# APPENDIX 'A'

# GEOTECHNICAL REPORT

Quality Engineering | Valued Relationships

WSP Canada Group Ltd

# 2018 Local Streets Package (PW File #: 18-R-04)

**Prepared for:**

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

**Project Number:**
0395 001 00

**Date:**
February 28, 2018
Final Report

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TREK GEOTECHNICAL

Quality Engineering | Valued Relationships

February 28, 2018

Our File No. 0395 001 00

Daniel Suh, EIT
WSP Canada Group Ltd.
111-93 Lombard Ave.
Winnipeg, MB R3B

**RE: Road Investigation Report for**
**2018 Local Streets Package (PW File #: 18-R-04)**

TREK Geotechnical Inc. is pleased to submit our report for the road investigation for the 2018 Local Streets Package (PW File #: 18-R-04).

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 | February 28, 2018 | Final Report |
| | | | |
| | | | |

## Authorization Signatures

**Prepared By:**

Angela Fidler-Kliewer C.Tech.

PROVINCE OF MANITOBA
REGISTERED PROFESSIONAL ENGINEER
N. J. FERREIRA
Member
22898
Feb 28, 2018

ENGINEERS GEOSCIENTISTS MANITOBA
Certificate of Authorization
TREK GEOTECHNICAL INC.
No. 4877 Date: Feb. 28, 2018

**Reviewed By:**

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

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## List of Appendices

# 1.0 Introduction

This report summarizes the results of the road investigation completed for the 2018 Local Streets Package 18-R-04 project. The streets included Beresford Ave., Churchill Drive, Haig Ave., Whitley Drive, Knightsbridge Drive, Haresford Crescent and Darwin 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 07 (attached) and the table below summarizes the investigation program per street.

**Road Investigation Program**

| Street | # of Locations | Investigation |
|---|---|---|
| **Beresford Avenue** – Daly Street to Osbourne Street. | 6 | Pavement Cores and Test Holes |
| **Churchill Drive –** Casey Street to Eccles Street | 6 | Pavement Cores and Test Holes |
| **Haig Avenue** – Des Meurons Street to Egerton Road. | 4 | Pavement Cores and Test Holes |
| **Whitley Drive –** Hawkins Crescent to Ashworth Street | 4 | Pavement Cores Only |
| **Knightsbridge Drive –** Knightsbridge Drive to Meadowood Drive | 6 | Pavement Cores Only |
| **Haresford Crescent –** Hawkins Crescent to Novavista Drive | 3 | Pavement Cores Only |
| **Darwin Street –** Riel Avenue to Riverband Avenue | 3 | Pavement Cores Only |

The road investigation was conducted between January 16, 2018 and January 20, 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 Maple Leaf Drilling Ltd. using their B40 Mobile truck mounted drill rig equipped with 125 mm diameter solid stem augers. The sub-surface conditions were observed during drilling and visually classified by Dawn Sellick 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 G). 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 001 00
WSP GROUP CANADA LTD.
Local Streets 18-R-04 Beresford Avenue

ANSI full bleed A (11.00 x 8.50 Inches)

FIG.001 2018-02-27 Test Hole Plan 0_A_SL 0406 001 00 (Beresford Ave.).dwg, 2/28/2018 8:04:18 AM


KEYPLAN
SCALE N.T.S.

0 50 100 150 m
SCALE = 1 : 3 000 (216 mm x 279 mm)

LEGEND: TEST HOLE (TREK, 2018)

NOTES: 1. AERIAL IMAGE FROM CITY OF WINNIPEG 2016

**Figure 01**
Test Hole Plan

TREK GEOTECHNICAL

0395 001 00
WSP GROUP CANADA LTD.
Local Streets 18-R-04 Churchill Drive

ANSI full bleed A (11.00 x 8.50 Inches)

FIG.002 2018-02-27 Test Hole Plan 0_A_SL 0406 001 00 (Churchill Dr.).dwg, 2/28/2018 8:06:39 AM


0 50 100 150 m
SCALE = 1 : 3 500 (216 mm x 279 mm)

LEGEND: TEST HOLE (TREK, 2018)

NOTES: 1. AERIAL IMAGE FROM CITY OF WINNIPEG 2016

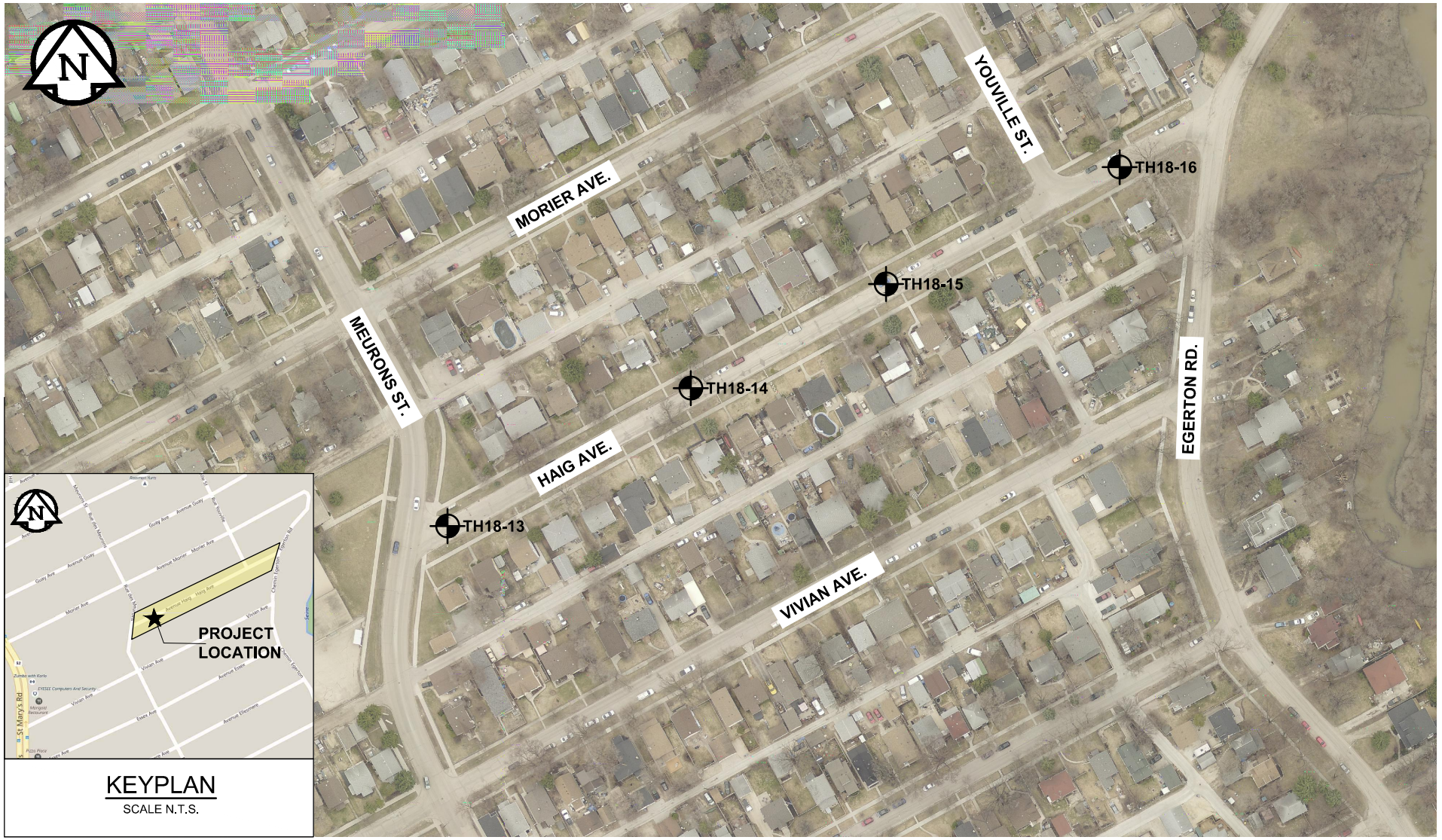
**Figure 02**
Test Hole Plan

TREK GEOTECHNICAL

0395 001 00
WSP GROUP CANADA LTD.
Local Streets 18-R-04 Haig Avenue

ANSI full bleed A (11.00 x 8.50 Inches)

FIG.003 2018-02-27 Test Hole Plan 0_A_SL 0406 001 00 (Haig Ave.).dwg, 2/28/2018 8:08:37 AM




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 03**
Test Hole Plan

TREK GEOTECHNICAL

0395 001 00
WSP GROUP CANADA LTD.
Local Streets 18-R-04 Whitley Drive

ANSI full bleed A (11.00 x 8.50 Inches)

FIG.004 2018-02-27 Test Hole Plan 0_A SL 0406 001 00 (Whitley Dr.).dwg, 2/28/2018 8:10:55 AM


0 50 100 150 m

SCALE = 1 : 2 500 (216 mm x 279 mm)

LEGEND: TEST HOLE (TREK, 2018)

NOTES: 1. AERIAL IMAGE FROM CITY OF WINNIPEG 2016

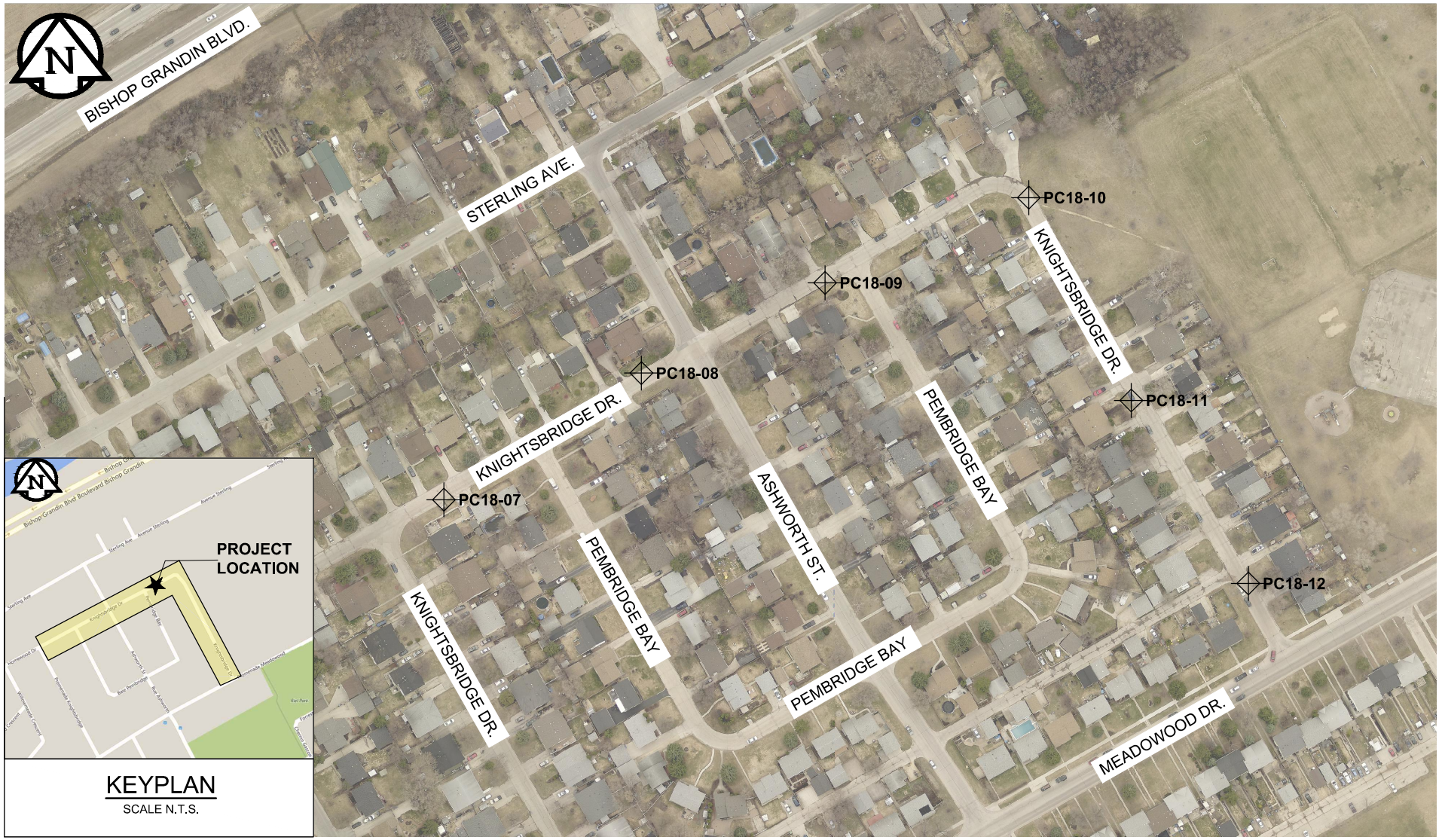
**Figure 04**
Test Hole Plan

TREK GEOTECHNICAL

0395 001 00
WSP GROUP CANADA LTD.
Local Streets 18-R-04 Knightsbridge Drive

ANSI full bleed A (11.00 x 8.50 Inches)

FIG.005 2018-02-27 Test Hole Plan 0_A_SL 0406 001 00 (Knightsbridge Dr.).dwg, 2/28/2018 8:17:21 AM




0 50 100 150 m

SCALE = 1 : 2 500 (216 mm x 279 mm)

LEGEND: TEST HOLE (TREK, 2018)

NOTES: 1. AERIAL IMAGE FROM CITY OF WINNIPEG 2016

**Figure 05**
Test Hole Plan

TREK GEOTECHNICAL

0395 001 00
WSP GROUP CANADA LTD.
Local Streets 18-R-04 Haresford Crescent

ANSI full bleed A (11.00 x 8.50 Inches)

FIG.006 2018-02-27 Test Hole Plan 0_A_SL 0406 001 00 (Haresford Cres.).dwg, 2/28/2018 8:22:52 AM


KEYPLAN
SCALE N.T.S.

0 25 50 75 m
SCALE = 1 : 1 500 (216 mm x 279 mm)

LEGEND: TEST HOLE (TREK, 2018)

NOTES: 1. AERIAL IMAGE FROM CITY OF WINNIPEG 2016

**Figure 06**
Test Hole Plan

TREK GEOTECHNICAL

0395 001 00
WSP GROUP CANADA LTD.
Local Streets 18-R-04 Darwin Street

ANSI full bleed A (11.00 x 8.50 Inches)

FIG.007 2018-02-27 Test Hole Plan 0_A_SL 0406 001 00 (Darwin St.).dwg, 2/28/2018 8:27:33 AM


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 07**
Test Hole Plan

# Appendix A

## Beresford Ave., between Osbourne St. and Daly St.

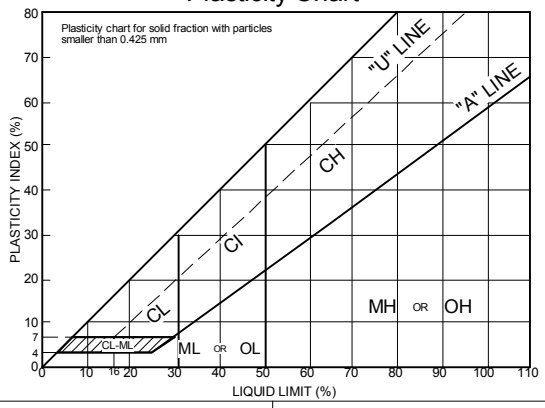
### Test Hole Logs, Summary Table, Lab Data and Photographs of Pavement Core Samples

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

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

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

**Other Symbol Types**

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

# EXPLANATION OF FIELD AND LABORATORY TESTING

## LEGEND OF ABBREVIATIONS AND SYMBOLS

LL - Liquid Limit (%)
PL - Plastic Limit (%)
PI - Plasticity Index (%)
MC - Moisture Content (%)
SPT - Standard Penetration Test
RQD - Rock Quality Designation
Qu - Unconfined Compression
Su - Undrained Shear Strength
VW - Vibrating Wire Piezometer
SI - Slope Inclinometer

▽ Water Level at Time of Drilling

▼ Water Level at End of Drilling

▼ Water Level After Drilling as Indicated on Test Hole Logs

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

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

## TERMS DESCRIBING CONSISTENCY OR COMPACTION CONDITION

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

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

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

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

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

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

# Sub-Surface Log

**Test Hole TH18-01**
1 of 1

| | | | |
|---|---|---|---|
| **Client:** | WSP Canada Group Ltd. | **Project Number:** | 0395-001-00 |
| **Project Name:** | Local Streets 18-R-04 - Beresford Avenue | **Location:** | UTM N-5524881, E-634266 |
| **Contractor:** | Maple Leaf Drilling | **Ground Elevation:** | Top of Pavement |
| **Method:** | 125mm Solid Stem Auger, B40 Mobile Truck Mount | **Date Drilled:** | 2018 January 16 |

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

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

| Depth (m) | Soil Symbol | MATERIAL DESCRIPTION | Sample Type | Sample Number | Bulk Unit Wt (kN/m³) 16 17 18 19 20 21 / Particle Size (%) 0 20 40 60 80 100 / PL MC LL | Undrained Shear Strength (kPa) 0 50 100 150 200 250 |
|---|---|---|---|---|---|---|
| | | ASPHALT - 51 mm thick | | | | |
| | | CONCRETE - 114 mm thick | | | | |
| | | SAND (FILL) - gravelly, some silt, trace clay, light brown, frozen, moist and loose when thawed, sub-angular to angular, carbonate (limestone) | | G01 | | |
| | | CLAY (FILL) - silty, trace sand, trace organics, hydrocarbon like odour to 0.2 m, grey, frozen, moist and soft when thawed, high plasticity | | | | |
| 0.5 | | SILT AND CLAY - trace sand<br>- light grey<br>- frozen to 0.9 m, moist and soft when thawed<br>- high plasticity | | G02 | | |
| | | | | G03 | | |
| 1.0 | | SILT - clayey<br>- light grey<br>- moist, soft<br>- low plasticity | | G04 | | |
| | | | | G05 | | |
| 1.5 | | CLAY - silty<br>- grey<br>- moist, firm<br>- high plasticity | | G06 | | |
| | | | | G07 | | |
| 2.0 | | | | | | |
| 2.5 | | - hydrocarbon like odour to 3.0 m<br>- silt inclusions (<15 mm diam.), light brown and black below 2.6 m | | G08 | | |
| | | | | G09 | | |
| 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 house #725, 1.2 m East of West Curb.

**Logged By:** Dawn Sellick **Reviewed By:** N.J Ferreira **Project Engineer:** Nelson Ferreira

SUB-SURFACE LOG LOGS 2018-02-21 LOCAL STREETS 18-R-04 BERESFORD AVENUE_0395-001-00_0_A_DS.GPJ TREK GEOTECHNICAL.GDT 18-2-28

# Sub-Surface Log

**Test Hole TH18-02**
1 of 1

| | | | |
|---|---|---|---|
| **Client:** | WSP Canada Group Ltd. | **Project Number:** | 0395-001-00 |
| **Project Name:** | Local Streets 18-R-04 - Beresford Avenue | **Location:** | UTM N-5524837, E-634174 |
| **Contractor:** | Maple Leaf Drilling | **Ground Elevation:** | Top of Pavement |
| **Method:** | 125mm Solid Stem Auger, B40 Mobile Truck Mount | **Date Drilled:** | 2018 January 16 |

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 |
|---|---|---|---|---|---|---|
| | | ASPHALT - 51 mm thick | | | | |
| | | CONCRETE - 178 mm thick | | | | |
| | | CLAY AND SILT - trace sand<br>- light brown,<br>- frozen, moist and soft when thawed<br>- high plasticity | | G10 | | |
| 0.5 | | SILT - trace clay, trace sand<br>- light brown<br>- frozen to 0.91 m, moist and soft when thawed<br>- low plasticity | | G11 | | |
| 1.0 | | | | G12 | | |
| | | CLAY - silty<br>- brown<br>- moist, stiff<br>- high plasticity | | G13 | | |
| 1.5 | | | | G14 | | |
| | | | | G15 | | |
| 2.0 | | | | G16 | | |
| 2.5 | | | | | | |
| 3.0 | | - trace precipitates (sulphate) below 2.9 m | | G17 | | |

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 house #491, 1.6 m West of East curb.

**Logged By:** Dawn Sellick **Reviewed By:** N.J Ferreira **Project Engineer:** Nelson Ferreira

SUB-SURFACE LOG LOGS 2018-02-21 LOCAL STREETS 18-R-04 BERESFORD AVENUE 0395-001-00 0 A DS.GPJ TREK GEOTECHNICAL.GDT 18-2-28

# Sub-Surface Log

**Test Hole TH18-03**
1 of 1

| | | | |
|---|---|---|---|
| **Client:** | WSP Canada Group Ltd. | **Project Number:** | 0395-001-00 |
| **Project Name:** | Local Streets 18-R-04 - Beresford Avenue | **Location:** | UTM N-5524780, E-634084 |
| **Contractor:** | Maple Leaf Drilling | **Ground Elevation:** | Top of Pavement |
| **Method:** | 125mm Solid Stem Auger, B40 Mobile Truck Mount | **Date Drilled:** | 2018 January 16 |

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 - 38 mm thick | | |
| | | CONCRETE - 89 mm thick | | |
| | | CLAY (FILL) - trace silt, trace sand<br>- dark grey<br>- frozen, moist and soft when thawed<br>- high plasticity | | G18 |
| 0.5 | | | | G19 |
| | | SILT - trace clay, trace sand<br>- light brown and grey<br>- frozen to 0.76 m, moist and soft when thawed<br>- intermediate plasticity | | G20 |
| 1.0 | | | | G21 |
| | | CLAY - silty<br>- brown<br>- moist, stiff<br>- high plasticity | | G22 |
| 1.5 | | | | G23 |
| 2.0 | | - light brown and grey mottled, firm below 2.0 m | | G24 |
| | | - precipitates (sulphate) below 2.1 m | | |
| 2.5 | | | | G25 |
| 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 house #517, 1.1 m East of West Curb.

**Logged By:** Dawn Sellick **Reviewed By:** N.J Ferreira **Project Engineer:** Nelson Ferreira

SUB-SURFACE LOG LOGS 2018-02-21 LOCAL STREETS 18-R-04 BERESFORD AVENUE_0395-001-00_0_A_DS.GPJ TREK GEOTECHNICAL.GDT 18-2-28

# Sub-Surface Log

**Test Hole TH18-04**
1 of 1

| | | | |
|---|---|---|---|
| **Client:** | WSP Canada Group Ltd. | **Project Number:** | 0395-001-00 |
| **Project Name:** | Local Streets 18-R-04 - Beresford Avenue | **Location:** | UTM N-5524749, E-634013 |
| **Contractor:** | Maple Leaf Drilling | **Ground Elevation:** | Top of Pavement |
| **Method:** | 125mm Solid Stem Auger, B40 Mobile Truck Mount | **Date Drilled:** | 2018 January 16 |

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

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

| Depth (m) | Soil Symbol | MATERIAL DESCRIPTION | Sample Type | Sample Number | Bulk Unit Wt (kN/m³) 16 17 18 19 20 21 / Particle Size (%) 0 20 40 60 80 100 / PL MC LL 0 20 40 60 80 100 | Undrained Shear Strength (kPa) Test Type: Torvane, Pocket Pen., Qu, Field Vane 0 50 100 150 200 250 |
|---|---|---|---|---|---|---|
| | | ASPHALT - 32 mm thick | | | | |
| | | CONCRETE - 191 mm thick | | | | |
| | | CLAY (FILL) - silty, trace sand<br>- dark grey<br>- frozen, moist and soft when thawed, high plasticity | | G26 | | |
| 0.5 | | SILT AND CLAY - trace sand<br>- light brown<br>- frozen to 0.76 m, moist and soft when thawed<br>- intermediate plasticity | | G27 | | |
| | | | | G28 | | |
| 1.0 | | | | G29 | | |
| | | CLAY - silty<br>- light brown<br>- moist, firm<br>- high plasticity | | G30 | | |
| 1.5 | | | | G31 | | |
| 2.0 | | | | G32 | | |
| | | - silt inclusions (<2 mm diam.) between 2.1 m to 2.3 m | | | | |
| | | - firm to stiff below 2.3 m | | G33 | | |
| 2.5 | | | | | | |
| 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 house #837, 1.3 m West of East curb.

**Logged By:** Dawn Sellick **Reviewed By:** N.J Ferreira **Project Engineer:** Nelson Ferreira

SUB-SURFACE LOG LOGS 2018-02-21 LOCAL STREETS 18-R-04 BERESFORD AVENUE_0395-001-00_0_A_DS.GPJ TREK GEOTECHNICAL.GDT 18-2-28

# Sub-Surface Log

**Test Hole TH18-05**
1 of 1

| | | | |
|---|---|---|---|
| **Client:** | WSP Canada Group Ltd. | **Project Number:** | 0395-001-00 |
| **Project Name:** | Local Streets 18-R-04 - Beresford Avenue | **Location:** | UTM N-5524696, E-633927 |
| **Contractor:** | Maple Leaf Drilling | **Ground Elevation:** | Top of Pavement |
| **Method:** | 125mm Solid Stem Auger, B40 Mobile Truck Mount | **Date Drilled:** | 2018 January 16 |

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

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

| Depth (m) | Soil Symbol | MATERIAL DESCRIPTION | Sample Type | Sample Number | Bulk Unit Wt (kN/m³) 16 17 18 19 20 21 / Particle Size (%) 0 20 40 60 80 100 / PL MC LL 0 20 40 60 80 100 | Undrained Shear Strength (kPa) Test Type: △ Torvane △ ✤ Pocket Pen. ✤ ☒ Qu ☒ ○ Field Vane ○ 0 50 100 150 200 250 |
|---|---|---|---|---|---|---|
| | | ASPHALT - 102 mm thick | | | | |
| | | CONCRETE - 140 mm thick | | | | |
| | | SILT AND SAND (FILL) - silty, trace clay, trace gravel<br>- grey<br>- frozen, moist and loose when thawed | | G34 | | |
| 0.5 | | CLAY (FILL) - silty, trace sand, trace organics<br>- light brown,<br>- frozen to 0.76 m, moist and soft when thawed<br>- high plasticity | | G35 | | |
| 1.0 | | SILT - trace sand<br>- light brown<br>- moist, soft<br>- low plasticity | | G36 | | |
| | | CLAY - silty<br>- brown<br>- moist, stiff to very stiff<br>- high plasticity | | G37 | | |
| 1.5 | | | | G38 | | |
| | | - grey and stiff, silt inclusions (<5 mm diam.) below 1.8 m | | G39 | | |
| 2.0 | | | | G40 | | |
| 2.5 | | | | | | |
| | | - firm below 2.9 m | | G41 | | |
| 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 house #576, 1 m East of West curb.

**Logged By:** Dawn Sellick **Reviewed By:** N.J Ferreira **Project Engineer:** Nelson Ferreira

SUB-SURFACE LOG LOGS 2018-02-21 LOCAL STREETS 18-R-04 BERESFORD AVENUE_0395-001-00_0_A_DS.GPJ TREK GEOTECHNICAL.GDT 18-2-28

# Sub-Surface Log

**Test Hole TH18-06**
1 of 1

| | | | |
|---|---|---|---|
| **Client:** | WSP Canada Group Ltd. | **Project Number:** | 0395-001-00 |
| **Project Name:** | Local Streets 18-R-04 - Beresford Avenue | **Location:** | UTM N-5524653, E-633841 |
| **Contractor:** | Maple Leaf Drilling | **Ground Elevation:** | Top of Pavement |
| **Method:** | 125mm Solid Stem Auger, B40 Mobile Truck Mount | **Date Drilled:** | 2018 January 16 |

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

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

| Depth (m) | Soil Symbol | MATERIAL DESCRIPTION | Sample Type | Sample Number | Bulk Unit Wt (kN/m³) 16 17 18 19 20 21 / Particle Size (%) 0 20 40 60 80 100 / PL MC LL | Undrained Shear Strength (kPa) 0 50 100 150 200 250 |
|---|---|---|---|---|---|---|
| | | ASPHALT - 76 mm thick | | | | |
| | | CONCRETE - 152 mm thick | | | | |
| | | CLAY (FILL) - trace silt, trace sand<br>- grey<br>- frozen, moist and soft when thawed, high plasticity | | G42 | | |
| 0.5 | | CLAY - silty, trace sand<br>- light brown<br>- frozen to 0.76 m, moist and soft when thawed<br>- high plasticity | | G43 | | |
| | | SILT - clayey, trace sand<br>- light brown<br>- moist, soft<br>- low plasticity | | G44 | | |
| 1.0 | | | | G45 | | |
| | | CLAY - silty<br>- brown<br>- moist, stiff to very stiff<br>- high plasticity | | G46 | | |
| 1.5 | | | | G47 | | |
| 2.0 | | - stiff below 2.0 m | | G48 | | |
| 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 house #595, 1.3 m West of East curb.

**Logged By:** Dawn Sellick **Reviewed By:** N.J Ferreira **Project Engineer:** Nelson Ferreira

SUB-SURFACE LOG LOGS 2018-02-21 LOCAL STREETS 18-R-04 BERESFORD AVENUE_0395-001-00_0_A_DS.GPJ TREK GEOTECHNICAL.GDT 18-2-28

**Local Streets Package 18-R-04**
**Sub-Surface Investigation**
**Beresford 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: 5524881 N, 634266 E Located at House #725, 1.2 m East of West curb. | Asphalt | 51 | Concrete | 114 | | | | | | | | | | | |
| | | | | | | CLAY (FILL) | 0.2 | 0.3 | 30 | | | | | | | |
| | | | | | | SILT AND CLAY | 0.5 | 0.6 | 27 | 0 | 8 | 52 | 41 | 13 | 41 | 28 |
| | | | | | | SILT AND CLAY | 0.8 | 0.9 | 28 | | | | | | | |
| | | | | | | SILT | 1.1 | 1.2 | 21 | | | | | | | |
| | | | | | | SILT | 1.4 | 1.5 | 22 | | | | | | | |
| | | | | | | CLAY | 1.5 | 1.7 | 36 | | | | | | | |
| | | | | | | CLAY | 1.8 | 2.0 | 44 | | | | | | | |
| | | | | | | CLAY | 2.6 | 2.7 | 39 | | | | | | | |
| | | | | | | CLAY | 2.9 | 3.0 | 50 | | | | | | | |
| TH18-02 | UTM: 5524837 N, 634174 E Located at House # 491, 1.6 m West of East curb. | Asphalt | 51 | Concrete | 178 | | | | | | | | | | | |
| | | | | | | SILT AND CLAY | 0.2 | 0.3 | 33 | 0 | 2 | 38 | 61 | 17 | 57 | 39 |
| | | | | | | SILT | 0.6 | 0.8 | 16 | | | | | | | |
| | | | | | | SILT | 0.9 | 1.1 | 15 | | | | | | | |
| | | | | | | CLAY | 1.1 | 1.2 | 31 | | | | | | | |
| | | | | | | CLAY | 1.4 | 1.5 | 41 | | | | | | | |
| | | | | | | CLAY | 1.7 | 1.8 | 42 | | | | | | | |
| | | | | | | CLAY | 2.0 | 2.1 | 47 | | | | | | | |
| | | | | | | CLAY | 2.9 | 3.0 | 52 | | | | | | | |
| TH18-03 | UTM: 5524780 N, 634084 E Located at House #517, 1.1 m East of West curb. | Asphalt | 38 | Concrete | 89 | | | | | | | | | | | |
| | | | | | | CLAY (FILL) | 0.2 | 0.3 | 36 | | | | | | | |
| | | | | | | CLAY (FILL) | 0.5 | 0.6 | 36 | | | | | | | |
| | | | | | | SILT | 0.8 | 0.9 | 31 | | | | | | | |
| | | | | | | SILT | 1.1 | 1.2 | 32 | | | | | | | |
| | | | | | | CLAY | 1.4 | 1.5 | 41 | | | | | | | |
| | | | | | | CLAY | 1.7 | 1.8 | 43 | | | | | | | |
| | | | | | | CLAY | 2.0 | 2.1 | 38 | | | | | | | |
| | | | | | | CLAY | 2.3 | 2.4 | 44 | | | | | | | |
| TH18-04 | UTM: 5524749 N, 634013 E Located at House #837, 1.3 m West of East curb. | Asphalt | 32 | Concrete | 191 | | | | | | | | | | | |
| | | | | | | CLAY (FILL) | 0.2 | 0.3 | 31 | | | | | | | |
| | | | | | | SILT AND CLAY | 0.5 | 0.6 | 37 | 0 | 3 | 41 | 56 | 19 | 55 | 36 |
| | | | | | | SILT AND CLAY | 0.6 | 0.8 | 20 | | | | | | | |
| | | | | | | SILT AND CLAY | 0.8 | 0.9 | 22 | | | | | | | |
| | | | | | | CLAY | 1.4 | 1.5 | 22 | | | | | | | |
| | | | | | | CLAY | 1.7 | 1.8 | 22 | | | | | | | |
| | | | | | | CLAY | 2.0 | 2.1 | 38 | | | | | | | |
| | | | | | | CLAY | 2.3 | 2.4 | 45 | | | | | | | |

**Local Streets Package 18-R-04**
**Sub-Surface Investigation**
**Beresford 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 |
| TH18-05 | UTM: 5524696 N, 633927 E Located at House #576, 1 m East of West curb. | Asphalt | 102 | Concrete | 140 | | | | | | | | | | | |
| | | | | | | SILT AND SAND (FILL) | 0.2 | 0.3 | 32 | 6 | 46 | 48 | | | | |
| | | | | | | CLAY | 0.6 | 0.9 | 35 | | | | | | | |
| | | | | | | SILT | 0.9 | 1.1 | 14 | | | | | | | |
| | | | | | | CLAY | 1.2 | 1.4 | 28 | | | | | | | |
| | | | | | | CLAY | 1.5 | 1.7 | 38 | | | | | | | |
| | | | | | | CLAY | 1.8 | 2.0 | 41 | | | | | | | |
| | | | | | | CLAY | 2.1 | 2.3 | 45 | | | | | | | |
| | | | | | | CLAY | 2.9 | 3.0 | 46 | | | | | | | |
| TH18-06 | UTM: 5524653 N, 633841 E Located at House #595, 1.3 m West of East curb. | Asphalt | 76 | Concrete | 152 | | | | | | | | | | | |
| | | | | | | CLAY (FILL) | 0.2 | 0.3 | 33 | | | | | | | |
| | | | | | | CLAY | 0.5 | 0.6 | 24 | | | | | | | |
| | | | | | | SILT | 0.8 | 0.9 | 18 | 0 | 4 | 72 | 24 | 15 | 27 | 12 |
| | | | | | | SILT | 1.1 | 1.2 | 16 | | | | | | | |
| | | | | | | CLAY | 1.4 | 1.5 | 36 | | | | | | | |
| | | | | | | CLAY | 1.7 | 1.8 | 39 | | | | | | | |
| | | | | | | CLAY | 2.0 | 2.1 | 45 | | | | | | | |
| | | | | | | CLAY | 2.7 | 2.9 | 48 | | | | | | | |

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# Moisture Content Report
## ASTM D2216-10

**Project No.** 0395-001-00
**Client** WSP
**Project** Local Streets 18-R-04 - Beresford Avenue

**Sample Date** 16-Jan-18
**Test Date** 5-Feb-18
**Technician** DS

| Test Pit | TH18-01 | TH18-01 | TH18-01 | TH18-01 | TH18-01 | TH18-01 |
|---|---|---|---|---|---|---|
| Depth (m) | 0.2 - 0.3 | 0.5 - 0.6 | 0.8 - 0.9 | 1.1 - 1.2 | 1.4 - 1.5 | 1.5 - 1.7 |
| Sample # | G01 | G02 | G03 | G04 | G05 | G06 |
| Tare ID | AB26 | K17 | Z97 | ac01 | F62 | F123 |
| Mass of tare | 6.6 | 8.4 | 8.6 | 6.6 | 8.4 | 8.4 |
| Mass wet + tare | 268.4 | 401.4 | 266.0 | 338.2 | 341.0 | 360.6 |
| Mass dry + tare | 208.0 | 318.4 | 210.4 | 280.2 | 280.6 | 268.4 |
| Mass water | 60.4 | 83.0 | 55.6 | 58.0 | 60.4 | 92.2 |
| Mass dry soil | 201.4 | 310.0 | 201.8 | 273.6 | 272.2 | 260.0 |
| Moisture % | 30.0% | 26.8% | 27.6% | 21.2% | 22.2% | 35.5% |

| Test Pit | TH18-01 | TH18-01 | TH18-01 | TH18-02 | TH18-02 | TH18-02 |
|---|---|---|---|---|---|---|
| Depth (m) | 1.8 - 2.0 | 2.6 - 2.7 | 2.9 - 3.0 | 0.2 - 0.3 | 0.6 - 0.8 | 0.9 - 1.1 |
| Sample # | G07 | G08 | G09 | G10 | G11 | G12 |
| Tare ID | AC29 | A17 | AB011 | E8 | AC18 | AC17 |
| Mass of tare | 6.6 | 8.6 | 6.8 | 8.6 | 6.6 | 6.6 |
| Mass wet + tare | 270.2 | 374.2 | 351.2 | 426 | 293.6 | 314 |
| Mass dry + tare | 189.8 | 272.6 | 235.8 | 321.8 | 254.2 | 273.8 |
| Mass water | 80.4 | 101.6 | 115.4 | 104.2 | 39.4 | 40.2 |
| Mass dry soil | 183.2 | 264.0 | 229.0 | 313.2 | 247.6 | 267.2 |
| Moisture % | 43.9% | 38.5% | 50.4% | 33.3% | 15.9% | 15.0% |

| Test Pit | TH18-02 | TH18-02 | TH18-02 | TH18-02 | TH18-02 | TH18-03 |
|---|---|---|---|---|---|---|
| Depth (m) | 1.1 - 1.2 | 1.4 - 1.5 | 1.7 - 1.8 | 2.0 - 2.1 | 2.9 - 3.0 | 0.2 - 0.3 |
| Sample # | G13 | G14 | G15 | G16 | G17 | G18 |
| Tare ID | N105 | Z114 | AC16 | W47 | E78 | k23 |
| Mass of tare | 8.4 | 8.4 | 6.8 | 8.4 | 8.6 | 8.8 |
| Mass wet + tare | 332.6 | 336.6 | 289.4 | 308.8 | 321.6 | 313.8 |
| Mass dry + tare | 255.4 | 241.2 | 205.6 | 213.2 | 214.6 | 233.4 |
| Mass water | 77.2 | 95.4 | 83.8 | 95.6 | 107.0 | 80.4 |
| Mass dry soil | 247.0 | 232.8 | 198.8 | 204.8 | 206.0 | 224.6 |
| Moisture % | 31.3% | 41.0% | 42.2% | 46.7% | 51.9% | 35.8% |

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# Moisture Content Report
## ASTM D2216-10

**Project No.** 0395-001-00
**Client** WSP
**Project** Local Streets 18-R-04 - Beresford Avenue

**Sample Date** 16-Jan-18
**Test Date** 5-Feb-18
**Technician** DS

| Test Pit | TH18-03 | TH18-03 | TH18-03 | TH18-03 | TH18-03 | TH18-03 |
|---|---|---|---|---|---|---|
| Depth (m) | 0.5 - 0.6 | 0.8 - 0.9 | 1.1 - 1.2 | 1.4 - 1.5 | 1.7 - 1.8 | 2.0 - 2.1 |
| Sample # | G19 | G20 | G21 | G22 | G23 | G24 |
| Tare ID | AA05 | C25 | P24 | N91 | N21 | K34 |
| Mass of tare | 6.6 | 8.4 | 8.6 | 8.4 | 8.6 | 8.4 |
| Mass wet + tare | 332.6 | 327.2 | 325.4 | 322.4 | 307.4 | 331.8 |
| Mass dry + tare | 245.6 | 251.0 | 249.4 | 231.0 | 217.2 | 242.8 |
| Mass water | 87.0 | 76.2 | 76.0 | 91.4 | 90.2 | 89.0 |
| Mass dry soil | 239.0 | 242.6 | 240.8 | 222.6 | 208.6 | 234.4 |
| Moisture % | 36.4% | 31.4% | 31.6% | 41.1% | 43.2% | 38.0% |

| Test Pit | TH18-03 | TH18-04 | TH18-04 | TH18-04 | TH18-04 | TH18-04 |
|---|---|---|---|---|---|---|
| Depth (m) | 2.3 - 2.4 | 0.2 - 0.3 | 0.5 - 0.6 | 0.6 - 0.8 | 0.8 - 0.9 | 1.4 - 1.5 |
| Sample # | G25 | G26 | G27 | G28 | G29 | G30 |
| Tare ID | F128 | P11 | E66 | N41 | F34 | F14 |
| Mass of tare | 8.6 | 8.4 | 9.2 | 8.4 | 8.4 | 8.4 |
| Mass wet + tare | 312.2 | 314.8 | 420.8 | 341.8 | 306.2 | 314.8 |
| Mass dry + tare | 219.4 | 242.8 | 310.6 | 287.4 | 252.6 | 258.8 |
| Mass water | 92.8 | 72.0 | 110.2 | 54.4 | 53.6 | 56.0 |
| Mass dry soil | 210.8 | 234.4 | 301.4 | 279.0 | 244.2 | 250.4 |
| Moisture % | 44.0% | 30.7% | 36.6% | 19.5% | 21.9% | 22.4% |

| Test Pit | TH18-04 | TH18-04 | TH18-04 | TH18-05 | TH18-05 | TH18-05 |
|---|---|---|---|---|---|---|
| Depth (m) | 1.7 - 1.8 | 2.0 - 2.1 | 2.3 - 2.4 | 0.2 - 0.3 | 0.6 - 0.9 | 0.9 - 1.1 |
| Sample # | G31 | G32 | G33 | G34 | G35 | G36 |
| Tare ID | AB68 | H56 | E25 | N44 | P13 | W98 |
| Mass of tare | 6.6 | 8.4 | 9.0 | 8.4 | 8.3 | 8.6 |
| Mass wet + tare | 371.6 | 300.2 | 283.6 | 482.4 | 315.5 | 326.9 |
| Mass dry + tare | 305.6 | 220.6 | 198.6 | 368.8 | 235.3 | 288.8 |
| Mass water | 66.0 | 79.6 | 85.0 | 113.6 | 80.2 | 38.1 |
| Mass dry soil | 299.0 | 212.2 | 189.6 | 360.4 | 227.0 | 280.2 |
| Moisture % | 22.1% | 37.5% | 44.8% | 31.5% | 35.3% | 13.6% |

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# Moisture Content Report
## ASTM D2216-10

**Project No.** 0395-001-00
**Client** WSP
**Project** Local Streets 18-R-04 - Beresford Avenue

**Sample Date** 16-Jan-18
**Test Date** 5-Feb-18
**Technician** DS

| Test Pit | TH18-05 | TH18-05 | TH18-05 | TH18-05 | TH18-05 | TH18-06 |
|---|---|---|---|---|---|---|
| Depth (m) | 1.2 - 1.4 | 1.5 - 1.7 | 1.8 - 2.0 | 2.1 - 2.3 | 2.9 - 3.0 | 0.2 - 0.3 |
| Sample # | G37 | G38 | G39 | G40 | G41 | G42 |
| Tare ID | E133 | K20 | K13 | Z13 | E118 | n82 |
| Mass of tare | 8.3 | 8.4 | 8.6 | 8.7 | 8.3 | 8.4 |
| Mass wet + tare | 325.1 | 311.4 | 378.1 | 318.9 | 358.2 | 317.3 |
| Mass dry + tare | 256.1 | 228.1 | 271.5 | 222.3 | 248.7 | 241.5 |
| Mass water | 69.0 | 83.3 | 106.6 | 96.6 | 109.5 | 75.8 |
| Mass dry soil | 247.8 | 219.7 | 262.9 | 213.6 | 240.4 | 233.1 |
| Moisture % | 27.8% | 37.9% | 40.5% | 45.2% | 45.5% | 32.5% |

| Test Pit | TH18-06 | TH18-06 | TH18-06 | TH18-06 | TH18-06 | TH18-06 |
|---|---|---|---|---|---|---|
| Depth (m) | 0.5 - 0.6 | 0.8 - 0.9 | 1.1 - 1.2 | 1.4 - 1.5 | 1.7 - 1.8 | 2.0 - 2.1 |
| Sample # | G43 | G44 | G45 | G46 | G47 | G48 |
| Tare ID | A13 | W31 | F119 | F1 | E41 | AA14 |
| Mass of tare | 8.3 | 8.3 | 8.3 | 8.7 | 8.4 | 6.8 |
| Mass wet + tare | 304.7 | 402.8 | 405.3 | 320.9 | 314.4 | 350.1 |
| Mass dry + tare | 247.8 | 343.0 | 349.8 | 238.5 | 229.2 | 243.3 |
| Mass water | 56.9 | 59.8 | 55.5 | 82.4 | 85.2 | 106.8 |
| Mass dry soil | 239.5 | 334.7 | 341.5 | 229.8 | 220.8 | 236.5 |
| Moisture % | 23.8% | 17.9% | 16.3% | 35.9% | 38.6% | 45.2% |

| Test Pit | TH18-06 | | | | | |
|---|---|---|---|---|---|---|
| Depth (m) | 2.7 - 2.9 | | | | | |
| Sample # | G49 | | | | | |
| Tare ID | AB65 | | | | | |
| Mass of tare | 6.7 | | | | | |
| Mass wet + tare | 345.9 | | | | | |
| Mass dry + tare | 235.7 | | | | | |
| Mass water | 110.2 | | | | | |
| Mass dry soil | 229.0 | | | | | |
| Moisture % | 48.1% | | | | | |

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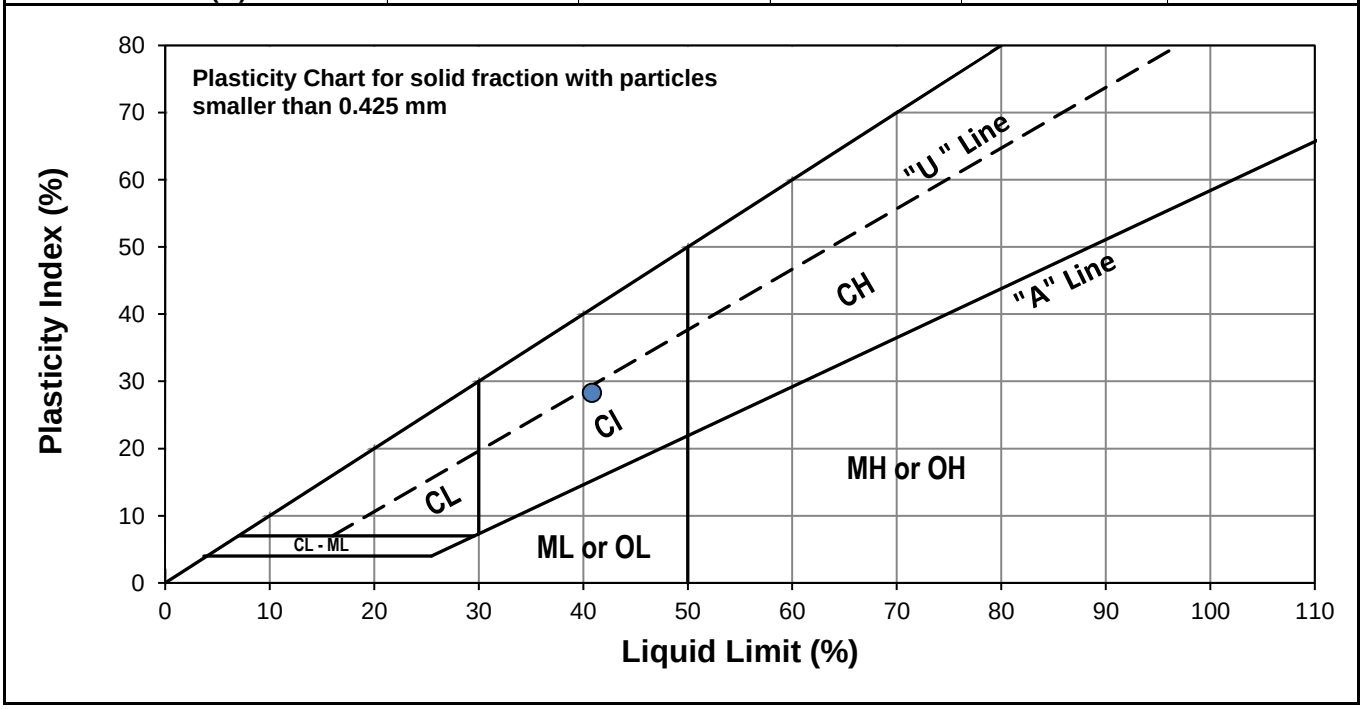
# Atterberg Limits
## ASTM D4318-10e1

| | |
|---|---|
| **Project No.** | 0395-001-00 |
| **Client** | WSP |
| **Project** | Local Streets 18-R-04 Beresford Ave |
| **Test Hole** | TH18-01 |
| **Sample #** | G02 |
| **Depth (m)** | 0.5-0.6 |
| **Sample Date** | 16-Jan-18 |
| **Test Date** | 8-Feb-18 |
| **Technician** | LI |

| | |
|---|---|
| **Liquid Limit** | 41 |
| **Plastic Limit** | 13 |
| **Plasticity Index** | 28 |

### Liquid Limit

| Trial # | 1 | 2 | 3 | | |
|---|---|---|---|---|---|
| **Number of Blows (N)** | 22 | 26 | 32 | | |
| **Mass Wet Soil + Tare (g)** | 26.934 | 25.135 | 26.467 | | |
| **Mass Dry Soil + Tare (g)** | 23.100 | 21.894 | 22.977 | | |
| **Mass Tare (g)** | 13.790 | 13.954 | 14.232 | | |
| **Mass Water (g)** | 3.834 | 3.241 | 3.490 | | |
| **Mass Dry Soil (g)** | 9.310 | 7.940 | 8.745 | | |
| **Moisture Content (%)** | 41.182 | 40.819 | 39.909 | | |




### Plastic Limit

| Trial # | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| **Mass Tare (g)** | 20.567 | 19.961 | | | |
| **Mass Wet Soil + Tare (g)** | 19.822 | 19.297 | | | |
| **Mass Dry Soil + Tare (g)** | 13.878 | 14.001 | | | |
| **Mass Water (g)** | 0.745 | 0.664 | | | |
| **Mass Dry Soil (g)** | 5.944 | 5.296 | | | |
| **Moisture Content (%)** | 12.534 | 12.538 | | | |

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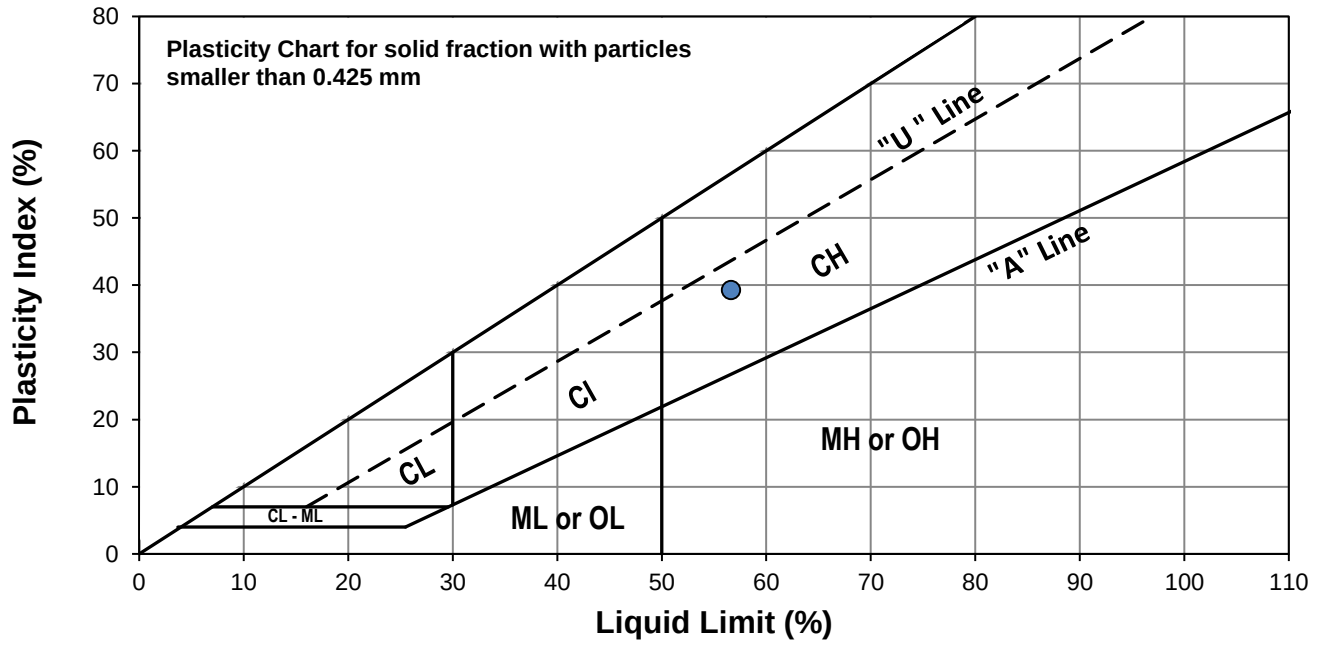
# Atterberg Limits
## ASTM D4318-10e1

| | |
|---|---|
| **Project No.** | 0395-001-00 |
| **Client** | WSP |
| **Project** | Local Streets 18-R-04 Beresford Ave |
| **Test Hole** | TH18-02 |
| **Sample #** | G10 |
| **Depth (m)** | 0.2-0.3 |
| **Sample Date** | 16-Jan-18 |
| **Test Date** | 8-Feb-18 |
| **Technician** | LI |

| | |
|---|---|
| **Liquid Limit** | 57 |
| **Plastic Limit** | 17 |
| **Plasticity Index** | 39 |

### Liquid Limit

| Trial # | 1 | 2 | 3 | | |
|---|---|---|---|---|---|
| **Number of Blows (N)** | 18 | 23 | 34 | | |
| **Mass Wet Soil + Tare (g)** | 27.207 | 26.677 | 24.500 | | |
| **Mass Dry Soil + Tare (g)** | 22.371 | 22.141 | 20.849 | | |
| **Mass Tare (g)** | 14.214 | 14.252 | 14.088 | | |
| **Mass Water (g)** | 4.836 | 4.536 | 3.651 | | |
| **Mass Dry Soil (g)** | 8.157 | 7.889 | 6.761 | | |
| **Moisture Content (%)** | 59.287 | 57.498 | 54.001 | | |




### Plastic Limit

| Trial # | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| **Mass Tare (g)** | 20.446 | 20.260 | | | |
| **Mass Wet Soil + Tare (g)** | 19.487 | 19.378 | | | |
| **Mass Dry Soil + Tare (g)** | 14.084 | 14.182 | | | |
| **Mass Water (g)** | 0.959 | 0.882 | | | |
| **Mass Dry Soil (g)** | 5.403 | 5.196 | | | |
| **Moisture Content (%)** | 17.749 | 16.975 | | | |

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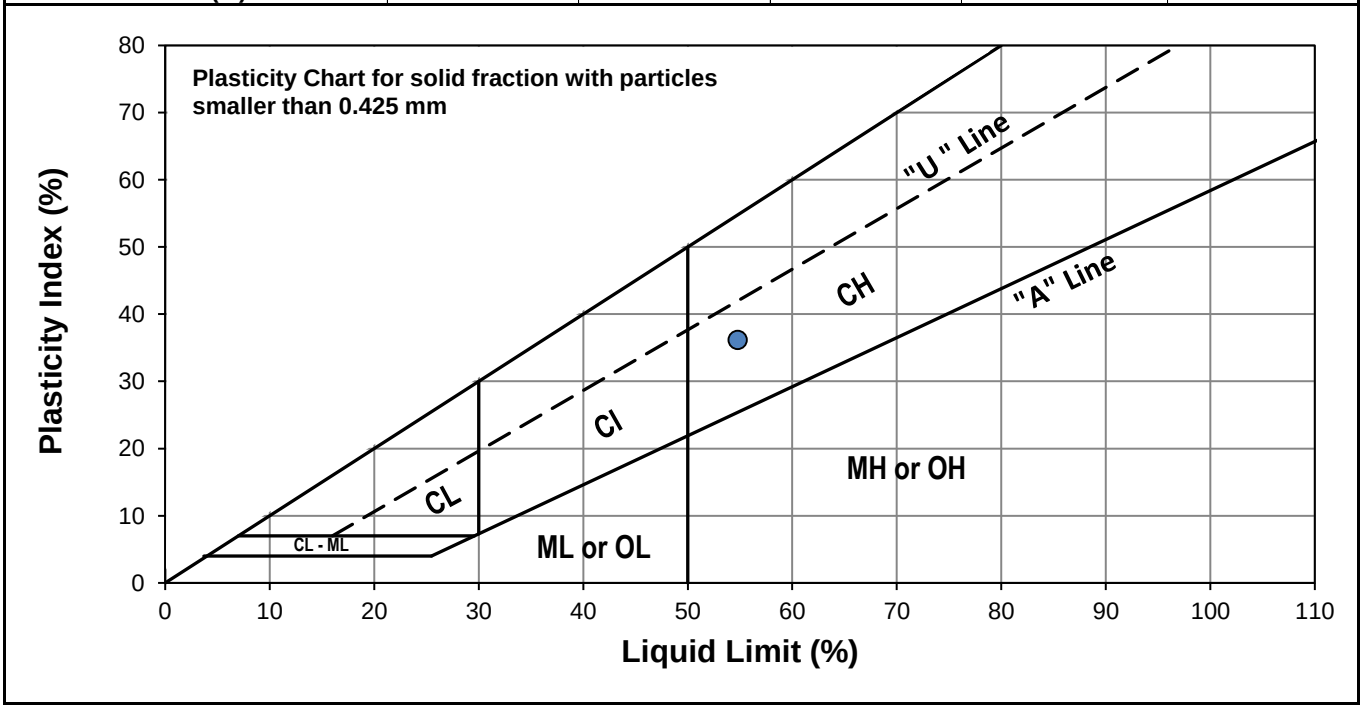
# Atterberg Limits
## ASTM D4318-10e1

| | |
|---|---|
| **Project No.** | 0395-001-00 |
| **Client** | WSP |
| **Project** | Local Streets 18-R-04 Beresford Ave |
| **Test Hole** | TH18-04 |
| **Sample #** | G27 |
| **Depth (m)** | 0.5-0.6 |
| **Sample Date** | 16-Jan-18 |
| **Test Date** | 14-Feb-18 |
| **Technician** | DS |

| | |
|---|---|
| **Liquid Limit** | 55 |
| **Plastic Limit** | 19 |
| **Plasticity Index** | 36 |

Liquid Limit

| Trial # | 1 | 2 | 3 | | |
|---|---|---|---|---|---|
| **Number of Blows (N)** | 17 | 21 | 31 | | |
| **Mass Wet Soil + Tare (g)** | 20.026 | 20.478 | 21.594 | | |
| **Mass Dry Soil + Tare (g)** | 17.831 | 18.226 | 18.904 | | |
| **Mass Tare (g)** | 13.997 | 14.198 | 13.863 | | |
| **Mass Water (g)** | 2.195 | 2.252 | 2.690 | | |
| **Mass Dry Soil (g)** | 3.834 | 4.028 | 5.041 | | |
| **Moisture Content (%)** | 57.251 | 55.909 | 53.362 | | |




Plastic Limit

| Trial # | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| **Mass Tare (g)** | 20.293 | 21.207 | | | |
| **Mass Wet Soil + Tare (g)** | 19.301 | 20.125 | | | |
| **Mass Dry Soil + Tare (g)** | 14.053 | 14.228 | | | |
| **Mass Water (g)** | 0.992 | 1.082 | | | |
| **Mass Dry Soil (g)** | 5.248 | 5.897 | | | |
| **Moisture Content (%)** | 18.902 | 18.348 | | | |

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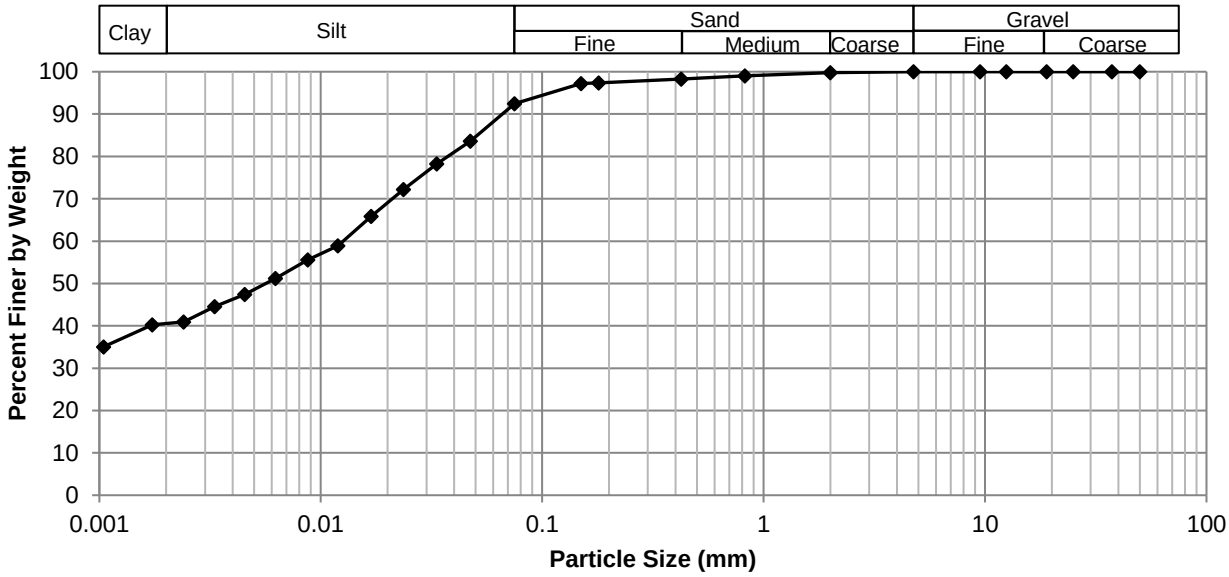
# Grain Size Analysis (Hydrometer Method)
## ASTM D422

| | |
|---|---|
| **Project No.** | 0395-001-00 |
| **Client** | WSP |
| **Project** | Local Streets 18-R-04 - Beresford Avenue |
| **Test Hole** | TH18-01 |
| **Sample #** | G02 |
| **Depth (m)** | 0.5 - 0.6 |
| **Sample Date** | 16-Jan-18 |
| **Test Date** | 8-Feb-18 |
| **Technician** | LI |

| | |
|---|---|
| **Gravel** | 0.0% |
| **Sand** | 7.5% |
| **Silt** | 52.0% |
| **Clay** | 40.5% |

### 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 | 92.47 |
| 37.5 | 100.00 | 2.00 | 99.77 | 0.0473 | 83.62 |
| 25.0 | 100.00 | 0.825 | 99.01 | 0.0335 | 78.23 |
| 19.0 | 100.00 | 0.425 | 98.28 | 0.0237 | 72.21 |
| 12.5 | 100.00 | 0.180 | 97.36 | 0.0169 | 65.87 |
| 9.50 | 100.00 | 0.150 | 97.20 | 0.0120 | 58.90 |
| 4.75 | 100.00 | 0.075 | 92.47 | 0.0088 | 55.62 |
| | | | | 0.0062 | 51.18 |
| | | | | 0.0045 | 47.42 |
| | | | | 0.0033 | 44.51 |
| | | | | 0.0024 | 40.89 |
| | | | | 0.0017 | 40.26 |
| | | | | 0.0010 | 35.06 |

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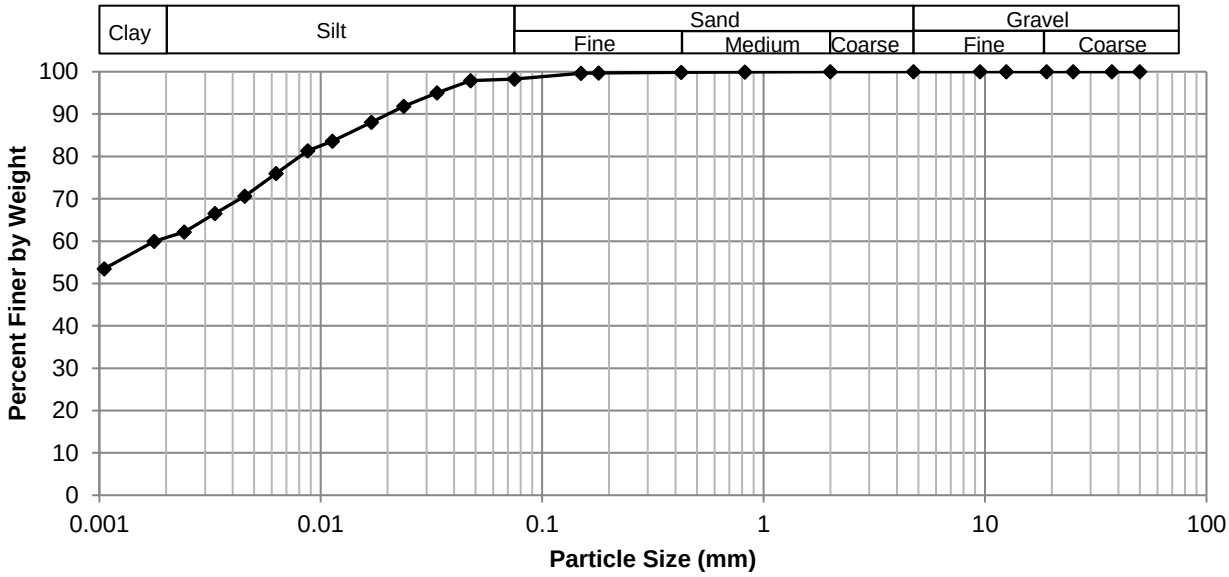
# Grain Size Analysis (Hydrometer Method)
## ASTM D422

| | |
|---|---|
| **Project No.** | 0395-001-00 |
| **Client** | WSP |
| **Project** | Local Streets 18-R-04 - Beresford Avenue |
| **Test Hole** | TH18-02 |
| **Sample #** | G10 |
| **Depth (m)** | 0.2 - 0.3 |
| **Sample Date** | 16-Jan-18 |
| **Test Date** | 8-Feb-18 |
| **Technician** | LI |

| | |
|---|---|
| **Gravel** | 0.0% |
| **Sand** | 1.7% |
| **Silt** | 37.5% |
| **Clay** | 60.7% |

### Particle Size Distribution Curve




| Gravel | | Sand | | Silt and Clay | |
|---|---|---|---|---|---|
| **Particle Size (mm)** | **Percent Passing** | **Particle Size (mm)** | **Percent Passing** | **Particle Size (mm)** | **Percent Passing** |
| 50.0 | 100.00 | 4.75 | 100.00 | 0.0750 | 98.28 |
| 37.5 | 100.00 | 2.00 | 99.98 | 0.0475 | 97.89 |
| 25.0 | 100.00 | 0.825 | 99.94 | 0.0336 | 95.03 |
| 19.0 | 100.00 | 0.425 | 99.87 | 0.0237 | 91.85 |
| 12.5 | 100.00 | 0.180 | 99.67 | 0.0170 | 88.04 |
| 9.50 | 100.00 | 0.150 | 99.61 | 0.0113 | 83.60 |
| 4.75 | 100.00 | 0.075 | 98.28 | 0.0088 | 81.37 |
| | | | | 0.0063 | 76.02 |
| | | | | 0.0045 | 70.62 |
| | | | | 0.0033 | 66.55 |
| | | | | 0.0024 | 62.18 |
| | | | | 0.0018 | 59.95 |
| | | | | 0.0011 | 53.47 |

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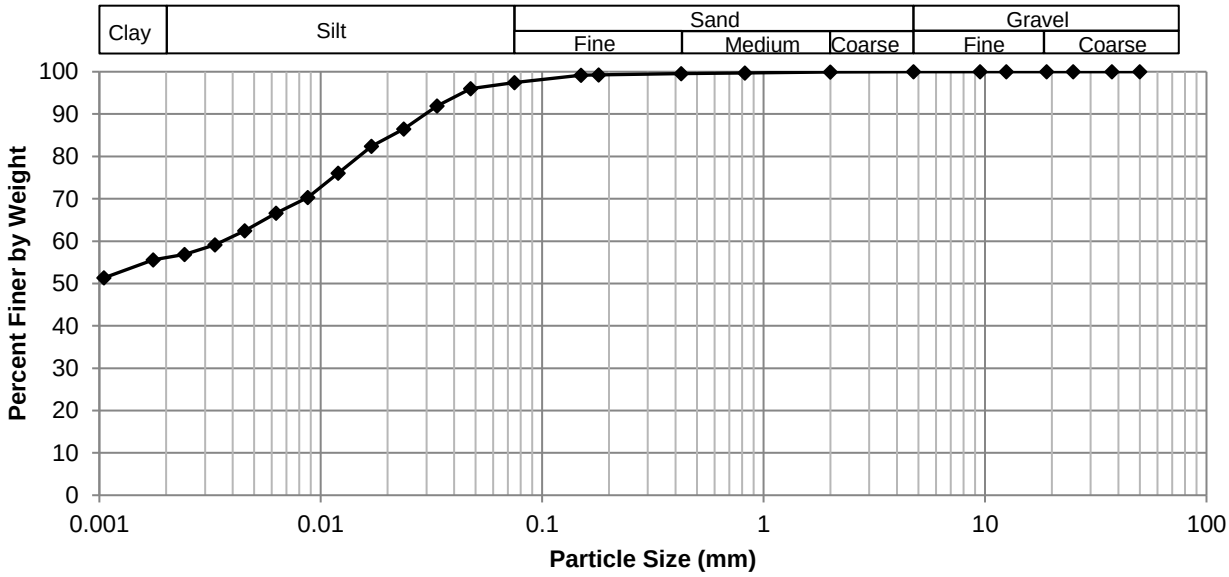
# Grain Size Analysis (Hydrometer Method)
## ASTM D422

| | |
|---|---|
| **Project No.** | 0395-001-00 |
| **Client** | WSP |
| **Project** | Local Streets 18-R-04 - Beresford Avenue |
| **Test Hole** | TH18-02 |
| **Sample #** | G27 |
| **Depth (m)** | 0.5 - 0.6 |
| **Sample Date** | 16-Jan-18 |
| **Test Date** | 8-Feb-18 |
| **Technician** | LI |

| | |
|---|---|
| **Gravel** | 0.0% |
| **Sand** | 2.5% |
| **Silt** | 41.4% |
| **Clay** | 56.0% |

### Particle Size Distribution Curve




| Gravel | | Sand | | Silt and Clay | |
|---|---|---|---|---|---|
| **Particle Size (mm)** | **Percent Passing** | **Particle Size (mm)** | **Percent Passing** | **Particle Size (mm)** | **Percent Passing** |
| 50.0 | 100.00 | 4.75 | 100.00 | 0.0750 | 97.45 |
| 37.5 | 100.00 | 2.00 | 99.96 | 0.0475 | 96.04 |
| 25.0 | 100.00 | 0.825 | 99.74 | 0.0336 | 91.91 |
| 19.0 | 100.00 | 0.425 | 99.55 | 0.0237 | 86.52 |
| 12.5 | 100.00 | 0.180 | 99.27 | 0.0170 | 82.39 |
| 9.50 | 100.00 | 0.150 | 99.20 | 0.0120 | 76.04 |
| 4.75 | 100.00 | 0.075 | 97.45 | 0.0088 | 70.32 |
| | | | | 0.0063 | 66.61 |
| | | | | 0.0045 | 62.43 |
| | | | | 0.0033 | 59.15 |
| | | | | 0.0024 | 56.84 |
| | | | | 0.0018 | 55.57 |
| | | | | 0.0010 | 51.32 |

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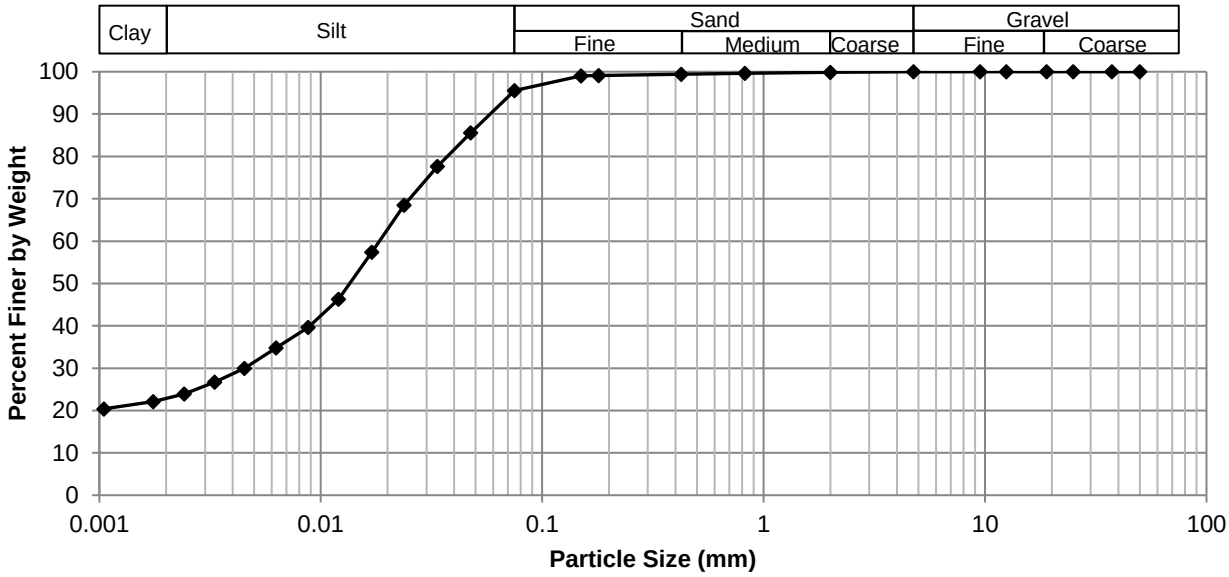
# Grain Size Analysis (Hydrometer Method)
## ASTM D422

| | |
|---|---|
| **Project No.** | 0395-001-00 |
| **Client** | WSP |
| **Project** | Local Streets 18-R-04 - Beresford Avenue |
| **Test Hole** | TH18-06 |
| **Sample #** | G44 |
| **Depth (m)** | 0.8 - 0.9 |
| **Sample Date** | 16-Jan-18 |
| **Test Date** | 12-Feb-18 |
| **Technician** | LI |

| | |
|---|---|
| **Gravel** | 0.0% |
| **Sand** | 4.4% |
| **Silt** | 72.0% |
| **Clay** | 23.5% |

### 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 | 95.58 |
| 37.5 | 100.00 | 2.00 | 99.90 | 0.0476 | 85.61 |
| 25.0 | 100.00 | 0.825 | 99.61 | 0.0337 | 77.68 |
| 19.0 | 100.00 | 0.425 | 99.40 | 0.0238 | 68.48 |
| 12.5 | 100.00 | 0.180 | 99.12 | 0.0170 | 57.37 |
| 9.50 | 100.00 | 0.150 | 99.05 | 0.0120 | 46.26 |
| 4.75 | 100.00 | 0.075 | 95.58 | 0.0088 | 39.60 |
| | | | | 0.0063 | 34.79 |
| | | | | 0.0045 | 29.97 |
| | | | | 0.0033 | 26.74 |
| | | | | 0.0024 | 23.95 |
| | | | | 0.0018 | 22.12 |
| | | | | 0.0010 | 20.40 |

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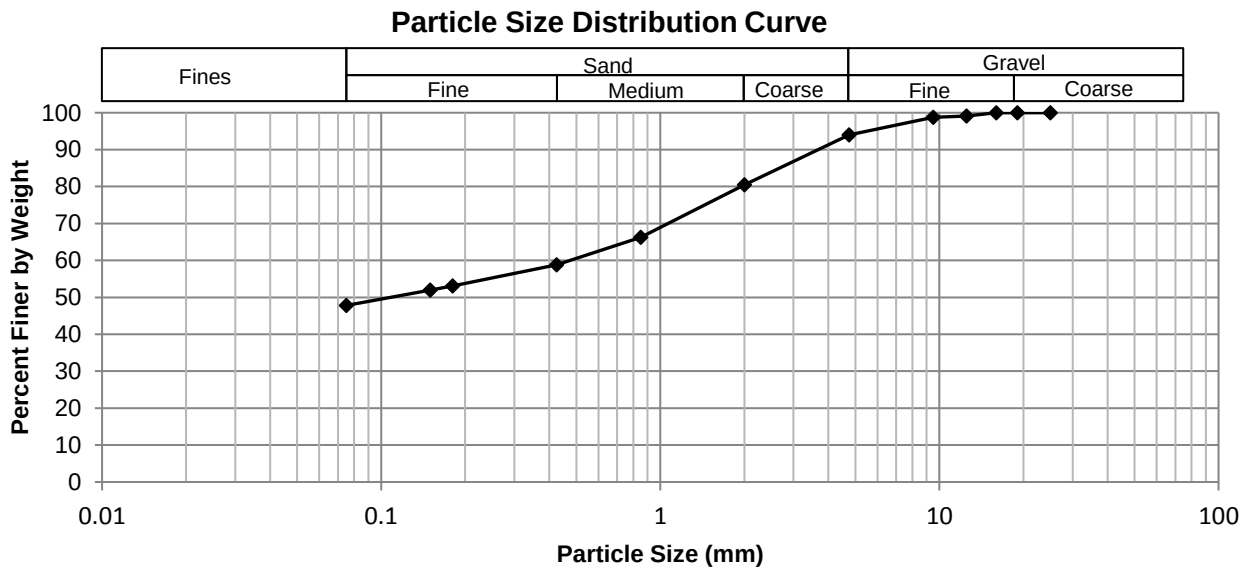
# Grain Size Analysis (Sieve Method)
## ASTM C136-06

**Project No.** 0395-001-00
**Client** WSP
**Project** Local Streets - 18-R-04 - Beresford Avenue

**Sample #** G34
**Source**
**Soil Desc.**
**Date Sampled** 16-Jan-18
**Date Tested** 17-Feb-18
**Technician** DS

| | |
|---|---|
| **Total Weight (g)** | 361.8 |
| **Gravel %** | 6.0 |
| **Sand %** | 46.2 |
| **Fines %** | 47.8 |




| Sieve Number | Sieve Opening (mm) | Percent Passing | Specification (Min-Max) |
|---|---|---|---|
| 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 | 100 | |
| 1/2" | 12.5 | 99 | |
| 3/8" | 9.50 | 99 | |
| no. 4 | 4.75 | 94 | |
| no. 10 | 2.00 | 81 | |
| no. 20 | 0.850 | 66 | |
| no. 40 | 0.425 | 59 | |
| no. 80 | 0.180 | 53.1 | |
| no. 100 | 0.150 | 52.0 | |
| no. 200 | 0.075 | 47.8 | |


Photo 1: Pavement Core Sample at Test Hole TH17-01


Photo 2: Pavement Core Sample at Test Hole TH17-02


Photo 3: Pavement Core Sample at Test Hole TH17-03


Photo 4: Pavement Core Sample at Test Hole TH17-04


Photo 5: Pavement Core Sample at Test Hole TH17-05


Photo 6: Pavement Core Sample at Test Hole TH17-06

# Appendix B

## Churchill Drive, between Casey St. to Eccles St.

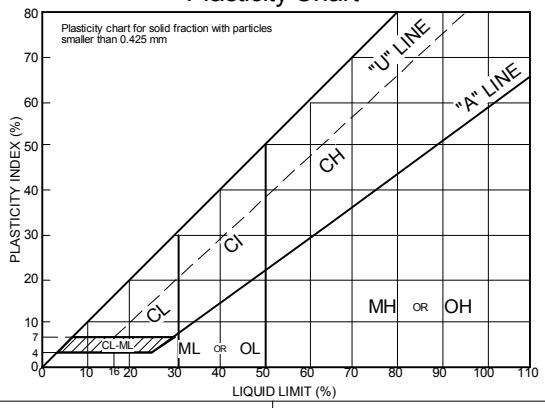
### Test Hole Logs, Summary Table, Lab Data and Photographs of Pavement Core Samples

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

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

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

**Other Symbol Types**

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

# EXPLANATION OF FIELD AND LABORATORY TESTING

## LEGEND OF ABBREVIATIONS AND SYMBOLS

LL - Liquid Limit (%)
PL - Plastic Limit (%)
PI - Plasticity Index (%)
MC - Moisture Content (%)
SPT - Standard Penetration Test
RQD - Rock Quality Designation
Qu - Unconfined Compression
Su - Undrained Shear Strength
VW - Vibrating Wire Piezometer
SI - Slope Inclinometer

▽ Water Level at Time of Drilling

▼ Water Level at End of Drilling

▼ Water Level After Drilling as Indicated on Test Hole Logs

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

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

## TERMS DESCRIBING CONSISTENCY OR COMPACTION CONDITION

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

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

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

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

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

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

# Sub-Surface Log

**Test Hole TH18-07**
1 of 1

| | | | |
|---|---|---|---|
| **Client:** | WSP Canada Group Ltd. | **Project Number:** | 0395-001-00 |
| **Project Name:** | Local Streets 18-R-04 - Churchill Drive | **Location:** | UTM N-5524622, E-634950 |
| **Contractor:** | Maple Leaf Drilling | **Ground Elevation:** | Top of Pavement |
| **Method:** | 125mm Solid Stem Auger, B40 Mobile Truck Mount | **Date Drilled:** | 2018 January 16 |

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

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

| Depth (m) | Soil Symbol | MATERIAL DESCRIPTION | Sample Type | Sample Number | Bulk Unit Wt (kN/m³) 16 17 18 19 20 21 / Particle Size (%) 0 20 40 60 80 100 / PL MC LL | Undrained Shear Strength (kPa) 0 50 100 150 200 250 |
|---|---|---|---|---|---|---|
| | | ASPHALT - 25 mm thick<br>CONCRETE - 203 mm thick | | | | |
| | | CLAY (FILL) - silty, some sand, trace gravel, dark brown, frozen, moist and soft when thawed, high plasticity | | G50 | | |
| 0.5 | | CLAY - silty, trace sand<br>- dark brown<br>- frozen to 1.22 m, moist and soft when thawed<br>- high plasticity | | G51 | | |
| | | | | G52 | | |
| 1.0 | | | | G53 | | |
| | | - very stiff below 1.37 m | | G54 | | |
| 1.5 | | | | G55 | | |
| | | | | G56 | | |
| 2.0 | | | | | | |
| 2.5 | | | | | | |
| | | - mottled light brown to brown, silt inclusions (<18 mm diam.) below 2.9 m | | G57 | | |
| 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 house #387, 16 m South of Cassey Eastbound Curb.

**Logged By:** Dawn Sellick **Reviewed By:** N.J Ferreira **Project Engineer:** Nelson Ferreira

SUB-SURFACE LOG LOGS 2018-02-21 LOCAL STREETS 18-R-04 CHURCHILL DRIVE_0395-001-00_0_A_DS.GPJ TREK GEOTECHNICAL.GDT 18-2-27

# Sub-Surface Log

**Test Hole TH18-08**
1 of 1

| | | | |
|---|---|---|---|
| **Client:** | WSP Canada Group Ltd. | **Project Number:** | 0395-001-00 |
| **Project Name:** | Local Streets 18-R-04 - Churchill Drive | **Location:** | UTM N-5524685, E-635036 |
| **Contractor:** | Maple Leaf Drilling | **Ground Elevation:** | Top of Pavement |
| **Method:** | 125mm Solid Stem Auger, B40 Mobile Truck Mount | **Date Drilled:** | 2018 January 16 |

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

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

| Depth (m) | Soil Symbol | MATERIAL DESCRIPTION | Sample Type | Sample Number | Bulk Unit Wt (kN/m³) 16 17 18 19 20 21 / Particle Size (%) 0 20 40 60 80 100 / PL MC LL | Undrained Shear Strength (kPa) 0 50 100 150 200 250 |
|---|---|---|---|---|---|---|
| | | ASPHALT - 25 mm thick | | | | |
| | | CONCRETE - 178 mm thick | | | | |
| | | CLAY (FILL) - silty, some sand, trace gravel, trace of precipitates (sulphates)<br>- brown<br>- frozen, moist and soft when thawed<br>- high plasticity | | G58 | | |
| 0.5 | | | | G59 | | |
| | | CLAY - some silt, some sand to 2.1 m, trace gravel to 0.76 m<br>- dark brown<br>- frozen to 1.2 m, moist and soft when thawed<br>- high plasticity<br>- soft to very stiff | | G60 | | |
| 1.0 | | | | G61 | | |
| | | - very stiff to stiff, mottled brown and grey below 1.4 m | | G62 | | |
| 1.5 | | | | G63 | | |
| 2.0 | | | | G64 | | |
| | | - brown and grey to dark grey, trace rootlets below 2.1 m | | G65 | | |
| 2.5 | | -drak grey to grey below 2.5 m | | | | |
| 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 house #117, 1.2 m South of North Curb.

**Logged By:** Dawn Sellick **Reviewed By:** N.J Ferreira **Project Engineer:** Nelson Ferreira

SUB-SURFACE LOG LOGS 2018-02-21 LOCAL STREETS 18-R-04 CHURCHILL DRIVE_0395-001-00_0_A_DS.GPJ TREK GEOTECHNICAL.GDT 18-2-27

# Sub-Surface Log

**Test Hole TH18-09**



| | | | |
|---|---|---|---|
| **Client:** | WSP Canada Group Ltd. | **Project Number:** | 0395-001-00 |
| **Project Name:** | Local Streets 18-R-04 - Churchill Drive | **Location:** | UTM N-5524758, E-635103 |
| **Contractor:** | Maple Leaf Drilling | **Ground Elevation:** | Top of Pavement |
| **Method:** | 125mm Solid Stem Auger, B40 Mobile Truck Mount | **Date Drilled:** | 2018 January 16 |

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 / Test Type: △ Torvane, ✤ Pocket Pen., ☒ Qu, ○ Field Vane |
|---|---|---|---|---|---|---|
| | | ASPHALT - 25 mm thick | | | | |
| | | CONCRETE - 165 mm thick | | | | |
| | | CLAY (FILL) - silty, some sand, trace gravel<br>- brown<br>- frozen, moist and soft when thawed<br>- high plasticity | | G66 | | |
| 0.5 | | | | G67 | | |
| | | CLAY - silty, trace sand to 1.52 m<br>- brown<br>- frozen to 1.07 m, moist and soft when thawed<br>- high plasticity | | G68 | | |
| 1.0 | | | | G69 | | |
| | | - very stiff below 1.37 m | | G70 | | |
| 1.5 | | - mottled brown and grey, trace rootlets below 1.52 m | | G71 | | |
| 2.0 | | | | G72 | | |
| 2.5 | | | | | | |
| | | | | G73 | | |
| 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 house #361, 2.7 m West of East Curb.

**Logged By:** Dawn Sellick **Reviewed By:** N.J Ferreira **Project Engineer:** Nelson Ferreira

# Sub-Surface Log

**Test Hole TH18-10**
1 of 1

| | | | |
|---|---|---|---|
| **Client:** | WSP Canada Group Ltd. | **Project Number:** | 0395-001-00 |
| **Project Name:** | Local Streets 18-R-04 - Churchill Drive | **Location:** | UTM N-5524831, E-635174 |
| **Contractor:** | Maple Leaf Drilling | **Ground Elevation:** | Top of Pavement |
| **Method:** | 125mm Solid Stem Auger, B40 Mobile Truck Mount | **Date Drilled:** | 2018 January 17 |

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

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

| Depth (m) | Soil Symbol | MATERIAL DESCRIPTION | Sample Type | Sample Number | Bulk Unit Wt (kN/m³) 16 17 18 19 20 21 / Particle Size (%) 0 20 40 60 80 100 / PL MC LL | Undrained Shear Strength (kPa) 0 50 100 150 200 250 |
|---|---|---|---|---|---|---|
| | | ASPHALT - 25 mm thick | | | | |
| | | CONCRETE - 178 mm thick | | | | |
| | | CLAY (FILL) - silty, trace sand<br>- brown<br>- frozen, moist and soft when thawed<br>- high plasticity | | G74 | | |
| 0.5 | | SILT AND CLAY - trace sand, grey and light brown, frozen, moist and soft when thawed, high plasticity | | G75 | | |
| | | CLAY - silty, trace sand to 1.22 m<br>- brown to dark brown<br>- frozen to 1.22 m, moist and soft when thawed<br>- high plasticity | | G76 | | |
| 1.0 | | - grey below 1.07 m | | G77 | | |
| | | - stiff, trace rootlets below 1.22 m | | G78 | | |
| 1.5 | | | | G79 | | |
| 2.0 | | | | | | |
| 2.5 | | | | G80 | | |
| 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 house #343, 1.1 m North of South Curb.

**Logged By:** Dawn Sellick **Reviewed By:** N.J Ferreira **Project Engineer:** Nelson Ferreira

SUB-SURFACE LOG LOGS 2018-02-21 LOCAL STREETS 18-R-04 CHURCHILL DRIVE_0395-001-00_0_A_DS.GPJ TREK GEOTECHNICAL.GDT 18-2-27

# Sub-Surface Log

**Test Hole TH18-11**
1 of 1

| | | | |
|---|---|---|---|
| **Client:** | WSP Canada Group Ltd. | **Project Number:** | 0395-001-00 |
| **Project Name:** | Local Streets 18-R-04 - Churchill Drive | **Location:** | UTM N-5524928, E-635238 |
| **Contractor:** | Maple Leaf Drilling | **Ground Elevation:** | Top of Pavement |
| **Method:** | 125mm Solid Stem Auger, B40 Mobile Truck Mount | **Date Drilled:** | 2018 January 17 |

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

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

| Depth (m) | Soil Symbol | MATERIAL DESCRIPTION | Sample Type | Sample Number | Bulk Unit Wt (kN/m³) 16 17 18 19 20 21 / Particle Size (%) 0 20 40 60 80 100 / PL MC LL 0 20 40 60 80 100 | Undrained Shear Strength (kPa) Test Type: △ Torvane △ ✤ Pocket Pen. ✤ ☒ Qu ☒ ○ Field Vane ○ 0 50 100 150 200 250 |
|---|---|---|---|---|---|---|
| | | ASPHALT - 25 mm thick | | | | |
| | | CONCRETE - 152 mm thick | | | | |
| | | CLAY (FILL) - silty, trace sand, trace gravel, brown, frozen, moist and soft when thawed, high plasticity | | G81 | | |
| 0.5 | | CLAY - silty, trace sand to 1.37 m, trace rootlets<br>- brown / dark brown<br>- frozen to 1.22 m, moist and soft when thawed<br>- high plasticity | | G82 | | |
| | | | | G83 | | |
| 1.0 | | | | G84 | | |
| | | - very stiff below 1.37 m | | G85 | | |
| 1.5 | | | | G86 | | |
| 2.0 | | | | | | |
| 2.5 | | | | G87 | | |
| 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 house #329, 1.9 m South of North Curb.

**Logged By:** Dawn Sellick **Reviewed By:** N.J Ferreira **Project Engineer:** Nelson Ferreira

SUB-SURFACE LOG LOGS 2018-02-21 LOCAL STREETS 18-R-04 CHURCHILL DRIVE_0395-001-00_0_A_DS.GPJ TREK GEOTECHNICAL.GDT 18-2-27

# Sub-Surface Log

**Test Hole TH18-12**
1 of 1

| | | | |
|---|---|---|---|
| **Client:** | WSP Canada Group Ltd. | **Project Number:** | 0395-001-00 |
| **Project Name:** | Local Streets 18-R-04 - Churchill Drive | **Location:** | UTM N-5525013, E-635294 |
| **Contractor:** | Maple Leaf Drilling | **Ground Elevation:** | Top of Pavement |
| **Method:** | 125mm Solid Stem Auger, B40 Mobile Truck Mount | **Date Drilled:** | 2018 January 17 |

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 - 229 mm thick | | | | |
| | | CLAY (FILL) - silty, trace sand, trace gravel, trace silt inclusions (<10 mm diam.)<br>- brown<br>- frozen to 1.22 m, moist and firm when thawed<br>- high plasticity | | G88 | | |
| 0.5 | | | | G89 | | |
| | | | | G90 | | |
| 1.0 | | | | G91 | | |
| | | CLAY - silty, trace sand to 1.52 m, trace silt inclusions (<5 mm diam.)<br>- mottled brown and black<br>- moist, stiff<br>- high plasticity | | G92 | | |
| 1.5 | | - brown, very stiff below 1.52 m | | G93 | | |
| 2.0 | | | | | | |
| 2.5 | | | | G94 | | |
| 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 house #315, 1.2 m North of South Curb.

**Logged By:** Dawn Sellick **Reviewed By:** N.J Ferreira **Project Engineer:** Nelson Ferreira

SUB-SURFACE LOG LOGS 2018-02-21 LOCAL STREETS 18-R-04 CHURCHILL DRIVE_0395-001-00_0_A_DS.GPJ TREK GEOTECHNICAL.GDT 18-2-27

**Local Streets Package 18-R-04**
**Sub-Surface Investigation**
**Churchill Drive**

| 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: 5524622 N, 634950 E Located at House #387, 16 m South of Cassey Eastbound curb. | Asphalt | 25 | Concrete | 203 | | | | | | | | | | | |
| | | | | | | CLAY (FILL) | 0.2 | 0.3 | 31 | | | | | | | |
| | | | | | | CLAY | 0.5 | 0.6 | 28 | | | | | | | |
| | | | | | | CLAY | 0.8 | 0.9 | 29 | | | | | | | |
| | | | | | | CLAY | 1.1 | 1.2 | 32 | | | | | | | |
| | | | | | | CLAY | 1.4 | 1.5 | 31 | | | | | | | |
| | | | | | | CLAY | 1.7 | 1.8 | 31 | | | | | | | |
| | | | | | | CLAY | 2.0 | 2.1 | 32 | | | | | | | |
| | | | | | | CLAY | 2.9 | 3.0 | 35 | | | | | | | |
| TH18-08 | UTM: 5524685 N, 635036 E Located at House # 117, 1.2 m South of North curb. | Asphalt | 25 | Concrete | 178 | | | | | | | | | | | |
| | | | | | | CLAY (FILL) | 0.2 | 0.3 | 37 | | | | | | | |
| | | | | | | CLAY (FILL) | 0.5 | 0.6 | 38 | | | | | | | |
| | | | | | | CLAY | 0.6 | 0.8 | 30 | 5 | 22 | 19 | 55 | 21 | 65 | 43 |
| | | | | | | CLAY | 0.9 | 1.2 | 29 | | | | | | | |
| | | | | | | CLAY | 1.4 | 1.5 | 32 | | | | | | | |
| | | | | | | CLAY | 1.7 | 1.8 | 32 | | | | | | | |
| | | | | | | CLAY | 2.0 | 2.1 | 40 | | | | | | | |
| | | | | | | CLAY | 2.9 | 3.0 | 44 | | | | | | | |
| TH18-09 | UTM: 5524758 N, 635103 E Located at House #361, 2.7 m West of East curb. | Asphalt | 25 | Concrete | 165 | | | | | | | | | | | |
| | | | | | | CLAY (FILL) | 0.2 | 0.3 | 36 | | | | | | | |
| | | | | | | CLAY (FILL) | 0.5 | 0.6 | 29 | | | | | | | |
| | | | | | | CLAY | 0.8 | 0.9 | 28 | | | | | | | |
| | | | | | | CLAY | 1.1 | 1.2 | 31 | | | | | | | |
| | | | | | | CLAY | 1.4 | 1.5 | 36 | | | | | | | |
| | | | | | | CLAY | 1.7 | 1.8 | 42 | | | | | | | |
| | | | | | | CLAY | 2.0 | 2.1 | 41 | | | | | | | |
| | | | | | | CLAY | 2.9 | 3.0 | 31 | | | | | | | |
| TH18-10 | UTM: 5524831 N, 635174 E Located at House #343, 1.1 m North of South curb. | Asphalt | 25 | Concrete | 178 | | | | | | | | | | | |
| | | | | | | CLAY (FILL) | 0.2 | 0.3 | 34 | | | | | | | |
| | | | | | | SILT AND CLAY | 0.5 | 0.6 | 34 | 0 | 4 | 30 | 67 | 21 | 67 | 47 |
| | | | | | | CLAY | 0.8 | 0.9 | 30 | | | | | | | |
| | | | | | | CLAY | 1.1 | 1.2 | 32 | | | | | | | |
| | | | | | | CLAY | 1.4 | 1.5 | 35 | | | | | | | |
| | | | | | | CLAY | 1.7 | 1.8 | 36 | | | | | | | |
| | | | | | | CLAY | 2.7 | 2.9 | 38 | | | | | | | |

**Local Streets Package 18-R-04**
**Sub-Surface Investigation**
**Churchill Drive**

| 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 |
| TH18-11 | UTM: 5524928 N, 635238 E Located at House #329, 1.9 m South of North curb. | Asphalt | 25 | Concrete | 152 | | | | | | | | | | | |
| | | | | | | CLAY (FILL) | 0.2 | 0.3 | 36 | | | | | | | |
| | | | | | | CLAY | 0.5 | 0.6 | 30 | | | | | | | |
| | | | | | | CLAY | 0.8 | 0.9 | 31 | | | | | | | |
| | | | | | | CLAY | 1.1 | 1.2 | 25 | | | | | | | |
| | | | | | | CLAY | 1.4 | 1.5 | 27 | | | | | | | |
| | | | | | | CLAY | 1.7 | 1.8 | 25 | | | | | | | |
| | | | | | | CLAY | 2.7 | 2.9 | 23 | | | | | | | |
| TH18-12 | UTM: 5525013 N, 635294 E Located at House #315, 1.2 m North of South curb. | Asphalt | N/A | Concrete | 229 | | | | | | | | | | | |
| | | | | | | CLAY (FILL) | 0.2 | 0.3 | 36 | 1 | 11 | 25 | 63 | 20 | 70 | 50 |
| | | | | | | CLAY (FILL) | 0.5 | 0.6 | 29 | | | | | | | |
| | | | | | | CLAY (FILL) | 0.8 | 0.9 | 33 | | | | | | | |
| | | | | | | CLAY | 1.1 | 1.2 | 35 | | | | | | | |
| | | | | | | CLAY | 1.4 | 1.5 | 34 | | | | | | | |
| | | | | | | CLAY | 1.7 | 1.8 | 34 | | | | | | | |
| | | | | | | CLAY | 2.7 | 2.9 | 29 | | | | | | | |

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# Moisture Content Report
## ASTM D2216-10

**Project No.** 0395-001-00
**Client** WSP
**Project** Local Streets 18-R-04 -Churchill Drive

**Sample Date** 16-Jan-18
**Test Date** 7-Feb-18
**Technician** LI

| Test Pit | TH18-07 | TH18-07 | TH18-07 | TH18-07 | TH18-07 | TH18-07 |
|---|---|---|---|---|---|---|
| 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 # | G50 | G51 | G52 | G53 | G54 | G55 |
| Tare ID | C15 | Z02 | W36 | N11 | F132 | GH67 |
| Mass of tare | 8.6 | 8.4 | 8.4 | 8.6 | 8.6 | 8.4 |
| Mass wet + tare | 256.4 | 270.8 | 258.8 | 295.6 | 312.4 | 345.0 |
| Mass dry + tare | 198.2 | 214.2 | 203.0 | 225.8 | 240.0 | 265.0 |
| Mass water | 58.2 | 56.6 | 55.8 | 69.8 | 72.4 | 80.0 |
| Mass dry soil | 189.6 | 205.8 | 194.6 | 217.2 | 231.4 | 256.6 |
| Moisture % | 30.7% | 27.5% | 28.7% | 32.1% | 31.3% | 31.2% |

| Test Pit | TH18-07 | TH18-07 | TH18-08 | TH18-08 | TH18-08 | TH18-08 |
|---|---|---|---|---|---|---|
| Depth (m) | 2.0 - 2.1 | 2.9 - 3.0 | 0.2 - 0.3 | 0.5 - 0.6 | 0.6 - 0.8 | 0.9 - 1.2 |
| Sample # | G56 | G57 | G58 | G59 | G60 | G61 |
| Tare ID | H74 | K5 | E61 | Z98 | N19 | F56 |
| Mass of tare | 8.6 | 8.6 | 8.4 | 8.4 | 8.6 | 8.4 |
| Mass wet + tare | 394.8 | 304.2 | 256.4 | 270.2 | 245.2 | 311 |
| Mass dry + tare | 301.0 | 228.4 | 189.0 | 198.6 | 191.2 | 243.0 |
| Mass water | 93.8 | 75.8 | 67.4 | 71.6 | 54.0 | 68.0 |
| Mass dry soil | 292.4 | 219.8 | 180.6 | 190.2 | 182.6 | 234.6 |
| Moisture % | 32.1% | 34.5% | 37.3% | 37.6% | 29.6% | 29.0% |

| Test Pit | TH18-08 | TH18-08 | TH18-08 | TH18-08 | TH18-09 | TH18-09 |
|---|---|---|---|---|---|---|
| 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 # | G62 | G63 | G64 | G65 | G66 | G67 |
| Tare ID | Z101 | E28 | W59 | E103 | Z132 | AB13 |
| Mass of tare | 8.4 | 8.4 | 8.4 | 8.6 | 8.4 | 6.6 |
| Mass wet + tare | 293.0 | 337.0 | 334.4 | 305.0 | 246.0 | 215.0 |
| Mass dry + tare | 224.6 | 257.0 | 241.8 | 214.2 | 183.4 | 168.2 |
| Mass water | 68.4 | 80.0 | 92.6 | 90.8 | 62.6 | 46.8 |
| Mass dry soil | 216.2 | 248.6 | 233.4 | 205.6 | 175.0 | 161.6 |
| Moisture % | 31.6% | 32.2% | 39.7% | 44.2% | 35.8% | 29.0% |

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# Moisture Content Report
## ASTM D2216-10

**Project No.** 0395-001-00
**Client** WSP
**Project** Local Streets 18-R-04 -Churchill Drive

**Sample Date** 16-Jan-18
**Test Date** 7-Feb-18
**Technician** LI

| Test Pit | TH18-09 | TH18-09 | TH18-09 | TH18-09 | TH18-09 | TH18-09 |
|---|---|---|---|---|---|---|
| Depth (m) | 0.8 - 0.9 | 1.1 - 1.2 | 1.4 - 1.5 | 1.7 - 1.8 | 2.0 - 2.1 | 2.9 - 3.0 |
| Sample # | G68 | G69 | G70 | G71 | G72 | G73 |
| Tare ID | AC25 | E40 | AB64 | Z49 | P14 | E33 |
| Mass of tare | 6.6 | 8.4 | 6.8 | 8.4 | 8.8 | 8.6 |
| Mass wet + tare | 281.4 | 299.4 | 275.6 | 306.2 | 309.4 | 282.8 |
| Mass dry + tare | 221.0 | 231.2 | 204.8 | 217.8 | 222.4 | 217.6 |
| Mass water | 60.4 | 68.2 | 70.8 | 88.4 | 87.0 | 65.2 |
| Mass dry soil | 214.4 | 222.8 | 198.0 | 209.4 | 213.6 | 209.0 |
| Moisture % | 28.2% | 30.6% | 35.8% | 42.2% | 40.7% | 31.2% |

| Test Pit | TH18-10 | TH18-10 | TH18-10 | TH18-10 | TH18-10 | TH18-10 |
|---|---|---|---|---|---|---|
| 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 # | G74 | G75 | G76 | G77 | G78 | G79 |
| Tare ID | AB88 | W82 | Z39 | F37 | Z135 | F137 |
| Mass of tare | 6.6 | 8.6 | 8.6 | 8.4 | 8.6 | 8.4 |
| Mass wet + tare | 272.6 | 264.2 | 268.0 | 223.8 | 273.0 | 328.2 |
| Mass dry + tare | 204.8 | 199.8 | 208.4 | 171.2 | 204.8 | 244.0 |
| Mass water | 67.8 | 64.4 | 59.6 | 52.6 | 68.2 | 84.2 |
| Mass dry soil | 198.2 | 191.2 | 199.8 | 162.8 | 196.2 | 235.6 |
| Moisture % | 34.2% | 33.7% | 29.8% | 32.3% | 34.8% | 35.7% |

| Test Pit | TH18-10 | TH18-11 | TH18-11 | TH18-11 | TH18-11 | TH18-11 |
|---|---|---|---|---|---|---|
| Depth (m) | 2.7 - 2.9 | 0.2 - 0.3 | 0.5 - 0.6 | 0.8 - 0.9 | 1.1 - 1.2 | 1.4 - 1.5 |
| Sample # | G80 | G81 | G82 | G83 | G84 | G85 |
| Tare ID | Z123 | H34 | F95 | W90 | AB02 | N54 |
| Mass of tare | 8.4 | 8.4 | 8.4 | 8.6 | 7.2 | 8.4 |
| Mass wet + tare | 308.6 | 261.0 | 247.2 | 288.6 | 270.4 | 292.0 |
| Mass dry + tare | 226.0 | 194.2 | 192.8 | 222.2 | 217.4 | 231.8 |
| Mass water | 82.6 | 66.8 | 54.4 | 66.4 | 53.0 | 60.2 |
| Mass dry soil | 217.6 | 185.8 | 184.4 | 213.6 | 210.2 | 223.4 |
| Moisture % | 38.0% | 36.0% | 29.5% | 31.1% | 25.2% | 26.9% |

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# Moisture Content Report
## ASTM D2216-10

**Project No.** 0395-001-00
**Client** WSP
**Project** Local Streets 18-R-04 -Churchill Drive

**Sample Date** 16-Jan-18
**Test Date** 7-Feb-18
**Technician** LI

| Test Pit | TH18-11 | TH18-11 | TH18-12 | TH18-12 | TH18-12 | TH18-12 |
|---|---|---|---|---|---|---|
| Depth (m) | 1.7 - 1.8 | 2.7 - 2.9 | 0.2 - 0.3 | 0.5 - 0.6 | 0.8 - 0.9 | 1.1 - 1.2 |
| Sample # | G86 | G87 | G88 | G89 | G90 | G91 |
| Tare ID | F84 | A26 | K28 | F10 | E49 | F20 |
| Mass of tare | 8.6 | 8.5 | 8.6 | 9.0 | 8.6 | 8.4 |
| Mass wet + tare | 358.4 | 309.6 | 272.0 | 322.8 | 304.8 | 315.8 |
| Mass dry + tare | 288.6 | 253.8 | 201.8 | 253.2 | 231.6 | 235.4 |
| Mass water | 69.8 | 55.8 | 70.2 | 69.6 | 73.2 | 80.4 |
| Mass dry soil | 280.0 | 245.3 | 193.2 | 244.2 | 223.0 | 227.0 |
| Moisture % | 24.9% | 22.7% | 36.3% | 28.5% | 32.8% | 35.4% |

| Test Pit | TH18-12 | TH18-12 | TH18-12 | | | |
|---|---|---|---|---|---|---|
| Depth (m) | 1.4 - 1.5 | 1.7 - 1.8 | 2.7 - 2.9 | | | |
| Sample # | G92 | G93 | G94 | | | |
| Tare ID | E13 | AB82 | F117 | | | |
| Mass of tare | 8.8 | 6.6 | 8.4 | | | |
| Mass wet + tare | 320.2 | 326.2 | 330.8 | | | |
| Mass dry + tare | 242.0 | 245.0 | 258.2 | | | |
| Mass water | 78.2 | 81.2 | 72.6 | | | |
| Mass dry soil | 233.2 | 238.4 | 249.8 | | | |
| Moisture % | 33.5% | 34.1% | 29.1% | | | |

| 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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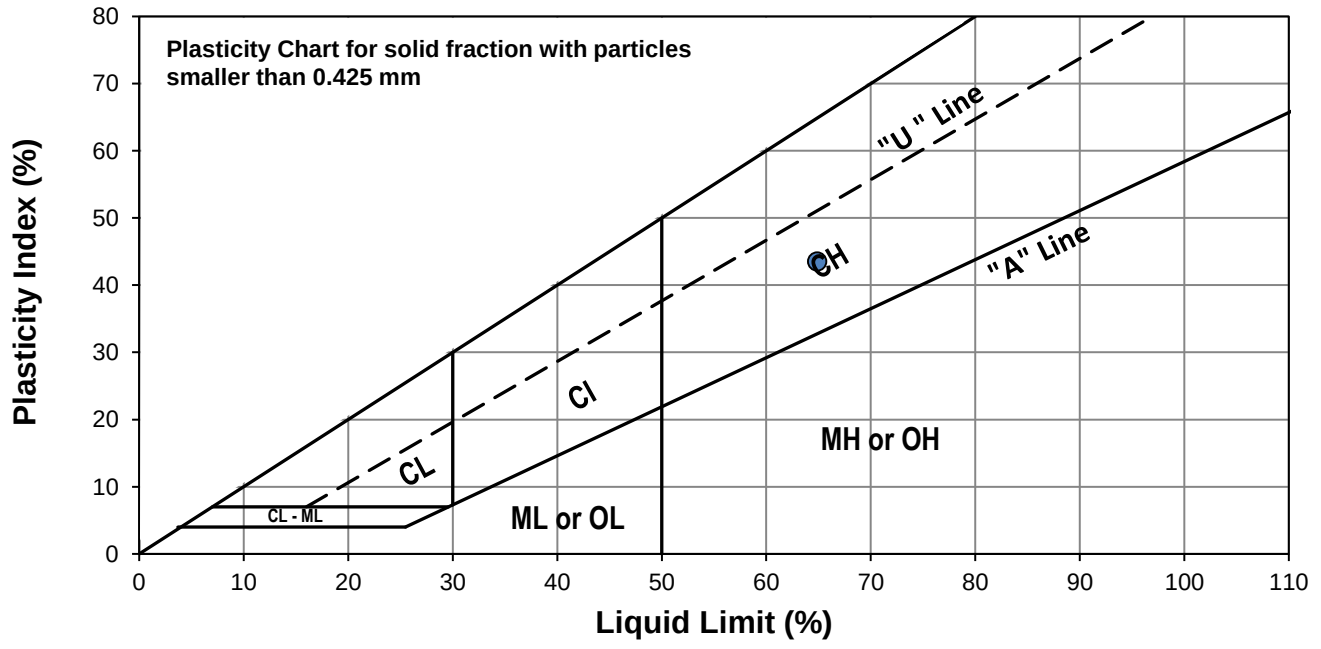
# Atterberg Limits
## ASTM D4318-10e1

| | |
|---|---|
| **Project No.** | 0395-001-00 |
| **Client** | WSP |
| **Project** | Local Streets 18-R-04 Churchill Drive |
| **Test Hole** | TH18-08 |
| **Sample #** | G60 |
| **Depth (m)** | 0.5-0.6 |
| **Sample Date** | 16-Jan-18 |
| **Test Date** | 18-Feb-18 |
| **Technician** | DS |

| | |
|---|---|
| **Liquid Limit** | 65 |
| **Plastic Limit** | 21 |
| **Plasticity Index** | 43 |

## Liquid Limit

| Trial # | 1 | 2 | 3 | | |
|---|---|---|---|---|---|
| **Number of Blows (N)** | 17 | 27 | 34 | | |
| **Mass Wet Soil + Tare (g)** | 20.860 | 20.885 | 20.399 | | |
| **Mass Dry Soil + Tare (g)** | 18.218 | 18.146 | 17.946 | | |
| **Mass Tare (g)** | 14.241 | 13.906 | 14.087 | | |
| **Mass Water (g)** | 2.642 | 2.739 | 2.453 | | |
| **Mass Dry Soil (g)** | 3.977 | 4.240 | 3.859 | | |
| **Moisture Content (%)** | 66.432 | 64.599 | 63.566 | | |




## Plastic Limit

| Trial # | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| **Mass Tare (g)** | 21.199 | 20.734 | | | |
| **Mass Wet Soil + Tare (g)** | 19.885 | 19.622 | | | |
| **Mass Dry Soil + Tare (g)** | 13.788 | 14.376 | | | |
| **Mass Water (g)** | 1.314 | 1.112 | | | |
| **Mass Dry Soil (g)** | 6.097 | 5.246 | | | |
| **Moisture Content (%)** | 21.552 | 21.197 | | | |

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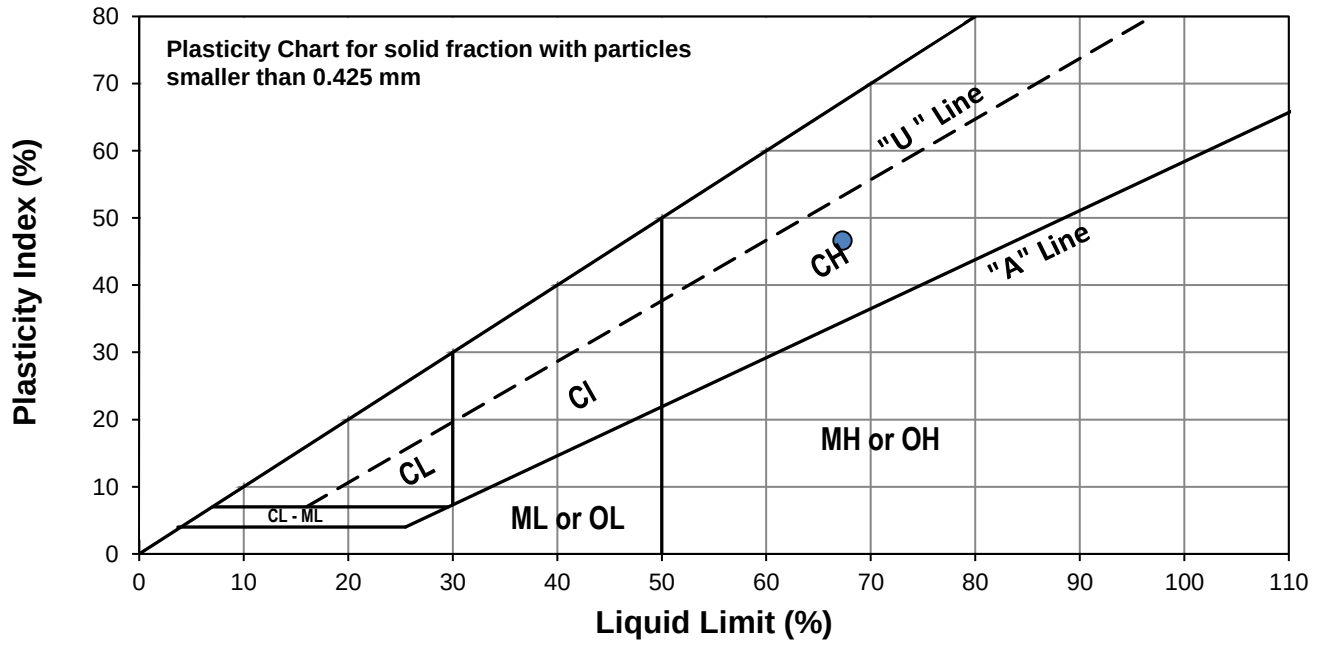
# Atterberg Limits
## ASTM D4318-10e1

| | |
|---|---|
| **Project No.** | 0395-001-00 |
| **Client** | WSP |
| **Project** | Local Streets 18-R-04 Churchill Drive |
| **Test Hole** | TH18-10 |
| **Sample #** | G75 |
| **Depth (m)** | 0.5-0.6 |
| **Sample Date** | 16-Jan-18 |
| **Test Date** | 18-Feb-18 |
| **Technician** | DS |

| | |
|---|---|
| **Liquid Limit** | 67 |
| **Plastic Limit** | 21 |
| **Plasticity Index** | 47 |

### Liquid Limit

| Trial # | 1 | 2 | 3 | | |
|---|---|---|---|---|---|
| **Number of Blows (N)** | 16 | 20 | 26 | | |
| **Mass Wet Soil + Tare (g)** | 22.468 | 20.842 | 22.460 | | |
| **Mass Dry Soil + Tare (g)** | 19.099 | 18.157 | 19.088 | | |
| **Mass Tare (g)** | 14.221 | 14.235 | 14.057 | | |
| **Mass Water (g)** | 3.369 | 2.685 | 3.372 | | |
| **Mass Dry Soil (g)** | 4.878 | 3.922 | 5.031 | | |
| **Moisture Content (%)** | 69.065 | 68.460 | 67.024 | | |




### Plastic Limit

| Trial # | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| **Mass Tare (g)** | 20.624 | 19.935 | | | |
| **Mass Wet Soil + Tare (g)** | 19.516 | 18.955 | | | |
| **Mass Dry Soil + Tare (g)** | 14.103 | 14.251 | | | |
| **Mass Water (g)** | 1.108 | 0.980 | | | |
| **Mass Dry Soil (g)** | 5.413 | 4.704 | | | |
| **Moisture Content (%)** | 20.469 | 20.833 | | | |

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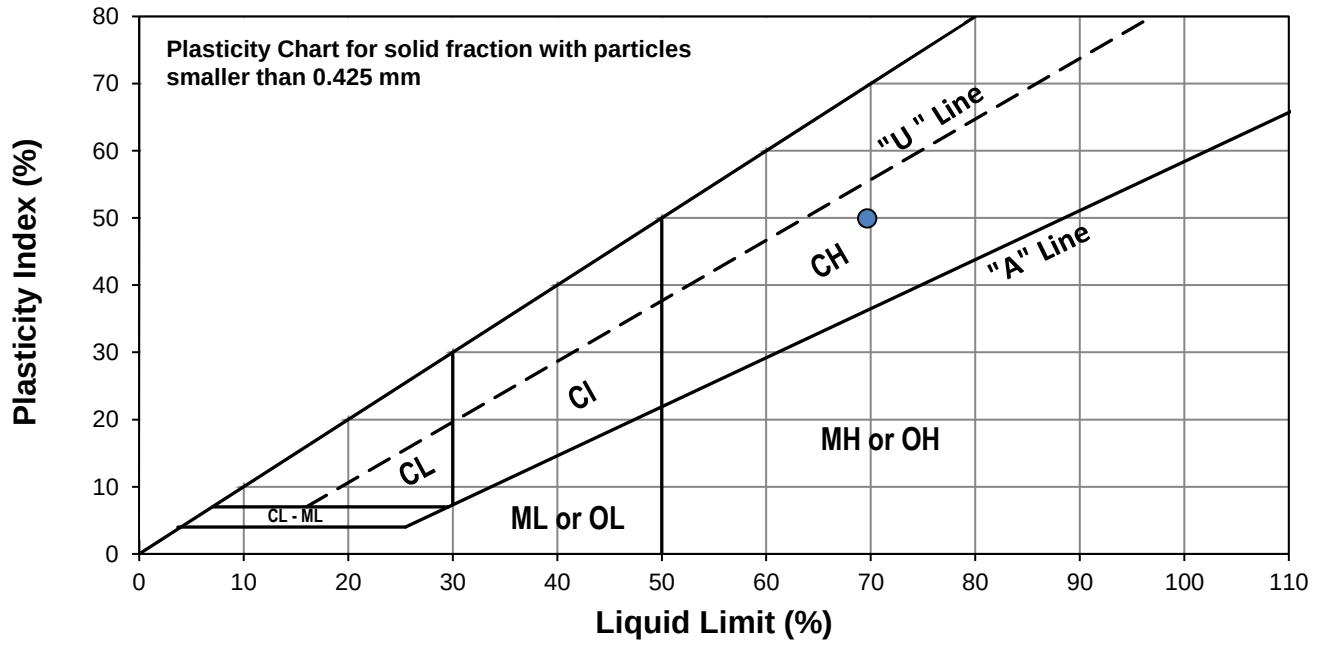
# Atterberg Limits
## ASTM D4318-10e1

| | |
|---|---|
| **Project No.** | 0395-001-00 |
| **Client** | WSP |
| **Project** | Local Streets 18-R-04 Churchill Drive |
| **Test Hole** | TH18-12 |
| **Sample #** | G88 |
| **Depth (m)** | 0.5-0.6 |
| **Sample Date** | 16-Jan-18 |
| **Test Date** | 20-Feb-18 |
| **Technician** | DS |

| | |
|---|---|
| **Liquid Limit** | 70 |
| **Plastic Limit** | 20 |
| **Plasticity Index** | 50 |

### Liquid Limit

| Trial # | 1 | 2 | 3 | | |
|---|---|---|---|---|---|
| **Number of Blows (N)** | 18 | 22 | 35 | | |
| **Mass Wet Soil + Tare (g)** | 20.050 | 20.740 | 20.552 | | |
| **Mass Dry Soil + Tare (g)** | 17.520 | 17.963 | 17.943 | | |
| **Mass Tare (g)** | 14.075 | 14.060 | 13.978 | | |
| **Mass Water (g)** | 2.530 | 2.777 | 2.609 | | |
| **Mass Dry Soil (g)** | 3.445 | 3.903 | 3.965 | | |
| **Moisture Content (%)** | 73.440 | 71.150 | 65.801 | | |




### Plastic Limit

| Trial # | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| **Mass Tare (g)** | 21.346 | 20.771 | | | |
| **Mass Wet Soil + Tare (g)** | 20.158 | 19.632 | | | |
| **Mass Dry Soil + Tare (g)** | 14.230 | 13.779 | | | |
| **Mass Water (g)** | 1.188 | 1.139 | | | |
| **Mass Dry Soil (g)** | 5.928 | 5.853 | | | |
| **Moisture Content (%)** | 20.040 | 19.460 | | | |

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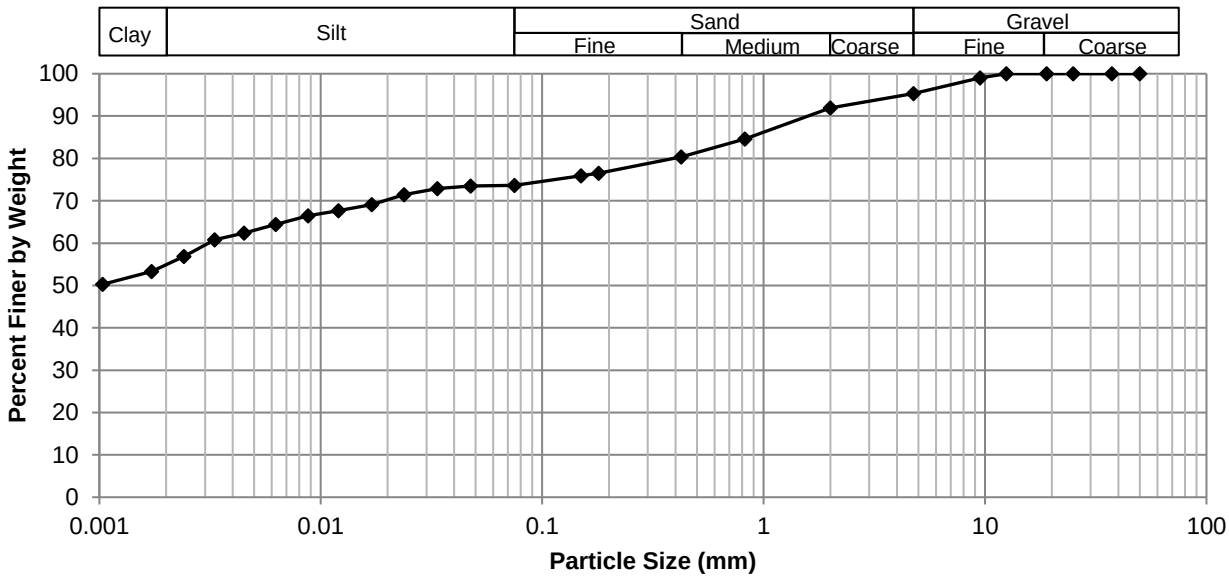
# Grain Size Analysis (Hydrometer Method)
## ASTM D422

| | |
|---|---|
| **Project No.** | 0395-001-00 |
| **Client** | WSP |
| **Project** | Local Streets 18-R-04 - Churchill Drive |
| **Test Hole** | TH18-08 |
| **Sample #** | G60 |
| **Depth (m)** | 0.6 - 0.8 |
| **Sample Date** | 16-Jan-18 |
| **Test Date** | 12-Feb-18 |
| **Technician** | LI |

| | |
|---|---|
| **Gravel** | 4.6% |
| **Sand** | 21.7% |
| **Silt** | 18.9% |
| **Clay** | 54.7% |

### Particle Size Distribution Curve




| Gravel | | Sand | | Silt and Clay | |
|---|---|---|---|---|---|
| **Particle Size (mm)** | **Percent Passing** | **Particle Size (mm)** | **Percent Passing** | **Particle Size (mm)** | **Percent Passing** |
| 50.0 | 100.00 | 4.75 | 95.35 | 0.0750 | 73.62 |
| 37.5 | 100.00 | 2.00 | 91.95 | 0.0476 | 73.49 |
| 25.0 | 100.00 | 0.825 | 84.61 | 0.0337 | 72.91 |
| 19.0 | 100.00 | 0.425 | 80.36 | 0.0238 | 71.45 |
| 12.5 | 100.00 | 0.180 | 76.50 | 0.0170 | 69.11 |
| 9.50 | 99.01 | 0.150 | 75.89 | 0.0120 | 67.65 |
| 4.75 | 95.35 | 0.075 | 73.62 | 0.0088 | 66.48 |
| | | | | 0.0063 | 64.44 |
| | | | | 0.0045 | 62.40 |
| | | | | 0.0033 | 60.79 |
| | | | | 0.0024 | 56.84 |
| | | | | 0.0017 | 53.31 |
| | | | | 0.0010 | 50.27 |

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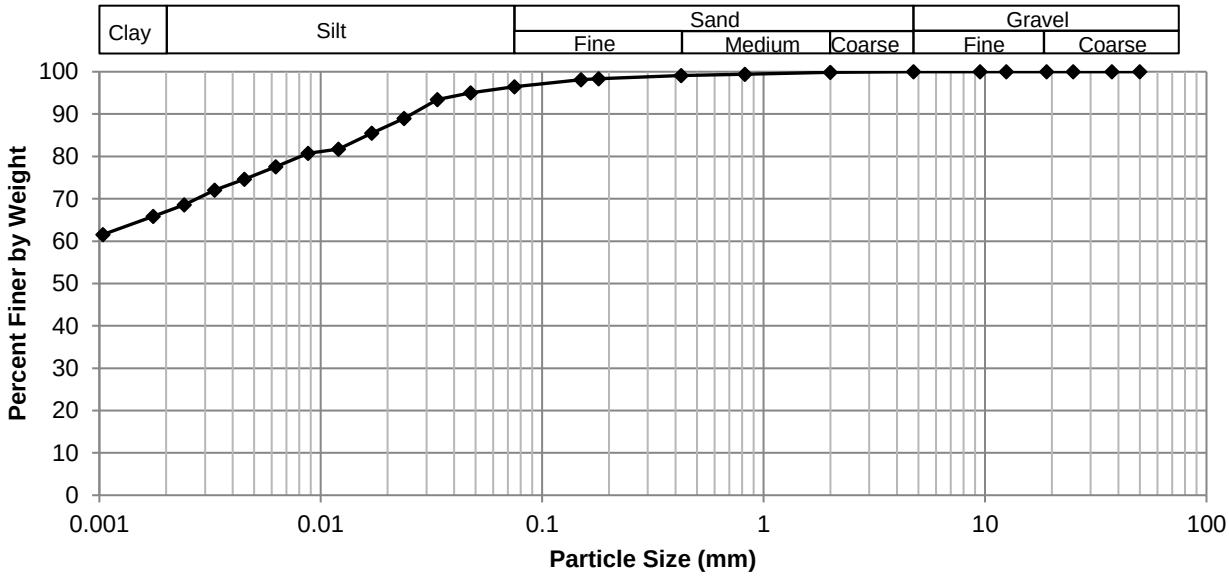
# Grain Size Analysis (Hydrometer Method)
## ASTM D422

| | |
|---|---|
| **Project No.** | 0395-001-00 |
| **Client** | WSP |
| **Project** | Local Streets 18-R-04 - Churchill Drive |
| **Test Hole** | TH18-10 |
| **Sample #** | G75 |
| **Depth (m)** | 0.5 - 0.6 |
| **Sample Date** | 16-Jan-18 |
| **Test Date** | 12-Feb-18 |
| **Technician** | LI |

| | |
|---|---|
| **Gravel** | 0.0% |
| **Sand** | 3.5% |
| **Silt** | 29.6% |
| **Clay** | 66.9% |

### 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 | 96.46 |
| 37.5 | 100.00 | 2.00 | 99.85 | 0.0476 | 95.04 |
| 25.0 | 100.00 | 0.825 | 99.44 | 0.0337 | 93.45 |
| 19.0 | 100.00 | 0.425 | 99.07 | 0.0238 | 89.01 |
| 12.5 | 100.00 | 0.180 | 98.32 | 0.0170 | 85.52 |
| 9.50 | 100.00 | 0.150 | 98.15 | 0.0120 | 81.71 |
| 4.75 | 100.00 | 0.075 | 96.46 | 0.0088 | 80.76 |
| | | | | 0.0063 | 77.59 |
| | | | | 0.0045 | 74.63 |
| | | | | 0.0033 | 72.04 |
| | | | | 0.0024 | 68.61 |
| | | | | 0.0018 | 65.82 |
| | | | | 0.0010 | 61.57 |

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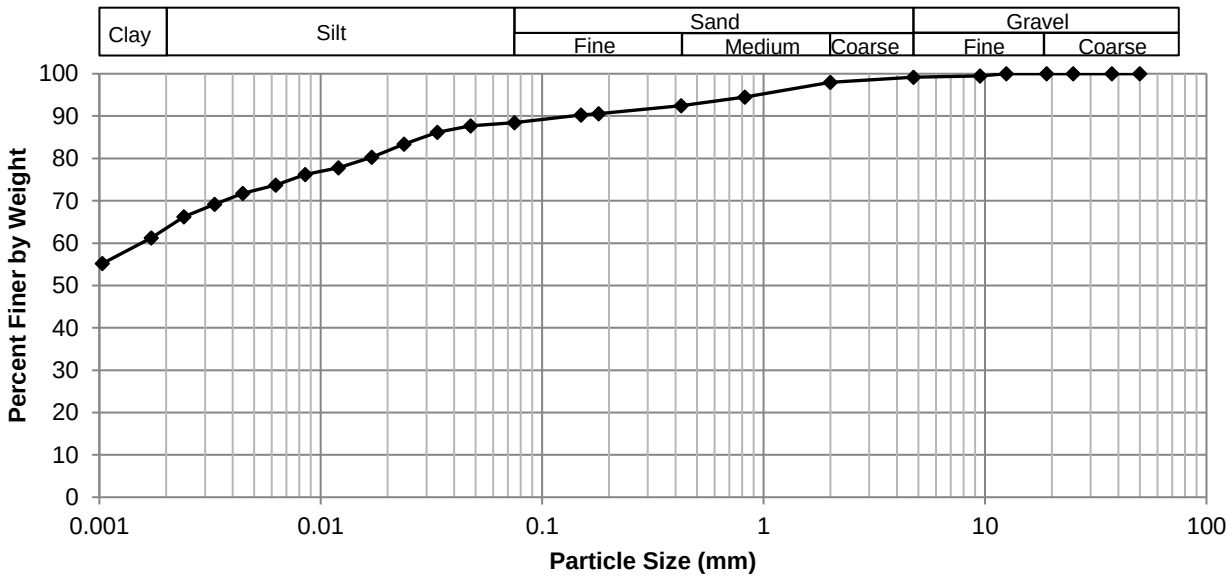
# Grain Size Analysis (Hydrometer Method)
## ASTM D422

| | |
|---|---|
| **Project No.** | 0395-001-00 |
| **Client** | WSP |
| **Project** | Local Streets 18-R-04 - Churchill Drive |
| **Test Hole** | TH18-12 |
| **Sample #** | G88 |
| **Depth (m)** | 0.2 - 0.3 |
| **Sample Date** | 16-Jan-18 |
| **Test Date** | 12-Feb-18 |
| **Technician** | LI |

| | |
|---|---|
| **Gravel** | 0.8% |
| **Sand** | 10.7% |
| **Silt** | 25.2% |
| **Clay** | 63.3% |

### 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 | 99.21 | 0.0750 | 88.48 |
| 37.5 | 100.00 | 2.00 | 98.01 | 0.0476 | 87.73 |
| 25.0 | 100.00 | 0.825 | 94.48 | 0.0337 | 86.17 |
| 19.0 | 100.00 | 0.425 | 92.42 | 0.0238 | 83.37 |
| 12.5 | 100.00 | 0.180 | 90.53 | 0.0170 | 80.26 |
| 9.50 | 99.47 | 0.150 | 90.23 | 0.0120 | 77.77 |
| 4.75 | 99.21 | 0.075 | 88.48 | 0.0085 | 76.21 |
| | | | | 0.0063 | 73.72 |
| | | | | 0.0045 | 71.74 |
| | | | | 0.0033 | 69.20 |
| | | | | 0.0024 | 66.24 |
| | | | | 0.0017 | 61.23 |
| | | | | 0.0010 | 55.19 |


Photo 1: Pavement Core Sample at Test Hole TH17-07


Photo 2: Pavement Core Sample at Test Hole TH17-08


Photo 3: Pavement Core Sample at Test Hole TH17-09


Photo 4: Pavement Core Sample at Test Hole TH17-10


Photo 5: Pavement Core Sample at Test Hole TH17-11


Photo 6: Pavement Core Sample at Test Hole TH17-12

# Appendix C

## Haig Ave., between Des Meurons St. to Egerton Road

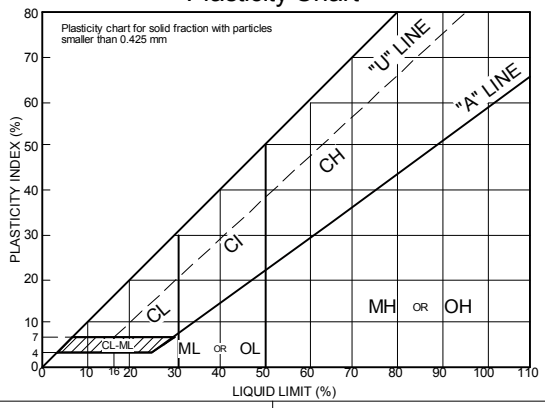
### Test Hole Logs, Summary Table, Lab Data and Photographs of Pavement Core Samples

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

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

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

**Other Symbol Types**

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

# EXPLANATION OF FIELD AND LABORATORY TESTING

## LEGEND OF ABBREVIATIONS AND SYMBOLS

LL - Liquid Limit (%)
PL - Plastic Limit (%)
PI - Plasticity Index (%)
MC - Moisture Content (%)
SPT - Standard Penetration Test
RQD - Rock Quality Designation
Qu - Unconfined Compression
Su - Undrained Shear Strength
VW - Vibrating Wire Piezometer
SI - Slope Inclinometer

▽ Water Level at Time of Drilling

▼ Water Level at End of Drilling

▼ Water Level After Drilling as Indicated on Test Hole Logs

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

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

## TERMS DESCRIBING CONSISTENCY OR COMPACTION CONDITION

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

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

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

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

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

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

# Sub-Surface Log

**Test Hole TH18-13**
1 of 1

| | | | |
|---|---|---|---|
| **Client:** | WSP Canada Group Ltd. | **Project Number:** | 0395-001-00 |
| **Project Name:** | Local Streets 18-R-04 - Haig Avenue | **Location:** | UTM N-5525896, E-635980 |
| **Contractor:** | Maple Leaf Drilling | **Ground Elevation:** | Top of Pavement |
| **Method:** | 125mm Solid Stem Auger, B40 Mobile Truck Mount | **Date Drilled:** | 2018 January 17 |

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 - 178 mm thick | | | | |
| | | CLAY (FILL) - silty, trace sand, trace gravel<br>- dark grey<br>- frozen, moist and firm when thawed<br>-high plasticity | | G95 | ● | △ ✤ |
| 0.5 | | CLAY - silty<br>- grey<br>- frozen to 1.22 m, moist and firm when thawed<br>- high plasticity | | G96 | ● | |
| | | | | G97 | ● | △ ✤ |
| 1.0 | | | | G98 | ● | |
| | | - stiff, precipitates (sulphate) below 1.37 m | | G99 | ● | △ ✤ |
| 1.5 | | | | G100 | ● | △ ✤ |
| | | SILT - trace clay, trace sand<br>- light brown<br>- wet, very soft<br>- low plasticity | | | | |
| 2.0 | | | | | | |
| 2.5 | | | | G101 | ● | ✤ |
| 3.0 | | | | | | |

END OF TEST HOLE AT 3.0 m IN SILT
1) No seepage or sloughing.
2) Test hole backfilled with auger cuttings, bentonite chips, sand and cold patch asphalt.
3) Test hole located at house #52, 2 m North of South Curb.

**Logged By:** Dawn Sellick **Reviewed By:** N.J Ferreira **Project Engineer:** Nelson Ferreira

SUB-SURFACE LOG LOGS 2018-02-21 LOCAL STREETS 18-R-04 HAIG AVENUE 0395-001-00 0 A DS.GPJ TREK GEOTECHNICAL.GDT 18-2-28

# Sub-Surface Log

**Test Hole TH18-14**
1 of 1

| | | | |
|---|---|---|---|
| **Client:** | WSP Canada Group Ltd. | **Project Number:** | 0395-001-00 |
| **Project Name:** | Local Streets 18-R-04 - Haig Avenue | **Location:** | UTM N-5525948, E-636064 |
| **Contractor:** | Maple Leaf Drilling | **Ground Elevation:** | Top of Pavement |
| **Method:** | 125mm Solid Stem Auger, B40 Mobile Truck Mount | **Date Drilled:** | 2018 January 17 |

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 - 178 mm thick | | | | |
| | | CLAY (FILL) - silty, trace sand<br>- dark grey<br>- frozen, moist and soft when thawed<br>- high plasticity | | G102 | | |
| 0.5 | | CLAY - silty<br>- grey<br>- frozen to 1.22 m, moist and firm when thawed<br>- high plasticity | | G103 | | |
| | | | | G104 | | |
| 1.0 | | | | G105 | | |
| | | SILT AND CLAY - trace sand<br>- light brown<br>- moist, very soft<br>- intermediate plasticity | | G106 | | |
| 1.5 | | CLAY - silty<br>- brown<br>- moist, stiff<br>- high plasticity | | G107 | | |
| 2.0 | | | | | | |
| 2.5 | | | | | | |
| | | - brown to grey, stiff below 2.74 m | | G108 | | |
| 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 house #77, 1.4 m South of North Curb.

**Logged By:** Dawn Sellick **Reviewed By:** N.J Ferreira **Project Engineer:** Nelson Ferreira

SUB-SURFACE LOG LOGS 2018-02-21 LOCAL STREETS 18-R-04 HAIG AVENUE 0395-001-00 0 A DS.GPJ TREK GEOTECHNICAL.GDT 18-2-28

# Sub-Surface Log

**Test Hole TH18-15**
1 of 1

| | | | |
|---|---|---|---|
| **Client:** | WSP Canada Group Ltd. | **Project Number:** | 0395-001-00 |
| **Project Name:** | Local Streets 18-R-04 - Haig Avenue | **Location:** | UTM N-5525981, E-636134 |
| **Contractor:** | Maple Leaf Drilling | **Ground Elevation:** | Top of Pavement |
| **Method:** | 125mm Solid Stem Auger, B40 Mobile Truck Mount | **Date Drilled:** | 2018 January 17 |

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 - 152 mm thick | | | | |
| | | CLAY (FILL) - silty, trace sand<br>- dark brown<br>- frozen, moist and soft when thawed<br>- intermediate plasticity | | G109 | | |
| 0.5 | | CLAY - silty, trace sand<br>- brown<br>- frozen to 1.22 m, moist and firm when thawed<br>- high plasticity | | G110 | | |
| | | | | G111 | | |
| 1.0 | | - brown to light brown below 1.07 m | | G112 | | |
| | | SILT - trace clay, trace sand<br>- light brown<br>- moist, soft<br>- low plasticity | | G113 | | |
| 1.5 | | CLAY - silty<br>- brown<br>- moist, very stiff<br>- high plasticity | | G114 | | |
| 2.0 | | | | | | |
| 2.5 | | | | | | |
| | | - grey, firm below 2.74 m | | G115 | | |
| 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 house #98, 2.6 m North of South Curb.

**Logged By:** Dawn Sellick **Reviewed By:** N.J Ferreira **Project Engineer:** Nelson Ferreira

SUB-SURFACE LOG LOGS 2018-02-21 LOCAL STREETS 18-R-04 HAIG AVENUE 0395-001-00 0 A DS.GPJ TREK GEOTECHNICAL.GDT 18-2-28

# Sub-Surface Log

**Test Hole TH18-16**
1 of 1

| | | | |
|---|---|---|---|
| **Client:** | WSP Canada Group Ltd. | **Project Number:** | 0395-001-00 |
| **Project Name:** | Local Streets 18-R-04 - Haig Avenue | **Location:** | UTM N-5526022, E-636216 |
| **Contractor:** | Maple Leaf Drilling | **Ground Elevation:** | Top of Pavement |
| **Method:** | 125mm Solid Stem Auger, B40 Mobile Truck Mount | **Date Drilled:** | 2018 January 17 |

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 - 152 mm thick | | |
| | | CLAY (FILL) - silty, trace sand, trace organics<br>- dark brown<br>- frozen, moist and soft when thawed<br>- high plasticity | | G116 |
| 0.5 | | CLAY - silty, trace sand<br>- brown<br>- frozen, moist and firm when thawed<br>- high plasticity | | G117 |
| | | - brown to light grey below 0.76 m | | G118 |
| 1.0 | | SILT - trace clay, trace sand<br>- light brown<br>- frozen to 1.22 m, moist and soft when thawed<br>- low plasticity | | G119 |
| | | CLAY - silty, trace precipitates (sulphate)<br>- brown<br>- moist, firm to stiff<br>- high plasticity | | G120 |
| 1.5 | | | | G121 |
| 2.0 | | | | |
| 2.5 | | | | |
| | | - grey, firm below 2.9 m | | G122 |
| 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 house #117, 1.2 m South of North Curb.

**Logged By:** Dawn Sellick **Reviewed By:** N.J Ferreira **Project Engineer:** Nelson Ferreira

SUB-SURFACE LOG LOGS 2018-02-21_LOCAL STREETS 18-R-04 HAIG AVENUE_0395-001-00_0_A_DS.GPJ TREK GEOTECHNICAL.GDT 18-2-28

**Local Streets Package 18-R-04**
**Sub-Surface Investigation**
**Haig 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 |
| TH18-13 | UTM: 5525896 N, 635980 E Located at House #52, 2 m North of South curb. | Asphalt | N/A | Concrete | 178 | | | | | | | | | | | |
| | | | | | | CLAY (FILL) | 0.2 | 0.3 | 36 | | | | | | | |
| | | | | | | CLAY | 0.5 | 0.6 | 31 | | | | | | | |
| | | | | | | CLAY | 0.8 | 0.9 | 31 | | | | | | | |
| | | | | | | CLAY | 1.1 | 1.2 | 30 | | | | | | | |
| | | | | | | CLAY | 1.4 | 1.5 | 32 | | | | | | | |
| | | | | | | CLAY | 1.7 | 1.8 | 35 | | | | | | | |
| | | | | | | SILT | 2.7 | 2.9 | 25 | | | | | | | |
| TH18-14 | UTM: 5525948 N, 636064 E Located at House # 77, 1.4 m South of North curb. | Asphalt | N/A | Concrete | 178 | | | | | | | | | | | |
| | | | | | | CLAY (FILL) | 0.2 | 0.3 | 39 | | | | | | | |
| | | | | | | CLAY | 0.5 | 0.6 | 30 | 0 | 1 | 19 | 80 | 22 | 77 | 54 |
| | | | | | | CLAY | 0.8 | 0.9 | 27 | | | | | | | |
| | | | | | | CLAY | 1.1 | 1.2 | 28 | | | | | | | |
| | | | | | | SILT AND CLAY | 1.4 | 1.5 | 24 | | | | | | | |
| | | | | | | CLAY | 1.7 | 1.8 | 30 | | | | | | | |
| | | | | | | CLAY | 2.7 | 2.9 | 50 | | | | | | | |
| TH18-15 | UTM: 5525981 N, 636134 E Located at House #98, 2.6 m North of South curb. | Asphalt | N/A | Concrete | 152 | | | | | | | | | | | |
| | | | | | | CLAY (FILL) | 0.2 | 0.3 | 39 | | | | | | | |
| | | | | | | CLAY | 0.5 | 0.6 | 36 | | | | | | | |
| | | | | | | CLAY | 0.8 | 0.9 | 57 | | | | | | | |
| | | | | | | CLAY | 1.1 | 1.2 | 34 | | | | | | | |
| | | | | | | SILT | 1.4 | 1.5 | 23 | | | | | | | |
| | | | | | | CLAY | 1.7 | 1.8 | 34 | | | | | | | |
| | | | | | | CLAY | 2.7 | 2.9 | 48 | | | | | | | |
| TH18-16 | UTM: 5526022 N, 636216 E Located at House #117, 1.2 m South of North curb. | Asphalt | N/A | Concrete | 152 | | | | | | | | | | | |
| | | | | | | CLAY (FILL) | 0.2 | 0.3 | 41 | 0 | 3 | 19 | 78 | 22 | 81 | 58 |
| | | | | | | CLAY | 0.5 | 0.6 | 36 | | | | | | | |
| | | | | | | CLAY | 0.8 | 0.9 | 39 | | | | | | | |
| | | | | | | SILT | 1.1 | 1.2 | 28 | | | | | | | |
| | | | | | | CLAY | 1.4 | 1.5 | 36 | | | | | | | |
| | | | | | | CLAY | 1.7 | 1.8 | 43 | | | | | | | |
| | | | | | | CLAY | 2.7 | 2.9 | 52 | | | | | | | |

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# Moisture Content Report
## ASTM D2216-10

**Project No.** 0395-001-00
**Client** WSP
**Project** Local Streets 18-R-04 - Haig Avenue

**Sample Date** 17-Jan-18
**Test Date** 08-Feb-18
**Technician** DS

| Test Pit | TH18-13 | TH18-13 | TH18-13 | TH18-13 | TH18-13 | TH18-13 |
|---|---|---|---|---|---|---|
| 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 # | G95 | G95 | G97 | G98 | G99 | G100 |
| Tare ID | W04 | AB96 | AC38 | F91 | K12 | N43 |
| Mass of tare | 8.5 | 6.7 | 6.6 | 8.3 | 8.5 | 8.4 |
| Mass wet + tare | 332.9 | 301.9 | 288.2 | 370.1 | 357.9 | 376.6 |
| Mass dry + tare | 246.8 | 232.6 | 221.5 | 287.0 | 272.5 | 281.3 |
| Mass water | 86.1 | 69.3 | 66.7 | 83.1 | 85.4 | 95.3 |
| Mass dry soil | 238.3 | 225.9 | 214.9 | 278.7 | 264.0 | 272.9 |
| Moisture % | 36.1% | 30.7% | 31.0% | 29.8% | 32.3% | 34.9% |

| Test Pit | TH18-13 | TH18-14 | TH18-14 | TH18-14 | TH18-14 | TH18-14 |
|---|---|---|---|---|---|---|
| Depth (m) | 2.7 - 2.9 | 0.2 - 0.3 | 0.5 - 0.6 | 0.8 - 0.9 | 1.1 - 1.2 | 1.4 - 1.5 |
| Sample # | G101 | G102 | G103 | G104 | G105 | G106 |
| Tare ID | E36 | N113 | AC24 | E99 | W75 | AA09 |
| Mass of tare | 8.6 | 8.4 | 6.6 | 8.4 | 8.4 | 7.0 |
| Mass wet + tare | 357.2 | 324.6 | 403 | 363.4 | 321.8 | 350.4 |
| Mass dry + tare | 288.3 | 236.2 | 312.8 | 287.6 | 253.1 | 283.9 |
| Mass water | 68.9 | 88.4 | 90.2 | 75.8 | 68.7 | 66.5 |
| Mass dry soil | 279.7 | 227.8 | 306.2 | 279.2 | 244.7 | 276.9 |
| Moisture % | 24.6% | 38.8% | 29.5% | 27.1% | 28.1% | 24.0% |

| Test Pit | TH18-14 | TH18-14 | TH18-15 | TH18-15 | TH18-15 | TH18-15 |
|---|---|---|---|---|---|---|
| Depth (m) | 1.7 - 1.8 | 2.7 - 2.9 | 0.2 - 0.3 | 0.5 - 0.6 | 0.8 - 0.9 | 1.1 - 1.2 |
| Sample # | G107 | G108 | G109 | G110 | G111 | G112 |
| Tare ID | E125 | F150 | A20 | A104 | AB73 | F114 |
| Mass of tare | 8.3 | 8.4 | 8.7 | 8.4 | 6.6 | 8.3 |
| Mass wet + tare | 360.0 | 357.2 | 316.8 | 302.1 | 332.1 | 315.9 |
| Mass dry + tare | 279.3 | 241.2 | 230.4 | 223.9 | 214.6 | 237.4 |
| Mass water | 80.7 | 116.0 | 86.4 | 78.2 | 117.5 | 78.5 |
| Mass dry soil | 271.0 | 232.8 | 221.7 | 215.5 | 208.0 | 229.1 |
| Moisture % | 29.8% | 49.8% | 39.0% | 36.3% | 56.5% | 34.3% |

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# Moisture Content Report
## ASTM D2216-10

**Project No.** 0395-001-00
**Client** WSP
**Project** Local Streets 18-R-04 - Haig Avenue

**Sample Date** 17-Jan-18
**Test Date** 08-Feb-18
**Technician** DS

| Test Pit | TH18-15 | TH18-15 | TH18-15 | TH18-16 | TH18-16 | TH18-16 |
|---|---|---|---|---|---|---|
| Depth (m) | 1.4 - 1.5 | 1.7 - 1.8 | 2.7 - 2.9 | 0.2 - 0.3 | 0.5 - 0.6 | 0.8 - 0.9 |
| Sample # | G113 | G114 | G115 | G116 | G117 | G118 |
| Tare ID | Z05 | W63 | F50 | N61 | E19 | K25 |
| Mass of tare | 8.4 | 8.8 | 8.7 | 8.6 | 8.4 | 8.5 |
| Mass wet + tare | 410.6 | 390.9 | 363.5 | 402.9 | 327.7 | 304.4 |
| Mass dry + tare | 334.7 | 293.2 | 249.2 | 288.8 | 242.8 | 220.9 |
| Mass water | 75.9 | 97.7 | 114.3 | 114.1 | 84.9 | 83.5 |
| Mass dry soil | 326.3 | 284.4 | 240.5 | 280.2 | 234.4 | 212.4 |
| Moisture % | 23.3% | 34.4% | 47.5% | 40.7% | 36.2% | 39.3% |

| Test Pit | TH18-16 | TH18-16 | TH18-16 | TH18-16 | | |
|---|---|---|---|---|---|---|
| Depth (m) | 1.1 - 1.2 | 1.4 - 1.5 | 1.7 - 1.8 | 2.7 - 2.9 | | |
| Sample # | G119 | G120 | G121 | G122 | | |
| Tare ID | E89 | K2 | N99 | P85 | | |
| Mass of tare | 8.8 | 8.6 | 8.6 | 8.7 | | |
| Mass wet + tare | 316.6 | 340.5 | 358.7 | 394.0 | | |
| Mass dry + tare | 250.3 | 252.4 | 253.7 | 261.6 | | |
| Mass water | 66.3 | 88.1 | 105.0 | 132.4 | | |
| Mass dry soil | 241.5 | 243.8 | 245.1 | 252.9 | | |
| Moisture % | 27.5% | 36.1% | 42.8% | 52.4% | | |

| 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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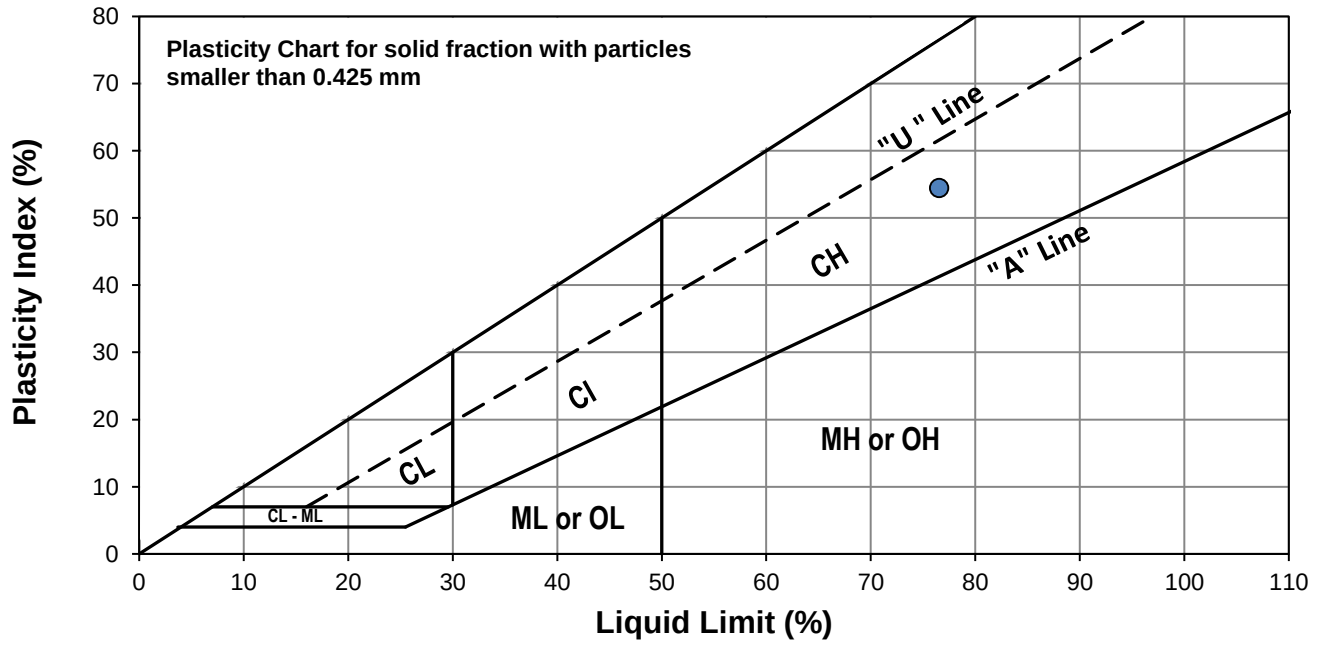
# Atterberg Limits
## ASTM D4318-10e1

| | |
|---|---|
| **Project No.** | 0395-001-00 |
| **Client** | WSP |
| **Project** | Local Streets 18-R-04 Haig Avenue |
| **Test Hole** | TH18-14 |
| **Sample #** | G103 |
| **Depth (m)** | 0.5-0.6 |
| **Sample Date** | 17-Jan-18 |
| **Test Date** | 21-Feb-18 |
| **Technician** | DS |

| | |
|---|---|
| **Liquid Limit** | 77 |
| **Plastic Limit** | 22 |
| **Plasticity Index** | 54 |

### Liquid Limit

| Trial # | 1 | 2 | 3 | | |
|---|---|---|---|---|---|
| **Number of Blows (N)** | 17 | 23 | 35 | | |
| **Mass Wet Soil + Tare (g)** | 19.645 | 19.742 | 20.111 | | |
| **Mass Dry Soil + Tare (g)** | 17.217 | 17.328 | 17.475 | | |
| **Mass Tare (g)** | 14.175 | 14.200 | 13.901 | | |
| **Mass Water (g)** | 2.428 | 2.414 | 2.636 | | |
| **Mass Dry Soil (g)** | 3.042 | 3.128 | 3.574 | | |
| **Moisture Content (%)** | 79.816 | 77.174 | 73.755 | | |




### Plastic Limit

| Trial # | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| **Mass Tare (g)** | 20.391 | 20.767 | | | |
| **Mass Wet Soil + Tare (g)** | 19.296 | 19.589 | | | |
| **Mass Dry Soil + Tare (g)** | 14.225 | 14.373 | | | |
| **Mass Water (g)** | 1.095 | 1.178 | | | |
| **Mass Dry Soil (g)** | 5.071 | 5.216 | | | |
| **Moisture Content (%)** | 21.593 | 22.584 | | | |

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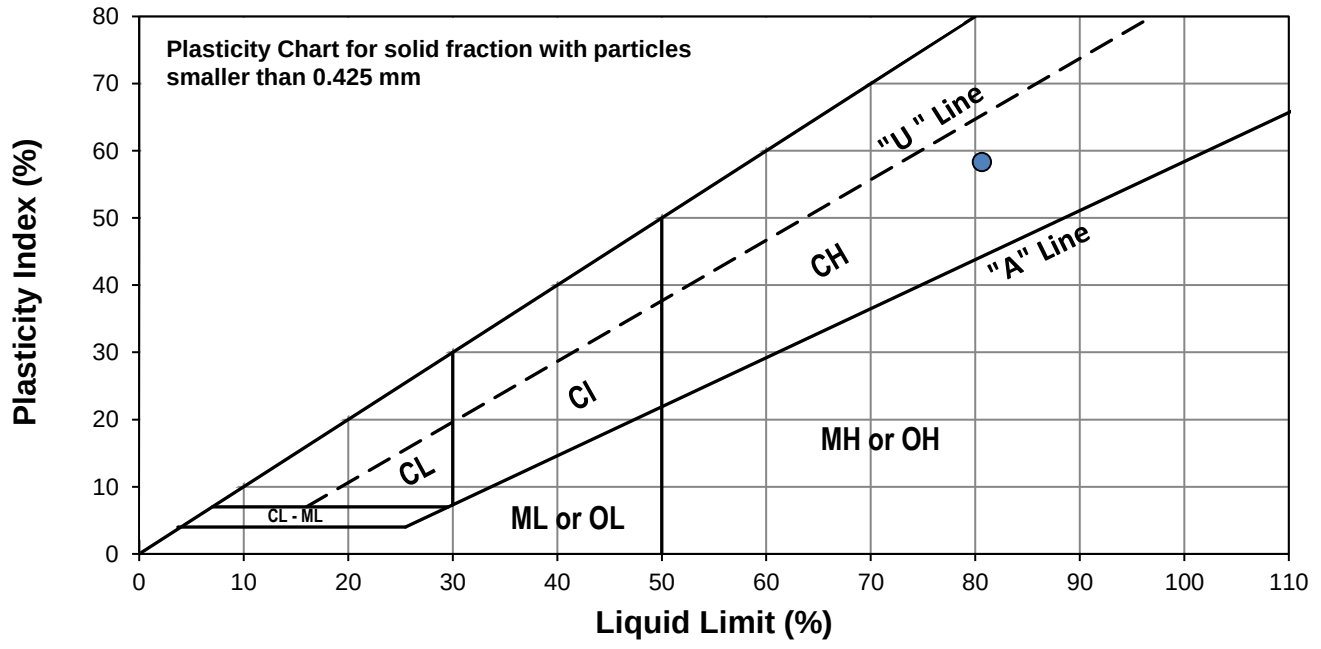
# Atterberg Limits
## ASTM D4318-10e1

| | |
|---|---|
| **Project No.** | 0395-001-00 |
| **Client** | WSP |
| **Project** | Local Streets 18-R-04 Haig Avenue |
| **Test Hole** | TH18-16 |
| **Sample #** | G116 |
| **Depth (m)** | 0.5-0.6 |
| **Sample Date** | 17-Jan-18 |
| **Test Date** | 21-Feb-18 |
| **Technician** | DS |

| | |
|---|---|
| **Liquid Limit** | 81 |
| **Plastic Limit** | 22 |
| **Plasticity Index** | 58 |

### Liquid Limit

| Trial # | 1 | 2 | 3 | | |
|---|---|---|---|---|---|
| **Number of Blows (N)** | 18 | 23 | 29 | | |
| **Mass Wet Soil + Tare (g)** | 20.945 | 19.717 | 20.915 | | |
| **Mass Dry Soil + Tare (g)** | 17.857 | 17.213 | 17.870 | | |
| **Mass Tare (g)** | 14.190 | 14.142 | 14.017 | | |
| **Mass Water (g)** | 3.088 | 2.504 | 3.045 | | |
| **Mass Dry Soil (g)** | 3.667 | 3.071 | 3.853 | | |
| **Moisture Content (%)** | 84.211 | 81.537 | 79.029 | | |




### Plastic Limit

| Trial # | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| **Mass Tare (g)** | 20.322 | 20.568 | | | |
| **Mass Wet Soil + Tare (g)** | 19.146 | 19.416 | | | |
| **Mass Dry Soil + Tare (g)** | 13.916 | 14.207 | | | |
| **Mass Water (g)** | 1.176 | 1.152 | | | |
| **Mass Dry Soil (g)** | 5.230 | 5.209 | | | |
| **Moisture Content (%)** | 22.486 | 22.116 | | | |

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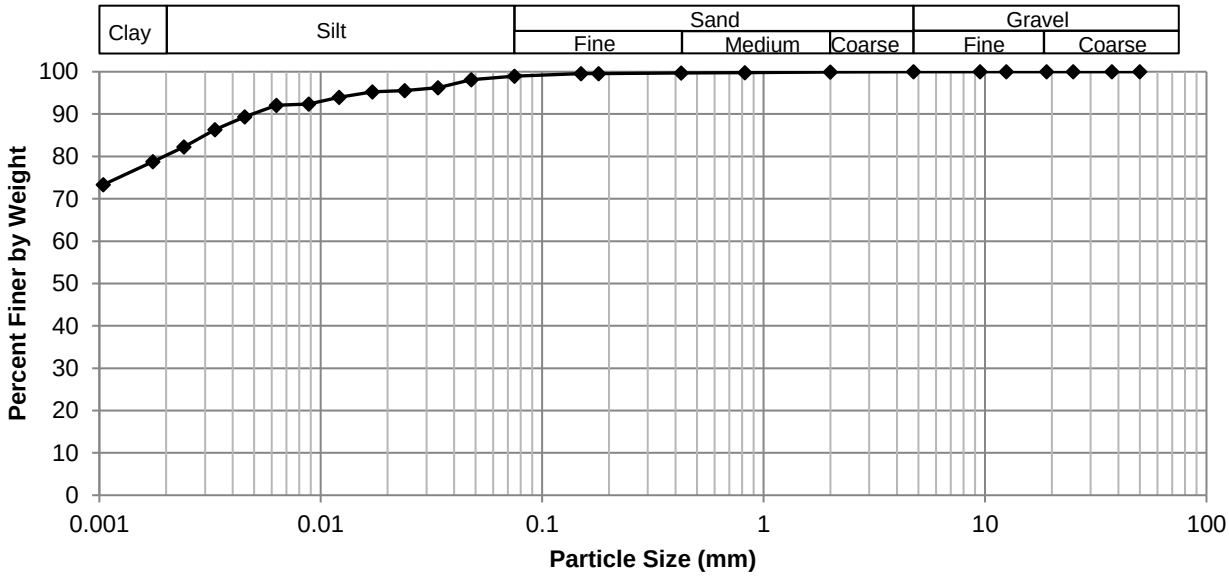
# Grain Size Analysis (Hydrometer Method)
## ASTM D422

| | |
|---|---|
| **Project No.** | 0395-001-00 |
| **Client** | WSP |
| **Project** | Local Streets 18-R-04 - Haig Avenue |
| **Test Hole** | TH18-14 |
| **Sample #** | G103 |
| **Depth (m)** | 0.5 - 0.6 |
| **Sample Date** | 17-Jan-18 |
| **Test Date** | 14-Feb-18 |
| **Technician** | DS |

| | |
|---|---|
| **Gravel** | 0.0% |
| **Sand** | 1.0% |
| **Silt** | 18.9% |
| **Clay** | 80.1% |

### Particle Size Distribution Curve




| Gravel | | Sand | | Silt and Clay | |
|---|---|---|---|---|---|
| **Particle Size (mm)** | **Percent Passing** | **Particle Size (mm)** | **Percent Passing** | **Particle Size (mm)** | **Percent Passing** |
| 50.0 | 100.00 | 4.75 | 100.00 | 0.0750 | 98.95 |
| 37.5 | 100.00 | 2.00 | 99.93 | 0.0479 | 98.10 |
| 25.0 | 100.00 | 0.825 | 99.80 | 0.0339 | 96.20 |
| 19.0 | 100.00 | 0.425 | 99.70 | 0.0240 | 95.57 |
| 12.5 | 100.00 | 0.180 | 99.53 | 0.0171 | 95.25 |
| 9.50 | 100.00 | 0.150 | 99.53 | 0.0121 | 93.98 |
| 4.75 | 100.00 | 0.075 | 98.95 | 0.0088 | 92.39 |
| | | | | 0.0063 | 92.07 |
| | | | | 0.0045 | 89.32 |
| | | | | 0.0033 | 86.36 |
| | | | | 0.0024 | 82.23 |
| | | | | 0.0017 | 78.74 |
| | | | | 0.0010 | 73.35 |

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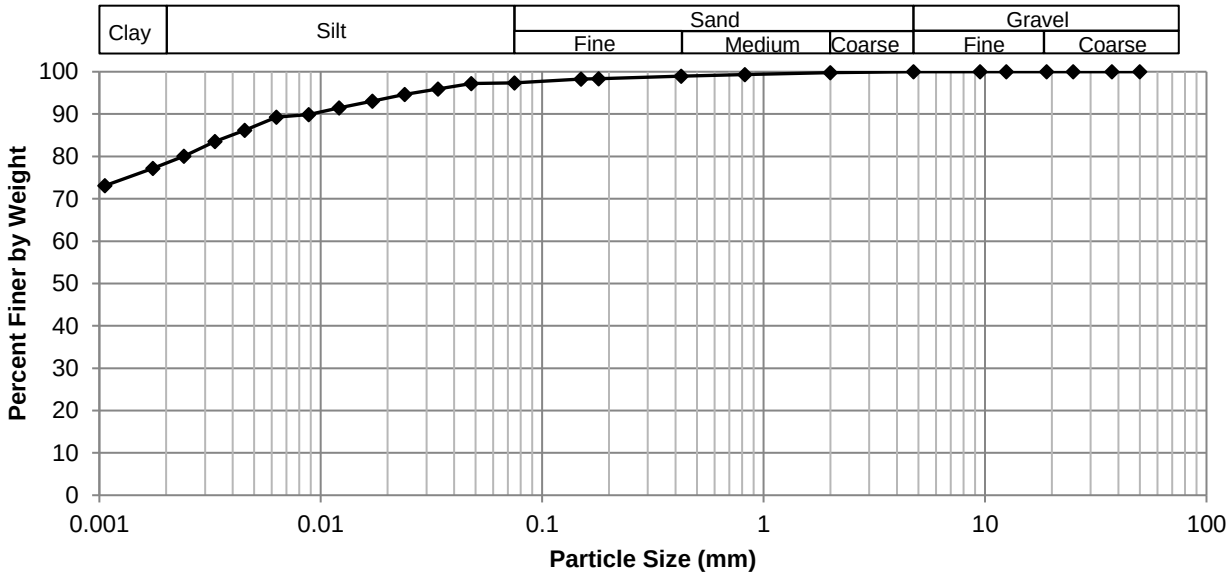
# Grain Size Analysis (Hydrometer Method)
## ASTM D422

| | |
|---|---|
| **Project No.** | 0395-001-00 |
| **Client** | WSP |
| **Project** | Local Streets 18-R-04 - Haig Avenue |
| **Test Hole** | TH18-16 |
| **Sample #** | G116 |
| **Depth (m)** | 0.2 - 0.3 |
| **Sample Date** | 17-Jan-18 |
| **Test Date** | 14-Feb-18 |
| **Technician** | DS |

| | |
|---|---|
| **Gravel** | 0.0% |
| **Sand** | 2.6% |
| **Silt** | 19.1% |
| **Clay** | 78.3% |

### Particle Size Distribution Curve




| Gravel | | Sand | | Silt and Clay | |
|---|---|---|---|---|---|
| **Particle Size (mm)** | **Percent Passing** | **Particle Size (mm)** | **Percent Passing** | **Particle Size (mm)** | **Percent Passing** |
| 50.0 | 100.00 | 4.75 | 100.00 | 0.0750 | 97.37 |
| 37.5 | 100.00 | 2.00 | 99.78 | 0.0479 | 97.19 |
| 25.0 | 100.00 | 0.825 | 99.37 | 0.0339 | 95.92 |
| 19.0 | 100.00 | 0.425 | 98.92 | 0.0240 | 94.66 |
| 12.5 | 100.00 | 0.180 | 98.37 | 0.0171 | 93.07 |
| 9.50 | 100.00 | 0.150 | 98.29 | 0.0121 | 91.49 |
| 4.75 | 100.00 | 0.075 | 97.37 | 0.0088 | 89.90 |
| | | | | 0.0063 | 89.27 |
| | | | | 0.0045 | 86.20 |
| | | | | 0.0033 | 83.56 |
| | | | | 0.0024 | 80.08 |
| | | | | 0.0017 | 77.22 |
| | | | | 0.0011 | 73.10 |


Photo 1: Pavement Core Sample at Test Hole TH17-13


Photo 2: Pavement Core Sample at Test Hole TH17-14


Photo 3: Pavement Core Sample at Test Hole TH17-15


Photo 4: Pavement Core Sample at Test Hole TH17-16

# Appendix D

## Whitley Drive, between Hawkins Cresc. To Ashworth St.

## Photographs of Pavement Core Samples


Photo 1: Pavement Core Sample at Test Hole PC18-13

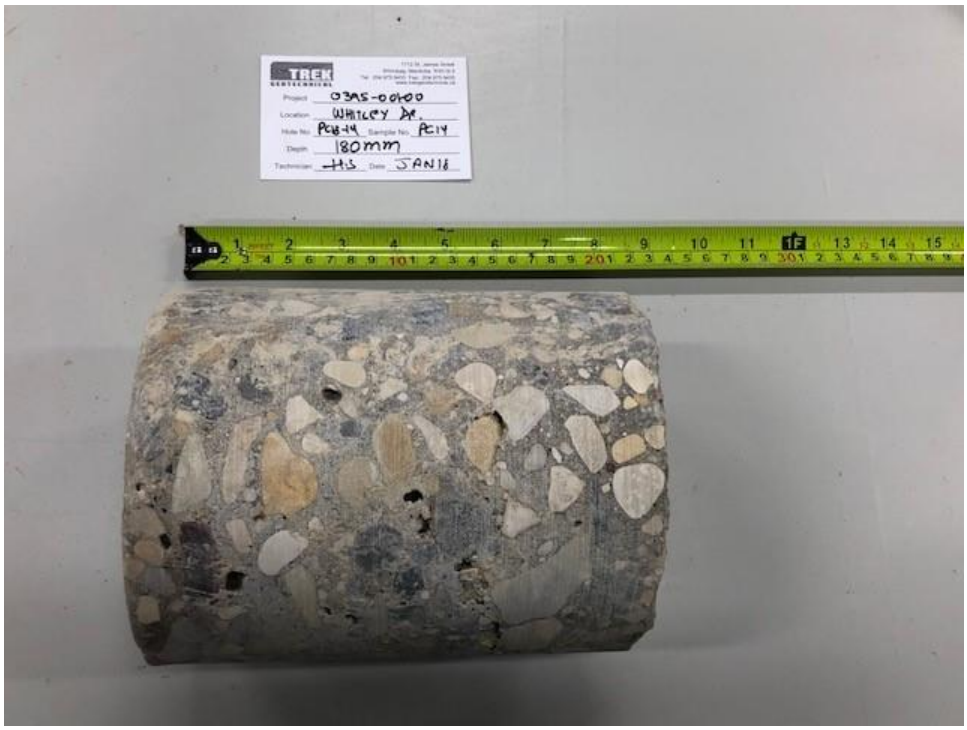



Photo 2: Pavement Core Sample at Test Hole PC18-14


Photo 3: Pavement Core Sample at Test Hole PC18-15


Photo 4: Pavement Core Sample at Test Hole PC18-16

# Appendix E

## Knightsbridge Drive, between Knightsbridge Dr. to Meadowood Dr.

## Photographs of Pavement Core Samples


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


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


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


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


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


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

# Appendix F

## Haresford Crescent, between Hawkins Cresc. To Novavista Dr.

## Photographs of Pavement Core Samples


Photo 1: Pavement Core Sample at Test Hole PC18-04


Photo 2: Pavement Core Sample at Test Hole PC18-05


Photo 3: Pavement Core Sample at Test Hole PC18-06

# Appendix G

## Darwin Street, between Riel Ave. To Riverbend Ave.

## Photographs of Pavement Core Samples


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


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


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