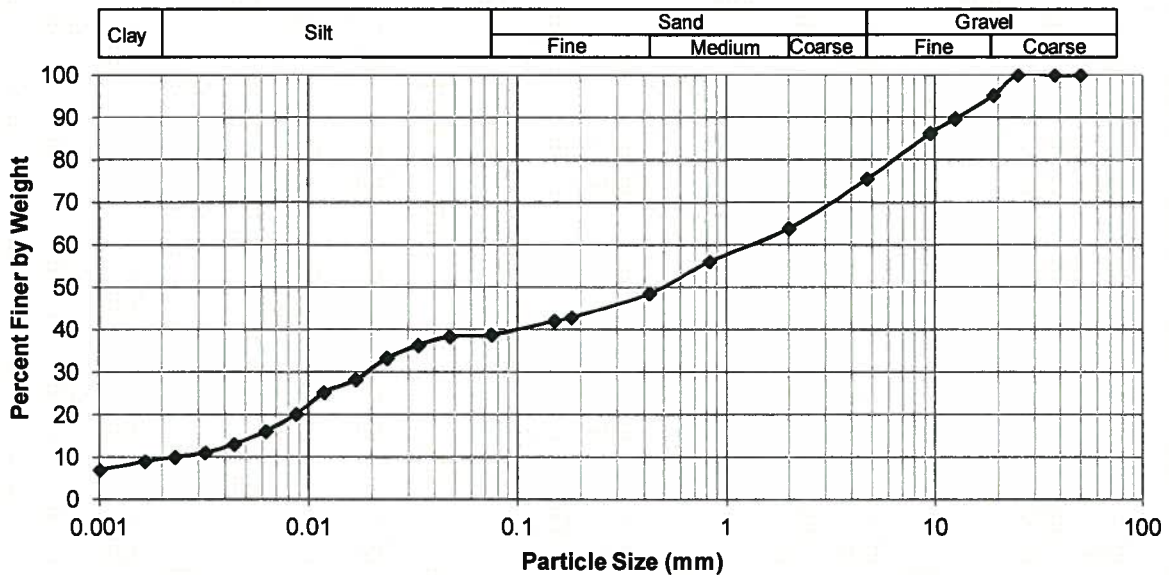
**Grain Size Analysis (Hydrometer Method)
 ASTM D422**

Project No. 0035 005 00
Client Morrison Hershfield
Project 2012 City of Winnipeg Regional Street Renewals - Fort Street

Test Hole TH12-05
Sample # G33
Depth (m) 0.8 - 0.9
Sample Date 27-Mar-12
Test Date 17-Apr-12
Technician Lee Boughton

Gravel	24.5%
Sand	36.7%
Silt	29.2%
Clay	9.6%

Particle Size Distribution Curve



Gravel		Sand		Silt and Clay	
Particle Size (mm)	Percent Passing	Particle Size (mm)	Percent Passing	Particle Size (mm)	Percent Passing
50.0	100.00	4.75	75.50	0.0750	38.81
37.5	100.00	2.00	63.85	0.0474	38.35
25.0	100.00	0.825	56.05	0.0335	36.33
19.0	95.12	0.425	48.51	0.0237	33.28
12.5	89.66	0.180	42.88	0.0167	28.21
9.50	86.26	0.150	42.07	0.0118	25.17
4.75	75.50	0.075	38.81	0.0087	20.10
				0.0062	16.05
				0.0044	13.00
				0.0032	10.98
				0.0023	9.96
				0.0017	8.95
				0.0010	6.92

Appendix C

Photographs of Pavement Core Samples



Photo 1: Asphalt and concrete core sample from Test Hole TH12-01

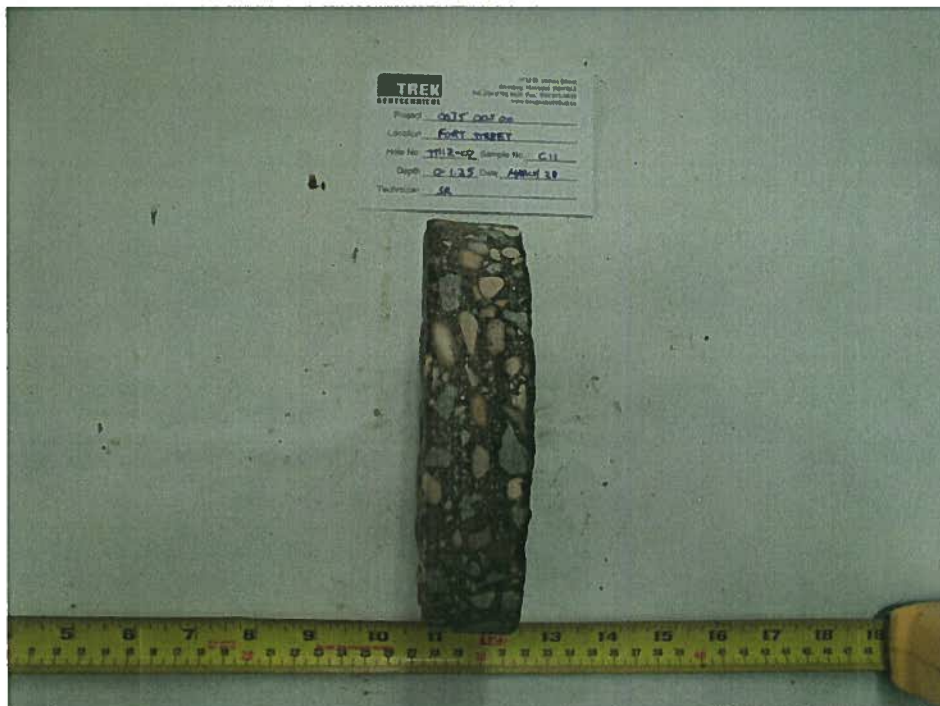


Photo 2: Asphalt core sample from Test Hole TH12-02

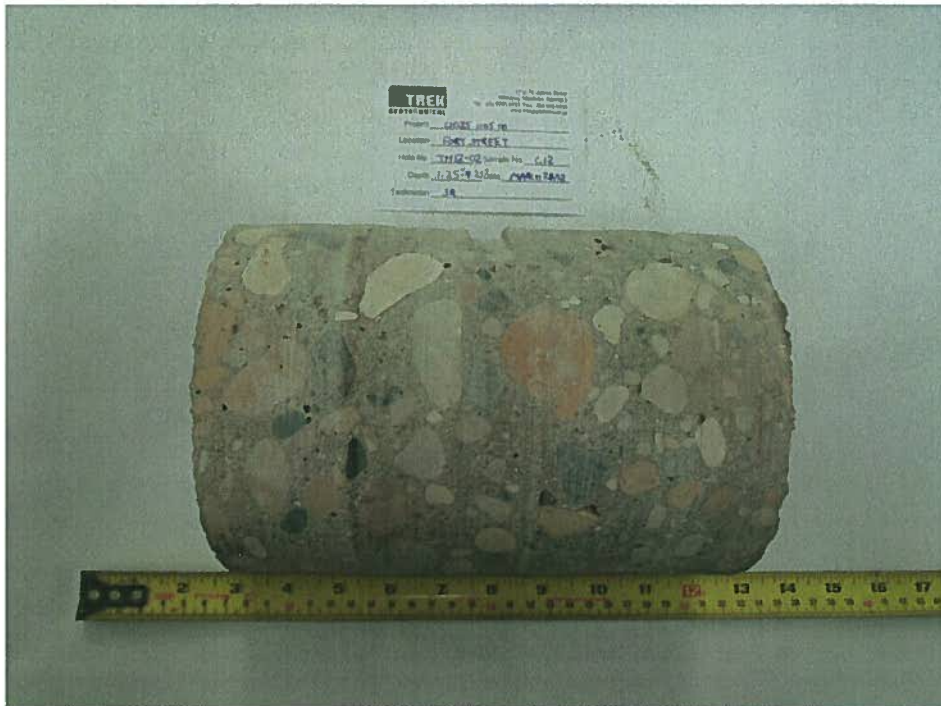


Photo 3: Concrete core sample from Test Hole TH12-02

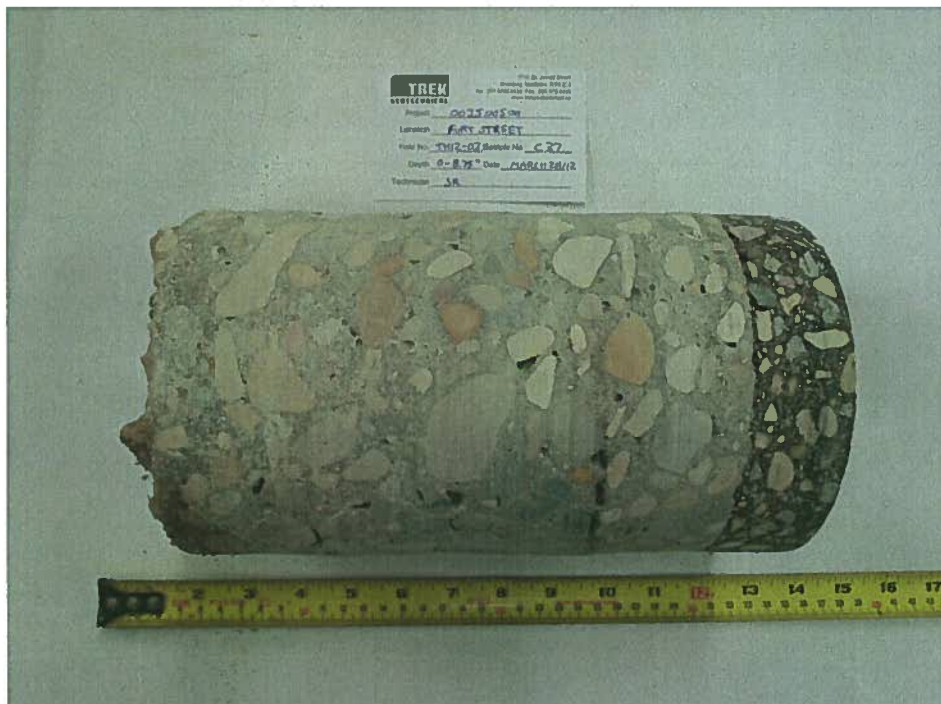


Photo 4: Asphalt and concrete core sample from Test Hole TH12-03

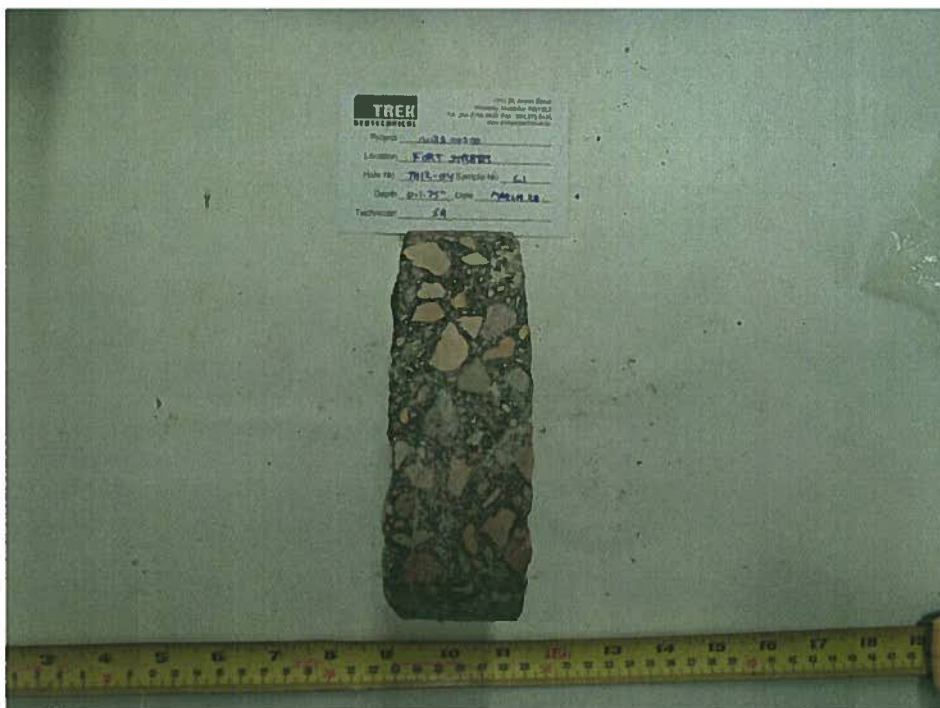


Photo 5: Asphalt core sample from Test Hole TH12-04



Photo 6: Concrete core sample from Test Hole TH12-04



Photo 7: Asphalt and concrete core sample from Test Hole TH12-05



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