

APPENDIX 'A'

GEOTECHNICAL REPORT



Quality Engineering | Valued Relationships

WSP Canada Group Ltd.

2026-2028 Downtown Pavement Renewals - Revised

Prepared for:

Mark Vogt, M.Sc., P.Eng.
WSP Canada Group Ltd.
111-93 Lombard Avenue
Winnipeg, MB
R3B 3B1

Project Number: 1000-043-30

Date: November 14, 2025



Quality Engineering | Valued Relationships

November 14, 2025

Our File No. 1000-043-30

Mark Vogt, M.Sc., P.Eng.
WSP Canada Group Ltd.
111-93 Lombard Avenue
Winnipeg, MB
R3B 3B1

RE: 2026-2028 Downtown Pavement Renewals - Revised

TREK Geotechnical Inc. is pleased to submit our Final Report for the geotechnical investigation for 2026-2028 Downtown Pavement Renewals project.

Please contact the undersigned should you have any questions.

Sincerely,

TREK Geotechnical Inc.
Per:

A handwritten signature in blue ink, appearing to read "N. Ferreira", is written over a light blue circular stamp.

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

Encl.

Revision History

Revision No.	Author	Issue Date	Description
0	KF	November 14, 2025	Final Report
1	KF	November 14, 2025	Revision 1

Authorization Signatures

Prepared By:



Kate Franklin M.Sc. (Geotechnical Engineering)
Technical Support Specialist



Reviewed By:

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

 **ENGINEERS
GEOSCIENTISTS
MANITOBA**

Certificate of Authorization

TREK GEOTECHNICAL INC.

No. 4877

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1.0 Introduction

This report summarizes the results of the road investigation completed for the 2026-2028 Downtown Pavement Renewals project. The project included drilling test holes and collecting pavement cores along several streets. The test hole information collected describes the pavement structure of the existing road as well as the soil stratigraphy beneath the pavement structure. The investigation was carried out following the City of Winnipeg RFP No. 751-2023 (Section E3 – Site Investigation Requirements).

2.0 Road Investigation

The investigation included coring of pavement at 63 locations on 12 different streets with drilling of test holes occurring at 33 locations along 8 streets. The investigation locations are shown on Figures 01 to 02 (attached) and the table below summarizes the investigation program per street.

Table 1 – Road Investigation Program

2026-2028 Downtown Pavement Renewals	# of Locations	Investigation
Carlton St – Ellice Ave to Notre Dame Ave	7	4 Test Holes to 3.0m 3 Cores
Hargrave St – Ellice Ave to Notre Dame	3	3 Test Holes to 3.0m
Carlton St – Broadway Ave to Portage Ave	9	6 Test Holes to 3.0m 3 Cores
Hargrave St – St. Mary Ave to Graham Ave	3	3 Test Holes to 3.0m
Kennedy St – Broadway Ave to Portage Ave	7	7 Test Holes to 3.0m
Edmonton St – Broadway Ave to Portage Ave	7	4 Test Holes to 3.0m 3 Cores
St. Mary Ave – Memorial Blvd to Main St	7	3 Test Holes to 3.0m 4 Cores
York Ave – Memorial Blvd to Garry St	9	3 Test Holes to 3.0m 6 Cores
Kennedy St – Ellice Ave. to Cumberland Ave	6	6 Cores
Qu’Appelle Ave – Kennedy St. to Hargrave St.	3	3 Cores
York Ave – Osbourne St to Colony St	1	1 Core
Colony St – Cooper Ave to York Ave	1	1 Core

The road investigation was conducted between September 29, 2025 to October 17, 2025. The pavement structure (asphalt/concrete) was cored by Arshpreet Bhullar of TREK Geotechnical Inc. (TREK) using a portable coring press equipped with a hollow 150 mm diameter diamond core drill bits. The test holes were drilled by Paddock Drilling Ltd to a depth of approximately 3.0 m below road surface using a truck mounted drill rig equipped with 125 mm diameter solid stem augers. The sub-surface conditions were observed during drilling and visually classified by Kate Franklin of TREK. Other pertinent information, such as groundwater and drilling conditions, was also recorded during the drilling investigation. Disturbed (auger cuttings) samples and bulk samples retrieved during the sub-surface investigation were transported to TREK's material testing laboratory for further testing. Pavement core samples were also retrieved and logged at TREK's material testing laboratory.

Core and test hole logs noted on the summary tables and test hole locations are based on UTM coordinates obtained using a hand-held GPS, and their location relative to the nearest address or intersection, measured distance from the edge of pavement, or other permanent features.

The laboratory testing program consisted of moisture content determination on all samples, as well as Atterberg Limits, and grain size analysis (mechanical sieve and hydrometer methods) on select samples between 0.6 and 0.9 m below pavement as well as Standard Proctor and CBR testing. Information gathered for each street package is included in separate appendices (Appendices A to L). The information provided in the Appendices includes test hole logs, laboratory testing summary tables and results, photos of the concrete cores, and summary of pavement core compressive strength.

Sixteen CBR's were completed on bulk samples of the soil units present below the pavement. Tests were performed on clay and silt layers encountered within the prescribed sample depth for CBR testing and the results are shown in the table below.

Table 1: CBR Testing Summary

Soil Unit	Street	Depth (m)	SPMDD (kg/m ³)	Opt. Moisture (%)	Percent Proctor (%)	Moisture Content (%)	CBR Value at 2.54 mm	CBR Value at 5.08 mm
Clay	Carlton St – Ellice Ave to Notre Dame Ave	0.8 – 2.0 1.5 – 2.0	1405	28.4	95.4	28.4	1.7%	1.2%
Silt	Carlton St – Ellice Ave to Notre Dame Ave	0.8 – 1.8	1846	14.5	95.1	14.4	9.4%	8.2%
Clay	Hargrave St – Ellice Ave to Notre Dame	0.8 - 2.0	1446	28.3	94.1	29.5	1.5%	1.2%
Silt	Hargrave St – Ellice Ave to Notre Dame	1.5 - 2.0	1851	14.4	94.3	14.4	6.5%	5.6%
Clay	Carlton St – Broadway Ave to Portage Ave	1.5 – 2.0	1426	30.6	94.7	31.0	3.1%	2.2%

Silt	Carlton St – Broadway Ave to Portage Ave	0.8 – 1.5 0.8 – 2.0	1800	15.3	94.9	15.8	5.4%	4.9%
Clay	Carlton St – Broadway Ave to Portage Ave	1.5 – 2.0 1.2 – 2.0	1426	29.3	93.8	30.5	1.5%	1.0%
Clay	Hargrave St – St. Mary Ave to Graham Ave	1.5 – 2.0	1430	30.4	94.8	30.2	2.5%	1.9%
Silt	Kennedy St – Broadway Ave to Portage Ave	1.2 – 2.0	1760	16.7	94.8	16.8	5.0%	4.5%
Clay	Kennedy St – Broadway Ave to Portage Ave	1.5 – 2.0 0.8 – 2.0	1434	28.6	94.7	29.2	2.4%	1.7%
Clay	Edmonton St – Broadway Ave to Portage Ave	0.8 – 2.0	1400	30.6	94.7	29.9	1.5%	1.2%
Silt	Edmonton St and York Ave	1.5 – 2.0	1787	14.7	94.9	14.8	2.4%	2.8%
Clay (Fill)	Edmonton St – Broadway Ave to Portage Ave	0.8 – 2.0	1510	25.8	94.3	26.8	2.3%	1.7%
Clay	St. Mary Ave – Memorial Blvd to Main St	1.5 – 2.0 0.8 – 2.0	1395	29.2	95.1	30.1	2.3%	1.7%
Silt	St. Mary Ave – Memorial Blvd to Main St	0.9 – 2.0	1817	15.4	94.8	15.4	7.8%	7.0%
Clay	York Ave – Memorial Blvd to Garry St	0.8 – 2.0	1408	29.6	64.5	29.3	1.5%	1.3%

The test hole logs include a description of the soil units encountered during drilling and other pertinent information such as groundwater conditions and a summary of the laboratory testing results. The soils were classified in general accordance with the Unified Soil Classification System (USCS) and the AASHTO soil classification system (American Association of state highway and transportation officials). The AASHTO system classifies soils based on laboratory testing results from Atterberg Limits and grain size testing methods (hydrometer and mechanical sieve method). Where laboratory testing was not conducted, the AASHTO classification of the soils were interpreted based on a visual assessment as indicated with a (I) on the test hole logs and attached tables. For cohesive soils, the AASHTO system uses a combination of testing results to determine the Group Index of the soils and thus, were only determined where sufficient laboratory test data was available.

Fifteen concrete cores were selected for concrete compressive strength breaks and the length to diameter ratio ranged between 0.80 to 1.34 for the cores collected. Although cores with length to diameter ratios below one are typically not tested since correction factors below 1.0 are not well established. TREK applied an interpolated correction factor for these cores (samples are noted in Table 2) as discussed with WSP.

The core compressive strength tests were tested in accordance with CSA A23.2-14C – wet dried condition. The measured compressive strengths were also corrected based on an adapted ACI 214.4R-03 Standard to estimate the in-place concrete strengths. The table below summarizes the compressive strength results while the compressive strength testing details and the correction factor methodology are included in Appendix A, C and F through L.

Table 2: Concrete Core Compressive Strength Results

Core ID (Location)	Uncorrected Compressive Strength (MPa)	Corrected Compressive Strength (MPa)
PC25-10 (Carlton St.)	62.02	69.37
PC25-11 (Carlton St.)	64.11	68.67
PC25-12* (Carlton St.)	66.23	71.04
PC25-27 (Carlton St.)	52.94	55.96
PC25-28 (Carlton St.)	53.26	55.03
PC25-29 (Carlton St.)	62.21	65.95
PC25-30* (Edmonton St.)	59.04	58.55
PC25-31* (Edmonton St.)	46.48	45.78
PC25-32 (Edmonton St.)	65.65	74.78
PC25-25 (St Mary Ave.)	71.36	77.01
PC25-32 (Kennedy St.)	60.61	67.68
PC25-08* (Qu'Appelle Ave.)	58.52	59.95
PC25-09 (Qu'Appelle Ave.)	68.09	70.54
PC25-19 (York Ave.)	70.33	75.95
PC25-20 (Colony St.)	68.06	72.37

* - Core length to diameter ratio is less than one.

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

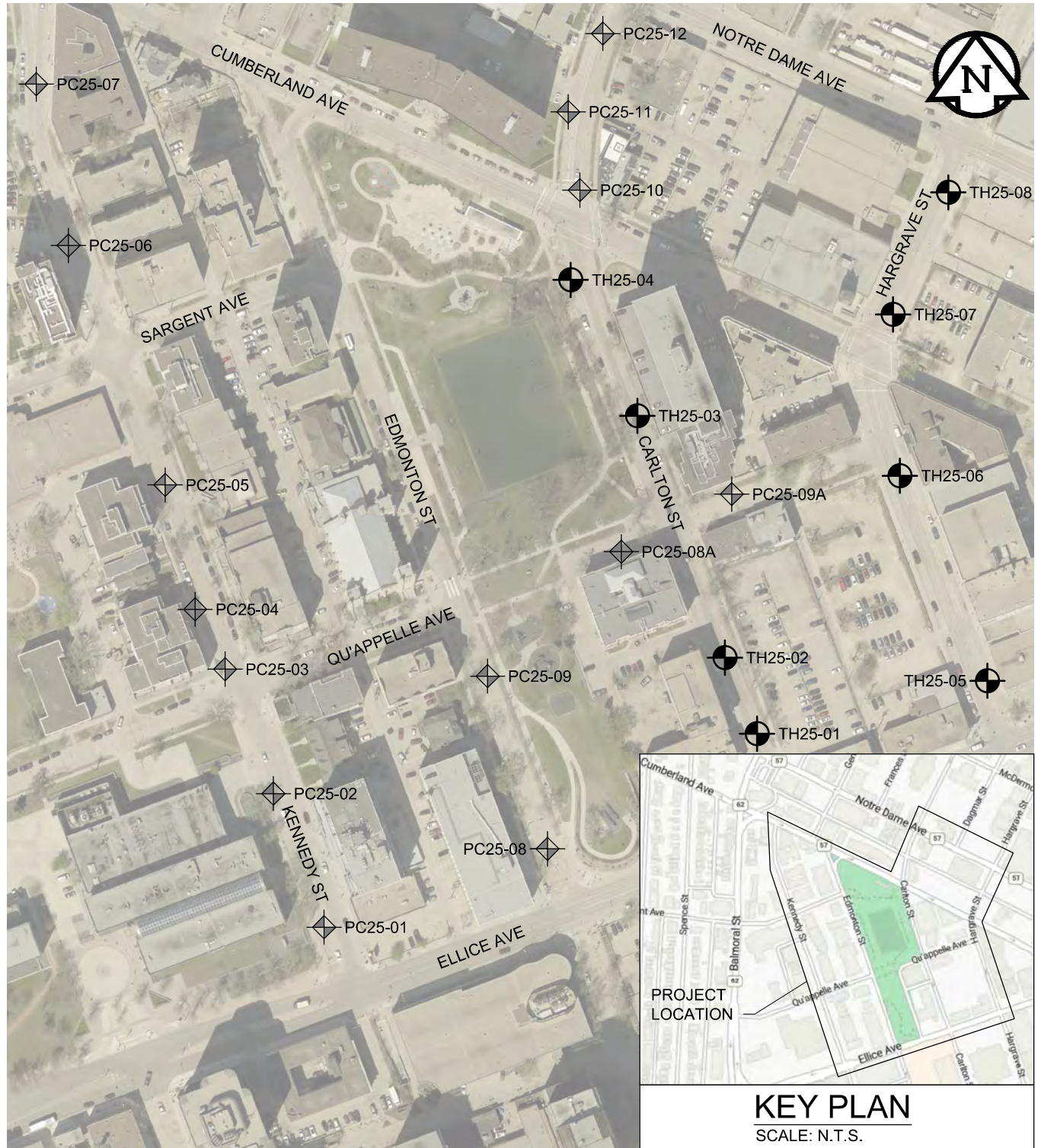
variable across a site. If sub-surface conditions are different than the conditions previously encountered on-site or those presented here, we should be notified to adjust our findings if necessary.

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 Ltd. (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

Z:\Projects\1000 Soils Lab\1000-043 WSP\1000-043-30 2026-2028 Downtown Pavement Renewals\3 Survey and Dwg\3.4 CAD\3.4.3 Working Folder\Figs 01 & 02 2025-10-29 Downtown Pavement Renewals 0_A 1000-043-30.dwg, 2025-10-29 8:06:08 AM



0 50 100 150 m
SCALE = 1 : 2 500 (216 mm x 279 mm)

Figure 01
Test Hole and Pavement Core
Location Plan

Z:\Projects\1000 Soils Lab\1000 Lab Projects\1000-043 WSP\1000-043-30 2026-2028 Downtown Pavement Renewals\3 Survey and Dwg\3.4 CAD\3.4.3 Working Folder\Figs 01 & 02 2025-10-29 Downtown Pavement Renewals 0_A 1000-043-30.dwg, 2025-10-29 8:03:58 AM



Appendix A
Test Hole Logs, Summary Tables, Lab Testing Results and
Photographs of Pavement Core Samples
Carlton St. – Ellice Ave to Notre Dame Ave



Sub-Surface Log

Test Hole TH25-01

1 of 1

Client: WSP

Project Number: 1000-043-30

Project Name: 2026-2028 Downtown Pavement Renewals

Location: UTM : 633082 E 5528584 N - Carlton St

Contractor: Maple Leaf Drilling

Ground Elevation: Top of Pavement

Method: 125mm Solid Stem Auger, B40 Mobile Truck Mount

Date Drilled: October 10, 2025

Sample Type:

Grab (G)

Shelby Tube (T)

Split Spoon (SS) / SPT

Split Barrel (SB) / LPT

Core (C)

Particle Size Legend:

Fines

Clay

Silt

Sand

Gravel

Cobbles

Boulders

Depth (m)	Soil Symbol	MATERIAL DESCRIPTION	Sample Type	Sample Number	Bulk Unit Wt (kN/m ³)						Undrained Shear Strength (kPa)						
					16	17	18	19	20	21	Test Type						
					Particle Size (%)												
					0	20	40	60	80	100							
						PL	MC	LL									
						0	20	40	60	80	100	0	50	100	150	200	
		ASPHALT															
		CONCRETE															
		SAND (FILL) - some gravel (<25mm diam.), light brown, moist, compact															
		- well graded (fine sand to coarse gravel), sub-angular															
		- AASHTO: A-1 (I)															
-0.5		CLAY - with silt, trace sand															
		- black to grey with depth															
		- moist, stiff															
		- high plasticity															
		- AASHTO: A-7-6 (37)															
-1.0			G211														
		SILT - some clay, trace sand															
		- light brown															
		- moist, soft to firm															
		- low plasticity															
		- AASHTO: A-4 (I)															
		- stiff below 1.3m															
-1.5			G212														
			G213														
		CLAY - silty															
		- grey															
		- moist, very stiff															
		- high plasticity															
		- AASHTO: A-7-6 (I)															
-2.0			G214														
			G215														
-2.5																	
			G216														
-3.0																	

END OF TEST HOLE AT 3.0m IN CLAY.

Notes:

1) Seepage and sloughing not observed.

2) Test hole dry and open to 2.9m depth immediately after drilling.

3) Test hole backfilled with cuttings and bentonite.

4) Bulk samples (B217 silt and B218 clay) collected between 0.8m and 2.0m.



Sub-Surface Log

Test Hole TH25-02

1 of 1

Client: WSP Project Number: 1000-043-30
Project Name: 2026-2028 Downtown Pavement Renewals Location: UTM : 633069 E 5528618 N - Carlton St
Contractor: Maple Leaf Drilling Ground Elevation: Top of Pavement
Method: 125mm Solid Stem Auger, B40 Mobile Truck Mount Date Drilled: October 10, 2025

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

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

Depth (m)	Soil Symbol	MATERIAL DESCRIPTION	Sample Type	Sample Number	Bulk Unit Wt (kN/m ³)		Particle Size (%)						Undrained Shear Strength (kPa)					
					16	17	18	19	20	21	Test Type							
											0 20 40 60 80 100				△ Torvane △ ✱ Pocket Pen. ✱ ⊠ Qu ⊠ ○ Field Vane ○			
											PL	MC	LL					
					0	20	40	60	80	100	0	50	100	150	200	250		
		ASPHALT																
		CONCRETE																
		SAND (FILL) - some gravel (<25mm diam.), light brown, moist, compact - well graded (fine sand to coarse gravel), sub-angular - AASHTO: A-1 (I)																
-0.5		CLAY (FILL) - silty, some gravel (<25mm diam.), trace sand - mottled brown and grey - moist, stiff - intermediate plasticity - AASHTO: A-6 (I)		G202														
				G203														
-1.0		SILT - some clay - light brown - moist, soft - low plasticity - AASHTO: A-4 (I)		G204														
		-transition to clay, stiff below 1.3m		G205														
-1.5		CLAY - silty - grey - moist, stiff - high plasticity - AASHTO: A-7-6 (I)		G206														
-2.0				G207														
		- trace silt pockets (<20mm diam. to 2.5m)) 2.1m to 2.5m																
-2.5				G208														
-3.0																		

END OF TEST HOLE AT 3.0m IN CLAY.

Notes:

- 1) Seepage and sloughing not observed.
- 2) Test hole dry and open to 3.0m depth immediately after drilling.
- 3) Test hole backfilled with cuttings and bentonite.
- 4) Bulk samples (B209 silt and B210 clay) collected between 0.8m and 2.0m.

Logged By: Kate Franklin Reviewed By: N.J Ferreira Project Engineer: Nelson Ferreira



Sub-Surface Log

Test Hole TH25-03

1 of 1

Client: WSP Project Number: 1000-043-30
Project Name: 2026-2028 Downtown Pavement Renewals Location: UTM : 633030 E 5528722 N - Carlton St
Contractor: Maple Leaf Drilling Ground Elevation: Top of Pavement
Method: 125mm Solid Stem Auger, B40 Mobile Truck Mount Date Drilled: October 10, 2025

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

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

Depth (m)	Soil Symbol	MATERIAL DESCRIPTION	Sample Type	Sample Number	Bulk Unit Wt (kN/m ³)						Undrained Shear Strength (kPa)			
					16	17	18	19	20	21	Test Type			
					Particle Size (%)						△ Torvane △			
					0 20 40 60 80 100						✱ Pocket Pen. ✱			
					PL MC LL						⊠ Qu ⊠			
					0 20 40 60 80 100						○ Field Vane ○			
					0 50 100 150 200250									
		ASPHALT												
		CONCRETE												
		SAND (FILL) - some gravel (<25mm diam.), light brown, moist, compact - well graded (fine sand to coarse gravel), sub-angular - AASHTO: A-1 (I)												
-0.5		CLAY (FILL) - with silt, trace sand, trace gravel (<25mm diam.) - mottled brown and grey - moist, stiff - intermediate plasticity - AASHTO: A-6 (15)	▲	G193										
			▲	G194										
-1.0		SILT - some clay - light brown - moist, soft - low plasticity - AASHTO: A-4 (I)	▲	G195										
			▲	G196										
-1.5														
-2.0		CLAY - silty - grey - moist, very stiff - high plasticity - AASHTO: A-7-6 (I)	▲	G197										
		- stiff below 2.1m - trace silt pockets (<20mm diam. to 2.5m)) 2.1m to 2.5m	▲	G198										
-2.5														
-3.0			▲	G199										

END OF TEST HOLE AT 3.0m IN CLAY.

Notes:

- 1) Seepage and sloughing not observed.
- 2) Test hole dry and open to 3.0m depth immediately after drilling.
- 3) Test hole backfilled with cuttings and bentonite.
- 4) Bulk samples (B200 silt and B201 clay) collected between 0.8m and 2.0m.

Logged By: Kate Franklin Reviewed By: N.J Ferreira Project Engineer: Nelson Ferreira



Sub-Surface Log

Test Hole TH25-04

1 of 1

Client: WSP

Project Name: 2026-2028 Downtown Pavement Renewals

Contractor: Maple Leaf Drilling

Method: 125mm Solid Stem Auger, B40 Mobile Truck Mount

Project Number: 1000-043-30

Location: UTM : 633001 E 5528781 N - Carlton St

Ground Elevation: Top of Pavement

Date Drilled: October 10, 2025

Sample Type:

Grab (G) Shelby Tube (T) Split Spoon (SS) / SPT Split Barrel (SB) / LPT 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)						Undrained Shear Strength (kPa)			
					Particle Size (%)						Test Type			
					0 20 40 60 80 100						△ Torvane △			
					0 20 40 60 80 100						✱ Pocket Pen. ✱			
0.0		ASPHALT												
0.1		CONCRETE												
0.2		SAND (FILL) - some gravel (<25mm diam.), light brown, moist, compact - well graded (fine sand to coarse gravel), angular, AASHTO: A-1 (I)												
0.3		CLAY - with silt, trace sand - black - moist, stiff - intermediate to high plasticity - AASHTO: A-6 (I)												
0.8		CLAY - silty, grey - moist, stiff, high plasticity - AASHTO: A-7-6 (I)	G186											
1.3			G187											
1.8			G188											
2.3			G189											
2.8			G190											
3.3			G191											

END OF TEST HOLE AT 3.0m IN CLAY.

Notes:

- Seepage and sloughing not observed.
- Test hole dry and open to 3.0m depth immediately after drilling.
- Test hole backfilled with cuttings and bentonite.
- Bulk samples (B192 clay) collected between 0.8m and 2.0m.

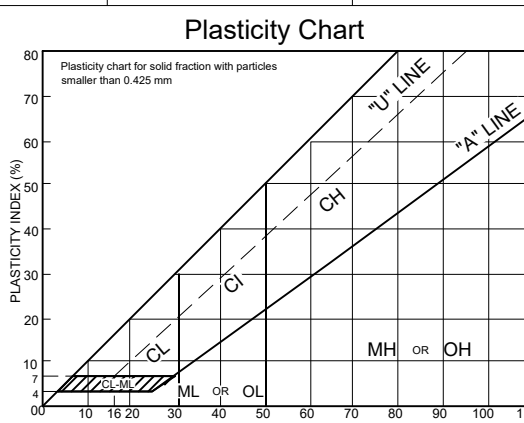
Logged By: Kate Franklin

Reviewed By: N.J Ferreira

Project Engineer: Nelson Ferreira

GENERAL NOTES

- Classifications are based on the Unified Soil Classification System and include consistency, moisture, and color. Field descriptions have been modified to reflect results of laboratory tests where deemed appropriate.
- Descriptions on these test hole logs apply only at the specific test hole locations and at the time the test holes were drilled. Variability of soil and groundwater conditions may exist between test hole locations.
- When the following classification terms are used in this report or test hole logs, the primary and secondary soil fractions may be visually estimated.

Major Divisions	USCS Classification	Symbols	Typical Names	Laboratory Classification Criteria	Particle Size	Material
Coarse-Grained soils (More than half the material is larger than No. 200 sieve size)	Gravels (More than half of coarse fraction is larger than 4.75 mm)	GW	Well-graded gravels, gravel-sand mixtures, little or no fines	$C_u = \frac{D_{60}}{D_{10}}$ greater than 4; $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ between 1 and 3	ASTM Sieve sizes	#10 to #4 #40 to #10 #200 to #40 < #200
		GP	Poorly-graded gravels, gravel-sand mixtures, little or no fines	Not meeting all gradation requirements for GW		
		GM	Silty gravels, gravel-sand-silt mixtures	Atterberg limits below "A" line or P.I. less than 4		
		GC	Clayey gravels, gravel-sand-silt mixtures	Atterberg limits above "A" line or P.I. greater than 7		
	Sands (More than half of coarse fraction is smaller than 4.75 mm)	SW	Well-graded sands, gravelly sands, little or no fines	$C_u = \frac{D_{60}}{D_{10}}$ greater than 6; $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ between 1 and 3	mm	2.00 to 4.75 0.425 to 2.00 0.075 to 0.425 < 0.075
		SP	Poorly-graded sands, gravelly sands, little or no fines	Not meeting all gradation requirements for SW		
		SM	Silty sands, sand-silt mixtures	Atterberg limits below "A" line or P.I. less than 4		
		SC	Clayey sands, sand-clay mixtures	Atterberg limits above "A" line or P.I. greater than 7		
Fine-Grained soils (More than half the material is smaller than No. 200 sieve size)	Silt 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  Von Post Classification Limit Strong colour or odour, and often fibrous texture	ASTM Sieve Sizes	> 12 in. 3 in. to 12 in. 3/4 in. to 3 in. #4 to 3/4 in.
		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			
	Silt and Clays (Liquid limit greater than 50)	MH	Inorganic silts, micaceous or distomaceous fine sandy or silty soils, organic silts		mm	> 300 75 to 300 19 to 75 4.75 to 19
		CH	Inorganic clays of high plasticity, fat clays			
		OH	Organic clays of medium to high plasticity, organic silts			
		Pt	Peat and other highly organic soils			
	Highly Organic Soils				Material	Boulders Cobbles Gravel 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

LEGEND OF ABBREVIATIONS AND SYMBOLS

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

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
with *	with silt, with sand	> 35 percent

* Used when the material is classified based on behaviour as a cohesive material

TERMS DESCRIBING CONSISTENCY OR COMPACTION CONDITION

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

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

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

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

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

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



**2026-2028 Downtown Pavement Renewals
Sub-Surface Investigation
Carlton St - Ellice Ave to Notre Dame Ave**

Test Hole No.	Test Hole Location	Pavement Surface		Pavement Structure Material		Subgrade Description	Sample Depth (m)		Moisture Content (%)	Grain Size Analysis				Atterberg Limits		
		Type	Thickness (mm)	Type	Thickness (mm)		Top (m)	Bottom (m)		Clay (%)	Silt (%)	Sand (%)	Gravel (%)	Plastic	Liquid	Plasticity Index
TH25-01	UTM : 5528584 N, 633082 E Located 38 m North of Ellice Ave intersection, Southbound curb lane, 3.0 m West of East curb.	Asphalt	20	Concrete	280	Clay, AASHTO: A-7-6 (37)	0.9	1.1	29	46	48	6	0	23	58	35
						Silt, AASHTO: A-4 (I)	1.2	1.4	23							
						Silt, AASHTO: A-4 (I)	1.5	1.7	24							
						Clay, AASHTO: A-7-6 (I)	1.9	2.1	34							
						Clay, AASHTO: A-7-6 (I)	2.3	2.4	41							
						Clay, AASHTO: A-7-6 (I)	2.8	3.0	44							
TH25-02	UTM : 5528618 N, 633069 E Located 55 m South of Qu'Appelle Ave intersection, Southbound curb lane, 2.5 m West of East curb.	Asphalt	35	Concrete	205	Clay, AASHTO: A-7-6 (I)	0.5	0.6	10							
						Clay, AASHTO: A-7-6 (I)	0.8	0.9	10							
						Silt, AASHTO: A-4 (I)	1.1	1.2	20							
						Silt, AASHTO: A-4 (I)	1.4	1.5	27							
						Clay, AASHTO: A-7-6 (I)	1.8	1.9	42							
						Clay, AASHTO: A-7-6 (I)	2.1	2.3	41							
TH25-03	UTM : 55288722 N, 633030 E Located 44 m North of Qu'Appelle Ave intersection, Southbound curb lane, 2.5 m West of East curb.	Asphalt	40	Concrete	210	Silt, AASHTO: A-6 (15)	0.5	0.6	9	17	75	7	2	15	32	17
						Silt, AASHTO: A-4 (I)	0.8	0.9	11							
						Silt, AASHTO: A-4 (I)	1.1	1.2	22							
						Silt, AASHTO: A-4 (I)	1.4	1.5	22							
						Clay, AASHTO: A-7-6 (I)	1.8	1.9	36							
						Clay, AASHTO: A-7-6 (I)	2.1	2.3	36							
TH25-04	UTM : 5528781 N, 633001 E Located 18 m South of Cumberland Ave intersection, Southbound curb lane, 3.0 m East of West curb.	Asphalt	190	Concrete	190	Clay, AASHTO: A-6 (I)	0.9	1.1	27							
						Clay, AASHTO: A-6 (I)	1.2	1.4	29							
						Clay, AASHTO: A-6 (I)	1.5	1.7	30							
						Clay, AASHTO: A-7-6 (I)	1.9	2.1	40							
						Clay, AASHTO: A-7-6 (I)	2.3	2.4	44							
						Clay, AASHTO: A-7-6 (I)	2.8	3.0	48							

Project No. 1000-043-30
Client WSP
Project 2026-2028 Downtown Pavement Renewals
Carlton St - Ellice Ave to Notre Dame Ave
Sample Date 10-Oct-25
Test Date 23-Oct-25
Technician J. Chua

Test Hole	TH25-01	TH25-01	TH25-01	TH25-01	TH25-01	TH25-01
Depth (m)	0.9 - 1.1	1.2 - 1.4	1.5 - 1.7	1.9 - 2.1	2.3 - 2.4	2.8 - 3.0
Sample #	G211	G212	G213	G214	G215	G216
Tare ID	K39	NA8	E96	P11	F135	AB18
Mass of tare	8.4	8.8	8.8	8.5	8.8	6.9
Mass wet + tare	478.6	204.7	218.5	213.0	220.2	164.3
Mass dry + tare	372.9	168.2	177.7	160.7	158.5	116.0
Mass water	105.7	36.5	40.8	52.3	61.7	48.3
Mass dry soil	364.5	159.4	168.9	152.2	149.7	109.1
Moisture %	29.0%	22.9%	24.2%	34.4%	41.2%	44.3%

Test Hole	TH25-02	TH25-02	TH25-02	TH25-02	TH25-02	TH25-02
Depth (m)	0.5 - 0.6	0.8 - 0.9	1.1 - 1.2	1.4 - 1.5	1.8 - 1.9	2.1 - 2.3
Sample #	G202	G203	G204	G205	G206	G207
Tare ID	E93	J69	QT10	AB06	E86	Z40
Mass of tare	6.9	6.8	8.4	6.9	7.0	8.7
Mass wet + tare	232.7	218.8	216.1	214.7	214.1	215.6
Mass dry + tare	211.9	199.7	181.3	170.2	153.2	155.3
Mass water	20.8	19.1	34.8	44.5	60.9	60.3
Mass dry soil	205.0	192.9	172.9	163.3	146.2	146.6
Moisture %	10.1%	9.9%	20.1%	27.3%	41.7%	41.1%

Test Hole	TH25-02	TH25-03	TH25-03	TH25-03	TH25-03	TH25-03
Depth (m)	2.7 - 2.8	0.5 - 0.6	0.8 - 0.9	1.1 - 1.2	1.4 - 1.5	1.8 - 1.9
Sample #	G208	G193	G194	G195	G196	G197
Tare ID	W102	ZD21	H80	A3	GF65	D5
Mass of tare	8.7	8.5	8.6	8.5	8.6	8.4
Mass wet + tare	217.9	191.7	209.0	395.9	192.4	214.2
Mass dry + tare	144.4	176.5	188.5	326.5	159.2	160.0
Mass water	73.5	15.2	20.5	69.4	33.2	54.2
Mass dry soil	135.7	168.0	179.9	318.0	150.6	151.6
Moisture %	54.2%	9.0%	11.4%	21.8%	22.0%	35.8%



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Moisture Content Report ASTM D2216-98

Project No. 1000-043-30
Client WSP
Project 2026-2028 Downtown Pavement Renewals
Carlton St - Ellice Ave to Notre Dame Ave
Sample Date 10-Oct-25
Test Date 23-Oct-25
Technician J. Chua

Test Hole	TH25-03	TH25-03	TH25-04	TH25-04	TH25-04	TH25-04
Depth (m)	2.1 - 2.3	2.7 - 2.8	0.9 - 1.1	1.2 - 1.4	1.5 - 1.7	1.9 - 2.1
Sample #	G198	G199	G186	G187	G188	G189
Tare ID	Z80	E33	W27	K9	F63	Z117
Mass of tare	8.7	8.7	8.4	8.7	8.7	8.2
Mass wet + tare	211.4	204.8	208.6	213.4	201.4	222.3
Mass dry + tare	157.5	142.7	166.5	167.6	156.5	161.6
Mass water	53.9	62.1	42.1	45.8	44.9	60.7
Mass dry soil	148.8	134.0	158.1	158.9	147.8	153.4
Moisture %	36.2%	46.3%	26.6%	28.8%	30.4%	39.6%

Test Hole	TH25-04	TH25-04				
Depth (m)	2.3 - 2.4	2.8 - 3.0				
Sample #	G190	G191				
Tare ID	D27	H29				
Mass of tare	8.6	8.8				
Mass wet + tare	230.2	220.9				
Mass dry + tare	162.9	152.3				
Mass water	67.3	68.6				
Mass dry soil	154.3	143.5				
Moisture %	43.6%	47.8%				

Project No. 1000-043-30
Client WSP
Project 2026-2028 Downtown Pavement Renewals

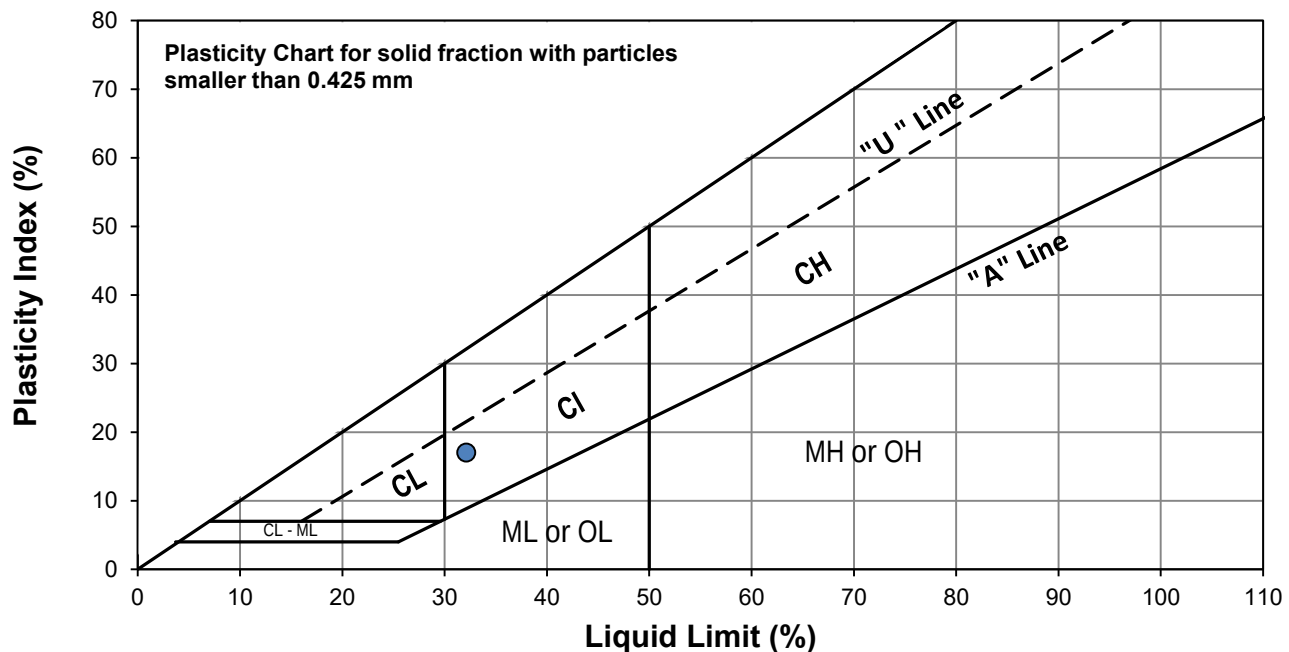


Test Hole TH25-03 (Carlton St - Ellice Ave to Notre Dame Ave)
Sample # G195
Depth (m) 1.1 - 1.2
Sample Date 10-Oct-25
Test Date 28-Oct-25
Technician A. Dustmamatov

Liquid Limit	32
Plastic Limit	15
Plasticity Index	17

Liquid Limit

Trial #	1	2	3		
Number of Blows (N)	15	22	32		
Mass Tare (g)	13.939	13.946	13.779		
Mass Wet Soil + Tare (g)	24.308	22.545	24.098		
Mass Dry Soil + Tare (g)	21.645	20.445	21.645		
Mass Water (g)	2.663	2.100	2.453		
Mass Dry Soil (g)	7.706	6.499	7.866		
Moisture Content (%)	34.557	32.313	31.185		



Plastic Limit

Trial #	1	2	3	4	5
Mass Tare (g)	14.051	13.957			
Mass Wet Soil + Tare (g)	20.936	22.320			
Mass Dry Soil + Tare (g)	20.035	21.217			
Mass Water (g)	0.901	1.103			
Mass Dry Soil (g)	5.984	7.260			
Moisture Content (%)	15.057	15.193			

Note: Additional information recorded/measured for this test is available upon request.

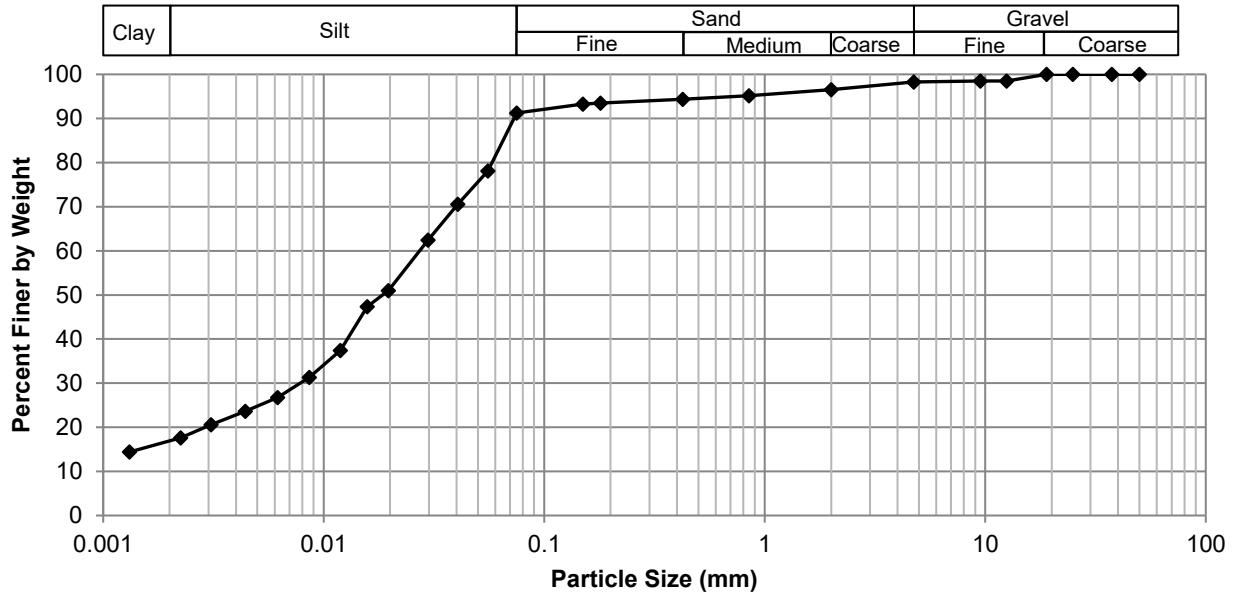
Project No. 1000-043-30
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Project 2026-2028 Downtown Pavement Renewals



Test Hole TH25-03 (Carlton St - Ellice Ave to Notre Dame Ave)
Sample # G195
Depth (m) 1.1 - 1.2
Sample Date 10-Oct-25
Test Date 27-Oct-25
Technician D. Sellick

Gravel	1.8%
Sand	7.0%
Silt	74.5%
Clay	16.8%

Particle Size Distribution Curve



Gravel		Sand		Silt and Clay	
Particle Size (mm)	Percent Passing	Particle Size (mm)	Percent Passing	Particle Size (mm)	Percent Passing
50.0	100.00	4.75	98.24	0.0750	91.27
37.5	100.00	2.00	96.51	0.0555	78.12
25.0	100.00	0.850	95.16	0.0406	70.57
19.0	100.00	0.425	94.35	0.0297	62.43
12.5	98.47	0.180	93.46	0.0197	50.96
9.50	98.47	0.150	93.26	0.0157	47.34
4.75	98.24	0.075	91.27	0.0119	37.38
				0.0086	31.30
				0.0062	26.72
				0.0044	23.65
				0.0031	20.59
				0.0022	17.62
				0.0013	14.40

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Project 2026-2028 Downtown Pavement Renewals

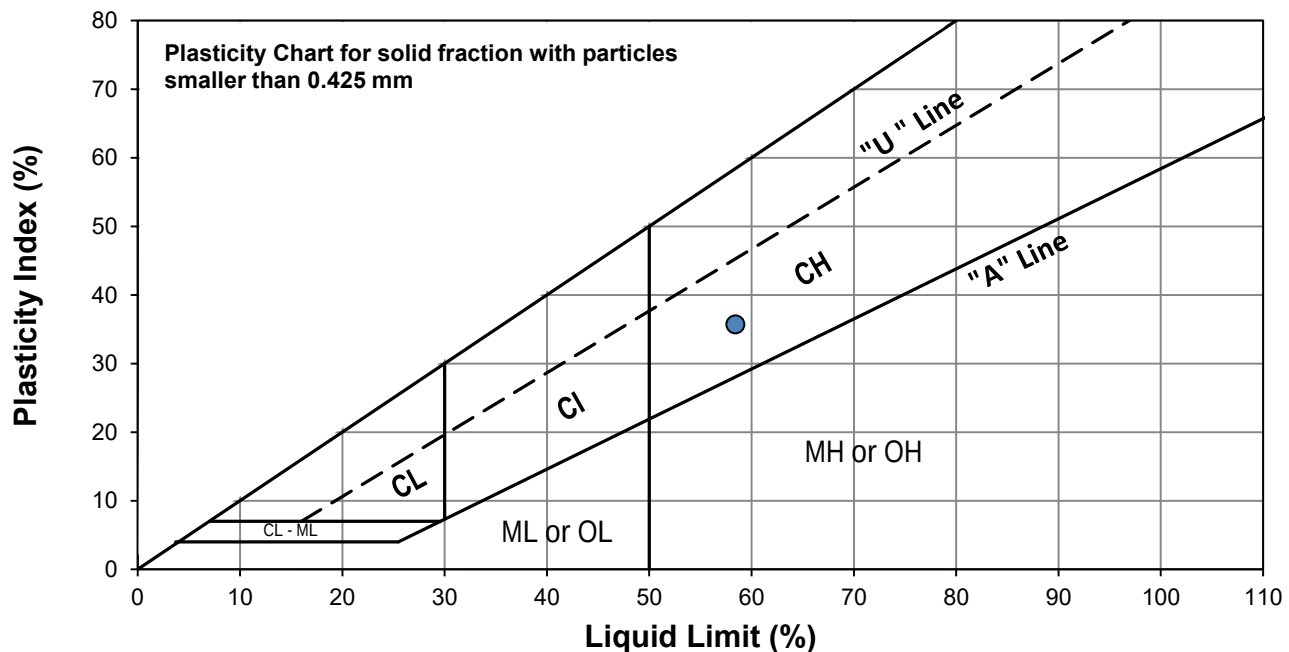


Test Hole TH25-03 (Carlton St - Ellice Ave to Notre Dame Ave)
Sample # G211
Depth (m) 0.9 - 1.1
Sample Date 10-Oct-25
Test Date 28-Oct-25
Technician A. Dustmamatov

Liquid Limit	58
Plastic Limit	23
Plasticity Index	36

Liquid Limit

Trial #	1	2	3		
Number of Blows (N)	18	26	35		
Mass Tare (g)	13.848	13.980	14.096		
Mass Wet Soil + Tare (g)	24.667	24.336	24.540		
Mass Dry Soil + Tare (g)	20.601	20.525	20.766		
Mass Water (g)	4.066	3.811	3.774		
Mass Dry Soil (g)	6.753	6.545	6.670		
Moisture Content (%)	60.210	58.228	56.582		



Plastic Limit

Trial #	1	2	3	4	5
Mass Tare (g)	13.976	13.936			
Mass Wet Soil + Tare (g)	21.453	21.266			
Mass Dry Soil + Tare (g)	20.078	19.900			
Mass Water (g)	1.375	1.366			
Mass Dry Soil (g)	6.102	5.964			
Moisture Content (%)	22.534	22.904			

Note: Additional information recorded/measured for this test is available upon request.

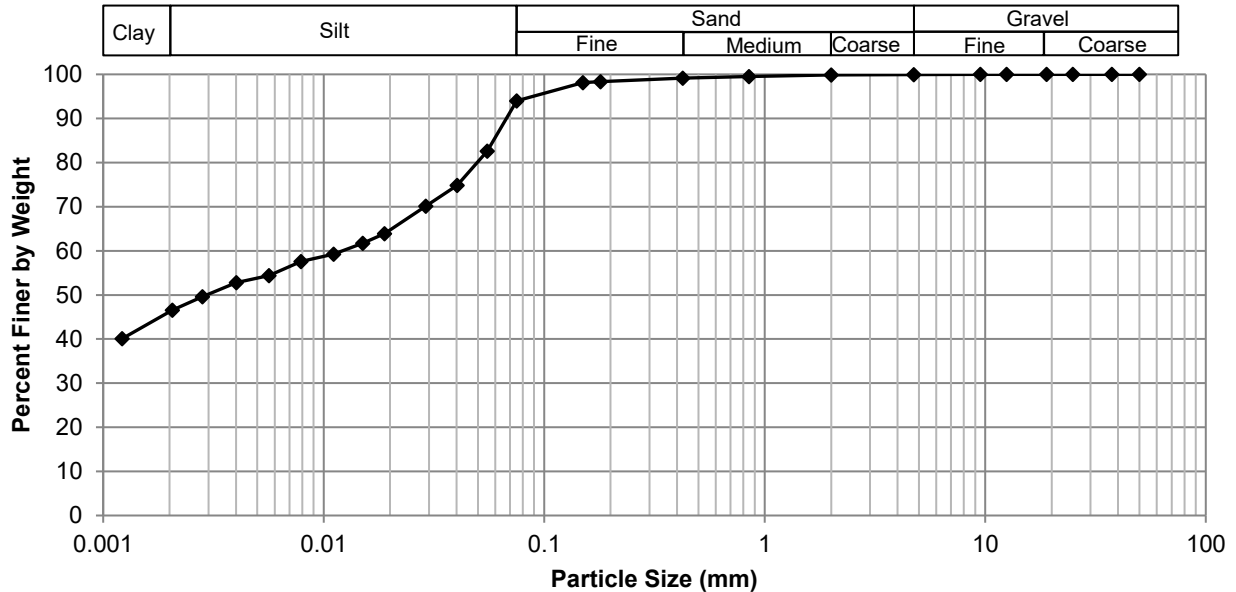
Project No. 1000-043-30
Client WSP
Project 2026-2028 Downtown Pavement Renewals



Test Hole TH25-01 (Carlton St - Ellice Ave to Notre Dame Ave)
Sample # G211
Depth (m) 0.9 - 1.1
Sample Date 10-Oct-25
Test Date 27-Oct-25
Technician D. Sellick

Gravel	0.0%
Sand	6.0%
Silt	47.9%
Clay	46.1%

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	99.96	0.0750	93.99
37.5	100.00	2.00	99.89	0.0551	82.64
25.0	100.00	0.850	99.55	0.0403	74.83
19.0	100.00	0.425	99.17	0.0291	70.15
12.5	100.00	0.180	98.37	0.0189	63.90
9.50	100.00	0.150	98.17	0.0150	61.71
4.75	99.96	0.075	93.99	0.0111	59.22
				0.0079	57.60
				0.0057	54.42
				0.0040	52.80
				0.0028	49.62
				0.0021	46.56
				0.0012	40.09



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Standard Proctor Compaction Test

ASTM D698-12e2

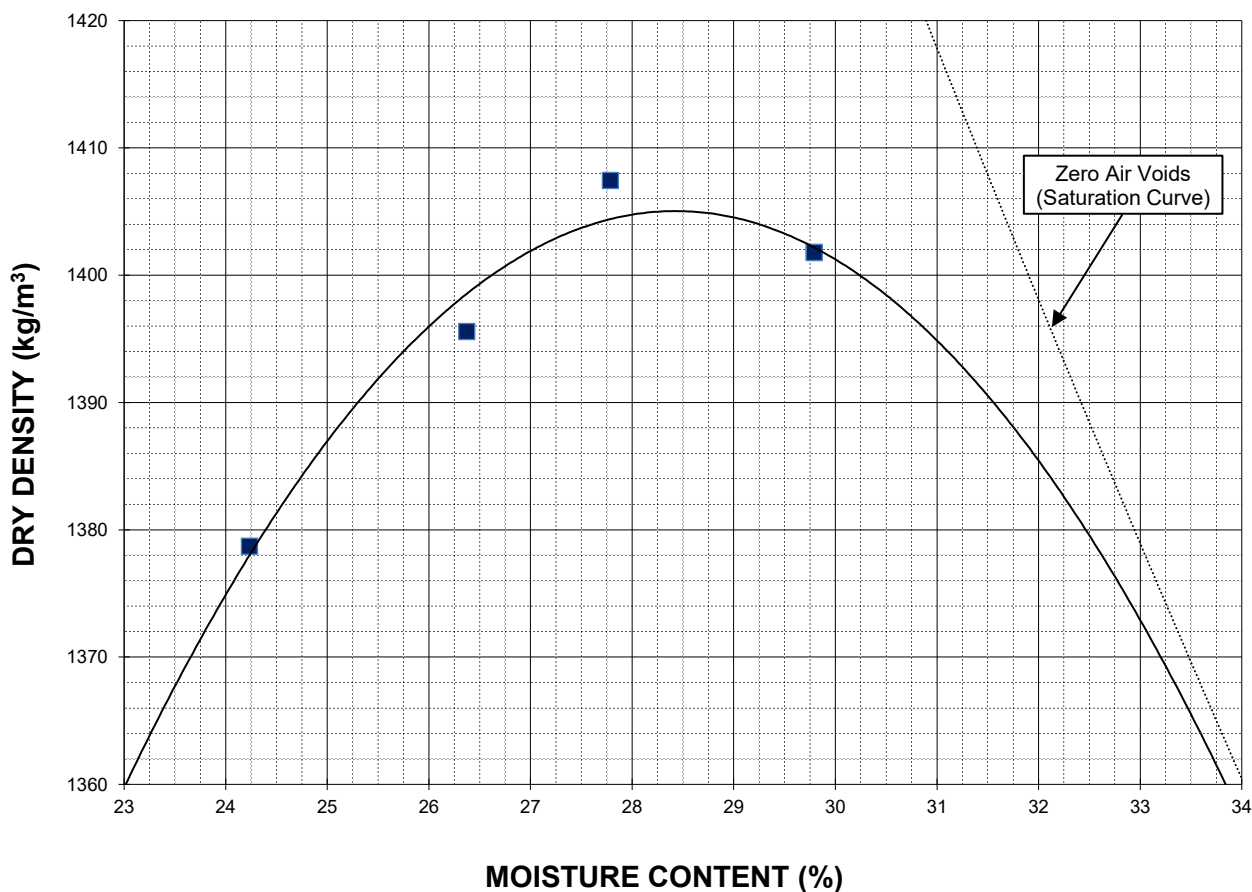
Project No. 1000-043-30
Client WSP
Project 2026-2028 Downtown Pavement Renewals



Sample # L25-443-12 (B192, B201, B210 & B218)
Source Carlton St (TH25-01, TH25-02, TH25-03 & TH25-04)
Material Clay
Sample Date 10-Oct-25
Test Date 17-Oct-25
Technician I. Araquil

Maximum Dry Density (kg/m³)	1405
Optimum Moisture (%)	28.4

Trial Number	1	2	3	4	
Wet Density (kg/m ³)	1713	1764	1799	1819	
Dry Density (kg/m ³)	1379	1396	1407	1402	
Moisture Content (%)	24.2	26.4	27.8	29.8	



Note: Additional information recorded/measured for this test is available upon request.



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California Bearing Ratio Test Data Sheet

ASTM D1883-21

Project No.	1000-043-30	Source	Carlton St (TH25-01, TH25-02, TH25-03 & TH25-04)
Client	WSP	Material	Clay
Project	2026-2028 Downtown Pavement Renewals	Sample Date	10-Oct-25
Sample #	L25-443-12 (B192, B201, B210 & B218)	Test Date	23-Oct-25
		Technician	A. Dustmamatov

Proctor Results (ASTM D698)

Maximum Dry Density	1405 kg/m ³
Optimum Moisture Content	28.4 %
Material Retained on 19 mm Sieve	0.0 %

CBR Sample Compaction

Dry Density	1340 kg/m ³
Initial Moisture Content	28.4 %
Relative Density	95.4 % SPMDD

Soaking Results

Surcharge	4.54 kg
Swell	7.4 %
Moisture Content in top 25 mm	44.6 %
Immersion Period	96 h

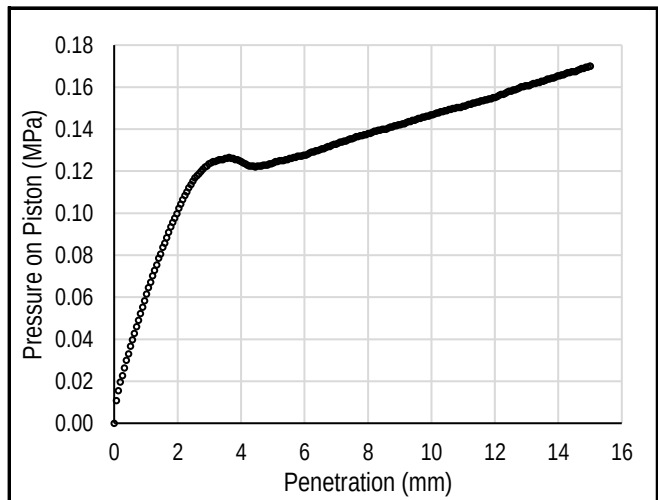
CBR Results

CBR at 2.54 mm	1.7 %
CBR at 5.08 mm	1.2 %
Zero Correction	0 mm

Test Data

Penetration (mm)	Measured Pressure (MPa)	Corrected Pressure (MPa)
0.64	0.04	0.04
1.27	0.07	0.07
1.91	0.10	0.10
2.54	0.12	0.12
3.18	0.12	0.12
3.81	0.13	0.13
4.45	0.12	0.12
5.08	0.12	0.12
7.62	0.14	0.14
10.16	0.15	0.15
12.70	0.16	0.16

Load/Penetration Curve



Comments:

Sample prepared in accordance with the City of Winnipeg guidelines.



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Standard Proctor Compaction Test

ASTM D698-12e2

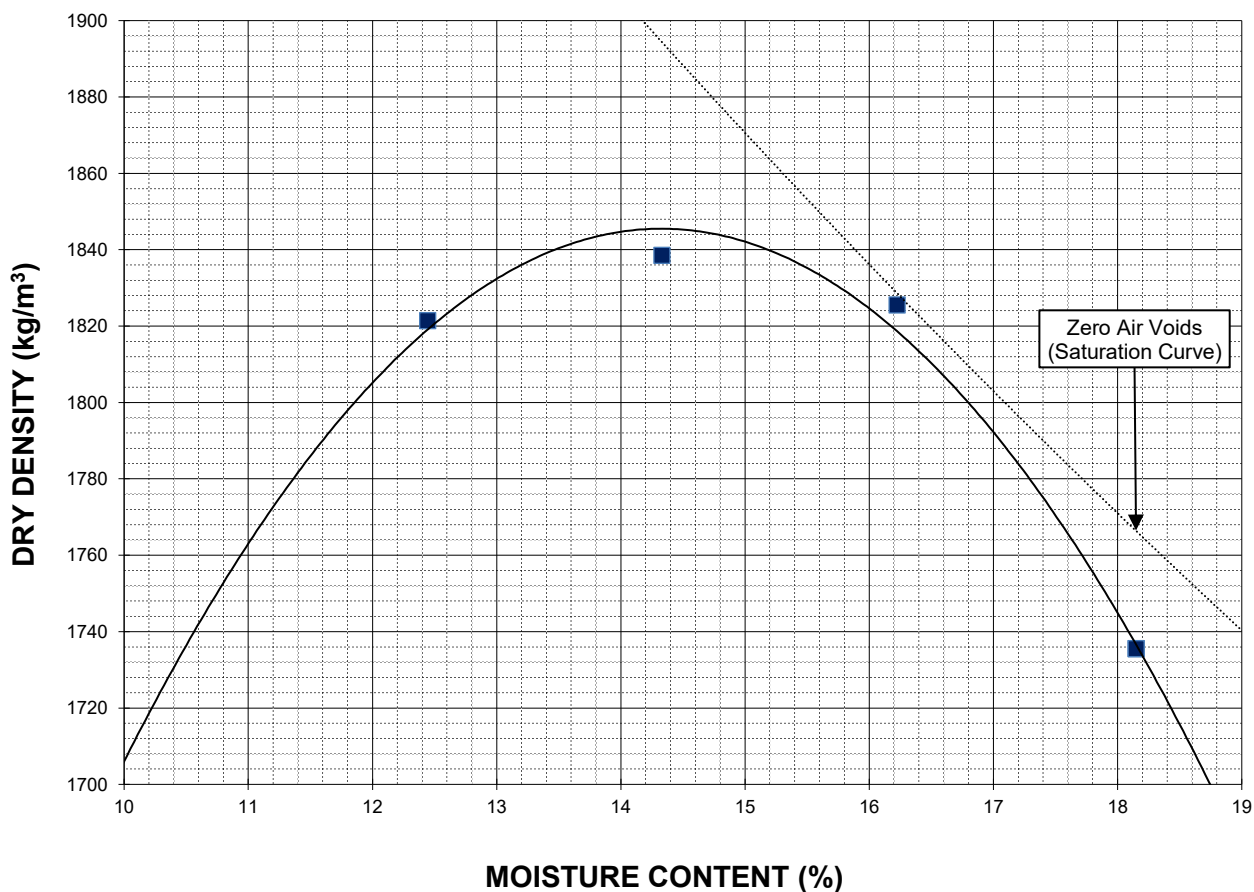


Project No. 1000-043-30
Client WSP
Project 2026-2028 Downtown Pavement Renewals

Sample # L24-443-13 (B200, B209 & B217)
Source Carlton St (TH25-01, TH25-02 & TH25-03)
Material Silt
Sample Date 10-Oct-25
Test Date 21-Oct-25
Technician A. Dustmamatov

Maximum Dry Density (kg/m³)	1846
Optimum Moisture (%)	14.3

Trial Number	1	2	3	4	
Wet Density (kg/m ³)	2048	2102	2122	2050	
Dry Density (kg/m ³)	1821	1839	1826	1736	
Moisture Content (%)	12.4	14.3	16.2	18.1	



Note: Additional information recorded/measured for this test is available upon request.



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California Bearing Ratio Test Data Sheet

ASTM D1883-21

Project No.	1000-043-30	Source	Carlton St (TH25-01, TH25-02 & TH25-03)
Client	WSP	Material	Silt
Project	2026-2028 Downtown Pavement Renewals	Sample Date	10-Oct-25
Sample #	L24-443-13 (B200, B209 & B217)	Test Date	23-Oct-25
		Technician	A. Dustmamatov

Proctor Results (ASTM D698)

Maximum Dry Density	1846 kg/m ³
Optimum Moisture Content	14.5 %
Material Retained on 19 mm Sieve	0.0 %

CBR Sample Compaction

Dry Density	1756 kg/m ³
Initial Moisture Content	14.4 %
Relative Density	95.1 % SPMDD

Soaking Results

Surcharge	4.54 kg
Swell	0.7 %
Moisture Content in top 25 mm	17.5 %
Immersion Period	96 h

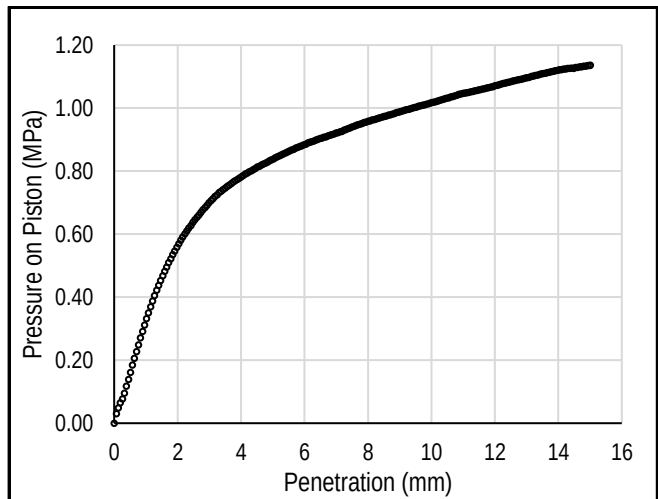
CBR Results

CBR at 2.54 mm	9.4 %
CBR at 5.08 mm	8.2 %
Zero Correction	0 mm

Test Data

Penetration (mm)	Measured Pressure (MPa)	Corrected Pressure (MPa)
0.64	0.21	0.21
1.27	0.41	0.41
1.91	0.55	0.55
2.54	0.65	0.65
3.18	0.72	0.72
3.81	0.77	0.77
4.45	0.81	0.81
5.08	0.84	0.84
7.62	0.95	0.95
10.16	1.02	1.02
12.70	1.09	1.09

Load/Penetration Curve



Comments:

Sample prepared in accordance with the City of Winnipeg guidelines.



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Concrete Core Compressive Strength Report

CSA A23.2-14C

Project No. 1000-043-30

Date October 29, 2025

Project 2026-2028 Downtown Pavement Renewals

Technician T. Green

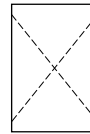
Client WSP Group Canada Inc.

Core Location	Core ID	Date Received	Date of Break	Age at Break	Diam. (mm)	Length (mm)	Moisture Conditioning	Compressive Strength (MPa)		Break Type	Correction Factors*				
								Uncorrected f_{conc}	Corrected* f_c		$F_{l/d}$	F_{dia}	F_{mc}	F_D	F_{reinf}
Carlton St	PC25-10	2025-10-10	2025-10-29	-	145	147	Soaked 48 h	62.02	69.37	1	0.9121	0.9802	1.0900	1.0600	1.0828
Carlton St	PC25-11	2025-10-10	2025-10-29	-	145	177	Soaked 48 h	64.11	68.67	1	0.9457	0.9802	1.0900	1.0600	1.0000
Carlton St	PC25-12 *2	2025-10-10	2025-11-03	-	145	128	Soaked 48 h	66.23	71.04	1	0.8895	0.9802	1.0900	1.0600	1.0648

Comments

*Correction factors $F_{l/d}$, F_{dia} , F_{mc} , and F_D calculated as per ACI 214.4R-03, and correction factor F_{reinf} calculated as per Khoury et al. (2014): $f_c = f_{conc} F_{l/d} F_{dia} F_{mc} F_D F_{reinf}$

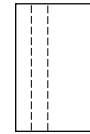
*2 Core length to diameter ratio is less than one.



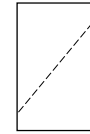
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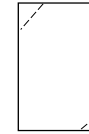
Type 2



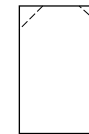
Type 3



Type 4



Type 5



Type 6

Reviewed by (print): Kate Franklin

Signature: Kate Franklin

Table 1 Factors involved in interpretation of core results by different codes.

List	Code/standard	Edition	Factors Considered					
			Aspect ratio	Diameter	Reinforcing	Moisture	Damage	Direction
1	Egyptian Code/Standard Specification	2008	✓		✓			✓
2	British Code/Standard Specification	2003	✓		✓			✓
3	American Concrete Institute ACI	1998	✓					
		2012	✓	✓		✓	✓	
4	European Standard Specification	1998	✓	✓	✓		✓	
		2009	✓		✓			
5	Japanese Standard	1998	✓					
6	Concrete Society	1987	✓		✓		✓	✓

In addition, for core specimen containing two bars no further apart than the diameter of the larger bar, only the bar corresponding to the higher value of $(\Phi_r * d)$ is considered. If the bars are further apart, their combined effect should be assessed by replacing the term $(\Phi_r * d)$ by the term $(\sum \Phi_r * d)$.

It should be pointed out that above equations used to interpret the core concrete strength to the in-situ concrete cube strength have been developed based on a set of assumptions and through many converting process. It is also of interest to note that the damage effect is considered in the development of the formulas in indirect way. The subject derivation and detailed formulas may be seen elsewhere [14].

3.2. American Concrete Institute (ACI)

3.2.1. Former ACI Code (2002) & Current ASTM (2009)

The methodology of core interpretation given in the former ACI code was remained without changes for decades and up to Year (2003). The in-place strength of concrete cylinder at the location from which a core test specimen was extracted can be computed using the equation:

$$f_{cy} = F_{l/d} \cdot f_{core} \quad (4)$$

where f_{cy} is the equivalent in-place concrete cylinder strength, f_{core} is concrete core strength, and $F_{l/d}$ is the strength correction factor for aspect ratio.

The former ACI code does not include any equation to calculate the correction factor ($F_{l/d}$); however, the code gives different values for this term that is associated with different aspect ratios (l/d) as given in Table 2. It should also be noted that the approach of current ASTM is similar to that mentioned above. The only considered variable is the aspect ratio (l/d). It should be noted that identical approach to that mentioned above is still effective in ASTM C42/C42M-03 [10].

3.2.2. Current ACI Code (2012) [15]

Starting from Year 2003, significant changes have been made to the relevant ACI Code provisions regarding the interpreta-

Table 2 Mean values for factor $F_{l/d}$ according to ACI Code (1998) and ASTM.

	Specimen length-to-diameter ratio, l/d			
	1.00	1.25	1.50	1.75
$F_{l/d}$	0.87	0.93	0.96	0.98

tion of core strength test results. New factors have been considered. These include core diameter, moisture content of core sample, core damage associated with drilling, in addition to the effect of aspect ratio that was previously considered in the former ACI edition (1998). According to the ACI 214.4R-03, the in-place concrete strength can be computed using the equation:

$$f_c = F_{l/d} \cdot F_{dia} \cdot F_{mc} \cdot F_D \cdot f_{core} \cdot \text{Front or cc. 12 or cc. 13} \quad (5)$$

where f_c is the equivalent in-place concrete cylinder strength, f_{core} is concrete core strength, $F_{l/d}$ is strength correction factor for aspect ratio, F_{dia} is strength correction factors for diameter, F_{mc} is strength correction factor for moisture condition of core sample, and F_D is the strength correction factor that accounts for effect of damage sustained during core drilling including micro-cracking and undulations at the drilled surface and cutting through coarse-aggregate particles that may subsequently pop out during testing.

The ACI committee considered the correction factors presented in Table 3 for converting core strengths into equivalent in-place strengths based on the work reported by Bartlett and MacGregor [6]. It should be noted that the magnitude of

Table 3 Strength correction factors according to ACI 214.4R-03.

List	Factors	Mean values
(1) ^b	$F_{l/d}$: l/d ratio	
	As-received	$1 - \{0.130 - \alpha f_{core}\} (2 - \frac{l}{d})^2$
	Soaked 48 h	$1 - \{0.117 - \alpha f_{core}\} (2 - \frac{l}{d})^2$
	Air dried ^a	$1 - \{0.144 - \alpha f_{core}\} (2 - \frac{l}{d})^2$
(2)	F_{dia} : core diameter	
	50 mm	1.06
	100 mm	1.00
	150 mm	0.98
(3)	F_{mc} : core moisture content	
	As-received	1.00
	Soaked 48 h	1.09
	Air dried ^a	0.96
(4)	F_D : damage due to drilling	1.06

^a Standard treatment specified in ASTM C 42/C 42M.

^b Constant α equals $4.3(10^{-4})$ 1/MPa for f_{core} in MPa.

Table 6 List of comparisons between tested cores to determine.

	A18	A17	A16	A15	A14	A13	A12	A11	A10	A9	A8	A7	A6	A5	A4	A3	A2	A1
A1	●	●	●	■	■		●				●			▲	▲	■	▲	
A2																		
A3						■				■								
A4																		
A5																		
A6								■	▲	■	▲		■	▲				
A7								■	▲	■	▲							
A8		●	◆	●	●													
A9																		
A10								■	▲									
A11																		
A12		●		●	●													
A13																		
A14		●		●														
A15		●																
A16	●	◆																
A17	◆																	
A18																		

- Diameter of steel bar.
- ▲ Distance of steel bar from nearly end of core.
- Number of steel bars and spacing between bars.
- ◆ Distance of steel bar from vertical axis of specimen.

This brief review indicated that the various proposed relationships for correction factors are all nonlinear. It should be noted that the equations given by the Egyptian Code takes into account most variables that may affect the interpretation of the results; however, the code ignores the deterioration of steel-concrete bond that may occur and also the position of the reinforcement from vertical axis of core specimens.

Weighted nonlinear regression analysis has been performed to determine the factor (F_{reinf}) with the use of the software "SAS" package and "Data Fit." This shows that the correction factor for reinforcement (F_{reinf}) is given by the following expression:

• For cores containing a single bar:

$$F_{\text{reinf}} = \left[1 + 1.5 \frac{[\Phi_r \times r + \Phi_r \times (S/10)]}{\Phi_c \times L} \right] \times \frac{1.13}{f_{\text{core}}^{0.015}} \quad (12)$$

- For core specimen containing two bars no further apart than the diameter of the larger bar, only the bar corresponding to the higher value of ($\Phi_r \times d$) is considered. If the bars are further apart, their combined effect is assessed by replacing the term ($\Phi_r \times r$) by ($\sum \Phi_r \times r$) as follows:

$$F_{\text{reinf}} = \left[1 + 1.5 \frac{\sum [\Phi_r \times r + \Phi_r \times (S/10)]}{\Phi_c \times L} \right] \times \frac{1.13}{f_{\text{core}}^{0.015}} \quad (13)$$

where F_{reinf} is the correction factor for reinforcement, Φ_r is the diameter of the reinforcement, Φ_c is the diameter of the concrete specimen, r is the distance of axis of bar from nearer end of specimen, S is the distance of axis of bar from axis of core specimen, L is the length of the specimen after end preparation by grinding or capping, and f_{core} is the concrete core strength (kg/cm^2).

6.1.6. Effect of moisture condition of core

Results of about 100 cores indicate that the strength of cores left to dry in air for 7 days is on average 13% greater than that of cores soaked at least 40 h before testing. The strength of cores with negligible moisture gradient and tested after cutting is found to be 7–9% larger than that of soaked cores as shown in Fig. 20. The authors strongly recommend to use a correction factor accounting for moisture condition (F_m) equals to 1.09 and 0.96, respectively, for cores tested after 48 h soaked in water and for those tested after 7 days dry in air.

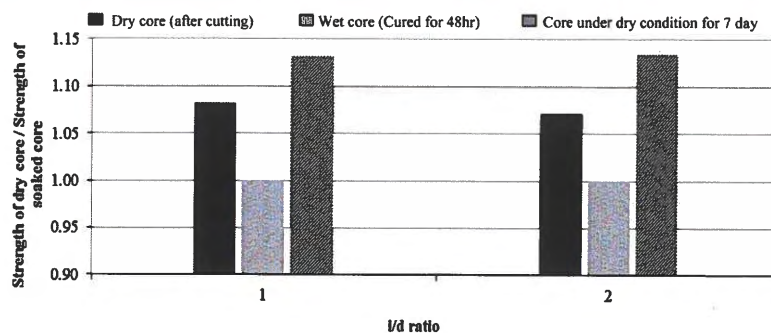
**Figure 20** Effect of core moisture condition on core strength for different aspect ratios (l/d).



Photo 1: Pavement Core Sample at TH25-01



Photo 2: Pavement Core Sample at TH25-02



Photo 3: Pavement Core Sample at TH25-03



Photo 4: Pavement Core Sample at TH25-04



2026-2028 Downtown Pavement Renewals
Carlton St - Ellice Ave to Notre Dame Ave

Pavement Core No.	Pavement Core Location	Pavement Surface		Pavement Structure Material		Corrected Compressive Strength (Mpa)
		Type	Thickness (mm)	Type	Thickness (mm)	
PC25-10	UTM : 5528828 m N, 633004 m E; Located 2 m North of Cumberland St, Southbound curb lane, 2.0 m West of East curb.	Asphalt	40	Concrete	210	69.37
PC25-11	UTM : 5528873 m N, 633004 m E; Located 56 m South of Notre Dame Ave, Southbound curb lane, 2.0 m West of East curb.	Asphalt	50	Concrete	225	68.67
PC25-12	UTM : 5528889 m N, 633014 m E; Located 12 m South of Notre Dame Ave, Southbound middle lane, 5.0 m West of East curb.	Asphalt	230	Concrete	110	71.04



Photo 1: Pavement Core Sample at PC25-10



Photo 2: Pavement Core Sample at PC25-11



Photo 3: Pavement Core Sample at PC25-12

Appendix B
Test Hole Logs, Summary Table, Lab Testing Results and
Photographs of Pavement Core Samples
Hargrave St. – Ellice Ave to Notre Dame



Sub-Surface Log

Test Hole TH25-05

1 of 1

Client: WSP

Project Number: 1000-043-30

Project Name: 2026-2028 Downtown Pavement Renewals

Location: UTM : 633182 E 5528607 N - Hargrave St

Contractor: Maple Leaf Drilling

Ground Elevation: Top of Pavement

Method: 125mm Solid Stem Auger, B40 Mobile Truck Mount

Date Drilled: October 10, 2025

Sample Type:

Grab (G) Shelby Tube (T) Split Spoon (SS) / SPT Split Barrel (SB) / LPT 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)		Particle Size (%)						Undrained Shear Strength (kPa)			
					16	17	18	19	20	21	Test Type					



Sub-Surface Log

Test Hole TH25-06

1 of 1

Client:WSP

Project Number:1000-043-30

Project Name:2026-2028 Downtown Pavement Renewals

Location:UTM : 633144 E 5528696 N - Hargrave St

Contractor:Maple Leaf Drilling

Ground Elevation:Top of Pavement

Method:125mm Solid Stem Auger, B40 Mobile Truck Mount

Date Drilled:October 10, 2025

Sample Type:

Grab (G)

Shelby Tube (T)

Split Spoon (SS) / SPT

Split Barrel (SB) / LPT

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)						Undrained Shear Strength (kPa)				
					16	17	18	19	20	21	Test Type				
					Particle Size (%)						Pocket Pen. Qu				
					0	20	40	60	80	100	Field Vane				
		ASPHALT													
		CONCRETE													
		SAND (FILL) - some gravel (<75mm diam.), brown, moist, loose													
		- well graded (fine sand to coarse gravel), rounded													
		- AASHTO: A-1 (I)													
-0.5		CLAY - silty, trace sand													
		- black													
		- moist, very stiff													
		- high plasticity													
		- AASHTO: A-7-6 (61)	G227												
-1.0															
		- grey below 1.2m	G228												
			G229												
-1.5															
		SILT - some clay													
		- light brown, moist, soft													
		- low plasticity													
		- AASHTO: A-4 (I)	G230												
-2.0															
			G231												
-2.5															
		CLAY - silty													
		- grey													
		- moist, stiff													
		- high plasticity													
		- AASHTO: A-7-6 (I)	G232												
-3.0															

END OF TEST HOLE AT 3.0m IN CLAY.

Notes:

- Seepage and sloughing not observed.
- Test hole dry and squeezed in (silt) at 2.1m depth immediately after drilling.
- Test hole backfilled with cuttings and bentonite.
- Bulk samples (B233 clay and B234 silt) collected between 0.8m and 2.0m.



Sub-Surface Log

Test Hole TH25-08

1 of 1

Client:WSP

Project Number:1000-043-30

Project Name:2026-2028 Downtown Pavement Renewals

Location:UTM : 633165 E 5528819 N - Hargrave St

Contractor:Maple Leaf Drilling

Ground Elevation:Top of Pavement

Method:125mm Solid Stem Auger, B40 Mobile Truck Mount

Date Drilled:October 17, 2025

Sample Type:

Grab (G)

Shelby Tube (T)

Split Spoon (SS) / SPT

Split Barrel (SB) / LPT

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)						Undrained Shear Strength (kPa)				
					16	17	18	19	20	21	Test Type				
					Particle Size (%)						Δ Torvane Δ				
					0	20	40	60	80	100	✦ Pocket Pen. ✦				
					PL MC LL						⊠ Qu ⊠				
					0	20	40	60	80	100	0	50	100	150	200250
		ASPHALT													
		CONCRETE													
		SAND (FILL) - some gravel (<75mm diam.), brown, moist, loose													
		- well graded (fine sand to coarse gravel), rounded, AASHTO: A-1 (I)													
-0.5		CLAY - silty, trace sand													
		- grey													
		- moist, stiff													
		- high plasticity													
		- AASHTO: A-7-6 (61)													
-1.0		SILT - some clay													
		- light brown													
		- moist													
		- soft to firm													
		- low plasticity													
		- AASHTO: A-4 (I)													
-1.5		CLAY - silty													
		- brown													
		- moist, very stiff													
		- high plasticity													
		- AASHTO: A-7-6 (I)													
-2.0		CLAY - silty													
		- brown													
		- moist, very stiff													
		- high plasticity													
		- AASHTO: A-7-6 (I)													
-2.5		- stiff below 2.5m													
-3.0															

END OF TEST HOLE AT 3.0m IN CLAY.

Notes:

1) Seepage and sloughing not observed.

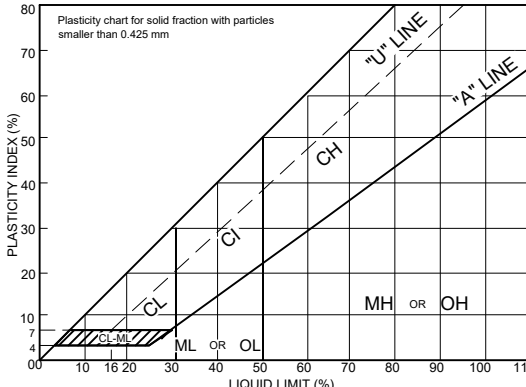
2) Test hole dry and open to 3.0m depth immediately after drilling.

3) Test hole backfilled with cuttings and bentonite.

4) Bulk samples (B241 silt and B242 clay) collected between 0.8m and 2.0m.

GENERAL NOTES

- Classifications are based on the Unified Soil Classification System and include consistency, moisture, and color. Field descriptions have been modified to reflect results of laboratory tests where deemed appropriate.
- Descriptions on these test hole logs apply only at the specific test hole locations and at the time the test holes were drilled. Variability of soil and groundwater conditions may exist between test hole locations.
- When the following classification terms are used in this report or test hole logs, the primary and secondary soil fractions may be visually estimated.

Major Divisions			USCS Classification	Symbols	Typical Names	Laboratory Classification Criteria		Particle Size	Material				
Coarse-Grained soils (More than half the material is larger than No. 200 sieve size)	Gravels (More than half of coarse fraction is larger than 4.75 mm)	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 cases requiring dual symbols*	$C_u = \frac{D_{60}}{D_{10}}$ greater than 4; $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ between 1 and 3	ASTM Sieve sizes	#10 to #4 #40 to #10 #200 to #40 < #200				
			GP		Poorly-graded gravels, gravel-sand mixtures, little or no fines		Not meeting all gradation requirements for GW						
			GM		Silty gravels, gravel-sand-silt mixtures		Atterberg limits below "A" line or P.I. less than 4			Above "A" line with P.I. between 4 and 7 are borderline cases requiring use of dual symbols			
			GC		Clayey gravels, gravel-sand-silt mixtures		Atterberg limits above "A" line or P.I. greater than 7						
	Sands (More than half of coarse fraction is smaller than 4.75 mm)	Clean sands (Little or no fines)	SW		Well-graded sands, gravelly sands, little or no fines		$C_u = \frac{D_{60}}{D_{10}}$ greater than 6; $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ between 1 and 3						
			SP		Poorly-graded sands, gravelly sands, little or no fines		Not meeting all gradation requirements for SW						
			SM		Silty sands, sand-silt mixtures		Atterberg limits below "A" line or P.I. less than 4			Above "A" line with P.I. between 4 and 7 are borderline cases requiring use of dual symbols			
			SC		Clayey sands, sand-clay mixtures		Atterberg limits above "A" line or P.I. greater than 7						
	Fine-Grained soils (More than half the material is smaller than No. 200 sieve size)	Silt 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					Strong colour or odour, and often fibrous texture	Particle Size	ASTM Sieve Sizes	Material
			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									
Silt 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								

LEGEND OF ABBREVIATIONS AND SYMBOLS

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

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
with *	with silt, with sand	> 35 percent

* Used when the material is classified based on behaviour as a cohesive material

TERMS DESCRIBING CONSISTENCY OR COMPACTION CONDITION

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

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

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

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

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

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



**2026-2028 Downtown Pavement Renewals
Sub-Surface Investigation
Hargrave St. - Ellice Ave to Notre Dame Ave**

Test Hole No.	Test Hole Location	Pavement Surface		Pavement Structure Material		Subgrade Description	Sample Depth (m)		Moisture Content (%)	Grain Size Analysis				Atterberg Limits		
		Type	Thickness (mm)	Type	Thickness (mm)		Top (m)	Bottom (m)		Clay (%)	Silt (%)	Sand (%)	Gravel (%)	Plastic	Liquid	Plasticity Index
TH25-05	UTM : 5528607 N, 633182 E Located 22 m North of Ellice Ave intersection, Northbound curb lane, 3.0 m West of East curb.	Asphalt	300	Concrete	200	Clay, AASHTO: A-7-6 (I)	0.9	1.1	32							
						Clay, AASHTO: A-7-6 (I)	1.2	1.4	31							
						Silt, AASTHO:A-4(I)	1.5	1.7	23							
						Clay, AASHTO: A-7-6 (I)	1.9	2.1	36							
						Clay, AASHTO: A-7-6 (I)	2.3	2.4	41							
						Clay, AASHTO: A-7-6 (I)	2.8	3.0	44							
TH25-06	UTM : 5528696 N, 633144 E Located 11 m South of Qu'Appelle Ave intersection, Northbound middle lane, 8.0 m East of West curb.	Asphalt	60	Concrete	200	Clay, AASHTO: A-7-6 (55)	0.8	0.9	36	57	40	3	0	27	76	48
						Clay, AASHTO: A-7-6 (55)	1.1	1.2	32							
						Clay, AASHTO: A-7-6 (55)	1.4	1.5	28							
						Silt, AASTHO:A-4(I)	1.8	1.9	22							
						Silt, AASTHO:A-4(I)	2.1	2.3	23							
						Clay, AASHTO: A-7-6 (I)	2.7	2.8	42							
TH25-08	UTM : 5528819 N, 633165 E Located 18 m South of Notre Dame Ave intersection, Northbound curb lane, 3.0 m West of East curb.	Asphalt	45	Concrete	205	Clay, AASHTO: A-7-6 (61)	0.8	0.9	34	70	26	4	0	21	77	56
						Silt, AASTHO:A-4(I)	1.1	1.2	25							
						Silt, AASTHO:A-4(I)	1.4	1.5	22							
						Clay, AASHTO: A-7-6 (I)	1.8	1.9	31							
						Clay, AASHTO: A-7-6 (I)	2.1	2.3	36							
						Clay, AASHTO: A-7-6 (I)	2.7	2.8	46							
						Clay, AASHTO: A-7-6 (I)	2.1	2.3	36							
						Clay, AASHTO: A-7-6 (I)	2.7	2.8	46							



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Moisture Content Report ASTM D2216-98

Project No. 1000-043-30
Client WSP
Project 2026-2028 Downtown Pavement Renewal - Hargrave St. N
Hargrave St. - Ellice Ave to Notre Dame Ave
Sample Date 10-Oct-25
Test Date 23-Oct-25
Technician J. Chua

Test Hole	TH25-05	TH25-05	TH25-05	TH25-05	TH25-05	TH25-05
Depth (m)	0.9 - 1.1	1.2 - 1.4	1.5 - 1.7	1.9 - 2.1	2.3 - 2.4	2.8 - 3.0
Sample #	G219	G220	G221	G222	G223	G224
Tare ID	R34	M96	A001	Z120	MOO	M62
Mass of tare	7.1	6.9	7.0	6.9	6.9	7.2
Mass wet + tare	224.0	229.8	191.7	223.1	208.8	181.0
Mass dry + tare	171.7	176.6	157.2	166.0	150.5	127.6
Mass water	52.3	53.2	34.5	57.1	58.3	53.4
Mass dry soil	164.6	169.7	150.2	159.1	143.6	120.4
Moisture %	31.8%	31.3%	23.0%	35.9%	40.6%	44.4%

Test Hole	TH25-06	TH25-06	TH25-06	TH25-06	TH25-06	TH25-06
Depth (m)	0.8 - 0.9	1.1 - 1.2	1.4 - 1.5	1.8 - 1.9	2.1 - 2.3	2.7 - 2.8
Sample #	G227	G228	G229	G230	G231	G232
Tare ID	E20	QT4	P05	QT82	F6	AA15
Mass of tare	6.9	8.3	6.9	8.4	6.9	7.5
Mass wet + tare	399.7	220.2	208.7	203.7	225.5	206.6
Mass dry + tare	294.8	169.0	164.9	168.4	184.8	147.8
Mass water	104.9	51.2	43.8	35.3	40.7	58.8
Mass dry soil	287.9	160.7	158.0	160.0	177.9	140.3
Moisture %	36.4%	31.9%	27.7%	22.1%	22.9%	41.9%

Test Hole	TH25-08	TH25-08	TH25-08	TH25-08	TH25-08	TH25-08
Depth (m)	0.8 - 0.9	1.1 - 1.2	1.4 - 1.5	1.8 - 1.9	2.1 - 2.3	2.7 - 2.8
Sample #	G235	G236	G237	G238	G239	G240
Tare ID	P34	QT45	QT88	AD19	E19	N12
Mass of tare	8.3	8.2	8.4	8.3	6.9	8.6
Mass wet + tare	376.9	202.3	200.2	198.7	199.1	191.7
Mass dry + tare	283.9	162.9	165.0	153.1	148.4	134.1
Mass water	93.0	39.4	35.2	45.6	50.7	57.6
Mass dry soil	275.6	154.7	156.6	144.8	141.5	125.5
Moisture %	33.7%	25.5%	22.5%	31.5%	35.8%	45.9%

Project No. 1000-043-30
Client WSP
Project 2026-2028 Downtown Pavement Renewals

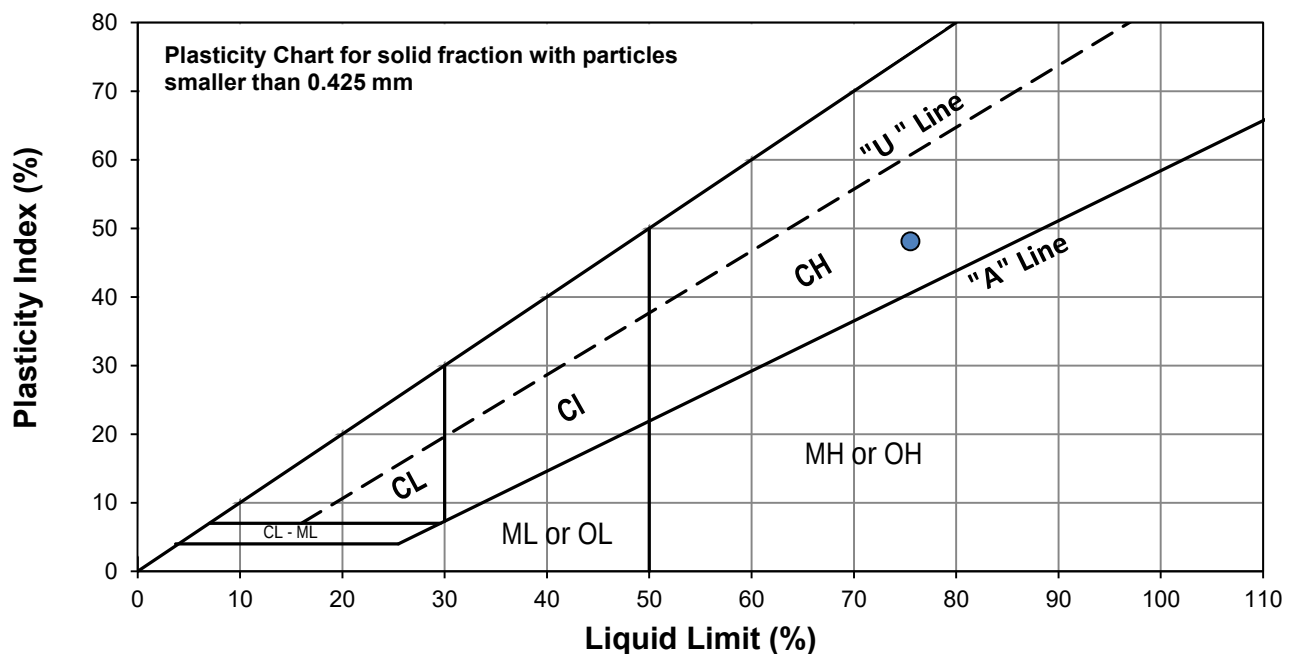


Test Hole TH25-08 (Hargrave St. - Ellice Ave to Notre Dame Ave)
Sample # G227
Depth (m) 19
Sample Date 17-Oct-25
Test Date 29-Oct-25
Technician D. Sellick

Liquid Limit	76
Plastic Limit	27
Plasticity Index	48

Liquid Limit

Trial #	1	2	3		
Number of Blows (N)	18	20	27		
Mass Tare (g)	13.554	13.938	13.943		
Mass Wet Soil + Tare (g)	21.310	22.585	22.305		
Mass Dry Soil + Tare (g)	17.907	18.816	18.723		
Mass Water (g)	3.403	3.769	3.582		
Mass Dry Soil (g)	4.353	4.878	4.780		
Moisture Content (%)	78.176	77.265	74.937		



Plastic Limit

Trial #	1	2	3	4	5
Mass Tare (g)	13.770	14.022			
Mass Wet Soil + Tare (g)	21.041	20.934			
Mass Dry Soil + Tare (g)	19.476	19.445			
Mass Water (g)	1.565	1.489			
Mass Dry Soil (g)	5.706	5.423			
Moisture Content (%)	27.427	27.457			

Note: Additional information recorded/measured for this test is available upon request.

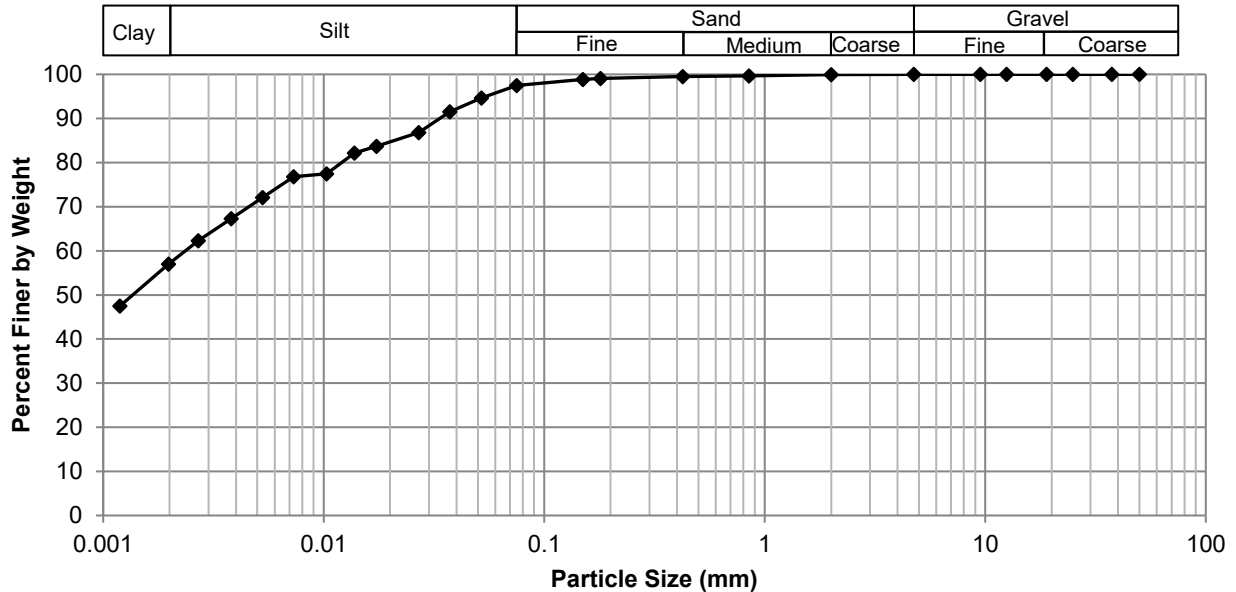
Project No. 1000-043-30
Client WSP
Project 2026-2028 Downtown Pavement Renewals



Test Hole TH25-06 (Hargrave St. - Ellice Ave to Notre Dame Ave)
Sample # G227
Depth (m) 0.8 - 0.9
Sample Date 10-Oct-25
Test Date 27-Oct-25
Technician D. Sellick

Gravel	0.0%
Sand	2.5%
Silt	40.3%
Clay	57.2%

Particle Size Distribution Curve



Gravel		Sand		Silt and Clay	
Particle Size (mm)	Percent Passing	Particle Size (mm)	Percent Passing	Particle Size (mm)	Percent Passing
50.0	100.00	4.75	100.00	0.0750	97.49
37.5	100.00	2.00	99.93	0.0520	94.66
25.0	100.00	0.850	99.67	0.0374	91.54
19.0	100.00	0.425	99.51	0.0270	86.85
12.5	100.00	0.180	99.06	0.0173	83.73
9.50	100.00	0.150	98.88	0.0138	82.16
4.75	100.00	0.075	97.49	0.0103	77.48
				0.0073	76.80
				0.0053	72.07
				0.0038	67.34
				0.0027	62.29
				0.0020	57.03
				0.0012	47.47

Project No. 1000-043-30
Client WSP
Project 2026-2028 Downtown Pavement Renewals

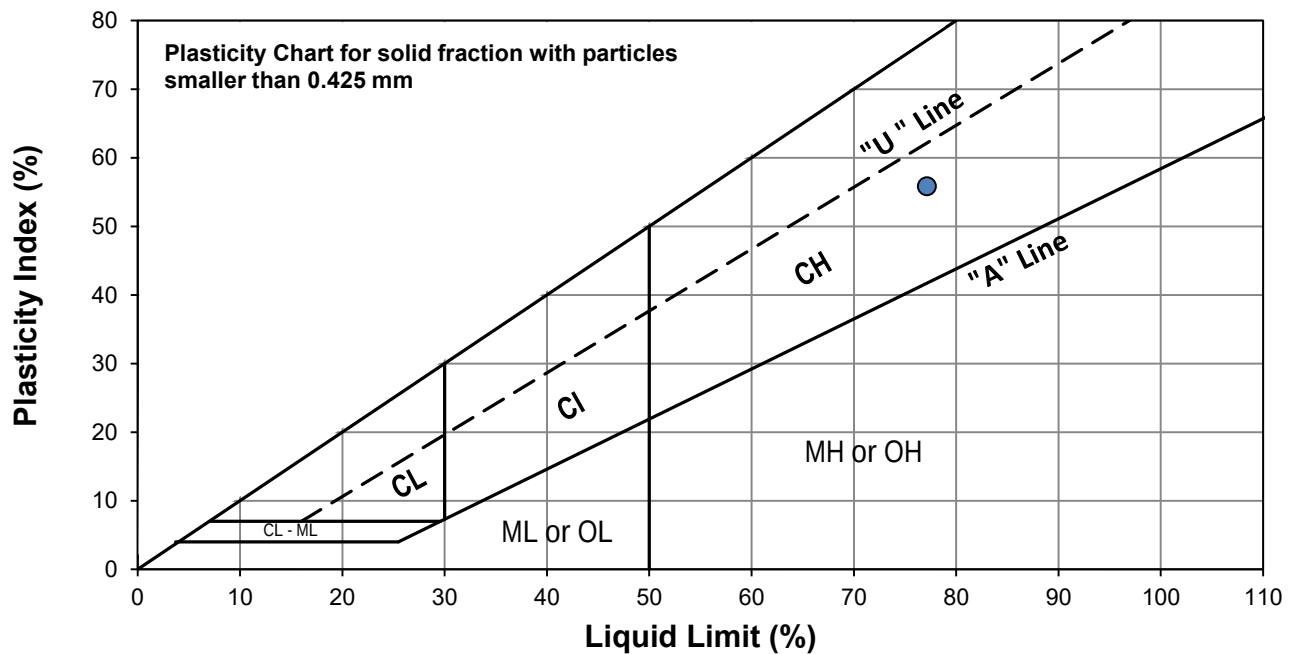


Test Hole TH25-08 (Hargrave St. - Ellice Ave to Notre Dame Ave)
Sample # G235
Depth (m) 0.8 - 0.9
Sample Date 17-Oct-25
Test Date 27-Oct-25
Technician A. Dustmamatov

Liquid Limit	77
Plastic Limit	21
Plasticity Index	56

Liquid Limit

Trial #	1	2	3		
Number of Blows (N)	15	27	34		
Mass Tare (g)	13.985	14.218	14.054		
Mass Wet Soil + Tare (g)	23.049	24.942	23.106		
Mass Dry Soil + Tare (g)	18.926	20.306	19.275		
Mass Water (g)	4.123	4.636	3.831		
Mass Dry Soil (g)	4.941	6.088	5.221		
Moisture Content (%)	83.445	76.150	73.377		



Plastic Limit

Trial #	1	2	3	4	5
Mass Tare (g)	14.017	14.088			
Mass Wet Soil + Tare (g)	22.740	21.535			
Mass Dry Soil + Tare (g)	21.199	20.234			
Mass Water (g)	1.541	1.301			
Mass Dry Soil (g)	7.182	6.146			
Moisture Content (%)	21.456	21.168			

Note: Additional information recorded/measured for this test is available upon request.

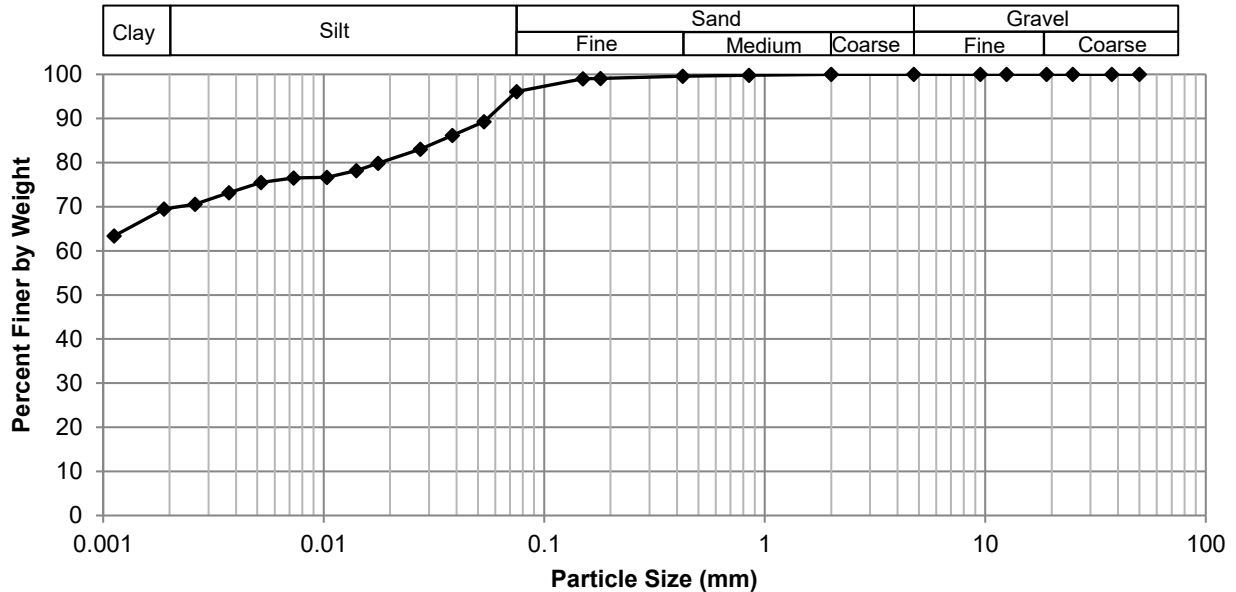
Project No. 1000-043-30
Client WSP
Project 2026-2028 Downtown Pavement Renewals



Test Hole TH25-08 (Hargrave St. - Ellice Ave to Notre Dame Ave)
Sample # G235
Depth (m) 0.8 - 0.9
Sample Date 17-Oct-25
Test Date 27-Oct-25
Technician D. Sellick

Gravel	0.0%
Sand	3.9%
Silt	26.5%
Clay	69.6%

Particle Size Distribution Curve



Gravel		Sand		Silt and Clay	
Particle Size (mm)	Percent Passing	Particle Size (mm)	Percent Passing	Particle Size (mm)	Percent Passing
50.0	100.00	4.75	100.00	0.0750	96.11
37.5	100.00	2.00	100.00	0.0534	89.26
25.0	100.00	0.850	99.83	0.0383	86.13
19.0	100.00	0.425	99.57	0.0275	83.01
12.5	100.00	0.180	99.11	0.0176	79.88
9.50	100.00	0.150	98.98	0.0141	78.21
4.75	100.00	0.075	96.11	0.0103	76.65
				0.0073	76.54
				0.0052	75.49
				0.0037	73.20
				0.0026	70.59
				0.0019	69.45
				0.0011	63.39



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Standard Proctor Compaction Test

ASTM D698-12e2

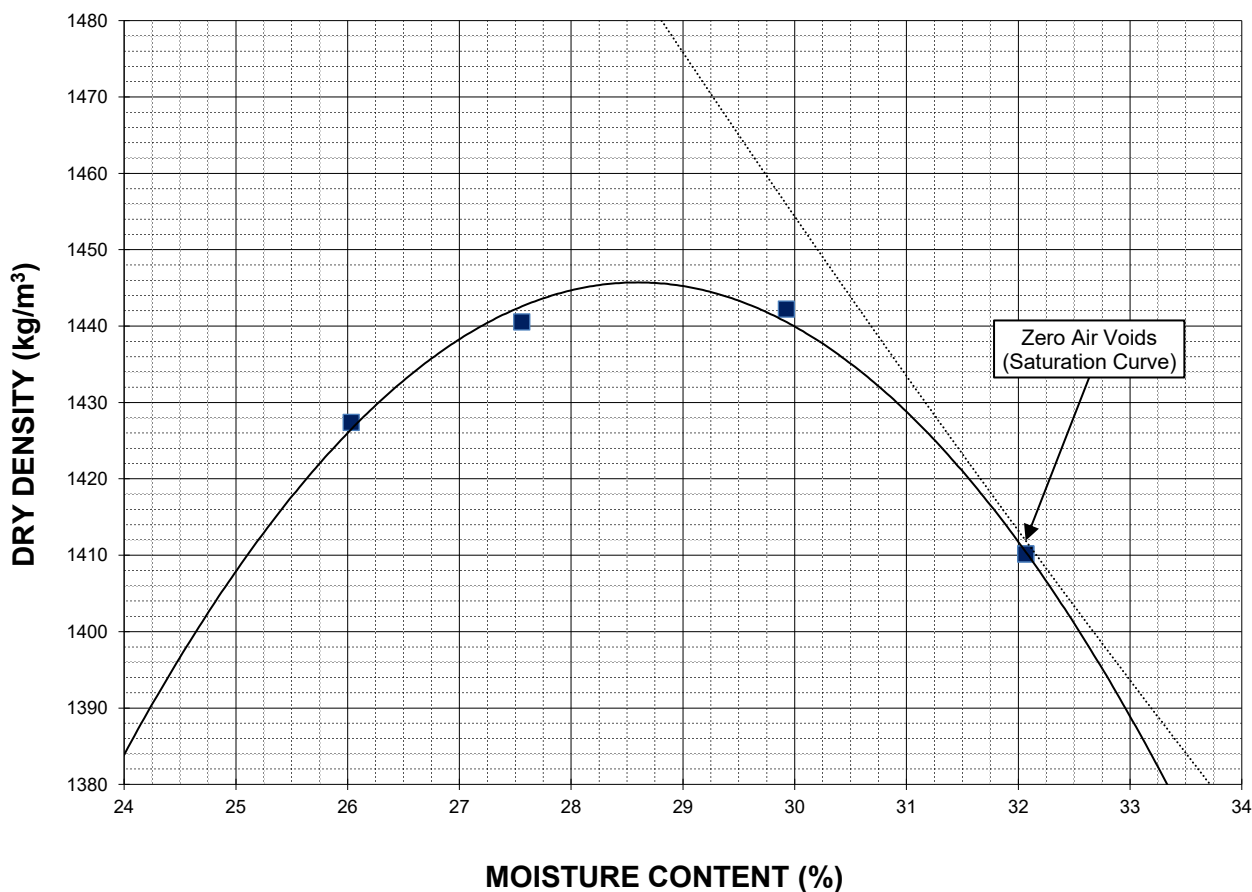
Project No. 1000-043-30
Client WSP
Project 2026-2028 Downtown Pavement Renewals



Sample # L24-443-14 (B226 & B242)
Source Hargrave St (TH25-05 & TH25-08)
Material Clay
Sample Date 10-Oct-25
Test Date 22-Oct-25
Technician A. Dustmamatov

Maximum Dry Density (kg/m³)	1446
Optimum Moisture (%)	28.6

Trial Number	1	2	3	4	
Wet Density (kg/m³)	1799	1838	1874	1862	
Dry Density (kg/m³)	1427	1441	1442	1410	
Moisture Content (%)	26.0	27.6	29.9	32.1	



Note: Additional information recorded/measured for this test is available upon request.



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California Bearing Ratio Test Data Sheet

ASTM D1883-21

Project No.	1000-043-30	Source	Hargrave St (TH25-05 & TH25-08)
Client	WSP	Material	Clay
Project	2026-2028 Downtown Pavement Renewals	Sample Date	10-Oct-25
Sample #	L24-443-14 (B226 & B242)	Test Date	27-Oct-25
		Technician	A. Dustmamatov

Proctor Results (ASTM D698)

Maximum Dry Density	1446 kg/m ³
Optimum Moisture Content	28.3 %
Material Retained on 19 mm Sieve	0.0 %

CBR Sample Compaction

Dry Density	1360 kg/m ³
Initial Moisture Content	29.5 %
Relative Density	94.1 % SPMDD

Soaking Results

Surcharge	4.54 kg
Swell	6.2 %
Moisture Content in top 25 mm	45.6 %
Immersion Period	96 h

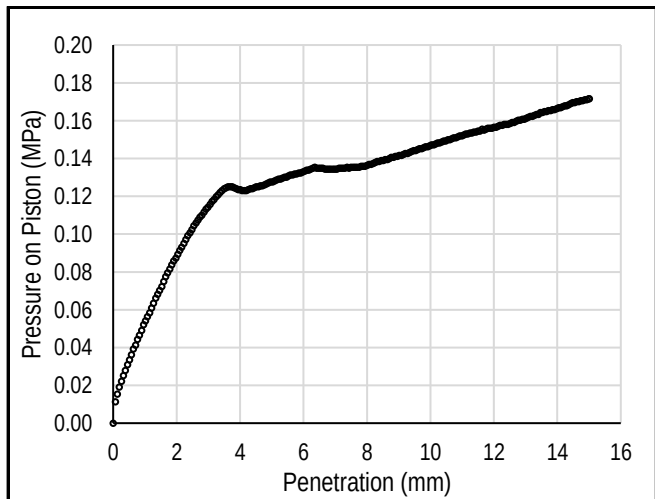
CBR Results

CBR at 2.54 mm	1.5 %
CBR at 5.08 mm	1.2 %
Zero Correction	0 mm

Test Data

Penetration (mm)	Measured Pressure (MPa)	Corrected Pressure (MPa)
0.64	0.04	0.04
1.27	0.06	0.06
1.91	0.09	0.09
2.54	0.10	0.10
3.18	0.12	0.12
3.81	0.12	0.12
4.45	0.12	0.12
5.08	0.13	0.13
7.62	0.14	0.14
10.16	0.15	0.15
12.70	0.16	0.16

Load/Penetration Curve



Comments:

Sample prepared in accordance with the City of Winnipeg guidelines.



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Standard Proctor Compaction Test

ASTM D698-12e2

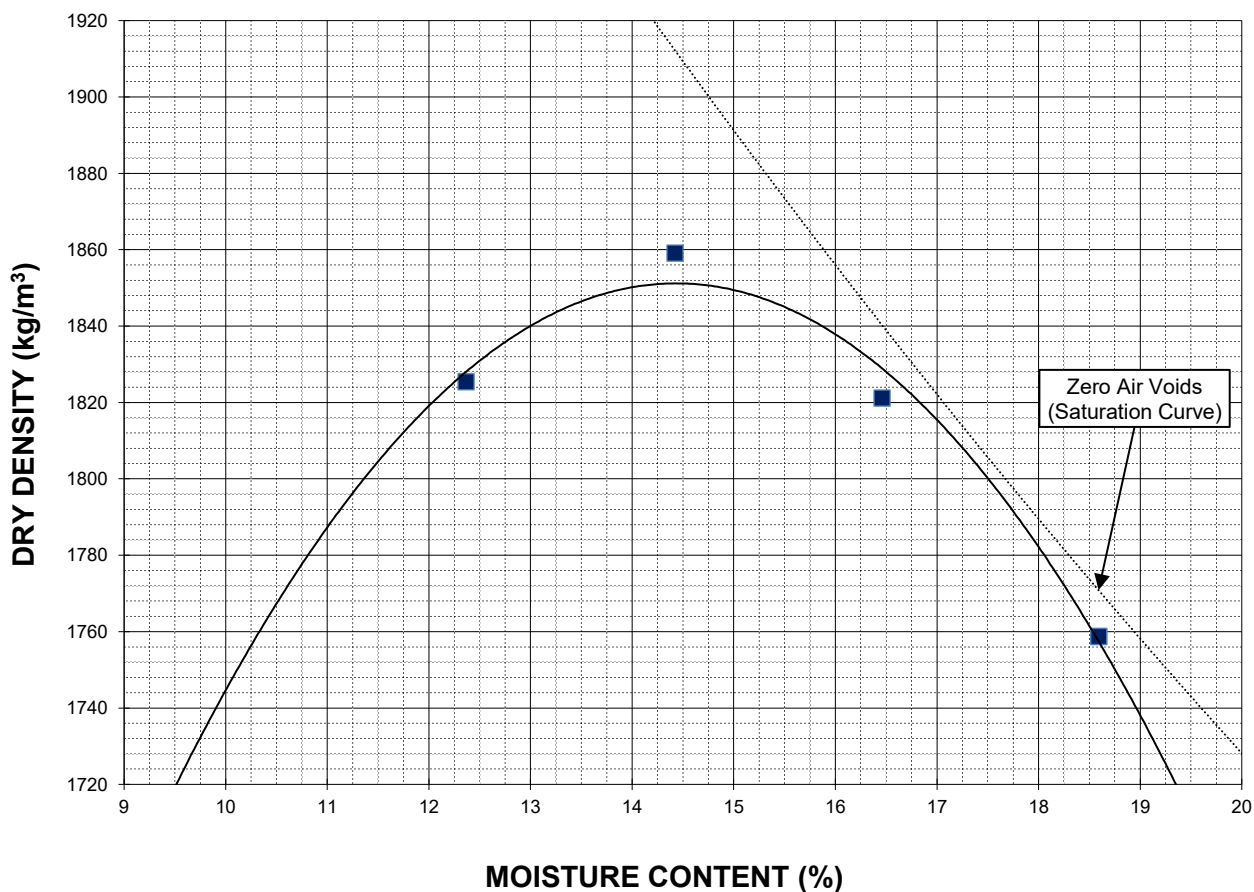
Project No. 1000-043-30
Client WSP
Project 2026-2028 Downtown Pavement Renewals



Sample # L24-443-15 (B225, B234 & B241)
Source Hargrave St (TH25-05, TH25-06 & TH25-08)
Material Clay
Sample Date 10-Oct-25
Test Date 24-Oct-25
Technician A. Dustmamatov

Maximum Dry Density (kg/m³)	1851
Optimum Moisture (%)	14.4

Trial Number	1	2	3	4	
Wet Density (kg/m ³)	2051	2127	2121	2086	
Dry Density (kg/m ³)	1825	1859	1821	1759	
Moisture Content (%)	12.4	14.4	16.5	18.6	



Note: Additional information recorded/measured for this test is available upon request.



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California Bearing Ratio Test Data Sheet

ASTM D1883-21

Project No.	1000-043-30	Source	Hargrave St (TH25-05, TH25-06 & TH25-08)
Client	WSP	Material	Silt
Project	2026-2028 Downtown Pavement Renewals	Sample Date	10-Oct-25
Sample #	L24-443-15 (B225, B234 & B241)	Test Date	23-Oct-25
		Technician	A. Dustmamatov

Proctor Results (ASTM D698)

Maximum Dry Density	1851 kg/m ³
Optimum Moisture Content	14.4 %
Material Retained on 19 mm Sieve	0.0 %

CBR Sample Compaction

Dry Density	1745 kg/m ³
Initial Moisture Content	14.4 %
Relative Density	94.3 % SPMDD

Soaking Results

Surcharge	4.54 kg
Swell	0.9 %
Moisture Content in top 25 mm	18.0 %
Immersion Period	96 h

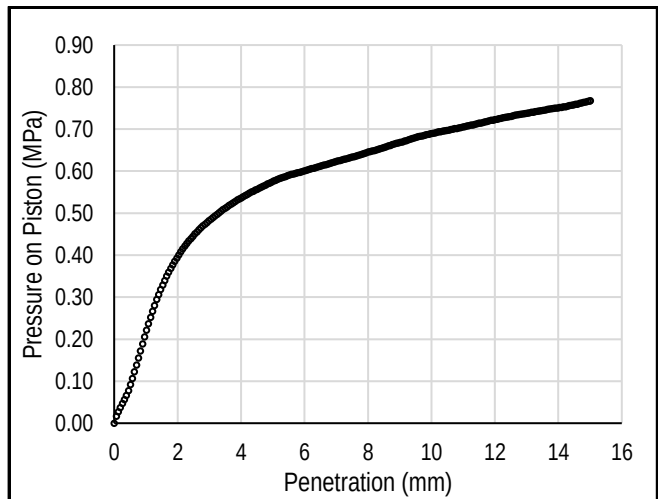
CBR Results

CBR at 2.54 mm	6.5 %
CBR at 5.08 mm	5.6 %
Zero Correction	0 mm

Test Data

Penetration (mm)	Measured Pressure (MPa)	Corrected Pressure (MPa)
0.64	0.12	0.12
1.27	0.28	0.28
1.91	0.39	0.39
2.54	0.45	0.45
3.18	0.49	0.49
3.81	0.53	0.53
4.45	0.56	0.56
5.08	0.58	0.58
7.62	0.64	0.64
10.16	0.69	0.69
12.70	0.73	0.73

Load/Penetration Curve



Comments:

Sample prepared in accordance with the City of Winnipeg guidelines.



Photo 1: Pavement Core Sample at TH25-05



Photo 2: Pavement Core Sample at TH25-06



Photo 3: Pavement Core Sample at TH25-08

Appendix C
Test Hole Logs, Summary Tables, Lab Testing Results and
Photographs of Pavement Core Samples
Carlton St. – Broadway Ave to Portage Ave



Sub-Surface Log

Test Hole TH25-13

1 of 1

Client: WSP Project Number: 1000-043-30
Project Name: 2026-2028 Downtown Pavement Renewals Location: UTM : 633373 E 5527812 N - Carlton St
Contractor: Maple Leaf Drilling Ground Elevation: Top of Pavement
Method: 125mm Solid Stem Auger, B40 Mobile Truck Mount Date Drilled: October 9, 2025

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

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

Depth (m)	Soil Symbol	MATERIAL DESCRIPTION	Sample Type	Sample Number	Bulk Unit Wt (kN/m ³)						Undrained Shear Strength (kPa)					
					16	17	18	19	20	21	Test Type					
					Particle Size (%)											
					0	20	40	60	80	100						
					PL	MC	LL									
					0	20	40	60	80	100	0	50	100	150	200	250
		ASPHALT														
		CONCRETE														
		SAND (FILL) - some gravel (<75mm diam.)														
		- brown														
		- moist, loose														
		- well graded (fine sand to coarse gravel), rounded														
		- AASHTO: A-1 (I)														
0.5		CLAY - silty, trace sand		G169												
		- black, moist, very stiff														
		- intermediate to high plasticity		G170												
		- AASHTO: A-7-6 (I)														
1.0		SILT - some clay		G171												
		- light brown, moist, firm, low plasticity														
		- AASHTO: A-4 (I)		G172												
1.5																
		- trace clay inclusions (<50mm diam.) below 1.5m		G173												
2.0																
				G174												
2.5		CLAY - silty														
		- grey														
		- moist, stiff														
		- high plasticity														
		- AASHTO: A-7-6 (I)		G175												
3.0																

END OF TEST HOLE AT 3.0m IN CLAY.

Notes:

- 1) Seepage and sloughing not observed.
- 2) Test hole dry and open to 3.0m depth immediately after drilling.
- 3) Test hole backfilled with cuttings and bentonite.
- 4) Bulk samples (B176 silt and B177 clay) collected between 0.8m and 2.0m.

Logged By: Kate Franklin Reviewed By: N.J Ferreira Project Engineer: Nelson Ferreira



Sub-Surface Log

Test Hole TH25-14

1 of 1

Client: WSP Project Number: 1000-043-30
Project Name: 2026-2028 Downtown Pavement Renewals Location: UTM : 633355 E 5527860 N - Carlton St
Contractor: Maple Leaf Drilling Ground Elevation: Top of Pavement
Method: 125mm Solid Stem Auger, B40 Mobile Truck Mount Date Drilled: October 9, 2025

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

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

Depth (m)	Soil Symbol	MATERIAL DESCRIPTION	Sample Type	Sample Number	Bulk Unit Wt (kN/m ³)						Undrained Shear Strength (kPa)			
					16	17	18	19	20	21	Test Type			
					Particle Size (%)						Torvane Δ			
					0 20 40 60 80 100						Pocket Pen. $\oplus$			
					PL MC LL						Qu $\boxtimes$			
					0 20 40 60 80 100						Field Vane $\bigcirc$			
					0 50 100 150 200 250									
		ASPHALT												
		CONCRETE												
		SAND (FILL) - some gravel (<75mm diam.), brown, moist, loose												
		- well graded (fine sand to coarse gravel), rounded												
		- AASHTO: A-1 (I)												
-0.5		CLAY - silty, trace sand												
		- black												
		- moist, very stiff												
		- intermediate to high plasticity												
		- AASHTO: A-7-6 (40)												
		- with silt, grey, high plasticity below 0.7m												
-1.0			G161											
			G162											
			G163											
-1.5														
		- silty below 1.7 m												
-2.0			G164											
			G165											
-2.5														
		- brown below below 2.2m												
		- trace silt pockets (<30mm diam.) 2.2m to 2.6m												
-3.0			G166											

END OF TEST HOLE AT 3.0m IN CLAY.

Notes:

- 1) Seepage and sloughing not observed.
- 2) Test hole dry and open to 3.0m depth immediately after drilling.
- 3) Test hole backfilled with cuttings and bentonite.
- 4) Bulk samples (B167 clay and silt and B168 clay) collected between 0.8m and 2.0m.

Logged By: Kate Franklin Reviewed By: N.J Ferreira Project Engineer: Nelson Ferreira



Sub-Surface Log

Test Hole TH25-16

1 of 1

Client:WSP

Project Name:2026-2028 Downtown Pavement Renewals

Contractor:Maple Leaf Drilling

Method:125mm Solid Stem Auger, B40 Mobile Truck Mount

Project Number:1000-043-30

Location:UTM : 633256 E 5528125 N - Carlton St

Ground Elevation:Top of Pavement

Date Drilled:October 9, 2025

Sample Type:

Grab (G)Shelby Tube (T)Split Spoon (SS) / SPTSplit Barrel (SB) / LPTCore (C)

Particle Size Legend:

FinesClaySiltSandGravelCobblesBoulders

Depth (m)	Soil Symbol	MATERIAL DESCRIPTION	Sample Type	Sample Number	Bulk Unit Wt (kN/m ³)		Particle Size (%)		Undrained Shear Strength (kPa)		Test Type					
					16	17	18	19	20	21						
					0 20 40 60 80 100											
					PL MC LL											

GENERAL NOTES

- Classifications are based on the Unified Soil Classification System and include consistency, moisture, and color. Field descriptions have been modified to reflect results of laboratory tests where deemed appropriate.
- Descriptions on these test hole logs apply only at the specific test hole locations and at the time the test holes were drilled. Variability of soil and groundwater conditions may exist between test hole locations.
- When the following classification terms are used in this report or test hole logs, the primary and secondary soil fractions may be visually estimated.

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

LEGEND OF ABBREVIATIONS AND SYMBOLS

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

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
with *	with silt, with sand	> 35 percent

* Used when the material is classified based on behaviour as a cohesive material

TERMS DESCRIBING CONSISTENCY OR COMPACTION CONDITION

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

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

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

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

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

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



**2026-2028 Downtown Pavement Renewals
Sub-Surface Investigation
Carlton St - Broadway Ave to Portage Ave**

Test Hole No.	Test Hole Location	Pavement Surface		Pavement Structure Material		Subgrade Description	Sample Depth (m)		Moisture Content (%)	Grain Size Analysis				Atterberg Limits		
		Type	Thickness (mm)	Type	Thickness (mm)		Top (m)	Bottom (m)		Clay (%)	Silt (%)	Sand (%)	Gravel (%)	Plastic	Liquid	Plasticity Index
TH25-12	UTM : 5527758 N, 633389 E Located 20 m North of Broadway Ave intersection, Southbound middle lane, 6.0 m East of West curb.	Asphalt	80	Concrete	190	Sand, AASHTO: A-3 (I)	0.5	0.6	6							
						Clay, AASHTO: A-7-6 (52)	0.8	0.9	30	62	29	7	1	21	73	52
						Clay, AASHTO: A-7-6 (52)	1.1	1.2	37							
						Clay, AASHTO: A-7-6 (52)	1.4	1.5	33							
						Clay, AASHTO: A-7-6 (52)	1.8	1.9	33							
						Clay, AASHTO: A-7-6 (52)	2.1	2.3	42							
						Clay, AASHTO: A-7-6 (52)	2.7	2.8	48							
TH25-13	UTM : 5527812 N, 633373 E Located 80 m South of York Ave intersection, Southbound middle lane, 5.0 m West of East curb.	Asphalt	50	Concrete	170	Sand, AASHTO: A-3 (I)	0.5	0.6	11							
						Clay, AASHTO: A-7-6 (I)	0.8	0.9	34							
						Silt, AASHTO: A-4 (I)	1.1	1.2	23							
						Silt, AASHTO: A-4 (I)	1.4	1.5	25							
						Silt, AASHTO: A-4 (I)	1.8	1.9	25							
						Silt, AASHTO: A-4 (I)	2.1	2.3	24							
						Clay, AASHTO: A-7-6 (I)	2.7	2.8	44							
TH25-14	UTM : 5527860 N, 633355 E Located 30 m South of York Ave intersection, Southbound middle lane, 6.5 m West of East curb.	Asphalt	90	Concrete	190	Clay, AASHTO: A-7-6 (40)	0.8	0.9	29							
						Clay, AASHTO: A-7-6 (40)	1.1	1.2	29	56	40	3	0	19	57	38
						Clay, AASHTO: A-7-6 (40)	1.4	1.5	30							
						Clay, AASHTO: A-7-6 (40)	1.8	1.9	34							
						Clay, AASHTO: A-7-6 (40)	2.1	2.3	44							
						Clay, AASHTO: A-7-6 (40)	2.7	2.8	46							
						Clay, AASHTO: A-7-6 (40)	2.7	2.8	46							



**2026-2028 Downtown Pavement Renewals
Sub-Surface Investigation
Carlton St - Broadway Ave to Portage Ave**

Test Hole No.	Test Hole Location	Pavement Surface		Pavement Structure Material		Subgrade Description	Sample Depth (m)		Moisture Content (%)	Grain Size Analysis				Atterberg Limits		
		Type	Thickness (mm)	Type	Thickness (mm)		Top (m)	Bottom (m)		Clay (%)	Silt (%)	Sand (%)	Gravel (%)	Plastic	Liquid	Plasticity Index
TH25-15	UTM : 5528074 N, 633273 E Located 11 m North of St Mary Ave intersection, Southbound middle lane, 6.0 m West of East curb.	Asphalt	110	Concrete	240	Clay, AASHTO: A-7-6 (I)	0.9	1.1	35							
						Silt, AASHTO: A-6 (I)	1.2	1.4	22							
						Clay, AASHTO: A-7-6 (I)	1.5	1.7	36							
						Silt, AASHTO: A-6 (I)	1.9	2.1	24							
						Silt, AASHTO: A-6 (I)	2.3	2.4	21							
						Clay, AASHTO: A-7-6 (I)	2.8	3.0	24							
TH25-16	UTM : 5528125 N, 633256 E Located at #220 Carlton St, Southbound curb lane, 1.0 m West of East curb.	Asphalt	100	Concrete	240	Silt, AASHTO: A-6 (11)	0.9	1.1	22	21	76	3	0	16	29	13
						Silt, AASHTO: A-6 (11)	1.2	1.4	25							
						Clay, AASHTO: A-7-6 (I)	1.5	1.7	39							
						Clay, AASHTO: A-7-6 (I)	1.9	2.1	42							
						Clay, AASHTO: A-7-6 (I)	2.3	2.4	45							
						Clay, AASHTO: A-7-6 (I)	2.8	3.0	50							
TH25-17	UTM : 5528197 N, 633227 E Located at #223 Carlton St, Southbound middle lane, 8.0 m West of East curb.	Asphalt	120	Concrete	320	Clay, AASHTO: A-7-6 (I)	0.9	1.1	32							
						Silt, AASHTO: A-6 (I)	1.2	1.4	22							
						Clay, AASHTO: A-7-6 (I)	1.5	1.7	31							
						Clay, AASHTO: A-7-6 (I)	1.9	2.1	38							
						Clay, AASHTO: A-7-6 (I)	2.3	2.4	40							
						Clay, AASHTO: A-7-6 (I)	2.8	3.0	49							



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Moisture Content Report ASTM D2216-98

Project No. 1000-043-30
Client WSP
Project 2026-2028 Downtown Pavement Renewals
Carlton St - Broadway Ave to Portage Ave
Sample Date 09-Oct-25
Test Date 23-Oct-25
Technician D. Sellick

Test Hole	TH25-12	TH25-12	TH25-12	TH25-12	TH25-12	TH25-12
Depth (m)	0.5 - 0.6	0.8 - 0.9	1.1 - 1.2	1.4 - 1.5	1.8 - 1.9	2.1 - 2.3
Sample #	G178	G179	G180	G181	G182	G183
Tare ID	P21	QT86	Z00	AC80	M64	E133
Mass of tare	8.4	8.4	8.4	6.8	6.8	8.4
Mass wet + tare	323.0	406.0	250.4	284.2	282.8	253.2
Mass dry + tare	305.4	313.8	185.0	215.6	214.0	180.4
Mass water	17.6	92.2	65.4	68.6	68.8	72.8
Mass dry soil	297.0	305.4	176.6	208.8	207.2	172.0
Moisture %	5.9%	30.2%	37.0%	32.9%	33.2%	42.3%

Test Hole	TH25-12	TH25-13	TH25-13	TH25-13	TH25-13	TH25-13
Depth (m)	2.7 - 2.8	0.5 - 0.6	0.8 - 0.9	1.1 - 1.2	1.4 - 1.5	1.8 - 1.9
Sample #	G184	G169	G170	G171	G172	G173
Tare ID	M50	Q9	M28	M12	M89	B6
Mass of tare	6.8	6.8	7.2	7.0	7.2	6.8
Mass wet + tare	276.2	319.8	283.2	304.8	277.2	310.0
Mass dry + tare	188.4	289.2	213.2	249.8	223.2	249.2
Mass water	87.8	30.6	70.0	55.0	54.0	60.8
Mass dry soil	181.6	282.4	206.0	242.8	216.0	242.4
Moisture %	48.3%	10.8%	34.0%	22.7%	25.0%	25.1%

Test Hole	TH25-13	TH25-13	TH25-14	TH25-14	TH25-14	TH25-14
Depth (m)	2.1 - 2.3	2.7 - 2.8	0.8 - 0.9	1.1 - 1.2	1.4 - 1.5	1.8 - 1.9
Sample #	G174	G175	G161	G162	G163	G164
Tare ID	D217	Z185	AA74	P33	AA17	E130
Mass of tare	6.8	8.4	6.8	8.6	6.8	8.8
Mass wet + tare	333.2	260.8	291.6	414.0	281.8	275.0
Mass dry + tare	269.8	183.6	227.6	324.0	218.6	207.8
Mass water	63.4	77.2	64.0	90.0	63.2	67.2
Mass dry soil	263.0	175.2	220.8	315.4	211.8	199.0
Moisture %	24.1%	44.1%	29.0%	28.5%	29.8%	33.8%

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Test Hole	TH25-14	TH25-14	TH25-15	TH25-15	TH25-15	TH25-15
Depth (m)	2.1 - 2.3	2.7 - 2.8	0.9 - 1.1	1.2 - 1.4	1.5 - 1.7	1.9 - 2.1
Sample #	G165	G166	G154	G155	G156	G157
Tare ID	W105	H30	N58	E10	D232	QT2
Mass of tare	8.6	8.8	8.6	7.0	6.8	8.2
Mass wet + tare	260.8	253.2	250.4	305.6	273.0	285.6
Mass dry + tare	183.8	176.2	188.0	251.0	202.4	231.6
Mass water	77.0	77.0	62.4	54.6	70.6	54.0
Mass dry soil	175.2	167.4	179.4	244.0	195.6	223.4
Moisture %	43.9%	46.0%	34.8%	22.4%	36.1%	24.2%

Test Hole	TH25-15	TH25-15	TH25-16	TH25-16	TH25-16	TH25-16
Depth (m)	2.3 - 2.4	2.8 - 3.0	0.9 - 1.1	1.2 - 1.4	1.5 - 1.7	1.9 - 2.1
Sample #	G158	G159	G146	G147	G148	G149
Tare ID	B23	QW10	M09	QT100	H90	QT38
Mass of tare	6.8	6.8	6.8	8.2	8.6	8.4
Mass wet + tare	300.6	296.2	428.4	288.2	257.4	295.6
Mass dry + tare	248.8	239.4	352.2	231.8	188.2	210.0
Mass water	51.8	56.8	76.2	56.4	69.2	85.6
Mass dry soil	242.0	232.6	345.4	223.6	179.6	201.6
Moisture %	21.4%	24.4%	22.1%	25.2%	38.5%	42.5%

Test Hole	TH25-16	TH25-16	TH25-17	TH25-17	TH25-17	TH25-17
Depth (m)	2.3 - 2.4	2.8 - 3.0	0.9 - 1.1	1.2 - 1.4	1.5 - 1.7	1.9 - 2.1
Sample #	G150	G151	G138	G139	G140	G141
Tare ID	P37	M58	Z1	Z26	MN44	QT53
Mass of tare	8.4	7.0	6.8	8.4	7.0	8.4
Mass wet + tare	254.4	264.6	267.6	257.0	281.2	249.8
Mass dry + tare	178.6	178.6	204.4	212.2	217.0	183.6
Mass water	75.8	86.0	63.2	44.8	64.2	66.2
Mass dry soil	170.2	171.6	197.6	203.8	210.0	175.2
Moisture %	44.5%	50.1%	32.0%	22.0%	30.6%	37.8%



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Carlton St - Broadway Ave to Portage Ave
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Technician D. Sellick

Test Hole	TH25-17	TH25-17				
Depth (m)	2.3 - 2.4	2.8 - 3.0				
Sample #	G142	G143				
Tare ID	QT31	QT57				
Mass of tare	8.2	8.2				
Mass wet + tare	250.6	267.6				
Mass dry + tare	181.2	182.8				
Mass water	69.4	84.8				
Mass dry soil	173.0	174.6				
Moisture %	40.1%	48.6%				

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Project 2026-2028 Downtown Pavement Renewals

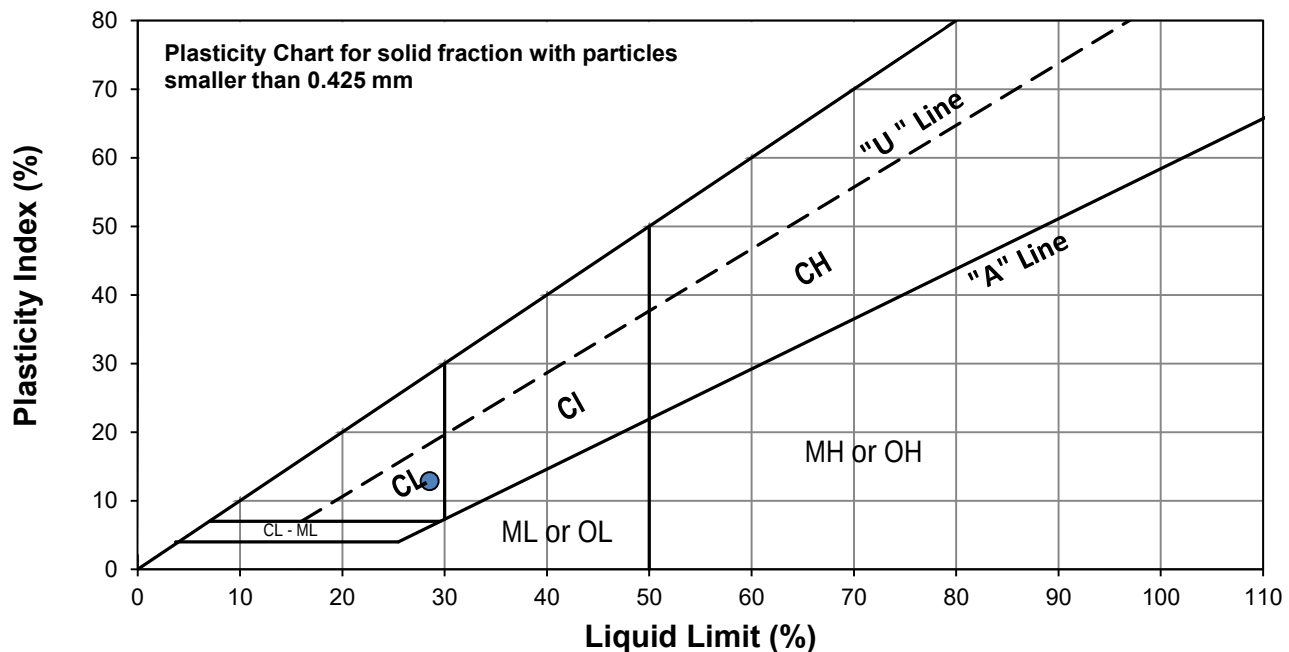


Test Hole TH25-16 (Carlton St - Broadway Ave to Portage Ave)
Sample # G146
Depth (m) 0.9 - 1.1
Sample Date 09-Oct-25
Test Date 28-Oct-25
Technician D. Sellick

Liquid Limit	29
Plastic Limit	16
Plasticity Index	13

Liquid Limit

Trial #	1	2	3		
Number of Blows (N)	15	29	34		
Mass Tare (g)	14.079	13.913	14.079		
Mass Wet Soil + Tare (g)	24.394	22.807	25.061		
Mass Dry Soil + Tare (g)	21.971	20.869	22.710		
Mass Water (g)	2.423	1.938	2.351		
Mass Dry Soil (g)	7.892	6.956	8.631		
Moisture Content (%)	30.702	27.861	27.239		



Plastic Limit

Trial #	1	2	3	4	5
Mass Tare (g)	13.796	14.025			
Mass Wet Soil + Tare (g)	20.180	21.016			
Mass Dry Soil + Tare (g)	19.320	20.061			
Mass Water (g)	0.860	0.955			
Mass Dry Soil (g)	5.524	6.036			
Moisture Content (%)	15.568	15.822			

Note: Additional information recorded/measured for this test is available upon request.

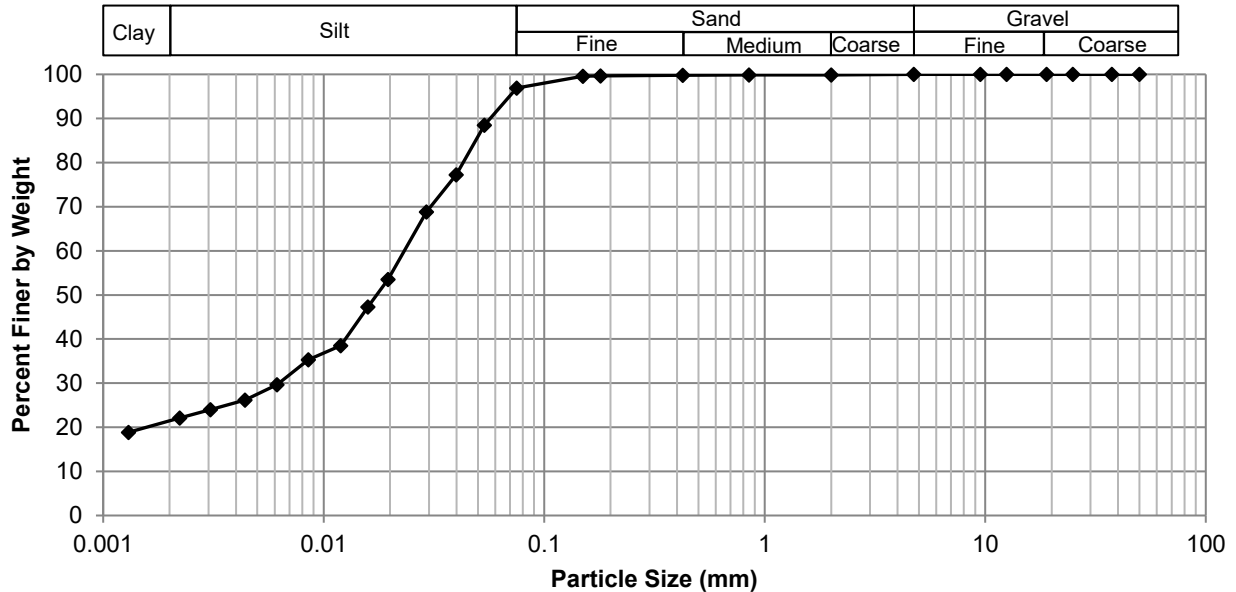
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Project 2026-2028 Downtown Pavement Renewals



Test Hole TH25-16 (Carlton St - Broadway Ave to Portage Ave)
Sample # G146
Depth (m) 0.9 - 1.1
Sample Date 09-Oct-25
Test Date 27-Oct-25
Technician D.Sellick

Gravel	0.0%
Sand	3.1%
Silt	75.5%
Clay	21.4%

Particle Size Distribution Curve



Gravel		Sand		Silt and Clay	
Particle Size (mm)	Percent Passing	Particle Size (mm)	Percent Passing	Particle Size (mm)	Percent Passing
50.0	100.00	4.75	100.00	0.0750	96.88
37.5	100.00	2.00	99.90	0.0536	88.49
25.0	100.00	0.850	99.86	0.0399	77.24
19.0	100.00	0.425	99.83	0.0292	68.81
12.5	100.00	0.180	99.68	0.0196	53.50
9.50	100.00	0.150	99.61	0.0158	47.26
4.75	100.00	0.075	96.88	0.0119	38.47
				0.0085	35.30
				0.0061	29.68
				0.0044	26.21
				0.0031	23.98
				0.0022	22.14
				0.0013	18.86

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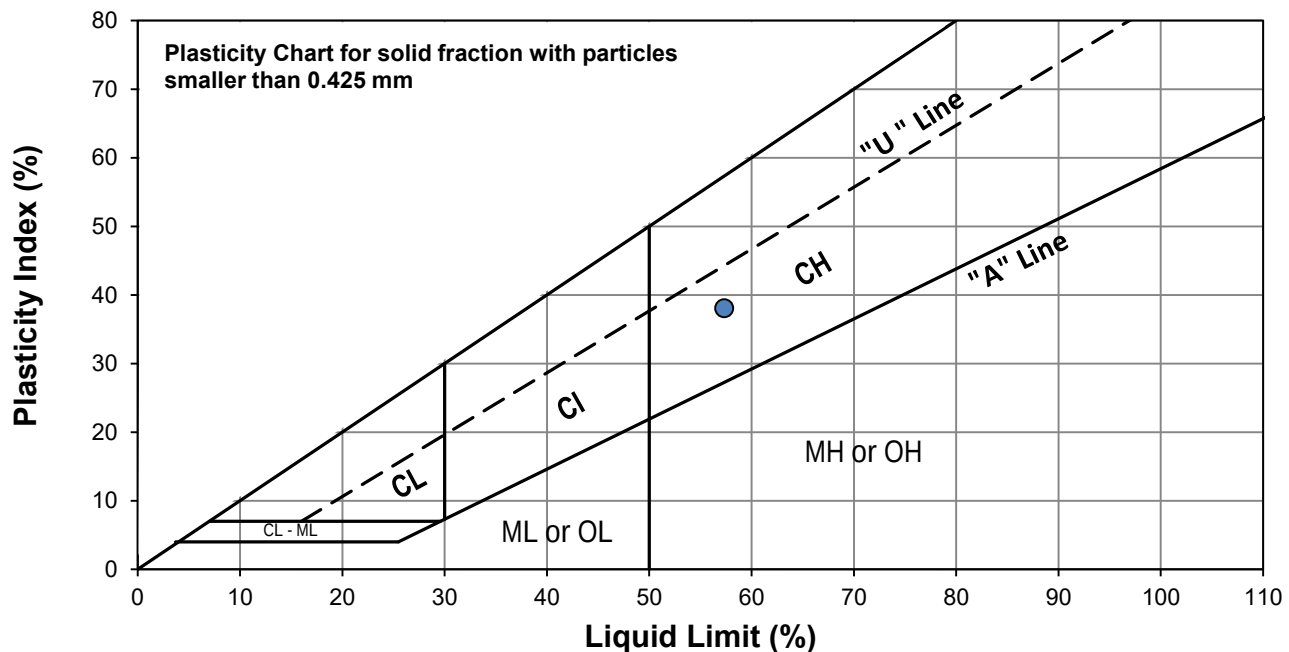


Test Hole TH25-14 (Carlton St - Broadway Ave to Portage Ave)
Sample # G162
Depth (m) 1.1 - 1.2
Sample Date 09-Oct-25
Test Date 30-Oct-25
Technician T. Green

Liquid Limit	57
Plastic Limit	19
Plasticity Index	38

Liquid Limit

Trial #	1	2	3		
Number of Blows (N)	20	27	32		
Mass Tare (g)	13.956	14.049	14.079		
Mass Wet Soil + Tare (g)	26.036	24.866	27.197		
Mass Dry Soil + Tare (g)	21.570	20.940	22.502		
Mass Water (g)	4.466	3.926	4.695		
Mass Dry Soil (g)	7.614	6.891	8.423		
Moisture Content (%)	58.655	56.973	55.740		



Plastic Limit

Trial #	1	2	3	4	5
Mass Tare (g)	14.173	13.934			
Mass Wet Soil + Tare (g)	23.926	23.085			
Mass Dry Soil + Tare (g)	22.353	21.601			
Mass Water (g)	1.573	1.484			
Mass Dry Soil (g)	8.180	7.667			
Moisture Content (%)	19.230	19.356			

Note: Additional information recorded/measured for this test is available upon request.

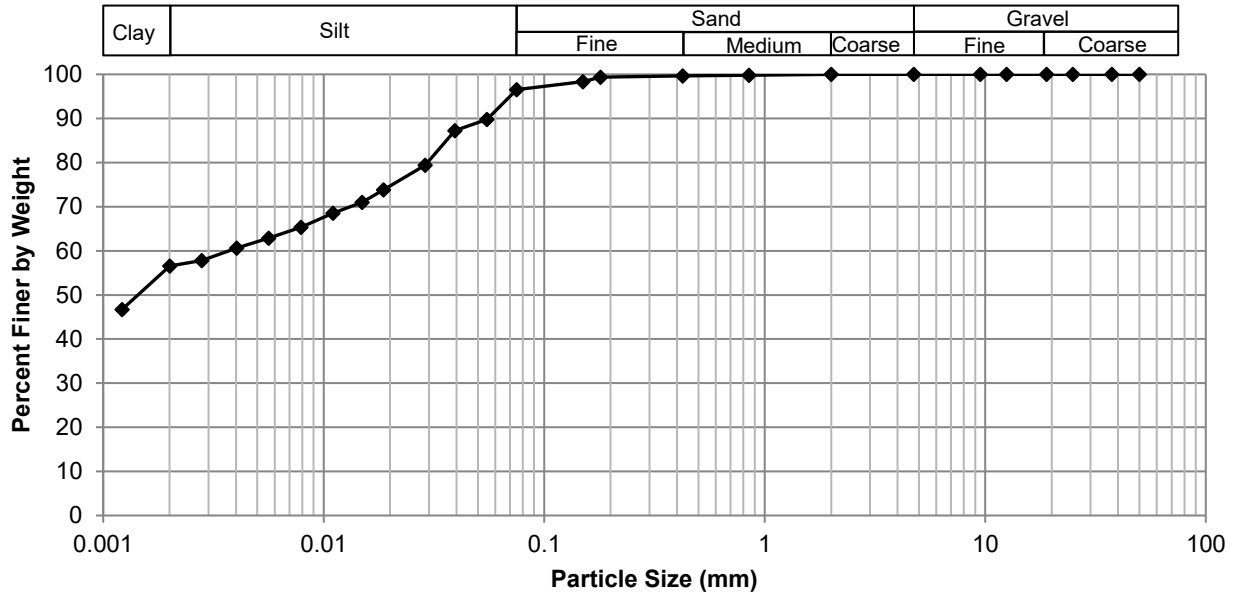
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Project 2026-2028 Downtown Pavement Renewals



Test Hole TH25-14 (Carlton St - Broadway Ave to Portage Ave)
Sample # G162
Depth (m) 1.1 - 1.2
Sample Date 09-Oct-25
Test Date 27-Oct-25
Technician D.Sellick

Gravel	0.0%
Sand	3.5%
Silt	40.0%
Clay	56.5%

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	96.54
37.5	100.00	2.00	100.00	0.0550	89.76
25.0	100.00	0.850	99.78	0.0393	87.26
19.0	100.00	0.425	99.62	0.0288	79.44
12.5	100.00	0.180	99.36	0.0187	73.82
9.50	100.00	0.150	98.36	0.0149	71.00
4.75	100.00	0.075	96.54	0.0110	68.50
				0.0079	65.37
				0.0056	62.87
				0.0040	60.64
				0.0028	57.79
				0.0020	56.60
				0.0012	46.71

Project No. 1000-043-30
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Project 2026-2028 Downtown Pavement Renewals

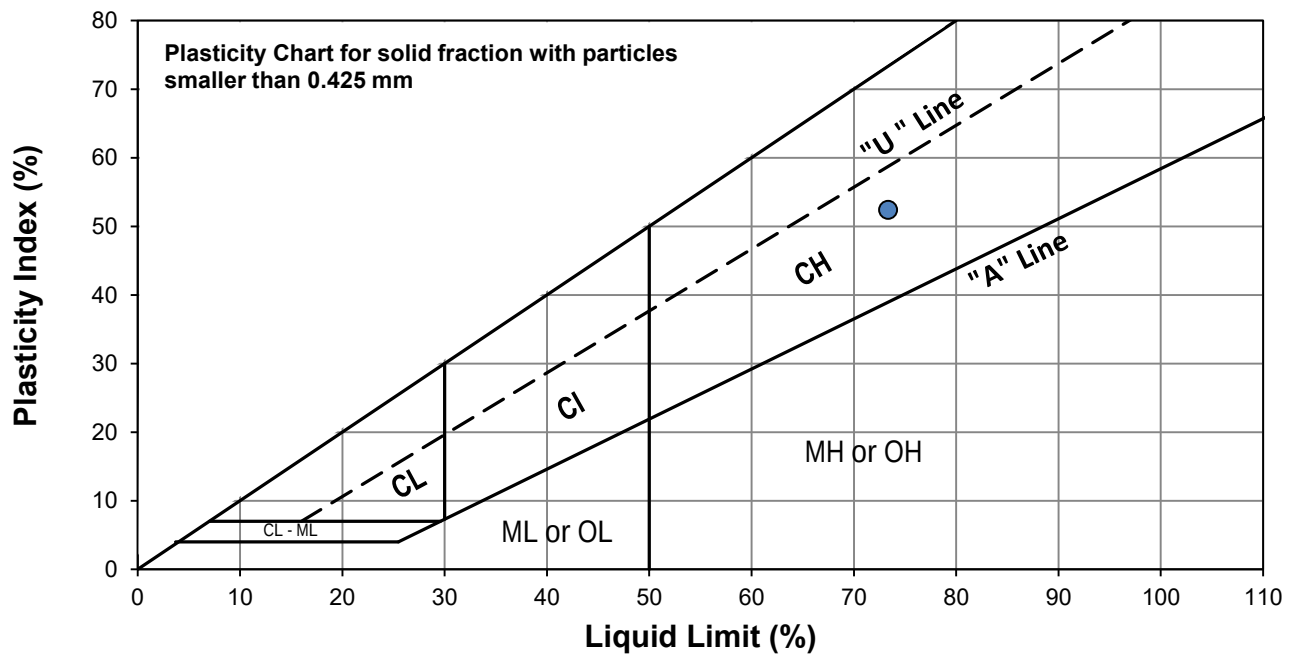


Test Hole TH25-12 (Carlton St - Broadway Ave to Portage Ave)
Sample # G179
Depth (m) 0.8 - 0.9
Sample Date 09-Oct-25
Test Date 30-Oct-25
Technician T. Green

Liquid Limit	73
Plastic Limit	21
Plasticity Index	52

Liquid Limit

Trial #	1	2	3		
Number of Blows (N)	15	27	33		
Mass Tare (g)	13.872	14.056	13.920		
Mass Wet Soil + Tare (g)	23.584	23.436	23.134		
Mass Dry Soil + Tare (g)	19.371	19.489	19.285		
Mass Water (g)	4.213	3.947	3.849		
Mass Dry Soil (g)	5.499	5.433	5.365		
Moisture Content (%)	76.614	72.649	71.743		



Plastic Limit

Trial #	1	2	3	4	5
Mass Tare (g)	14.076	14.009			
Mass Wet Soil + Tare (g)	21.140	21.530			
Mass Dry Soil + Tare (g)	19.932	20.211			
Mass Water (g)	1.208	1.319			
Mass Dry Soil (g)	5.856	6.202			
Moisture Content (%)	20.628	21.267			

Note: Additional information recorded/measured for this test is available upon request.

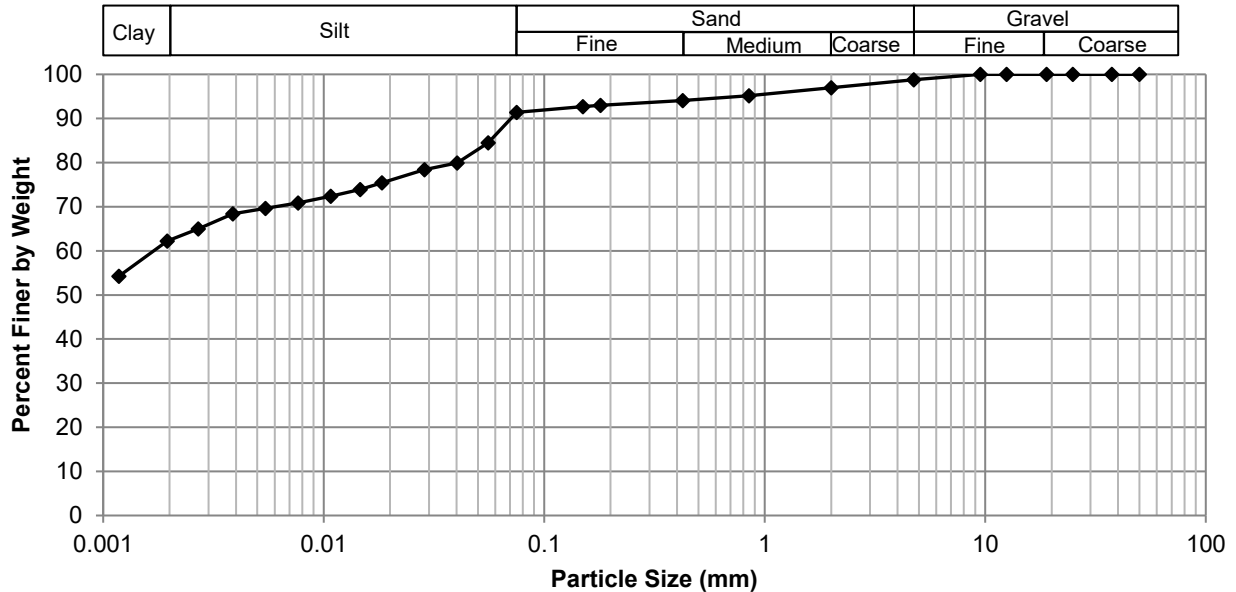
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Project 2026-2028 Downtown Pavement Renewals



Test Hole TH25-12 (Carlton St - Broadway Ave to Portage Ave)
Sample # G179
Depth (m) 0.8 - 0.9
Sample Date 09-Oct-25
Test Date 27-Oct-25
Technician D.Sellick

Gravel	1.2%
Sand	7.4%
Silt	29.0%
Clay	62.4%

Particle Size Distribution Curve



Gravel		Sand		Silt and Clay	
Particle Size (mm)	Percent Passing	Particle Size (mm)	Percent Passing	Particle Size (mm)	Percent Passing
50.0	100.00	4.75	98.79	0.0750	91.42
37.5	100.00	2.00	97.01	0.0557	84.50
25.0	100.00	0.850	95.15	0.0402	79.95
19.0	100.00	0.425	94.09	0.0287	78.44
12.5	100.00	0.180	92.97	0.0184	75.40
9.50	100.00	0.150	92.73	0.0146	73.89
4.75	98.79	0.075	91.42	0.0108	72.37
				0.0077	70.85
				0.0054	69.64
				0.0039	68.39
				0.0027	64.97
				0.0020	62.22
				0.0012	54.24



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Standard Proctor Compaction Test

ASTM D698-12e2

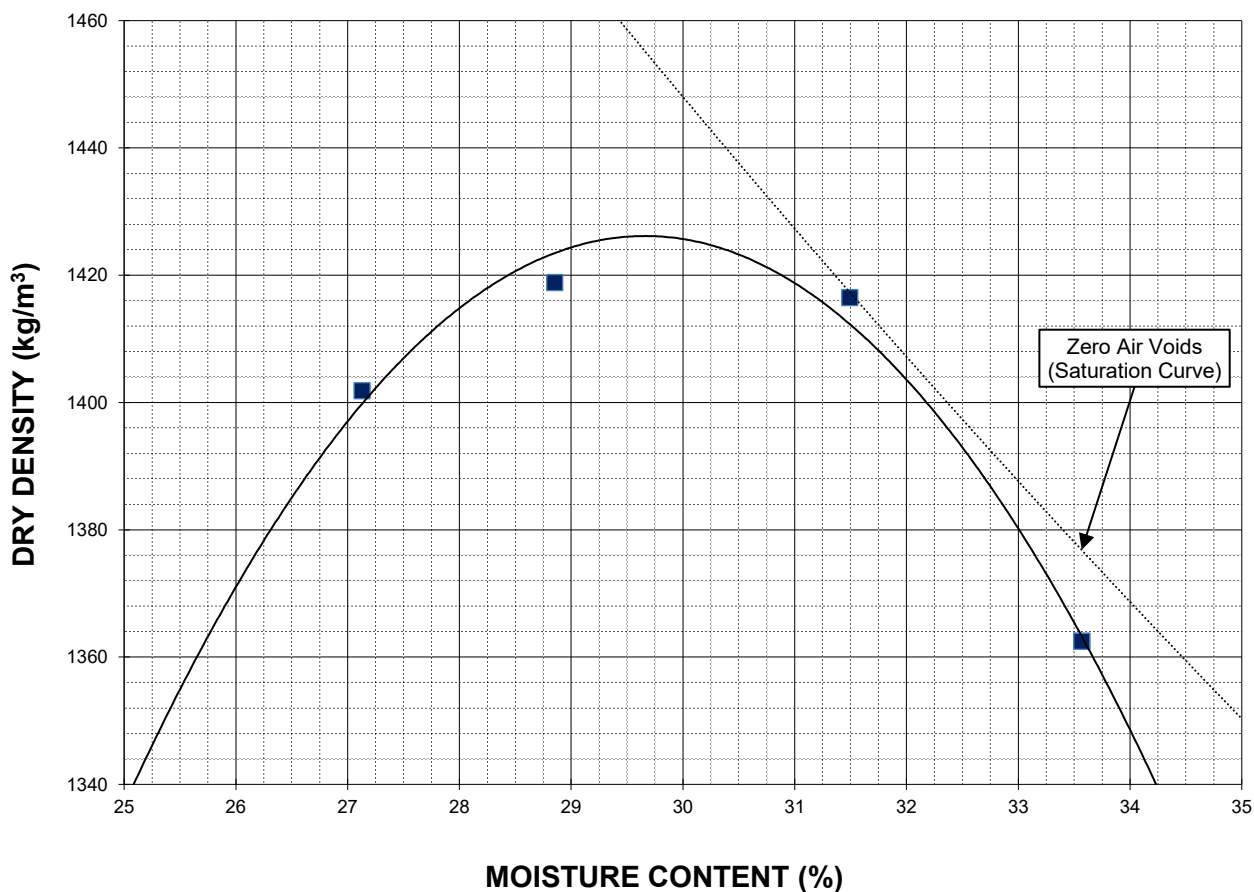
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Client WSP
Project 2026-2028 Downtown Pavement Renewals



Sample # L25-443-10 (B168, B177 & B185)
Source Carlton St (TH25-12, TH25-13 & TH25-14)
Material Clay
Sample Date 09-Oct-25
Test Date 15-Oct-25
Technician I. Araquil

Maximum Dry Density (kg/m³)	1426
Optimum Moisture (%)	29.7

Trial Number	1	2	3	4	
Wet Density (kg/m ³)	1782	1828	1863	1820	
Dry Density (kg/m ³)	1402	1419	1416	1362	
Moisture Content (%)	27.1	28.9	31.5	33.6	



Note: Additional information recorded/measured for this test is available upon request.



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California Bearing Ratio Test Data Sheet

ASTM D1883-21

Project No.	1000-043-30	Source	Carlton St (TH25-12, TH25-13 & TH25-14)
Client	WSP	Material	Clay
Project	2026-2028 Downtown Pavement Renewals	Sample Date	09-Oct-25
Sample #	L25-443-10 (B168, B177 & B185)	Test Date	23-Oct-25
		Technician	A. Dustmamatov

Proctor Results (ASTM D698)

Maximum Dry Density	1426 kg/m ³
Optimum Moisture Content	30.6 %
Material Retained on 19 mm Sieve	0.0 %

CBR Sample Compaction

Dry Density	1350 kg/m ³
Initial Moisture Content	31.0 %
Relative Density	94.7 % SPMDD

Soaking Results

Surcharge	4.54 kg
Swell	3.4 %
Moisture Content in top 25 mm	40.7 %
Immersion Period	96 h

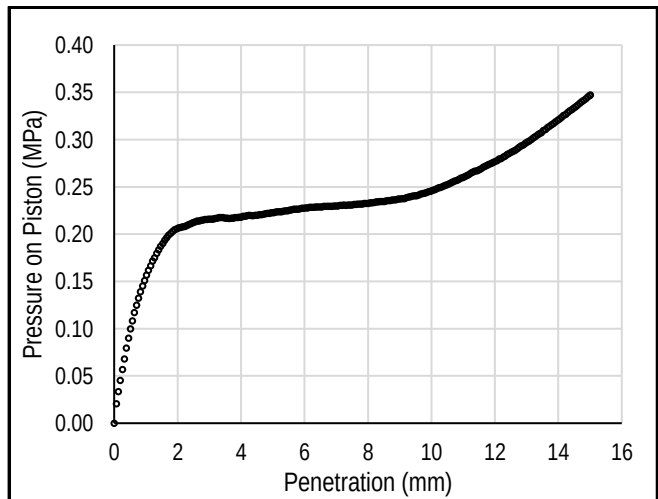
CBR Results

CBR at 2.54 mm	3.1 %
CBR at 5.08 mm	2.2 %
Zero Correction	0 mm

Test Data

Penetration (mm)	Measured Pressure (MPa)	Corrected Pressure (MPa)
0.64	0.12	0.12
1.27	0.18	0.18
1.91	0.20	0.20
2.54	0.21	0.21
3.18	0.22	0.22
3.81	0.22	0.22
4.45	0.22	0.22
5.08	0.22	0.22
7.62	0.23	0.23
10.16	0.25	0.25
12.70	0.29	0.29

Load/Penetration Curve



Comments:

Sample prepared in accordance with the City of Winnipeg guidelines.



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Standard Proctor Compaction Test

ASTM D698-12e2

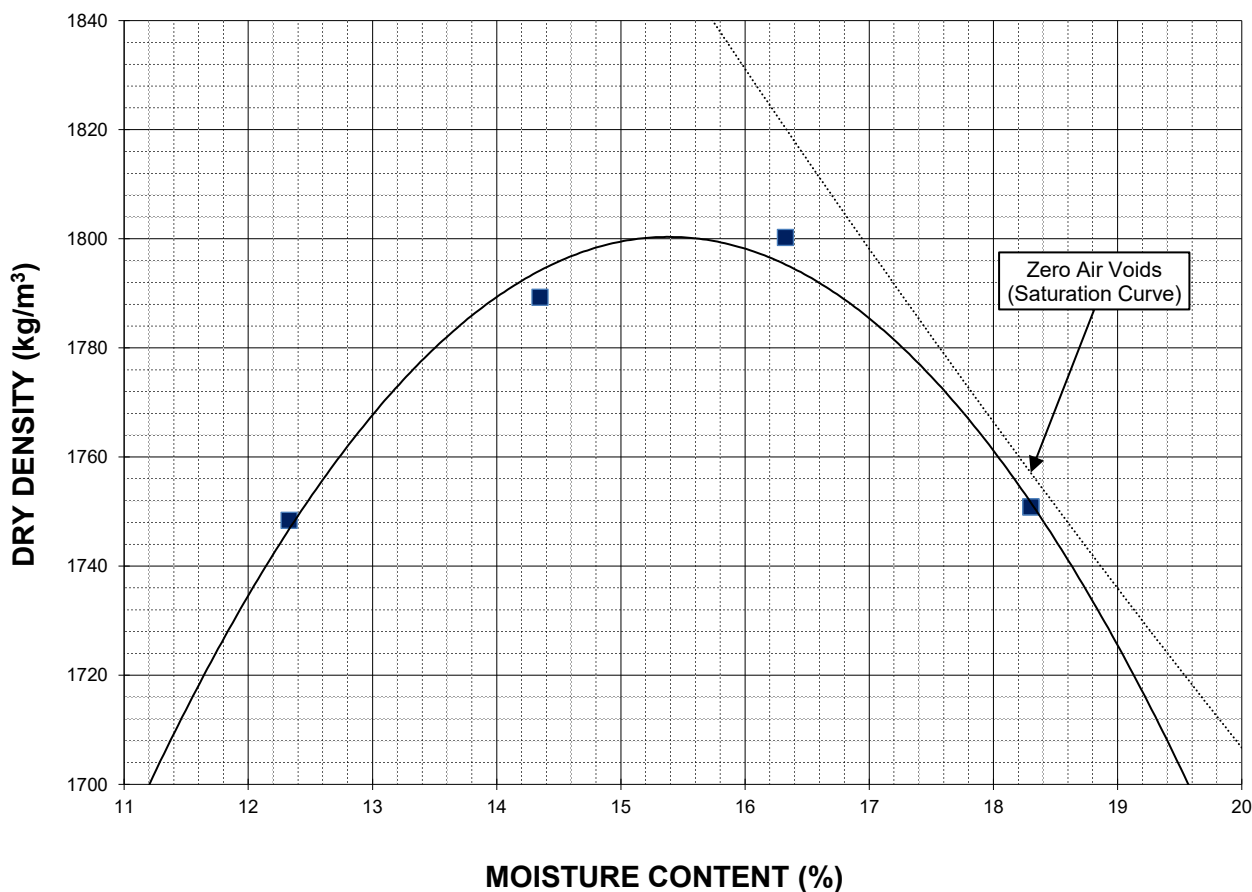
Project No. 1000-043-30
Client WSP
Project 2026-2028 Downtown Pavement Renewals



Sample # L25-443-11 (B160 & B176)
Source Carlton St (TH25-13 & TH25-15)
Material Silt
Sample Date 09-Oct-25
Test Date 21-Oct-25
Technician A. Dustmamatov

Maximum Dry Density (kg/m³)	1800
Optimum Moisture (%)	15.4

Trial Number	1	2	3	4	
Wet Density (kg/m³)	1964	2046	2094	2071	
Dry Density (kg/m³)	1748	1789	1800	1751	
Moisture Content (%)	12.3	14.3	16.3	18.3	



Note: Additional information recorded/measured for this test is available upon request.



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California Bearing Ratio Test Data Sheet

ASTM D1883-21

Project No.	1000-043-30	Source	Carlton St (TH25-13 & TH25-15)
Client	WSP	Material	Silt
Project	2026-2028 Downtown Pavement Renewals	Sample Date	09-Oct-25
Sample #	L25-443-11 (B160 & B176)	Test Date	27-Oct-25
		Technician	A. Dustmamatov

Proctor Results (ASTM D698)

Maximum Dry Density	1800 kg/m ³
Optimum Moisture Content	15.3 %
Material Retained on 19 mm Sieve	0.0 %

CBR Sample Compaction

Dry Density	1708 kg/m ³
Initial Moisture Content	15.8 %
Relative Density	94.9 % SPMDD

Soaking Results

Surcharge	4.54 kg
Swell	1.2 %
Moisture Content in top 25 mm	22.2 %
Immersion Period	96 h

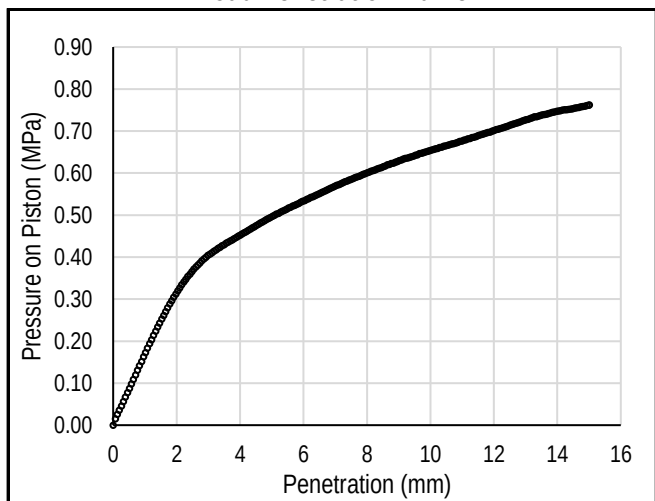
CBR Results

CBR at 2.54 mm	5.4 %
CBR at 5.08 mm	4.9 %
Zero Correction	0 mm

Test Data

Penetration (mm)	Measured Pressure (MPa)	Corrected Pressure (MPa)
0.64	0.11	0.11
1.27	0.21	0.21
1.91	0.31	0.31
2.54	0.37	0.37
3.18	0.41	0.41
3.81	0.44	0.44
4.45	0.47	0.47
5.08	0.50	0.50
7.62	0.59	0.59
10.16	0.66	0.66
12.70	0.72	0.72

Load/Penetration Curve



Comments:

Sample prepared in accordance with the City of Winnipeg guidelines.



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Standard Proctor Compaction Test

ASTM D698-12e2

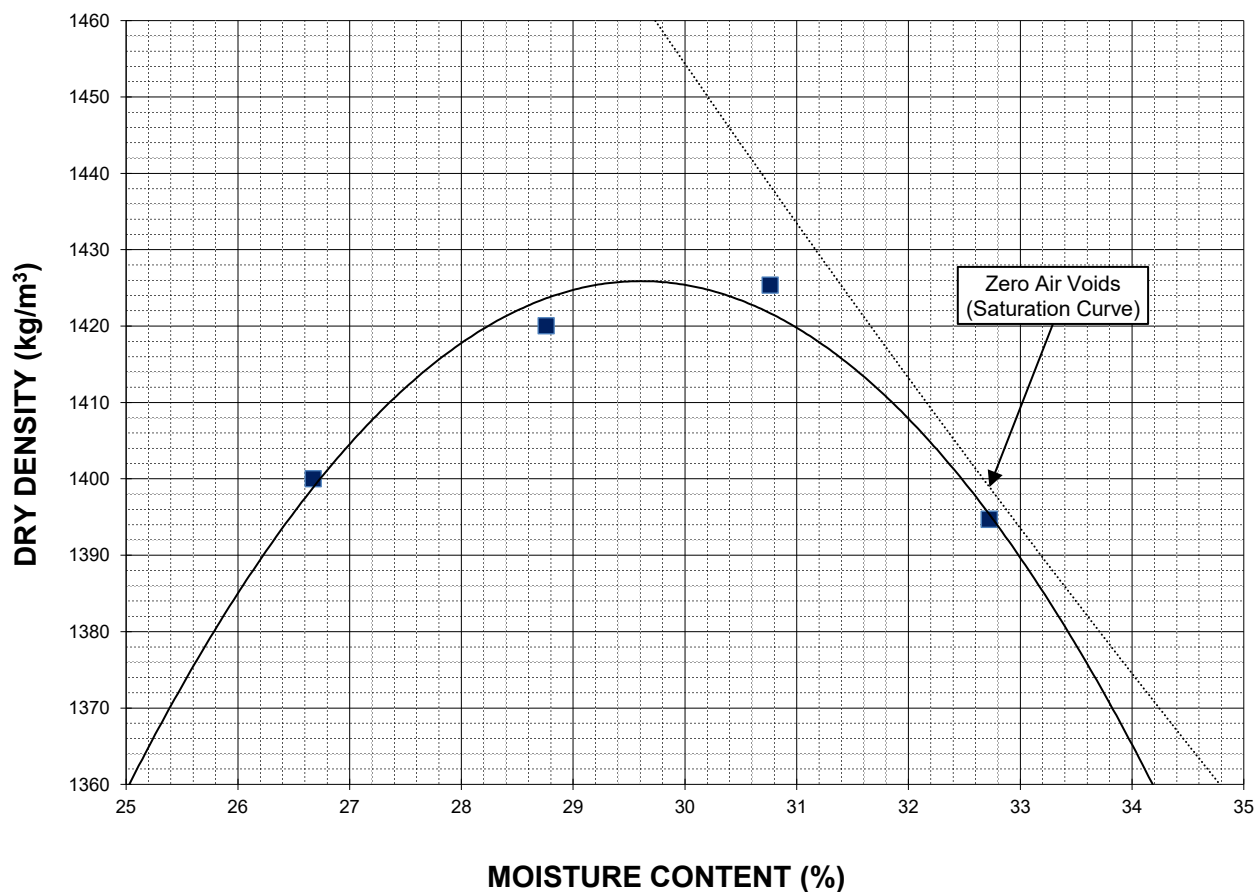


Project No. 1000-043-30
Client WSP
Project 2026-2028 Downtown Pavement Renewals

Sample # L24-443-16 (B145 & B153)
Source Carlton St (TH25-16 & TH25-17)
Material Clay
Sample Date 09-Oct-25
Test Date 22-Oct-25
Technician A. Dustmamatov

Maximum Dry Density (kg/m³)	1426
Optimum Moisture (%)	29.6

Trial Number	1	2	3	4	
Wet Density (kg/m ³)	1773	1828	1864	1851	
Dry Density (kg/m ³)	1400	1420	1425	1395	
Moisture Content (%)	26.7	28.8	30.8	32.7	



Note: Additional information recorded/measured for this test is available upon request.



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California Bearing Ratio Test Data Sheet

ASTM D1883-21

Project No.	1000-043-30	Source	Carlton St (TH25-16 & TH25-17)
Client	WSP	Material	Clay
Project	2026-2028 Downtown Pavement Renewals	Sample Date	09-Oct-25
Sample #	L24-443-16 (B145 & B153)	Test Date	27-Oct-25
		Technician	A. Dustmamatov

Proctor Results (ASTM D698)

Maximum Dry Density	1426 kg/m ³
Optimum Moisture Content	29.6 %
Material Retained on 19 mm Sieve	0.0 %

CBR Sample Compaction

Dry Density	1337 kg/m ³
Initial Moisture Content	30.5 %
Relative Density	93.8 % SPMD

Soaking Results

Surcharge	4.54 kg
Swell	11.0 %
Moisture Content in top 25 mm	48.1 %
Immersion Period	96 h

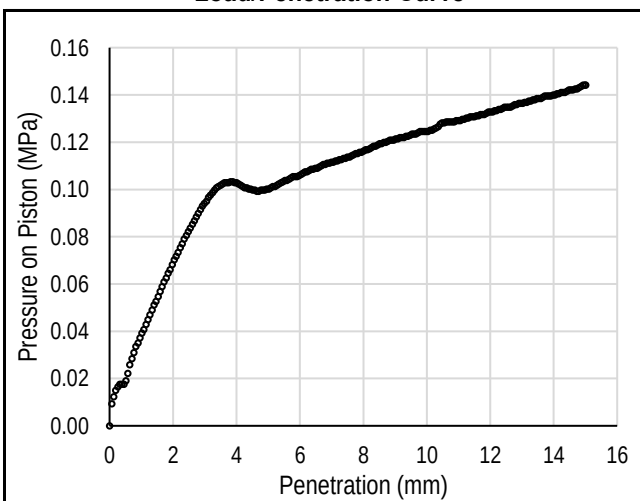
CBR Results

CBR at 2.54 mm	1.2 %
CBR at 5.08 mm	1.0 %
Zero Correction	0 mm

Test Data

Penetration (mm)	Measured Pressure (MPa)	Corrected Pressure (MPa)
0.64	0.03	0.03
1.27	0.05	0.05
1.91	0.07	0.07
2.54	0.08	0.08
3.18	0.10	0.10
3.81	0.10	0.10
4.45	0.10	0.10
5.08	0.10	0.10
7.62	0.11	0.11
10.16	0.13	0.13
12.70	0.14	0.14

Load/Penetration Curve



Comments:

Sample prepared in accordance with the City of Winnipeg guidelines.



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Concrete Core Compressive Strength Report

CSA A23.2-14C

Project No. 1000-043-30

Date October 29, 2025

Project 2026-2028 Downtown Pavement Renewals

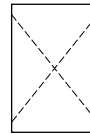
Technician T. Green

Client WSP Group Canada Inc.

Core Location	Core ID	Date Received	Date of Break	Age at Break	Diam. (mm)	Length (mm)	Moisture Conditioning	Compressive Strength (MPa)		Break Type	Correction Factors*				
								Uncorrected f_{conc}	Corrected* f_c		$F_{l/d}$	F_{dia}	F_{mc}	F_D	F_{reinf}
Carlton St	PC25-27	2025-10-16	2025-10-29	-	145	168	Soaked 48 h	52.94	55.96	1	0.9333	0.9802	1.0900	1.0600	1.0000
Carlton St	PC25-28	2025-10-16	2025-10-29	-	145	150	Soaked 48 h	53.26	55.03	1	0.9123	0.9802	1.0900	1.0600	1.0000
Carlton St	PC25-29	2025-10-16	2025-10-29	-	145	168	Soaked 48 h	62.21	65.95	1	0.9361	0.9802	1.0900	1.0600	1.0000

Comments

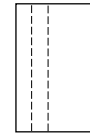
*Correction factors $F_{l/d}$, F_{dia} , F_{mc} , and F_D calculated as per ACI 214.4R-03, and correction factor F_{reinf} calculated as per Khoury et al. (2014): $f_c = f_{conc} F_{l/d} F_{dia} F_{mc} F_D F_{reinf}$



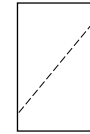
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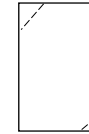
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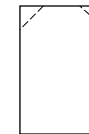
Type 3



Type 4



Type 5



Type 6

Reviewed by (print): Kate Franklin

Signature: Kate Franklin

Table 1 Factors involved in interpretation of core results by different codes.

List	Code/standard	Edition	Factors Considered					
			Aspect ratio	Diameter	Reinforcing	Moisture	Damage	Direction
1	Egyptian Code/Standard Specification	2008	✓		✓			✓
2	British Code/Standard Specification	2003	✓		✓			✓
3	American Concrete Institute ACI	1998	✓					
		2012	✓	✓		✓	✓	
4	European Standard Specification	1998	✓	✓	✓		✓	
		2009	✓		✓			
5	Japanese Standard	1998	✓					
6	Concrete Society	1987	✓		✓		✓	✓

In addition, for core specimen containing two bars no further apart than the diameter of the larger bar, only the bar corresponding to the higher value of $(\Phi_r * d)$ is considered. If the bars are further apart, their combined effect should be assessed by replacing the term $(\Phi_r * d)$ by the term $(\sum \Phi_r * d)$.

It should be pointed out that above equations used to interpret the core concrete strength to the in-situ concrete cube strength have been developed based on a set of assumptions and through many converting process. It is also of interest to note that the damage effect is considered in the development of the formulas in indirect way. The subject derivation and detailed formulas may be seen elsewhere [14].

3.2. American Concrete Institute (ACI)

3.2.1. Former ACI Code (2002) & Current ASTM (2009)

The methodology of core interpretation given in the former ACI code was remained without changes for decades and up to Year (2003). The in-place strength of concrete cylinder at the location from which a core test specimen was extracted can be computed using the equation:

$$f_{cy} = F_{l/d} \cdot f_{core} \quad (4)$$

where f_{cy} is the equivalent in-place concrete cylinder strength, f_{core} is concrete core strength, and $F_{l/d}$ is the strength correction factor for aspect ratio.

The former ACI code does not include any equation to calculate the correction factor ($F_{l/d}$); however, the code gives different values for this term that is associated with different aspect ratios (l/d) as given in Table 2. It should also be noted that the approach of current ASTM is similar to that mentioned above. The only considered variable is the aspect ratio (l/d). It should be noted that identical approach to that mentioned above is still effective in ASTM C42/C42M-03 [10].

3.2.2. Current ACI Code (2012) [15]

Starting from Year 2003, significant changes have been made to the relevant ACI Code provisions regarding the interpreta-

Table 2 Mean values for factor $F_{l/d}$ according to ACI Code (1998) and ASTM.

	Specimen length-to-diameter ratio, l/d			
	1.00	1.25	1.50	1.75
$F_{l/d}$	0.87	0.93	0.96	0.98

tion of core strength test results. New factors have been considered. These include core diameter, moisture content of core sample, core damage associated with drilling, in addition to the effect of aspect ratio that was previously considered in the former ACI edition (1998). According to the ACI 214.4R-03, the in-place concrete strength can be computed using the equation:

$$f_c = F_{l/d} \cdot F_{dia} \cdot F_{mc} \cdot F_D \cdot f_{core} \cdot \text{Front or cc. 12 or cc. 13} \quad (5)$$

where f_c is the equivalent in-place concrete cylinder strength, f_{core} is concrete core strength, $F_{l/d}$ is strength correction factor for aspect ratio, F_{dia} is strength correction factors for diameter, F_{mc} is strength correction factor for moisture condition of core sample, and F_D is the strength correction factor that accounts for effect of damage sustained during core drilling including micro-cracking and undulations at the drilled surface and cutting through coarse-aggregate particles that may subsequently pop out during testing.

The ACI committee considered the correction factors presented in Table 3 for converting core strengths into equivalent in-place strengths based on the work reported by Bartlett and MacGregor [6]. It should be noted that the magnitude of

Table 3 Strength correction factors according to ACI 214.4R-03.

List	Factors	Mean values
(1) ^b	$F_{l/d}$: l/d ratio	
	As-received	$1 - \{0.130 - \alpha f_{core}\} (2 - \frac{l}{d})^2$
	Soaked 48 h	$1 - \{0.117 - \alpha f_{core}\} (2 - \frac{l}{d})^2$
	Air dried ^a	$1 - \{0.144 - \alpha f_{core}\} (2 - \frac{l}{d})^2$
(2)	F_{dia} : core diameter	
	50 mm	1.06
	100 mm	1.00
	150 mm	0.98
(3)	F_{mc} : core moisture content	
	As-received	1.00
	Soaked 48 h	1.09
	Air dried ^a	0.96
(4)	F_D : damage due to drilling	1.06

^a Standard treatment specified in ASTM C 42/C 42M.

^b Constant α equals $4.3(10^{-4})$ 1/MPa for f_{core} in MPa.

Table 6 List of comparisons between tested cores to determine.

	A18	A17	A16	A15	A14	A13	A12	A11	A10	A9	A8	A7	A6	A5	A4	A3	A2	A1
A1	●	●	●	■	■		●				●			▲	▲	■	▲	
A2																		
A3						■				■								
A4																		
A5																		
A6								■	▲	■	▲		■	▲				
A7								■	▲	■	▲							
A8		●	◆	●	●													
A9																		
A10								■	▲									
A11																		
A12		●		●	●													
A13																		
A14		●		●														
A15		●																
A16	●	◆																
A17	◆																	
A18																		

- Diameter of steel bar.
- ▲ Distance of steel bar from nearly end of core.
- Number of steel bars and spacing between bars.
- ◆ Distance of steel bar from vertical axis of specimen.

This brief review indicated that the various proposed relationships for correction factors are all nonlinear. It should be noted that the equations given by the Egyptian Code takes into account most variables that may affect the interpretation of the results; however, the code ignores the deterioration of steel-concrete bond that may occur and also the position of the reinforcement from vertical axis of core specimens.

Weighted nonlinear regression analysis has been performed to determine the factor (F_{reinf}) with the use of the software "SAS" package and "Data Fit." This shows that the correction factor for reinforcement (F_{reinf}) is given by the following expression:

• For cores containing a single bar:

$$F_{\text{reinf}} = \left[1 + 1.5 \frac{[\Phi_r \times r + \Phi_r \times (S/10)]}{\Phi_c \times L} \right] \times \frac{1.13}{f_{\text{core}}^{0.015}} \quad (12)$$

- For core specimen containing two bars no further apart than the diameter of the larger bar, only the bar corresponding to the higher value of ($\Phi_r \times d$) is considered. If the bars are further apart, their combined effect is assessed by replacing the term ($\Phi_r \times r$) by ($\sum \Phi_r \times r$) as follows:

$$F_{\text{reinf}} = \left[1 + 1.5 \frac{\sum [\Phi_r \times r + \Phi_r \times (S/10)]}{\Phi_c \times L} \right] \times \frac{1.13}{f_{\text{core}}^{0.015}} \quad (13)$$

where F_{reinf} is the correction factor for reinforcement, Φ_r is the diameter of the reinforcement, Φ_c is the diameter of the concrete specimen, r is the distance of axis of bar from nearer end of specimen, S is the distance of axis of bar from axis of core specimen, L is the length of the specimen after end preparation by grinding or capping, and f_{core} is the concrete core strength (kg/cm^2).

6.1.6. Effect of moisture condition of core

Results of about 100 cores indicate that the strength of cores left to dry in air for 7 days is on average 13% greater than that of cores soaked at least 40 h before testing. The strength of cores with negligible moisture gradient and tested after cutting is found to be 7–9% larger than that of soaked cores as shown in Fig. 20. The authors strongly recommend to use a correction factor accounting for moisture condition (F_m) equals to 1.09 and 0.96, respectively, for cores tested after 48 h soaked in water and for those tested after 7 days dry in air.

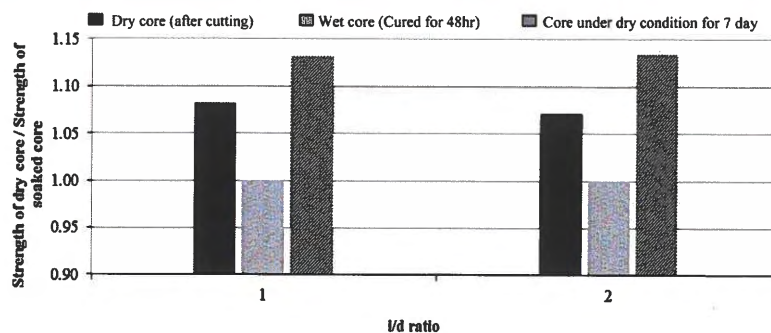
**Figure 20** Effect of core moisture condition on core strength for different aspect ratios (l/d).



Photo 1: Pavement Core Sample at TH25-12



Photo 2: Pavement Core Sample at TH25-13



Photo 3: Pavement Core Sample at TH25-14



Photo 4: Pavement Core Sample at TH25-15



Photo 5: Pavement Core Sample at TH25-16



Photo 6: Pavement Core Sample at TH25-17



2026-2028 Downtown Pavement Renewals
Carlton St - Broadway Ave to Portage Ave

Pavement Core No.	Pavement Core Location	Pavement Surface		Pavement Structure Material		Corrected Compressive Strength (Mpa)
		Type	Thickness (mm)	Type	Thickness (mm)	
PC25-27	UTM : 5528245 m N, 633201 m E; Located 7 m North of Graham St, Southbound curb lane, 2.0 m West of East curb.	Asphalt		Concrete	250	55.96
PC25-28	UTM : 5528280 m N, 633190 m E; Located 47 m North of Graham St, Southbound middle lane, 6.0 m East of West curb.	Asphalt		Concrete	250	55.03
PC25-29	UTM : 5528315 m N, 633174 m E; Located in front of #275 Carlton St, Southbound curb lane, 2.0 m East of West curb.	Asphalt		Concrete	240	65.95



Photo 1: Pavement Core Sample at PC25-27



Photo 2: Pavement Core Sample at PC25-28



Photo 3: Pavement Core Sample at PC25-29

Appendix D
Test Hole Logs, Summary Table, Lab Testing Results and
Photographs of Pavement Core Samples
Hargrave St – St. Mary Ave to Graham Ave



Sub-Surface Log

Test Hole TH25-10

1 of 1

Client:WSP

Project Name:2026-2028 Downtown Pavement Renewals

Contractor:Maple Leaf Drilling

Method:125mm Solid Stem Auger, B40 Mobile Truck Mount

Project Number:1000-043-30

Location:UTM : 633339 E 5528167 N - Hargrave St

Ground Elevation:Top of Pavement

Date Drilled:October 8, 2025

Sample Type:

Grab (G)

Shelby Tube (T)

Split Spoon (SS) / SPT

Split Barrel (SB) / LPT

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)						Undrained Shear Strength (kPa)					
					Particle Size (%)						Test Type					
					0 20 40 60 80 100						0 50 100 150 200					
					PL MC LL						△ Torvane △ ✦ Pocket Pen. ✦ ⊠ Qu ⊠ ○ Field Vane ○					
		ASPHALT														
		CONCRETE														
0.5		CLAY, with silt, trace sand - black - moist, very stiff - high plasticity - AASHTO: A-7-6 (55)		G123												
		- transition to silt below 1.0m		G124												
		SILT - sandy, some clay, trace gravel - light brown, moist, firm, low plasticity - AASHTO: A-6 (5)		G125												
1.5		CLAY - silty - grey - moist, stiff - high plasticity - AASHTO: A-7-6 (I)		G126												
				G127												
2.5		- trace silt inclusions (<20mm diam.) between 2.4m and 2.7m		G128												
				G129												

END OF TEST HOLE AT 3.0m IN CLAY.
Notes:
1) Seepage below 1.5m at base of SILT.
2) Sloughing not observed.
3) Test hole dry and open to 3.0m depth immediately after drilling.
4) Test hole backfilled with cuttings and bentonite.
5) Bulk samples (B241 silt and B242 clay) collected between 0.8m and 2.0m.



Sub-Surface Log

Client: WSP Project Number: 1000-043-30
Project Name: 2026-2028 Downtown Pavement Renewals Location: UTM : 633319 E 5528220 N - Hargrave St
Contractor: Maple Leaf Drilling Ground Elevation: Top of Pavement
Method: 125mm Solid Stem Auger, B40 Mobile Truck Mount Date Drilled: October 8, 2025

Sample Type: ☒ Grab (G) ☐ Shelby Tube (T) ☐ Split Spoon (SS) / SPT ☐ Split Barrel (SB) / LPT ☐ Core (C)

Particle Size Legend: ☒ Fines ☐ Clay ☐ Silt ☐ Sand ☐ Gravel ☐ Cobbles ☐ Boulders

Depth (m)	Soil Symbol	MATERIAL DESCRIPTION	Sample Type	Sample Number	Bulk Unit Wt (kN/m ³)						Undrained Shear Strength (kPa)				
					16	17	18	19	20	21	Test Type				
					Particle Size (%)						Torvane Δ				
					0	20	40	60	80	100	Pocket Pen. $\oplus$				
					PL MC LL						$\boxtimes$ Qu $\boxtimes$				
					0	20	40	60	80	100	Field Vane $\bigcirc$				
					0	20	40	60	80	100	0	50	100	150	200250
		ASPHALT													
		CONCRETE													
		SAND (FILL) - trace gravel (<25mm diam.), trace clay													
		- brown													
		- moist, compact													
		- poorly graded, sub-angular													
		- AASHTO: A-3 (I)													
-0.5															
-1.0				G131											
-1.5				G132											
-2.0				G133											
-2.5				G134											
-3.0				G135											
-3.0				G136											

END OF TEST HOLE AT 3.0m IN SAND.

Notes:

- 1) Seepage not observed.
- 2) Caving below 0.9m in SAND.
- 3) Test hole dry and open to 1.5m depth immediately after drilling.
- 4) Test hole backfilled with cuttings and bentonite.

GENERAL NOTES

- Classifications are based on the Unified Soil Classification System and include consistency, moisture, and color. Field descriptions have been modified to reflect results of laboratory tests where deemed appropriate.
- Descriptions on these test hole logs apply only at the specific test hole locations and at the time the test holes were drilled. Variability of soil and groundwater conditions may exist between test hole locations.
- When the following classification terms are used in this report or test hole logs, the primary and secondary soil fractions may be visually estimated.

Major Divisions			USCS Classification	Symbols	Typical Names	Laboratory Classification Criteria			Particle Size	ASTM Sieve sizes	#10 to #4 #40 to #10 #200 to #40 < #200			
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	$C_u = \frac{D_{60}}{D_{10}}$ greater than 4; $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ between 1 and 3				Not meeting all gradation requirements for GW	mm	2.00 to 4.75 0.425 to 2.00 0.075 to 0.425 < 0.075
Sands (More than half of coarse fraction is smaller than 4.75 mm)	Gravel with fines (Appreciable amount of fines)	GM		Silty gravels, gravel-sand-silt mixtures	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 with fines (Appreciable amount of fines)	Clean sands (Little or no fines)	GC		Clayey gravels, gravel-sand-silt mixtures	$C_u = \frac{D_{60}}{D_{10}}$ greater than 6; $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ between 1 and 3	Not meeting all gradation requirements for SW	
Sands with fines (Appreciable amount of fines)	Clean sands (Little or no fines)	SW		Well-graded sands, gravelly sands, little or no fines	Not meeting all gradation requirements for SW	mm								2.00 to 4.75 0.425 to 2.00 0.075 to 0.425 < 0.075
							Sands with fines (Appreciable amount of fines)	Clean sands (Little or no fines)	SP		Poorly-graded sands, gravelly sands, little or no fines	Atterberg limits below "A" line or P.I. less than 4	Above "A" line with P.I. between 4 and 7 are borderline cases requiring use of dual symbols	
Sands with fines (Appreciable amount of fines)	Clean sands (Little or no fines)	SM		Silty sands, sand-silt mixtures	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 with fines (Appreciable amount of fines)	Clean sands (Little or no fines)	SC		Clayey sands, sand-clay mixtures	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 with fines (Appreciable amount of fines)	Clean sands (Little or no fines)	ML		Inorganic silts and very fine sands, rock floor, silty or clayey fine sands or clayey silts with slight plasticity	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 with fines (Appreciable amount of fines)	Clean sands (Little or no fines)	CL		Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays	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 with fines (Appreciable amount of fines)	Clean sands (Little or no fines)	OL		Organic silts and organic silty clays of low plasticity	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 with fines (Appreciable amount of fines)	Clean sands (Little or no fines)	MH		Inorganic silts, micaceous or distomaceous fine sandy or silty soils, organic silts	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 with fines (Appreciable amount of fines)	Clean sands (Little or no fines)	CH		Inorganic clays of high plasticity, fat clays	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 with fines (Appreciable amount of fines)	Clean sands (Little or no fines)	OH		Organic clays of medium to high plasticity, organic silts	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 with fines (Appreciable amount of fines)	Clean sands (Little or no fines)	Pt		Peat and other highly organic soils	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								
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							Sands with fines (Appreciable amount of fines)	Clean sands (Little or no fines)	Pt		Peat and other highly organic soils			

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

Other Symbol Types

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

LEGEND OF ABBREVIATIONS AND SYMBOLS

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

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
with *	with silt, with sand	> 35 percent

* Used when the material is classified based on behaviour as a cohesive material

TERMS DESCRIBING CONSISTENCY OR COMPACTION CONDITION

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

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

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

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

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

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



**2026-2028 Downtown Pavement Renewals
Sub-Surface Investigation
Hargrave St - St Mary Ave to Graham Ave**

Test Hole No.	Test Hole Location	Pavement Surface		Pavement Structure Material		Subgrade Description	Sample Depth (m)		Moisture Content (%)	Grain Size Analysis				Atterberg Limits		
		Type	Thickness (mm)	Type	Thickness (mm)		Top (m)	Bottom (m)		Clay (%)	Silt (%)	Sand (%)	Gravel (%)	Plastic	Liquid	Plasticity Index
TH25-09	UTM : 5528118 N, 633358 E Located 19 m North of St Mary Ave intersection, Northbound middle lane, 5.0 m East of West curb.	Asphalt	65	Concrete	265	Sand, AASHTO: A-3 (1)	0.9	1.1	10	4		96	0			
						Sand, AASHTO: A-3 (1)	1.2	1.4	11							
						Sand, AASHTO: A-3 (1)	1.5	1.7	11							
						Sand, AASHTO: A-3 (1)	1.9	2.1	12							
						Sand, AASHTO: A-3 (1)	2.3	2.4	13							
						Sand, AASHTO: A-3 (1)	2.8	3.0	21							
TH25-10	UTM : 5528167 N, 633339 E Located 62 m North of St Mary Ave intersection, Northbound middle lane, 6.0 m East of West curb.	Asphalt	300	Concrete	240	Clay, AASHTO: A-7-6 (55)	0.8	0.9	36	48	43	8	0	23	77	54
						Clay, AASHTO: A-7-6 (55)	1.1	1.2	31							
						Silt, AASHTO: A-6 (5)	1.4	1.5	19	17	40	36	6	12	27	15
						Clay, AASHTO: A-7-6 (I)	1.7	1.8	35							
						Clay, AASHTO: A-7-6 (I)	2.1	2.2	42							
						Clay, AASHTO: A-7-6 (I)	2.4	2.6	45							
TH25-11	UTM : 5528220 N, 633319 E Located 32 m South of Graham Ave intersection, Northbound middle lane, 4.0 m East of West curb.	Asphalt	95	Concrete	205	Sand, AASHTO: A-3 (I)	0.9	1.1	6							
						Sand, AASHTO: A-3 (I)	1.2	1.4	6							
						Sand, AASHTO: A-3 (I)	1.5	1.7	5							
						Sand, AASHTO: A-3 (I)	1.9	2.1	5							
						Sand, AASHTO: A-3 (I)	2.3	2.4	5							
						Sand, AASHTO: A-3 (I)	2.8	3.0	9							
						Sand, AASHTO: A-3 (I)	2.7	2.8	46							



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Moisture Content Report ASTM D2216-98

Project No. 1000-043-30
Client WSP
Project 2026-2028 Downtown Pavement Renewal
Hargrave St - St Mary Ave to Graham Ave
Sample Date 08-Oct-25
Test Date 23-Oct-25
Technician D. Sellick

Test Hole	TH25-09	TH25-09	TH25-09	TH25-09	TH25-09	TH25-09
Depth (m)	0.9 - 1.1	1.2 - 1.4	1.5 - 1.7	1.9 - 2.1	2.3 - 2.4	2.8 - 3.0
Sample #	G116	G117	G118	G119	G120	G121
Tare ID	H	D35	W26	AA5	QT16	E140
Mass of tare	677.2	6.8	7.2	7.0	8.6	8.6
Mass wet + tare	2492.8	332.0	341.4	410.0	473.0	318.4
Mass dry + tare	2323.4	298.8	308.4	368.2	418.2	265.4
Mass water	169.4	33.2	33.0	41.8	54.8	53.0
Mass dry soil	1646.2	292.0	301.2	361.2	409.6	256.8
Moisture %	10.3%	11.4%	11.0%	11.6%	13.4%	20.6%

Test Hole	TH25-10	TH25-10	TH25-10	TH25-10	TH25-10	TH25-10
Depth (m)	0.8 - 0.9	1.1 - 1.2	1.4 - 1.5	1.7 - 1.8	2.1 - 2.2	2.4 - 2.6
Sample #	G123	G124	G125	G126	G127	G128
Tare ID	E500	E9	M57	AB22	F110	QW5
Mass of tare	6.8	6.8	6.8	6.6	8.2	6.8
Mass wet + tare	416.4	251.8	413.2	237.6	262.2	287.8
Mass dry + tare	308.0	193.6	347.6	177.8	187.2	201.2
Mass water	108.4	58.2	65.6	59.8	75.0	86.6
Mass dry soil	301.2	186.8	340.8	171.2	179.0	194.4
Moisture %	36.0%	31.2%	19.2%	34.9%	41.9%	44.5%

Test Hole	TH25-10	TH25-11	TH25-11	TH25-11	TH25-11	TH25-11
Depth (m)	3.0 - 3.1	0.9 - 1.1	1.2 - 1.4	1.5 - 1.7	1.9 - 2.1	2.3 - 2.4
Sample #	G129	G131	G132	G133	G134	G135
Tare ID	E101	W99	E95	Z114	P06	AC36
Mass of tare	8.6	8.6	7.0	8.4	8.8	6.8
Mass wet + tare	247.8	256.8	314.2	264.4	267.4	317.2
Mass dry + tare	166.2	241.8	295.8	252.0	255.2	303.0
Mass water	81.6	15.0	18.4	12.4	12.2	14.2
Mass dry soil	157.6	233.2	288.8	243.6	246.4	296.2
Moisture %	51.8%	6.4%	6.4%	5.1%	5.0%	4.8%



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Moisture Content Report ASTM D2216-98

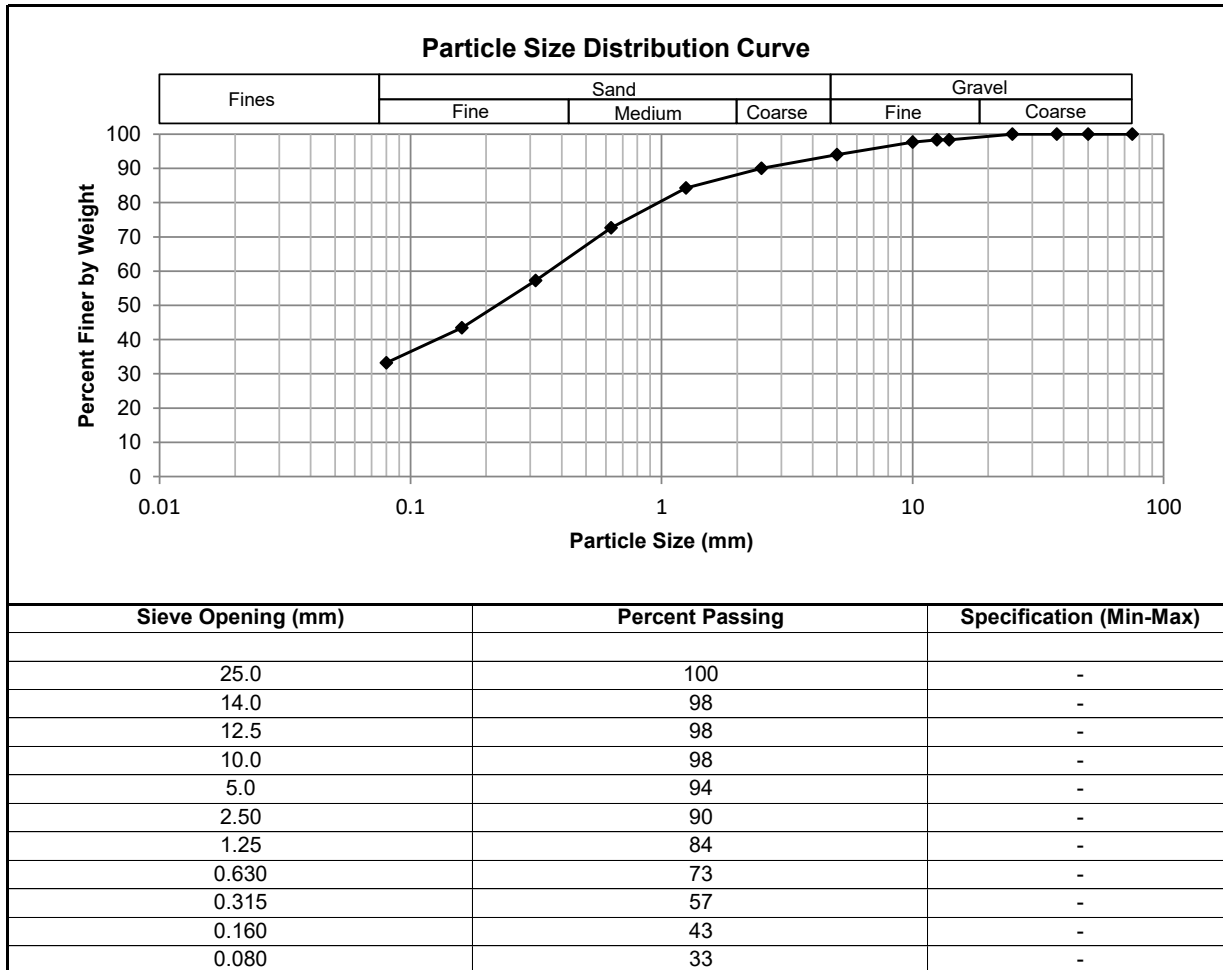
Project No. 1000-043-30
Client WSP
Project 2026-2028 Downtown Pavement Renewal
Hargrave St - St Mary Ave to Graham Ave
Sample Date 08-Oct-25
Test Date 23-Oct-25
Technician D. Sellick

Test Hole	TH25-11					
Depth (m)	2.8 - 3.0					
Sample #	G136					
Tare ID	N47					
Mass of tare	8.4					
Mass wet + tare	312.4					
Mass dry + tare	286.4					
Mass water	26.0					
Mass dry soil	278.0					
Moisture %	9.4%					

Project No. 1000-043-30
Client WSP
Project 2026-2028 Downtown Pavement Renewals

Test Hole TH25-09 (Hargrave St - St Mary Ave to Graham Ave)
Sample # G116
Depth (m) 0.9 - 1.1
Date Sampled 10-Oct-25
Date Tested 27-Oct-25
Technician Z. Dypiangco

Total Weight (g)	1646.2
Gravel %	6.0
Sand %	60.8
Fines %	33.2



Project No. 1000-043-30
Client WSP
Project 2026-2028 Downtown Pavement Renewals

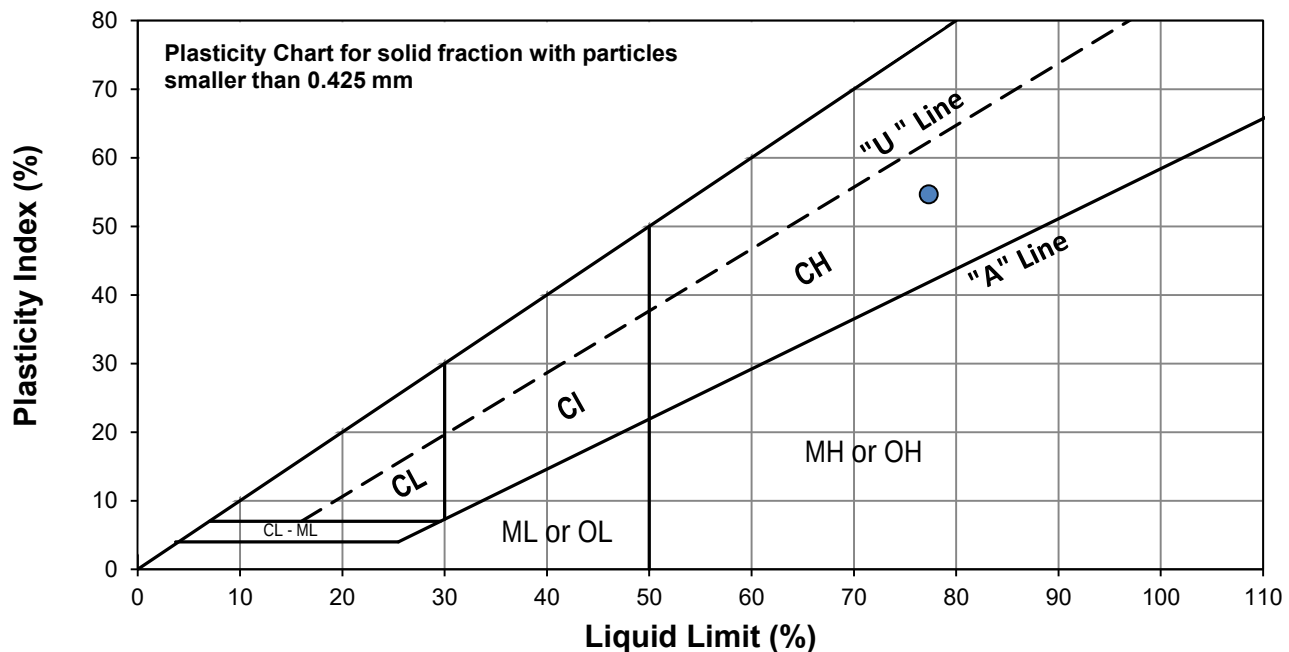


Test Hole TH25-10 (Hargrave St - St Mary Ave to Graham Ave)
Sample # G123
Depth (m) 0.8 - 0.9
Sample Date 08-Oct-25
Test Date 30-Oct-25
Technician T. Green

Liquid Limit	77
Plastic Limit	23
Plasticity Index	55

Liquid Limit

Trial #	1	2	3		
Number of Blows (N)	15	23	35		
Mass Tare (g)	14.058	14.028	13.920		
Mass Wet Soil + Tare (g)	23.084	23.640	23.363		
Mass Dry Soil + Tare (g)	19.081	19.445	19.287		
Mass Water (g)	4.003	4.195	4.076		
Mass Dry Soil (g)	5.023	5.417	5.367		
Moisture Content (%)	79.693	77.441	75.946		



Plastic Limit

Trial #	1	2	3	4	5
Mass Tare (g)	13.734	13.831			
Mass Wet Soil + Tare (g)	21.857	21.495			
Mass Dry Soil + Tare (g)	20.346	20.089			
Mass Water (g)	1.511	1.406			
Mass Dry Soil (g)	6.612	6.258			
Moisture Content (%)	22.852	22.467			

Note: Additional information recorded/measured for this test is available upon request.

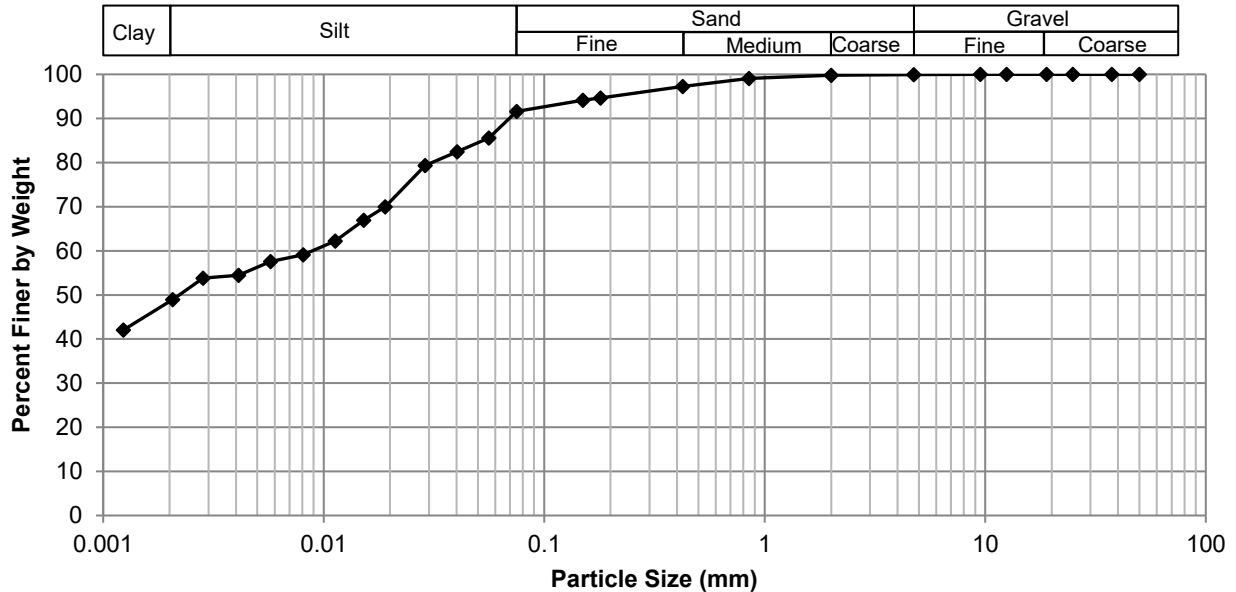
Project No. 1000-043-30
Client WSP
Project 2026-2028 Downtown Pavement Renewals



Test Hole TH25-10 (Hargrave St - St Mary Ave to Graham Ave)
Sample # G123
Depth (m) 0.8 - 0.9
Sample Date 08-Oct-25
Test Date 29-Oct-25
Technician A. Fidler-Kliewer

Gravel	0.1%
Sand	8.3%
Silt	43.2%
Clay	48.4%

Particle Size Distribution Curve



Gravel		Sand		Silt and Clay	
Particle Size (mm)	Percent Passing	Particle Size (mm)	Percent Passing	Particle Size (mm)	Percent Passing
50.0	100.00	4.75	99.93	0.0750	91.62
37.5	100.00	2.00	99.79	0.0561	85.57
25.0	100.00	0.850	99.05	0.0402	82.45
19.0	100.00	0.425	97.30	0.0289	79.33
12.5	100.00	0.180	94.67	0.0190	69.97
9.50	100.00	0.150	94.14	0.0152	66.91
4.75	99.93	0.075	91.62	0.0113	62.23
				0.0081	59.11
				0.0057	57.55
				0.0041	54.43
				0.0028	53.78
				0.0021	48.93
				0.0012	42.06

Project No. 1000-043-30
Client WSP
Project 2026-2028 Downtown Pavement Renewals

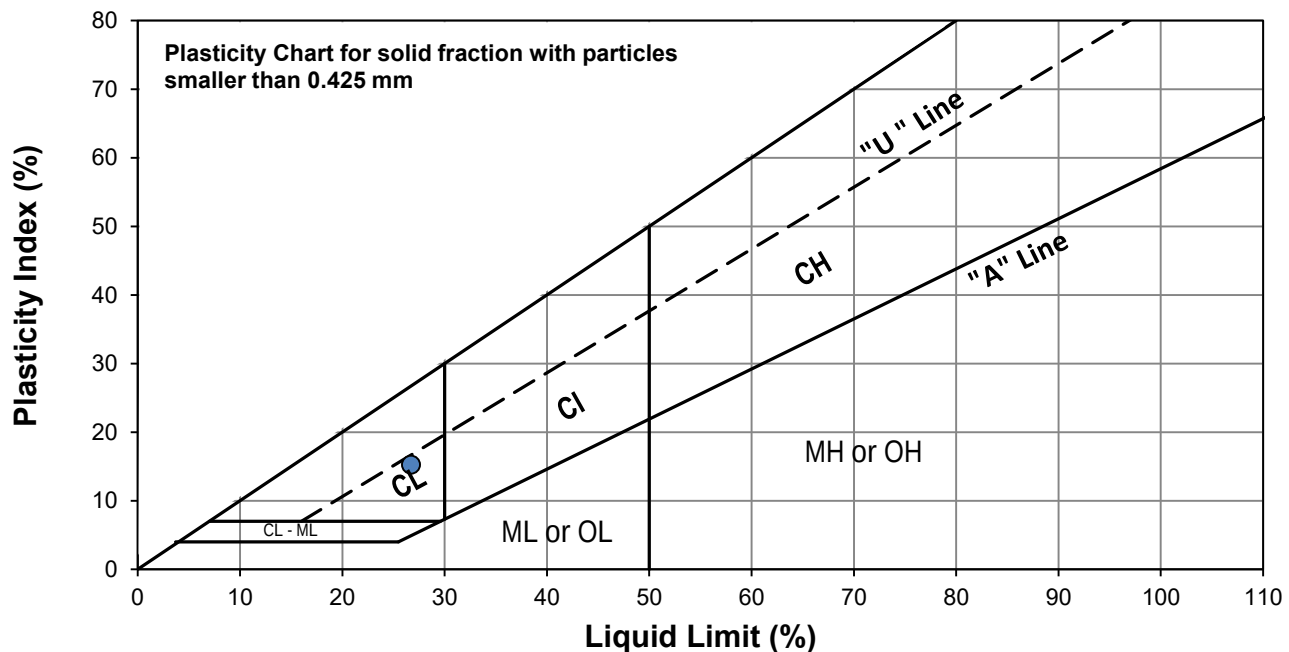


Test Hole TH25-10 (Hargrave St - St Mary Ave to Graham Ave)
Sample # G125
Depth (m) 1.4 - 1.5
Sample Date 08-Oct-25
Test Date 30-Oct-25
Technician T. Green

Liquid Limit	27
Plastic Limit	12
Plasticity Index	15

Liquid Limit

Trial #	1	2	3		
Number of Blows (N)	18	22	35		
Mass Tare (g)	14.066	13.939	14.132		
Mass Wet Soil + Tare (g)	28.930	27.688	29.681		
Mass Dry Soil + Tare (g)	25.666	24.730	26.553		
Mass Water (g)	3.264	2.958	3.128		
Mass Dry Soil (g)	11.600	10.791	12.421		
Moisture Content (%)	28.138	27.412	25.183		



Plastic Limit

Trial #	1	2	3	4	5
Mass Tare (g)	13.943	14.097			
Mass Wet Soil + Tare (g)	26.300	22.976			
Mass Dry Soil + Tare (g)	25.025	22.058			
Mass Water (g)	1.275	0.918			
Mass Dry Soil (g)	11.082	7.961			
Moisture Content (%)	11.505	11.531			

Note: Additional information recorded/measured for this test is available upon request.

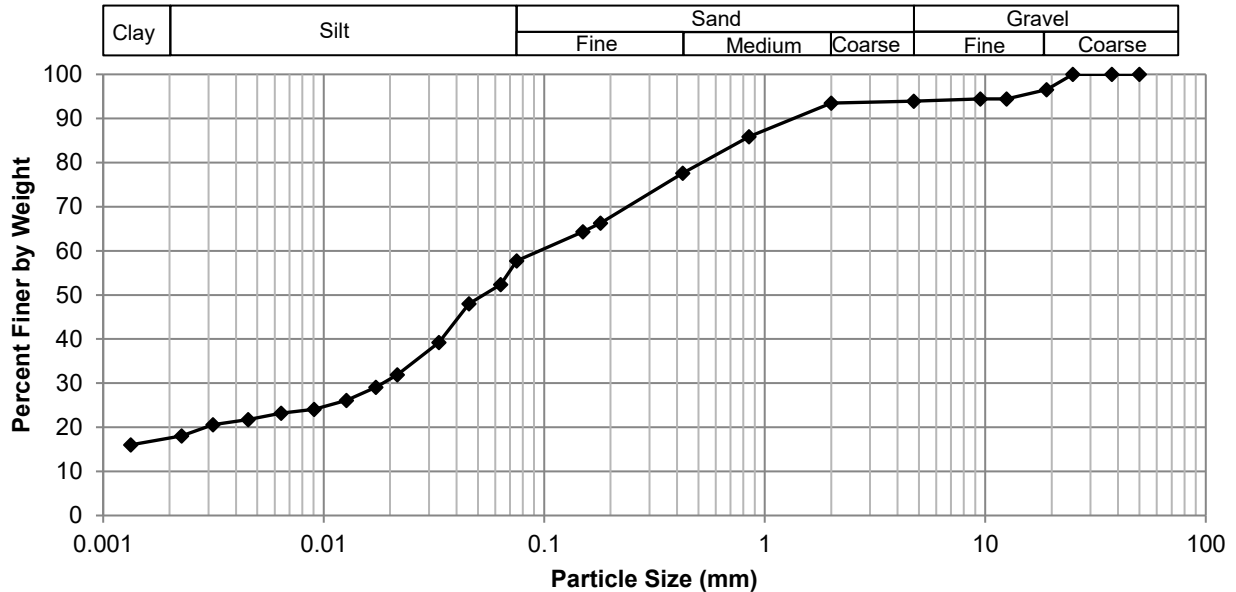
Project No. 1000-043-30
Client WSP
Project 2026-2028 Downtown Pavement Renewals



Test Hole TH25-10 (Hargrave St - St Mary Ave to Graham Ave)
Sample # G125
Depth (m) 1.4 - 1.5
Sample Date 08-Oct-25
Test Date 29-Oct-25
Technician A. Fidler-Kliewer

Gravel	6.1%
Sand	36.1%
Silt	40.3%
Clay	17.5%

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	93.90	0.0750	57.76
37.5	100.00	2.00	93.46	0.0634	52.38
25.0	100.00	0.850	85.91	0.0456	48.00
19.0	96.56	0.425	77.60	0.0333	39.23
12.5	94.45	0.180	66.29	0.0216	31.93
9.50	94.45	0.150	64.33	0.0172	29.06
4.75	93.90	0.075	57.76	0.0127	26.14
				0.0090	24.09
				0.0064	23.21
				0.0046	21.75
				0.0031	20.56
				0.0023	18.06
				0.0013	16.02



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Standard Proctor Compaction Test

ASTM D698-12e2

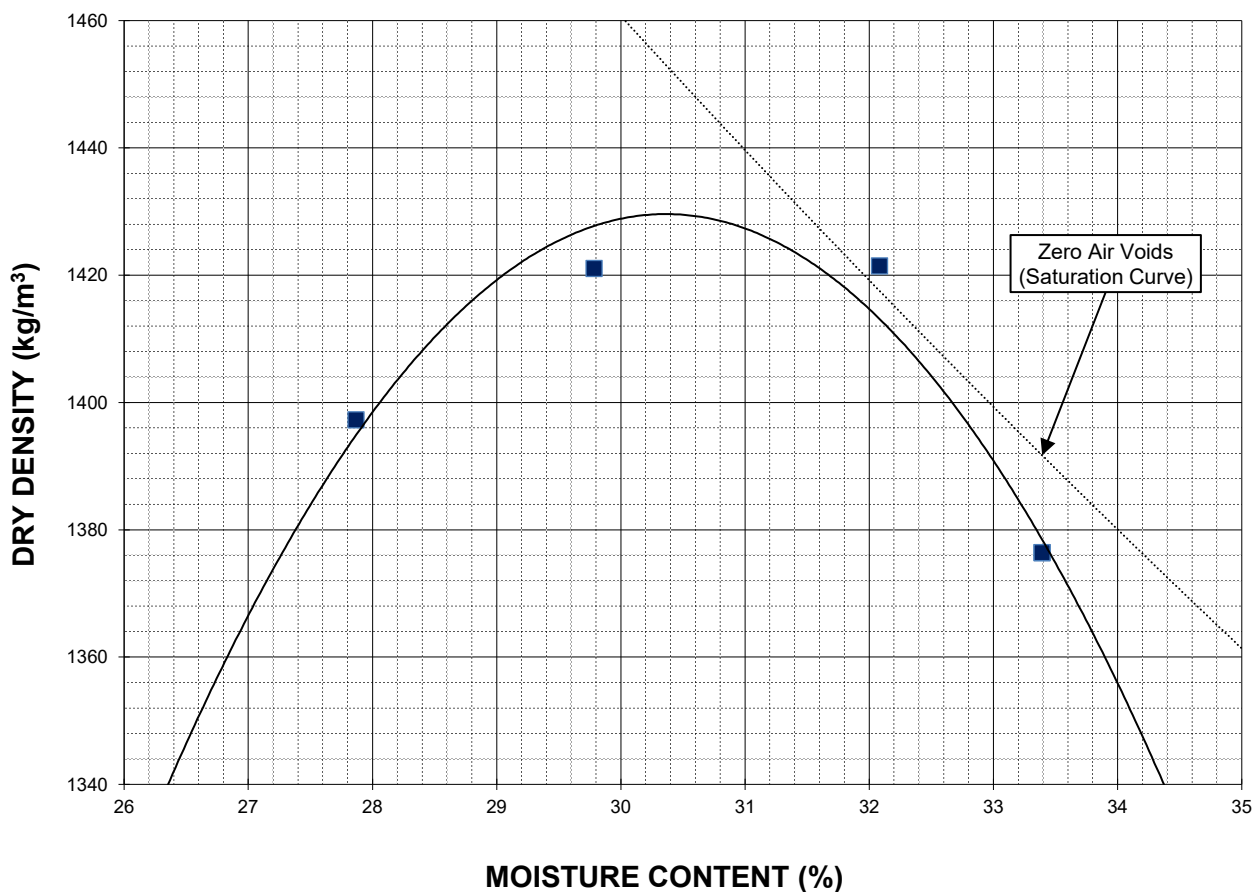
Project No. 1000-043-30
Client WSP
Project 2026-2028 Downtown Pavement Renewals



Sample # L25-443-09 (B130)
Source Hargrave St (TH25-10)
Material Clay
Sample Date 08-Oct-25
Test Date 14-Oct-25
Technician I. Araquil

Maximum Dry Density (kg/m³)	1430
Optimum Moisture (%)	30.4

Trial Number	1	2	3	4	
Wet Density (kg/m ³)	1787	1844	1878	1836	
Dry Density (kg/m ³)	1397	1421	1421	1376	
Moisture Content (%)	27.9	29.8	32.1	33.4	



Note: Additional information recorded/measured for this test is available upon request.



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California Bearing Ratio Test Data Sheet

ASTM D1883-21

Project No.	1000-043-30	Source	Hargrave St (TH25-10)
Client	WSP	Material	Clay
Project	2026-2028 Downtown Pavement Renewals	Sample Date	08-Oct-25
Sample #	L25-443-09 (B130)	Test Date	23-Oct-25
		Technician	A. Dustmamatov

Proctor Results (ASTM D698)

Maximum Dry Density	1430 kg/m ³
Optimum Moisture Content	30.4 %
Material Retained on 19 mm Sieve	0.0 %

CBR Sample Compaction

Dry Density	1356 kg/m ³
Initial Moisture Content	30.2 %
Relative Density	94.8 % SPMDD

Soaking Results

Surcharge	4.54 kg
Swell	3.6 %
Moisture Content in top 25 mm	41.2 %
Immersion Period	96 h

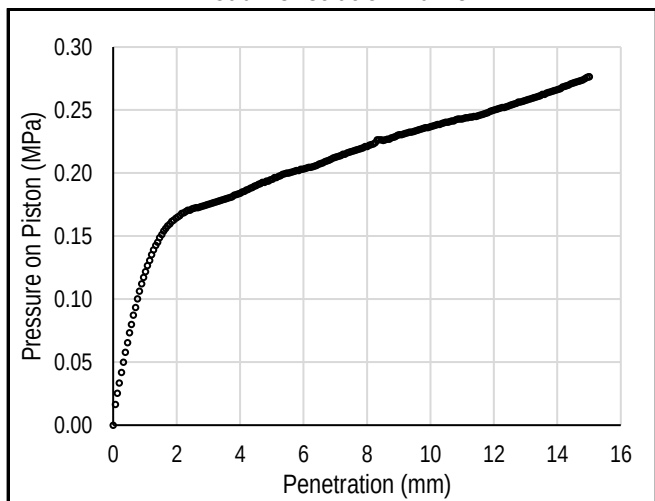
CBR Results

CBR at 2.54 mm	2.5 %
CBR at 5.08 mm	1.9 %
Zero Correction	0 mm

Test Data

Penetration (mm)	Measured Pressure (MPa)	Corrected Pressure (MPa)
0.64	0.09	0.09
1.27	0.14	0.14
1.91	0.16	0.16
2.54	0.17	0.17
3.18	0.18	0.18
3.81	0.18	0.18
4.45	0.19	0.19
5.08	0.20	0.20
7.62	0.22	0.22
10.16	0.24	0.24
12.70	0.26	0.26

Load/Penetration Curve



Comments:

Sample prepared in accordance with the City of Winnipeg guidelines.



Photo 1: Pavement Core Sample at TH25-09



Photo 2: Pavement Core Sample at TH25-10



Photo 3: Pavement Core Sample at TH25-11

Appendix E
Test Hole Logs, Summary Table, Lab Testing Results and
Photographs of Pavement Core Samples
Kennedy St. – Broadway Ave to Portage Ave



Sub-Surface Log

Test Hole TH25-23

1 of 1

Client:WSP

Project Name:2026-2028 Downtown Pavement Renewals

Contractor:Maple Leaf Drilling

Method:125mm Solid Stem Auger, B40 Mobile Truck Mount

Project Number:1000-043-30

Location:UTM : 633204 E 5527683 N - Kennedy St

Ground Elevation:Top of Pavement

Date Drilled:October 6, 2025

Sample Type:

Grab (G)

Shelby Tube (T)

Split Spoon (SS) / SPT

Split Barrel (SB) / LPT

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)						Undrained Shear Strength (kPa)					
					16	17	18	19	20	21	Test Type					
					Particle Size (%)						Torvane Δ					
					0	20	40	60	80	100	Pocket Pen. ⊕					
					PL MC LL						Qu ⊠					
					0	20	40	60	80	100	0	50	100	150	200	
		ASPHALT														
		CONCRETE														
0.5		CLAY - silty, trace sand - black - moist, stiff - intermediate to high plasticity - AASHTO: A-7-6 (I)														
1.0		- with silt, grey, firm below 1.1m		G45												
1.5				G46												
2.0		- silty, trace sand to 2.1m, very stiff, high plasticity below 1.8m		G47												
2.5		- brown, stiff below 2.2m		G48												
3.0				G49												
				G50												

END OF TEST HOLE AT 3.0m IN CLAY.
Notes:
1) Seepage and sloughing not observed.
2) Test hole dry and open to 3.0m depth immediately after drilling.
3) Test hole backfilled with cuttings and bentonite.
4) Bulk samples (B51 silt and clay and B52 clay) collected between 0.8m and 2.0m.



Sub-Surface Log

Client: WSP Project Number: 1000-043-30
Project Name: 2026-2028 Downtown Pavement Renewals Location: UTM : 633167 E 5527779 N - Kennedy St
Contractor: Maple Leaf Drilling Ground Elevation: Top of Pavement
Method: 125mm Solid Stem Auger, B40 Mobile Truck Mount Date Drilled: October 6, 2025

Sample Type: ☒ Grab (G) ☐ Shelby Tube (T) ☐ Split Spoon (SS) / SPT ☐ Split Barrel (SB) / LPT ☐ 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)						Undrained Shear Strength (kPa)				
					16	17	18	19	20	21	Test Type				
					Particle Size (%)						Torvane Δ				
					0	20	40	60	80	100	Pocket Pen. $\boxplus$				
					PL MC LL						$\boxtimes$ Qu $\boxtimes$				
					0	20	40	60	80	100	Field Vane $\bigcirc$				
					0	20	40	60	80	100	0	50	100	150	200250
		ASPHALT													
		CONCRETE													
		SAND (FILL) - trace gravel (<25mm diam.), trace fines													
		- brown													
		- moist, compact													
		- poorly graded, sub-angular													
		- AASHTO: A-1 (I)													
-0.5															
-1.0				G38											
-1.5				G39											
-2.0				G40											
-2.5				G41											
-3.0				G42											
-3.5				G43											

END OF TEST HOLE AT 3.0m IN SAND.

Notes:

- 1) Seepage not observed.
- 2) Caving below 1.0m in SAND.
- 3) Test hole dry and open to 2.5m depth immediately after drilling.
- 4) Test hole backfilled with cuttings and bentonite.



Sub-Surface Log

Test Hole TH25-25

1 of 1

Client:WSP

Project Name:2026-2028 Downtown Pavement Renewals

Contractor:Maple Leaf Drilling

Method:125mm Solid Stem Auger, B40 Mobile Truck Mount

Project Number:1000-043-30

Location:UTM : 633145 E 5527843 N - Kennedy St

Ground Elevation:Top of Pavement

Date Drilled:October 6, 2025

Sample Type:

Grab (G)

Shelby Tube (T)

Split Spoon (SS) / SPT

Split Barrel (SB) / LPT

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)						Particle Size (%)						Undrained Shear Strength (kPa)					
					16	17	18	19	20	21	0 20 40 60 80 100						0 50 100 150 200 250					
					PL MC LL						0 20 40 60 80 100						0 50 100 150 200 250					
		ASPHALT																				
		CONCRETE																				
-0.5		CLAY - silty, trace sand - dark grey to black - moist, stiff - intermediate plasticity - AASHTO: A-7-6 (I)																				
-1.0				G31																		
-1.5		SILT - some clay to clayey, trace sand - light brown - moist, soft, intermediate plasticity - AASHTO: A-6 (18)																				
-1.5				G32																		
-2.0				G33																		
-2.5				G34																		
-3.0				G35																		
-3.0		CLAY - silty - grey - moist, very stiff - high plasticity - AASHTO: A-7-6 (I)																				
-3.0				G36																		

END OF TEST HOLE AT 3.0m IN CLAY.

Notes:

1) Seepage an sloughing not observed.

2) Test hole dry and open to 3.0m depth immediately after drilling.

3) Test hole backfilled with cuttings and bentonite.

4) Bulk samples (B37 silt) collected between 1.2m and 2.0m.



Sub-Surface Log

Test Hole TH25-27

1 of 1

Client: WSP

Project Number: 1000-043-30

Project Name: 2026-2028 Downtown Pavement Renewals

Location: UTM : 633072 E 5528030 N - Kennedy St

Contractor: Maple Leaf Drilling

Ground Elevation: Top of Pavement

Method: 125mm Solid Stem Auger, B40 Mobile Truck Mount

Date Drilled: October 6, 2025

Sample Type:

Grab (G)

Shelby Tube (T)

Split Spoon (SS) / SPT

Split Barrel (SB) / LPT

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)						Undrained Shear Strength (kPa)				
					16	17	18	19	20	21	Test Type				
					Particle Size (%)						Δ Torvane Δ				
					0	20	40	60	80	100	✱ Pocket Pen. ✱				
					PL MC LL						⊠ Qu ⊠				
					0	20	40	60	80	100	0	50	100	150	200250
		ASPHALT													
		CONCRETE													
-0.5		CLAY - silty, trace sand to 0.9m - black - moist, stiff - intermediate plasticity - AASHTO: A-7-6 (I)													
-1.0		SILT - some clay, trace sand - light brown - moist, soft to firm - low to intermediate plasticity - AASHTO: A-6 (I)		G17											
-1.5				G18											
-2.0				G19											
-2.5				G20											
-3.0		CLAY - silty - grey - moist, stiff - high plasticity - AASHTO: A-7-6 (I)		G21											
				G22											

END OF TEST HOLE AT 3.0m IN CLAY.

Notes:

- Seepage and sloughing not observed.
- Test hole dry and squeezed in at 2.2m depth (in silt) immediately after drilling.
- Test hole backfilled with cuttings and bentonite.
- Bulk samples (B23 silt) collected between 0.8m and 2.0m.



Sub-Surface Log

Test Hole TH25-28

1 of 1

Client: WSP Project Number: 1000-043-30
Project Name: 2026-2028 Downtown Pavement Renewals Location: UTM : 633036 E 5528123 N - Kennedy St
Contractor: Maple Leaf Drilling Ground Elevation: Top of Pavement
Method: 125mm Solid Stem Auger, B40 Mobile Truck Mount Date Drilled: October 6, 2025

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

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

Depth (m)	Soil Symbol	MATERIAL DESCRIPTION	Sample Type	Sample Number	Bulk Unit Wt (kN/m ³)		Particle Size (%)		Undrained Shear Strength (kPa)																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																						
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Sub-Surface Log

Test Hole TH25-29

1 of 1

Client: WSP

Project Name: 2026-2028 Downtown Pavement Renewals

Contractor: Maple Leaf Drilling

Method: 125mm Solid Stem Auger, B40 Mobile Truck Mount

Project Number: 1000-043-30

Location: UTM : 633008 E 5528196 N - Kennedy St

Ground Elevation: Top of Pavement

Date Drilled: October 6, 2025

Sample Type:

Grab (G) Shelby Tube (T) Split Spoon (SS) / SPT Split Barrel (SB) / LPT 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)		Particle Size (%)					Undrained Shear Strength (kPa)				
					16	17	18	19	20	21	Test Type					
		ASPHALT														
		CONCRETE														
-0.5		CLAY - silty, trace sand - black - moist, stiff - intermediate plasticity - AASHTO: A-7-6 (I)		G01												
-1.0		SILT - some clay - light brown, moist, firm, low plasticity - AASHTO: A-6 (I)		G02												
-1.5				G03												
-2.0		CLAY - silty - grey - moist, very stiff - high plasticity - AASHTO: A-7-6 (I) - stiff below 1.8m		G04												
-2.5				G05												
-3.0		- trace oxidation (<20mm diam.) between 2.3m and 2.6m		G06												
				G07												

END OF TEST HOLE AT 3.0m IN CLAY.

Notes:

1) Seepage and sloughing not observed.

2) Test hole dry and open to 3.0m depth immediately after drilling.

3) Test hole backfilled with cuttings and bentonite.

4) Bulk samples (B08 silt and B09 clay) collected between 0.8m and 2.0m.

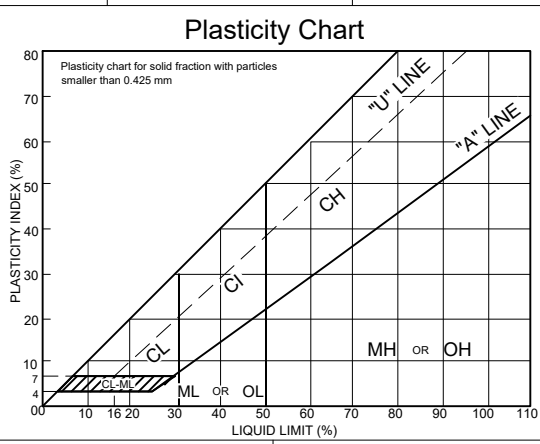
Logged By: Kate Franklin

Reviewed By: N.J Ferreira

Project Engineer: Nelson Ferreira

GENERAL NOTES

- Classifications are based on the Unified Soil Classification System and include consistency, moisture, and color. Field descriptions have been modified to reflect results of laboratory tests where deemed appropriate.
- Descriptions on these test hole logs apply only at the specific test hole locations and at the time the test holes were drilled. Variability of soil and groundwater conditions may exist between test hole locations.
- When the following classification terms are used in this report or test hole logs, the primary and secondary soil fractions may be visually estimated.

Major Divisions	USCS Classification	Symbols	Typical Names	Laboratory Classification Criteria	Particle Size	Material
Coarse-Grained soils (More than half the material is larger than No. 200 sieve size)	Gravels (More than half of coarse fraction is larger than 4.75 mm)	GW	Well-graded gravels, gravel-sand mixtures, little or no fines	$C_u = \frac{D_{60}}{D_{10}}$ greater than 4; $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ between 1 and 3	ASTM Sieve sizes	Sand
		GP	Poorly-graded gravels, gravel-sand mixtures, little or no fines	Not meeting all gradation requirements for GW		
		GM	Silty gravels, gravel-sand-silt mixtures	Atterberg limits below "A" line or P.I. less than 4		
		GC	Clayey gravels, gravel-sand-silt mixtures	Atterberg limits above "A" line or P.I. greater than 7		
	Sands (More than half of coarse fraction is smaller than 4.75 mm)	SW	Well-graded sands, gravelly sands, little or no fines	$C_u = \frac{D_{60}}{D_{10}}$ greater than 6; $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ between 1 and 3	mm	Coarse Medium Fine
		SP	Poorly-graded sands, gravelly sands, little or no fines	Not meeting all gradation requirements for SW		
		SM	Silty sands, sand-silt mixtures	Atterberg limits below "A" line or P.I. less than 4		
		SC	Clayey sands, sand-clay mixtures	Atterberg limits above "A" line or P.I. greater than 7		
Fine-Grained soils (More than half the material is smaller than No. 200 sieve size)	Silt and Silts (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  Von Post Classification Limit Strong colour or odour, and often fibrous texture	ASTM Sieve Sizes	Material
		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			
	Silt and Clays (Liquid limit greater than 50)	MH	Inorganic silts, micaceous or distomaceous fine sandy or silty soils, organic silts		mm	Boulders Cobbles Gravel Coarse Fine
		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			

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

Other Symbol Types

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

LEGEND OF ABBREVIATIONS AND SYMBOLS

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

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
with *	with silt, with sand	> 35 percent

* Used when the material is classified based on behaviour as a cohesive material

TERMS DESCRIBING CONSISTENCY OR COMPACTION CONDITION

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

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

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

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

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

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



**2026-2028 Downtown Pavement Renewals
Sub-Surface Investigation
Kennedy St - Broadway Ave to Portage Ave**

Test Hole No.	Test Hole Location	Pavement Surface		Pavement Structure Material		Subgrade Description	Sample Depth (m)		Moisture Content (%)	Grain Size Analysis				Atterberg Limits		
		Type	Thickness (mm)	Type	Thickness (mm)		Top (m)	Bottom (m)		Clay (%)	Silt (%)	Sand (%)	Gravel (%)	Plastic	Liquid	Plasticity Index
TH25-23	UTM : 5527683 N, 633204 E Located 18 m North of Broadway Ave intersection, Southbound middle lane, 5.0 m West of East curb.	Asphalt	170	Concrete	200	Clay, AASHTO: A-7-6 (I)	0.9	1.1	30							
						Clay, AASHTO: A-7-6 (I)	1.2	1.4	35							
						Clay, AASHTO: A-7-6 (I)	1.5	1.7	31							
						Clay, AASHTO: A-7-6 (I)	1.9	2.1	34							
						Clay, AASHTO: A-7-6 (I)	2.3	2.4	42							
						Clay, AASHTO: A-7-6 (I)	2.8	3.0	48							
TH25-24	UTM : 5527779 N, 633167 E Located 21 m South of York Ave intersection, Southbound middle lane, 5.7 m West of East curb.	Asphalt	130	Concrete	240	Sand, AASHTO: A-1 (I)	0.9	1.1	6							
						Sand, AASHTO: A-1 (I)	1.2	1.4	4							
						Sand, AASHTO: A-1 (I)	1.5	1.7	8							
						Sand, AASHTO: A-1 (I)	1.9	2.1	12							
						Sand, AASHTO: A-1 (I)	2.3	2.4	7							
						Sand, AASHTO: A-1 (I)	2.8	3.0	7							
TH25-25	UTM : 5527843 N, 633145 E Located 25 m North of York Ave intersection, Southbound middle lane, 4.0 m West of East curb.	Asphalt	205	Concrete	95	Clay, AASHTO: A-7-6 (I)	0.9	1.1	38							
						Silt, AASHTO: A-6 (18)	1.2	1.4	24	23	73	4	0	14	34	20
						Silt, AASHTO: A-6 (18)	1.5	1.7	24							
						Silt, AASHTO: A-6 (18)	1.9	2.1	22							
						Silt, AASHTO: A-6 (18)	2.3	2.4	25							
						Clay, AASHTO: A-7-6 (I)	2.8	3.0	35							
TH25-26	UTM : 5527941 N, 633106 E Located 8 m North of #183 Kennedy St, Southbound middle lane, 4.0 m East of West curb.	Asphalt	180	Concrete	95	Sand, AASHTO: A-1 (I)	0.8	0.9	8							
						Clay, AASHTO: A-7-6 (I)	1.1	1.2	31							
						Clay, AASHTO: A-7-6 (I)	1.4	1.5	31							
						Clay, AASHTO: A-7-6 (I)	1.8	1.9	35							
						Clay, AASHTO: A-7-6 (I)	2.1	2.3	41							
						Clay, AASHTO: A-7-6 (I)	2.7	2.8	43							



**2026-2028 Downtown Pavement Renewals
Sub-Surface Investigation
Kennedy St - Broadway Ave to Portage Ave**

Test Hole No.	Test Hole Location	Pavement Surface		Pavement Structure Material		Subgrade Description	Sample Depth (m)		Moisture Content (%)	Grain Size Analysis				Atterberg Limits		
		Type	Thickness (mm)	Type	Thickness (mm)		Top (m)	Bottom (m)		Clay (%)	Silt (%)	Sand (%)	Gravel (%)	Plastic	Liquid	Plasticity Index
TH25-27	UTM : 5528030 N, 633072 E Located at #203 Kennedy St, Southbound middle lane, 5.0 m East of West curb.	Asphalt	280	Concrete	100	Clay, AASHTO: A-7-6 (I)	0.9	1.1	36							
						Silt, AASHTO: A-6 (I)	1.2	1.4	29							
						Silt, AASHTO: A-6 (I)	1.5	1.7	33							
						Silt, AASHTO: A-6 (I)	1.9	2.1	28							
						Clay, AASHTO: A-7-6 (I)	2.3	2.4	35							
						Clay, AASHTO: A-7-6 (I)	2.8	3.0	42							
TH25-28	UTM : 5528126 N, 633036 E Located at #244 Kennedy St, Southbound middle lane, 3.0 m East of West curb.	Asphalt	250	Concrete	130	Clay, AASHTO: A-7-6 (60)	0.9	1.1	35	63	34	3	0	24	78	54
						Silt, AASHTO: A-6 (I)	1.2	1.4	23							
						Silt, AASHTO: A-6 (I)	1.5	1.7	28							
						Silt, AASHTO: A-6 (I)	1.9	2.1	21							
						Silt, AASHTO: A-6 (I)	2.3	2.4	43							
						Clay, AASHTO: A-7-6 (I)	2.8	3.0	43							
TH25-29	UTM : 5528196 N, 633008 E Located at #258 Kennedy St, Southbound curb lane, 2.5 m East of West curb.	Asphalt	150	Concrete	210	Clay, AASHTO: A-7-6 (I)	0.6	0.8	51							
						Silt, AASHTO: A-6 (I)	0.9	1.1	25							
						Silt, AASHTO: A-6 (I)	1.2	1.4	23							
						Clay, AASHTO: A-7-6 (I)	1.5	1.7	37							
						Clay, AASHTO: A-7-6 (I)	1.9	2.1	42							
						Clay, AASHTO: A-7-6 (I)	2.3	2.4	47							
						Clay, AASHTO: A-7-6 (I)	2.8	3.0	50							

Project No. 1000-043-30
Client WSP
Project 2026-2028 Downtown Pavement Renewals - Kennedy St.
Kennedy St - Broadway Ave to Portage Ave
Sample Date 06-Oct-25
Test Date 24-Oct-25
Technician G. Shvartsman

Test Hole	TH25-23	TH25-23	TH25-23	TH25-23	TH25-23	TH25-23
Depth (m)	0.9 - 1.1	1.2 - 1.4	1.5 - 1.7	1.9 - 2.1	2.3 - 2.4	2.8 - 3.0
Sample #	G45	G46	G47	G48	G49	G50
Tare ID	W96	D20	F18	QT4	AB46	QT124
Mass of tare	8.9	8.2	7.0	8.3	6.8	8.2
Mass wet + tare	163.8	164.6	153.0	157.6	155.9	160.5
Mass dry + tare	128.3	124.1	118.3	119.9	111.7	111.1
Mass water	35.5	40.5	34.7	37.7	44.2	49.4
Mass dry soil	119.4	115.9	111.3	111.6	104.9	102.9
Moisture %	29.7%	34.9%	31.2%	33.8%	42.1%	48.0%

Test Hole	TH25-24	TH25-24	TH25-24	TH25-24	TH25-24	TH25-24
Depth (m)	0.9 - 1.1	1.2 - 1.4	1.5 - 1.7	1.9 - 2.1	2.3 - 2.4	2.8 - 3.0
Sample #	G38	G39	G40	G41	G42	G43
Tare ID	KWAS	D216	K1	N72	Z68	N56
Mass of tare	6.7	7.0	6.8	8.6	8.5	8.6
Mass wet + tare	165.8	162.3	175.4	168.0	164.0	159.8
Mass dry + tare	156.3	155.8	163.2	151.2	154.1	149.4
Mass water	9.5	6.5	12.2	16.8	9.9	10.4
Mass dry soil	149.6	148.8	156.4	142.6	145.6	140.8
Moisture %	6.4%	4.4%	7.8%	11.8%	6.8%	7.4%

Test Hole	TH25-25	TH25-25	TH25-25	TH25-25	TH25-25	TH25-25
Depth (m)	0.9 - 1.1	1.2 - 1.4	1.5 - 1.7	1.9 - 2.1	2.3 - 2.4	2.8 - 3.0
Sample #	G31	G32	G33	G34	G35	G36
Tare ID	B10	QT78	N59	Z132	QT3	M21
Mass of tare	6.8	8.4	8.4	9.0	8.4	7.2
Mass wet + tare	229.6	418.0	299.8	265.4	331.0	246.4
Mass dry + tare	168.2	339.0	242.8	219.0	266.6	184.0
Mass water	61.4	79.0	57.0	46.4	64.4	62.4
Mass dry soil	161.4	330.6	234.4	210.0	258.2	176.8
Moisture %	38.0%	23.9%	24.3%	22.1%	24.9%	35.3%

Project No. 1000-043-30
Client WSP
Project 2026-2028 Downtown Pavement Renewals - Kennedy St.
Kennedy St - Broadway Ave to Portage Ave
Sample Date 06-Oct-25
Test Date 24-Oct-25
Technician G. Shvartsman

Test Hole	TH25-26	TH25-26	TH25-26	TH25-26	TH25-26	TH25-26
Depth (m)	0.8 - 0.9	1.1 - 1.2	1.4 - 1.5	1.8 - 1.9	2.1 - 2.3	2.7 - 2.8
Sample #	G24	G25	G26	G27	G28	G29
Tare ID	F91	W10	E73	ZD16	B18	B9
Mass of tare	8.4	8.6	7.0	8.2	6.8	7.0
Mass wet + tare	229.6	257.0	240.6	255.8	278.8	253.4
Mass dry + tare	213.2	197.8	185.4	192.2	199.6	179.0
Mass water	16.4	59.2	55.2	63.6	79.2	74.4
Mass dry soil	204.8	189.2	178.4	184.0	192.8	172.0
Moisture %	8.0%	31.3%	30.9%	34.6%	41.1%	43.3%

Test Hole	TH25-27	TH25-27	TH25-27	TH25-27	TH25-27	TH25-27
Depth (m)	0.9 - 1.1	1.2 - 1.4	1.5 - 1.7	1.9 - 2.1	2.3 - 2.4	2.8 - 3.0
Sample #	G17	G18	G19	G20	G21	G22
Tare ID	F64	D235	F34	H50	E81	M59
Mass of tare	8.6	6.8	8.6	8.6	7.0	8.6
Mass wet + tare	251.8	254.4	276.6	293.6	241.2	236.0
Mass dry + tare	187.2	199.4	210.8	231.4	181.0	169.0
Mass water	64.6	55.0	65.8	62.2	60.2	67.0
Mass dry soil	178.6	192.6	202.2	222.8	174.0	160.4
Moisture %	36.2%	28.6%	32.5%	27.9%	34.6%	41.8%

Test Hole	TH25-28	TH25-28	TH25-28	TH25-28	TH25-28	TH25-28
Depth (m)	0.9 - 1.1	1.2 - 1.4	1.5 - 1.7	1.9 - 2.1	2.3 - 2.4	2.8 - 3.0
Sample #	G10	G11	G12	G13	G14	G15
Tare ID	QT35	QT61	AC30	QT42	M11	E35
Mass of tare	8.0	8.4	7.2	8.2	6.8	7.2
Mass wet + tare	417.4	264.2	304.8	289.0	267.2	261.2
Mass dry + tare	310.8	215.6	239.8	239.6	188.4	184.4
Mass water	106.6	48.6	65.0	49.4	78.8	76.8
Mass dry soil	302.8	207.2	232.6	231.4	181.6	177.2
Moisture %	35.2%	23.5%	27.9%	21.3%	43.4%	43.3%



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

Moisture Content Report ASTM D2216-98

Project No. 1000-043-30
Client WSP
Project 2026-2028 Downtown Pavement Renewals - Kennedy St.
Kennedy St - Broadway Ave to Portage Ave
Sample Date 06-Oct-25
Test Date 24-Oct-25
Technician G. Shvartsman

Test Hole	TH25-29	TH25-29	TH25-29	TH25-29	TH25-29	TH25-29
Depth (m)	0.6 - 0.8	0.9 - 1.1	1.2 - 1.4	1.5 - 1.7	1.9 - 2.1	2.3 - 2.4
Sample #	G01	G02	G03	G04	G05	G06
Tare ID	AB37	Z78	W80	Z09	Z41	M10
Mass of tare	6.8	8.6	8.6	8.6	8.6	6.8
Mass wet + tare	277.8	270.0	320.0	265.4	247.0	304.6
Mass dry + tare	186.0	217.4	262.8	196.4	176.2	208.8
Mass water	91.8	52.6	57.2	69.0	70.8	95.8
Mass dry soil	179.2	208.8	254.2	187.8	167.6	202.0
Moisture %	51.2%	25.2%	22.5%	36.7%	42.2%	47.4%

Test Hole	TH25-29					
Depth (m)	2.8 - 3.0					
Sample #	G07					
Tare ID	E25					
Mass of tare	7.0					
Mass wet + tare	286.0					
Mass dry + tare	193.4					
Mass water	92.6					
Mass dry soil	186.4					
Moisture %	49.7%					

Project No. 1000-043-30
Client WSP
Project 2026-2028 Downtown Pavement Renewals

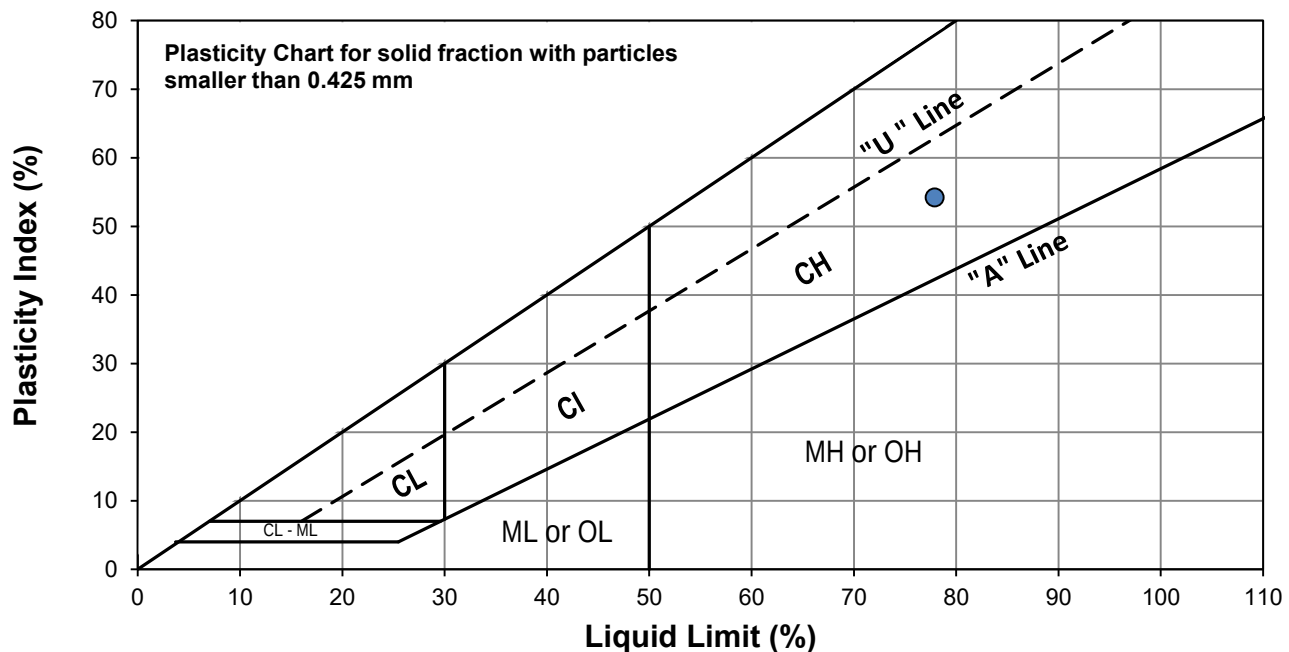


Test Hole TH25-28 (Kennedy St - Broadway Ave to Portage Ave)
Sample # G10
Depth (m) 0.9 - 1.1
Sample Date 06-Oct-25
Test Date 30-Oct-25
Technician T. Green

Liquid Limit	78
Plastic Limit	24
Plasticity Index	54

Liquid Limit

Trial #	1	2	3		
Number of Blows (N)	19	25	33		
Mass Tare (g)	14.063	13.829	13.974		
Mass Wet Soil + Tare (g)	24.584	23.219	23.480		
Mass Dry Soil + Tare (g)	19.922	19.102	19.373		
Mass Water (g)	4.662	4.117	4.107		
Mass Dry Soil (g)	5.859	5.273	5.399		
Moisture Content (%)	79.570	78.077	76.070		



Plastic Limit

Trial #	1	2	3	4	5
Mass Tare (g)	14.167	14.209			
Mass Wet Soil + Tare (g)	22.910	19.580			
Mass Dry Soil + Tare (g)	21.233	18.552			
Mass Water (g)	1.677	1.028			
Mass Dry Soil (g)	7.066	4.343			
Moisture Content (%)	23.733	23.670			

Note: Additional information recorded/measured for this test is available upon request.

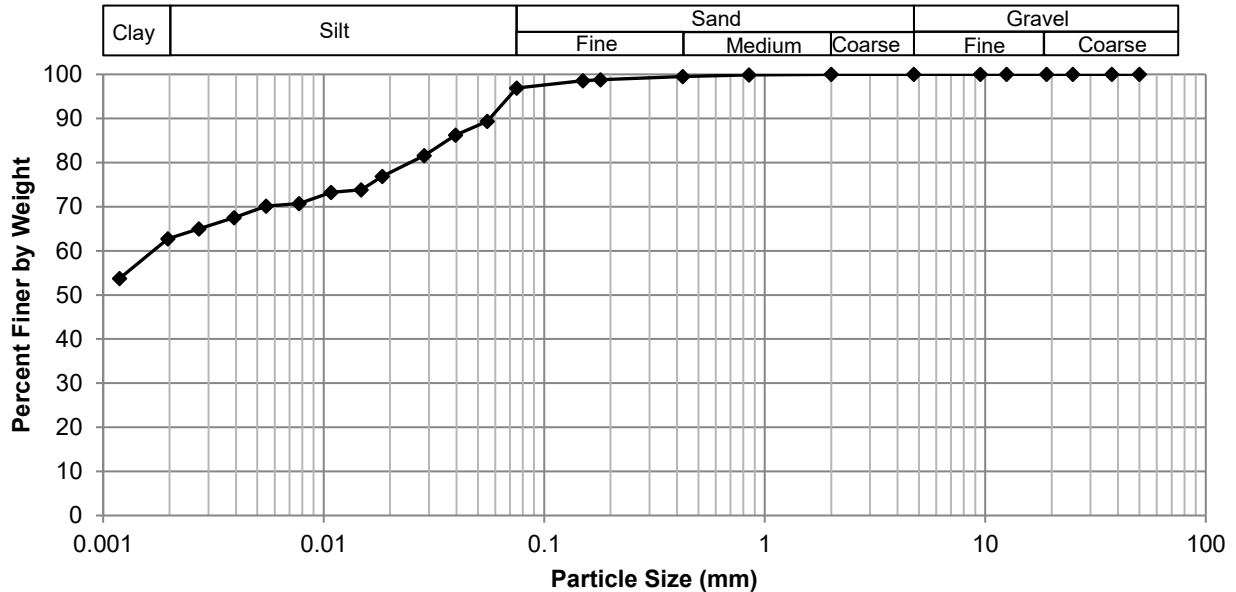
Project No. 1000-043-30
Client WSP
Project 2026-2028 Downtown Pavement Renewals



Test Hole TH25-28 (Kennedy St - Broadway Ave to Portage Ave)
Sample # G10
Depth (m) 0.9 - 1.1
Sample Date 06-Oct-25
Test Date 29-Oct-25
Technician A. Fidler-Kliwer

Gravel	0.0%
Sand	3.1%
Silt	34.1%
Clay	62.9%

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	96.93
37.5	100.00	2.00	100.00	0.0551	89.38
25.0	100.00	0.850	99.84	0.0396	86.25
19.0	100.00	0.425	99.50	0.0286	81.56
12.5	100.00	0.180	98.77	0.0185	76.87
9.50	100.00	0.150	98.56	0.0148	73.85
4.75	100.00	0.075	96.93	0.0108	73.23
				0.0077	70.73
				0.0055	70.10
				0.0039	67.49
				0.0027	65.01
				0.0020	62.74
				0.0012	53.75

Project No. 1000-043-30
Client WSP
Project 2026-2028 Downtown Pavement Renewals

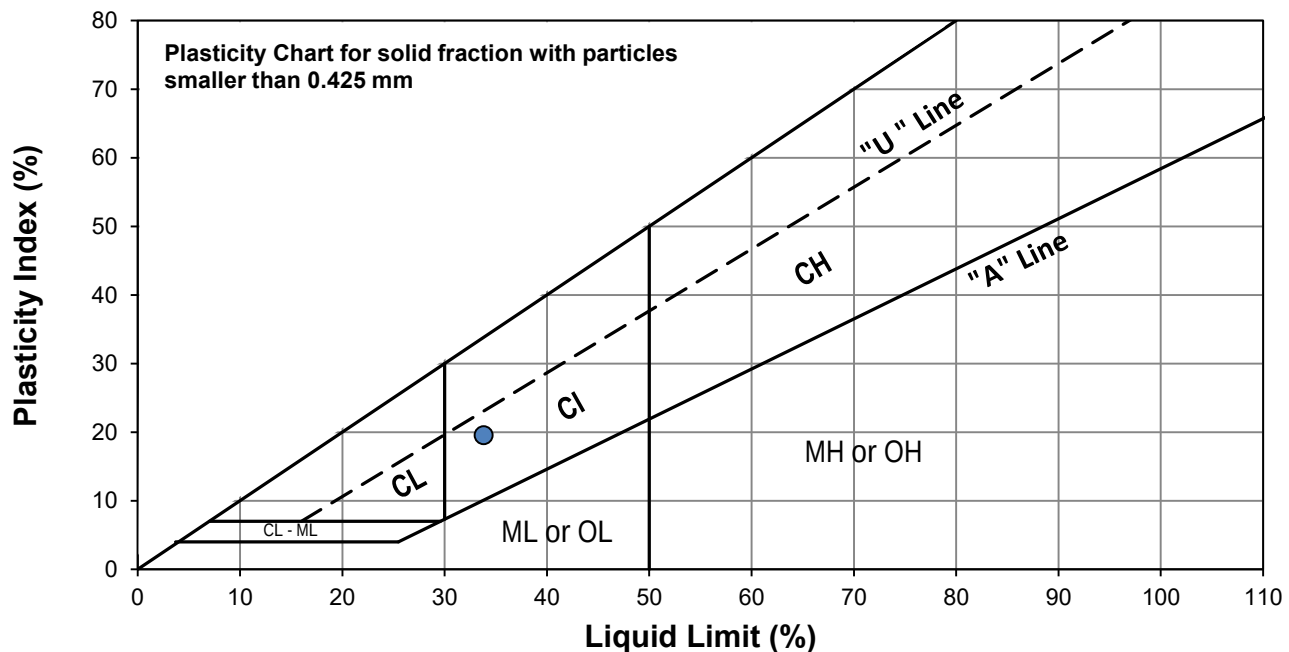


Test Hole TH25-25 (Kennedy St - Broadway Ave to Portage Ave)
Sample # G32
Depth (m) 1.2 - 1.4
Sample Date 06-Oct-25
Test Date 29-Oct-25
Technician D. Sellick

Liquid Limit	34
Plastic Limit	14
Plasticity Index	20

Liquid Limit

Trial #	1	2	3		
Number of Blows (N)	15	20	34		
Mass Tare (g)	14.070	13.794	13.779		
Mass Wet Soil + Tare (g)	23.873	23.029	23.360		
Mass Dry Soil + Tare (g)	21.350	20.686	20.961		
Mass Water (g)	2.523	2.343	2.399		
Mass Dry Soil (g)	7.280	6.892	7.182		
Moisture Content (%)	34.657	33.996	33.403		



Plastic Limit

Trial #	1	2	3	4	5
Mass Tare (g)	14.024	13.957			
Mass Wet Soil + Tare (g)	21.884	21.607			
Mass Dry Soil + Tare (g)	20.907	20.647			
Mass Water (g)	0.977	0.960			
Mass Dry Soil (g)	6.883	6.690			
Moisture Content (%)	14.194	14.350			

Note: Additional information recorded/measured for this test is available upon request.

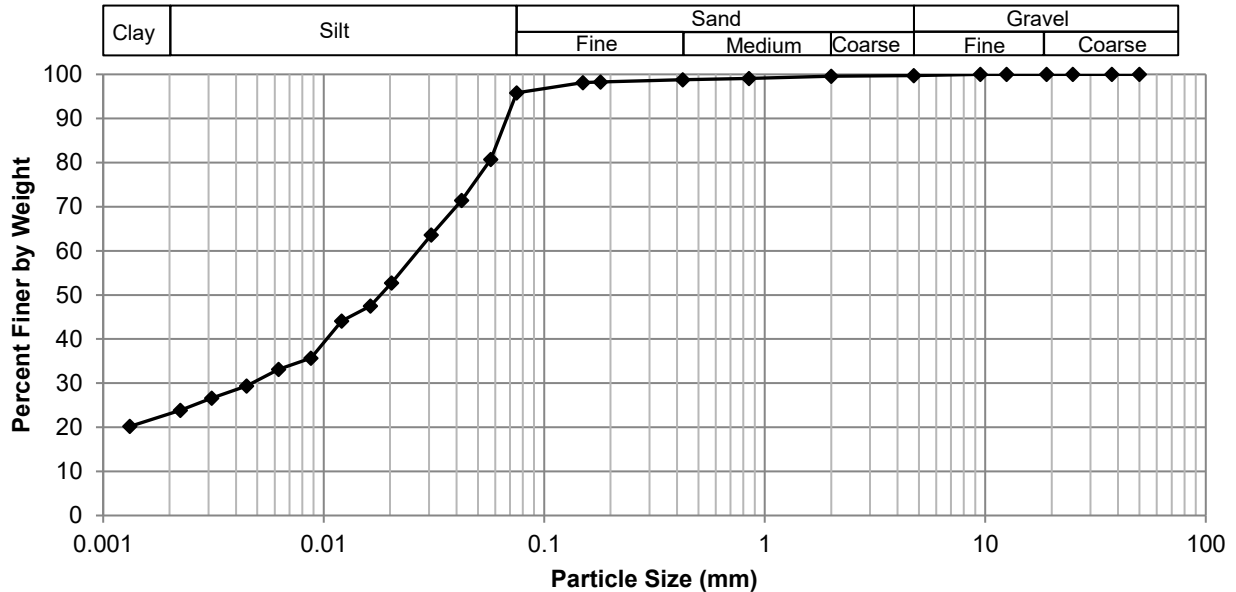
Project No. 1000-043-30
Client WSP
Project 2026-2028 Downtown Pavement Renewals



Test Hole TH25-25 (Kennedy St - Broadway Ave to Portage Ave)
Sample # G32
Depth (m) 1.2 - 1.4
Sample Date 06-Oct-25
Test Date 29-Oct-25
Technician A. Fidler-Kliewer

Gravel	0.2%
Sand	4.0%
Silt	72.9%
Clay	22.9%

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	99.76	0.0750	95.79
37.5	100.00	2.00	99.56	0.0573	80.75
25.0	100.00	0.850	99.05	0.0422	71.41
19.0	100.00	0.425	98.77	0.0308	63.63
12.5	100.00	0.180	98.29	0.0203	52.73
9.50	100.00	0.150	98.14	0.0163	47.49
4.75	99.76	0.075	95.79	0.0121	44.07
				0.0088	35.66
				0.0062	33.17
				0.0045	29.38
				0.0031	26.58
				0.0022	23.88
				0.0013	20.20



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Standard Proctor Compaction Test

ASTM D698-12e2

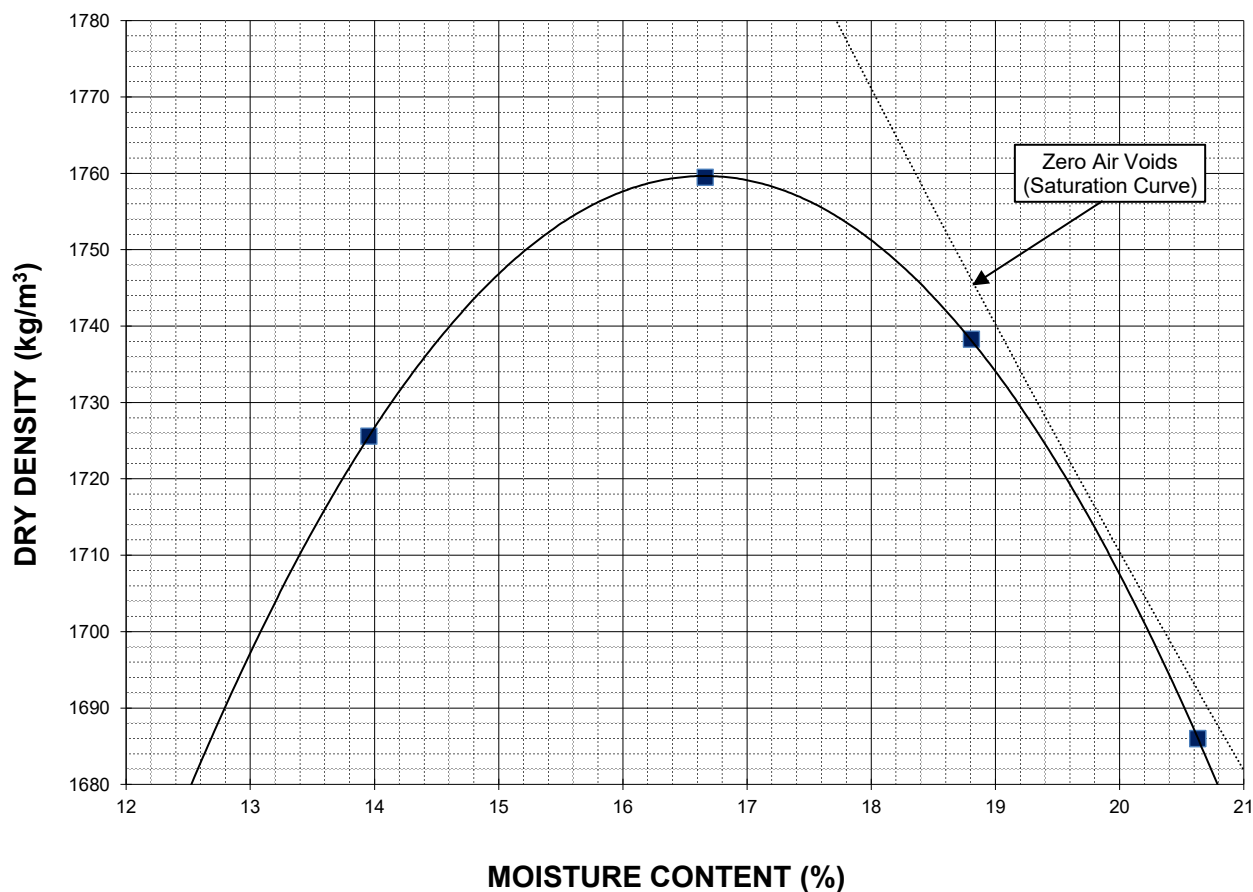
Project No. 1000-043-30
Client WSP
Project 2026-2028 Downtown Pavement Renewals



Sample # L25-443-01 (B16, B23 & B37)
Source Kennedy St (TH25-25, TH25-7 & TH25-28)
Material Silt
Sample Date 06-Oct-25
Test Date 09-Oct-25
Technician K. Desikan

Maximum Dry Density (kg/m³)	1760
Optimum Moisture (%)	16.7

Trial Number	1	2	3	4	
Wet Density (kg/m ³)	1966	2053	2065	2034	
Dry Density (kg/m ³)	1726	1760	1738	1686	
Moisture Content (%)	14.0	16.7	18.8	20.6	



Note: Additional information recorded/measured for this test is available upon request.



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California Bearing Ratio Test Data Sheet

ASTM D1883-21

Project No.	1000-043-30	Source	Kennedy St (TH25-25, TH25-7 & TH25-28)
Client	WSP	Material	Silt
Project	2026-2028 Downtown Pavement Renewals	Sample Date	06-Oct-25
Sample #	L25-443-01 (B16, B23 & B37)	Test Date	16-Oct-25
		Technician	A. Dustmamatov

Proctor Results (ASTM D698)

Maximum Dry Density	1760 kg/m ³
Optimum Moisture Content	16.7 %
Material Retained on 19 mm Sieve	0.0 %

CBR Sample Compaction

Dry Density	1669 kg/m ³
Initial Moisture Content	16.8 %
Relative Density	94.8 % SPMDD

Soaking Results

Surcharge	4.54 kg
Swell	1.1 %
Moisture Content in top 25 mm	23.1 %
Immersion Period	96 h

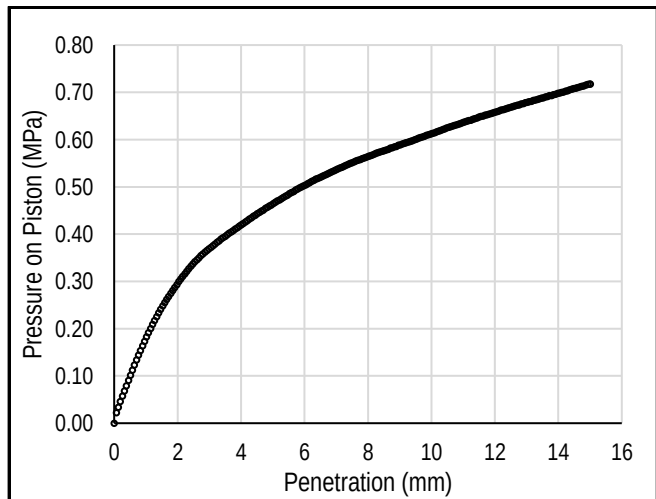
CBR Results

CBR at 2.54 mm	5.0 %
CBR at 5.08 mm	4.5 %
Zero Correction	0 mm

Test Data

Penetration (mm)	Measured Pressure (MPa)	Corrected Pressure (MPa)
0.64	0.12	0.12
1.27	0.22	0.22
1.91	0.29	0.29
2.54	0.34	0.34
3.18	0.38	0.38
3.81	0.41	0.41
4.45	0.44	0.44
5.08	0.47	0.47
7.62	0.56	0.56
10.16	0.62	0.62
12.70	0.67	0.67

Load/Penetration Curve



Comments:

Sample prepared in accordance with the City of Winnipeg guidelines.



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California Bearing Ratio Test Data Sheet

ASTM D1883-21

Project No.	1000-043-30	Source	Kennedy St (TH25-23, TH25-26 & TH25-29)
Client	WSP	Material	Clay
Project	2026-2028 Downtown Pavement Renewals	Sample Date	06-Oct-25
Sample #	L25-443-02 (B09, B30 & B52)	Test Date	16-Oct-25
		Technician	A. Dustmamatov

Proctor Results (ASTM D698)

Maximum Dry Density	1434 kg/m ³
Optimum Moisture Content	28.6 %
Material Retained on 19 mm Sieve	0.0 %

CBR Sample Compaction

Dry Density	1357 kg/m ³
Initial Moisture Content	29.2 %
Relative Density	94.7 % SPMDD

Soaking Results

Surcharge	4.54 kg
Swell	4.5 %
Moisture Content in top 25 mm	42.5 %
Immersion Period	96 h

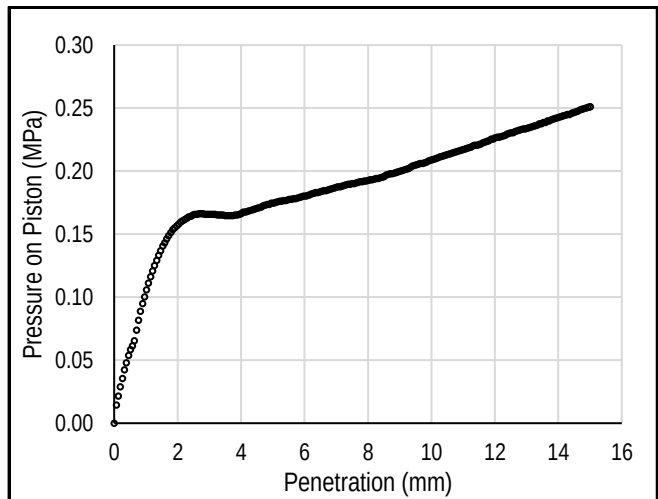
CBR Results

CBR at 2.54 mm	2.4 %
CBR at 5.08 mm	1.7 %
Zero Correction	0 mm

Test Data

Penetration (mm)	Measured Pressure (MPa)	Corrected Pressure (MPa)
0.64	0.07	0.07
1.27	0.13	0.13
1.91	0.16	0.16
2.54	0.17	0.17
3.18	0.17	0.17
3.81	0.17	0.17
4.45	0.17	0.17
5.08	0.18	0.18
7.62	0.19	0.19
10.16	0.21	0.21
12.70	0.23	0.23

Load/Penetration Curve



Comments:

Sample prepared in accordance with the City of Winnipeg guidelines.



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Standard Proctor Compaction Test

ASTM D698-12e2

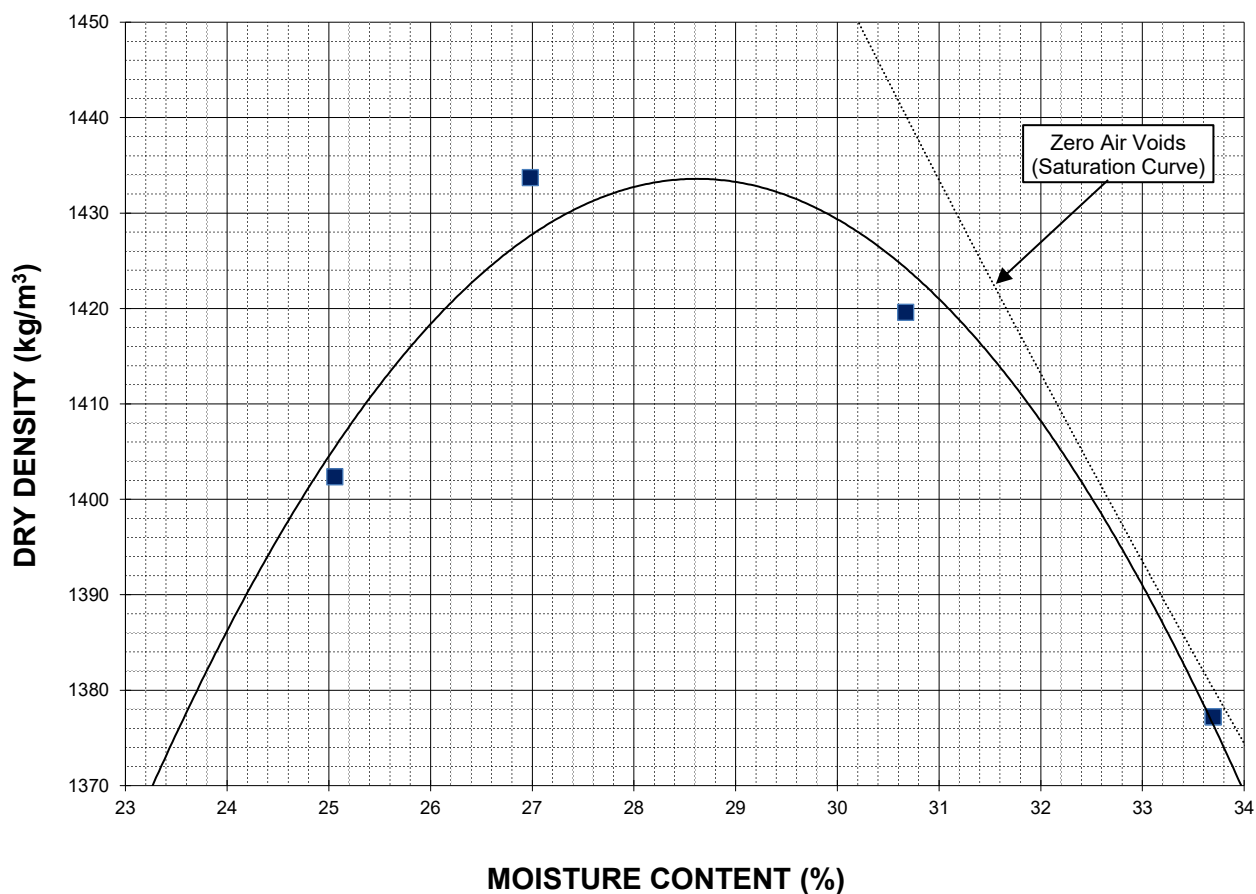
Project No. 1000-043-30
Client WSP
Project 2026-2028 Downtown Pavement Renewals



Sample # L25-443-02 (B09, B30 & B52)
Source Kennedy St (TH25-23, TH25-26 & TH25-29)
Material Clay
Sample Date 06-Oct-25
Test Date 09-Oct-25
Technician K. Desikan

Maximum Dry Density (kg/m³)	1434
Optimum Moisture (%)	28.6

Trial Number	1	2	3	4	
Wet Density (kg/m ³)	1754	1821	1855	1841	
Dry Density (kg/m ³)	1402	1434	1420	1377	
Moisture Content (%)	25.1	27.0	30.7	33.7	



Note: Additional information recorded/measured for this test is available upon request.



Photo 1: Pavement Core Sample at TH25-23



Photo 2: Pavement Core Sample at TH25-24



Photo 3: Pavement Core Sample at TH25-25



Photo 4: Pavement Core Sample at TH25-26



Photo 5: Pavement Core Sample at TH25-27



Photo 6: Pavement Core Sample at TH25-28



Photo 7: Pavement Core Sample at TH25-29

Appendix F
Test Hole Logs, Summary Tables, Lab Testing Results and
Photographs of Pavement Core Samples
Edmonton St. – Broadway Ave to Portage Ave



Sub-Surface Log

Test Hole TH25-18

1 of 1

Client:WSP

Project Name:2026-2028 Downtown Pavement Renewals

Contractor:Maple Leaf Drilling

Method:125mm Solid Stem Auger, B40 Mobile Truck Mount

Project Number:1000-043-30

Location:UTM : 633296 E 5527742 N - Edmonton St

Ground Elevation:Top of Pavement

Date Drilled:October 7, 2025

Sample Type:

Grab (G)

Shelby Tube (T)

Split Spoon (SS) / SPT

Split Barrel (SB) / LPT

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)						Undrained Shear Strength (kPa)				
					16	17	18	19	20	21	Test Type				
					Particle Size (%)						Torvane				
					0	20	40	60	80	100	Pocket Pen.				
					PL MC LL						Qu				
					0	20	40	60	80	100	0	50	100	150	200250
		ASPHALT													
		CONCRETE													
		CLAY - with silt, trace sand, trace gravel													
		- black													
		- moist, very stiff													
		- high plasticity													
		- AASHTO: A-7-6 (39)													
-0.5															
		- light brown, firm below 0.9m													
-1.0															
		- silty, greyish brown below 1.2m													
-1.5															
		- stiff below 1.7m													
-2.0															
		- trace silt inclusions (<40mm diam.) between 2.1m and 2.4m													
-2.5															
-3.0															

END OF TEST HOLE AT 3.0m IN CLAY.

Notes:

- 1) Seepage and sloughing not observed.
- 2) Test hole dry and open to 3.0m depth immediately after drilling.
- 3) Test hole backfilled with cuttings and bentonite.
- 4) Bulk samples (B59 clay) collected between 0.8m and 2.0m.



Sub-Surface Log

Test Hole TH25-19

1 of 1

Client:WSP

Project Number:1000-043-30

Project Name:2026-2028 Downtown Pavement Renewals

Location:UTM : 633254 E 5527831 N - Edmonton St

Contractor:Maple Leaf Drilling

Ground Elevation:Top of Pavement

Method:125mm Solid Stem Auger, B40 Mobile Truck Mount

Date Drilled:October 7, 2025

Sample Type:

Grab (G)

Shelby Tube (T)

Split Spoon (SS) / SPT

Split Barrel (SB) / LPT

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)						Undrained Shear Strength (kPa)				
					16	17	18	19	20	21	Test Type				
					Particle Size (%)						Torvane				
					0	20	40	60	80	100	Pocket Pen.				
PL MC LL						Qu									
0 20 40 60 80 100						0 50 100 150 200									
0 20 40 60 80 100						0 50 100 150 200									
		ASPHALT													
		CONCRETE													
		SAND (FILL) - some gravel (<50mm diam.), light brown, moist, compact - well graded (fine sand to coarse gravel), angular, AASHTO: A-1 (I)	G60												
-0.5		CLAY - silty, trace sand to 0.9m - black - moist, very stiff - intermediate to high plasticity - AASHTO: A-7-6 (I)													
-1.0		- brown, high plasticity below 0.9 m	G61												
			G62												
			G63												
-1.5		- with silt, light brown, soft, intermediate plasticity below 1.5m	G64												
			G65												
-2.0															
-2.5		- firm below below 2.4m	G66												
-3.0															

END OF TEST HOLE AT 3.0m IN SILT and CLAY.

Notes:

1) Seepage and sloughing not observed.

2) Test hole dry and open to 3.0m depth immediately after drilling.

3) Test hole backfilled with cuttings and bentonite.

4) Bulk samples (B67 clay and B68 silt and clay) collected between 0.8m and 2.0m.



Sub-Surface Log

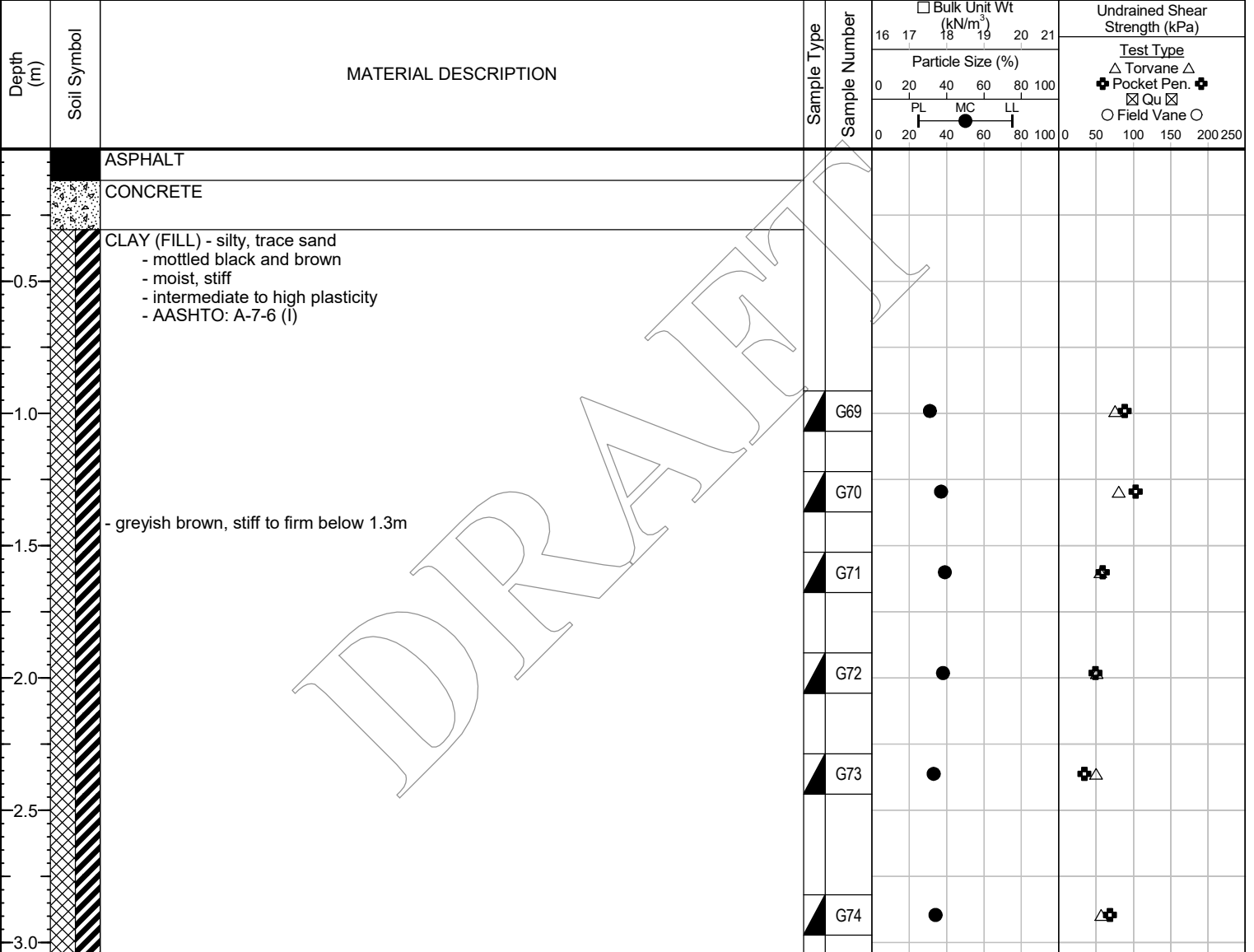
Test Hole TH25-21

1 of 1

Client: WSP Project Number: 1000-043-30
Project Name: 2026-2028 Downtown Pavement Renewals Location: UTM : 633177 E 5528053 N - Edmonton St
Contractor: Maple Leaf Drilling Ground Elevation: Top of Pavement
Method: 125mm Solid Stem Auger, B40 Mobile Truck Mount Date Drilled: October 7, 2025

Sample Type: ☒ Grab (G) ☐ Shelby Tube (T) ☐ Split Spoon (SS) / SPT ☐ Split Barrel (SB) / LPT ☐ Core (C)

Particle Size Legend: ☒ Fines ☐ Clay ☐ Silt ☐ Sand ☐ Gravel ☐ Cobbles ☐ Boulders



END OF TEST HOLE AT 3.0m IN CLAY.

Notes:

- 1) Seepage and sloughing not observed.
- 2) Test hole dry and squeezed in at 1.8m depth immediately after drilling.
- 3) Test hole backfilled with cuttings and bentonite.
- 4) Bulk samples (B75 clay) collected between 0.8m and 2.0m.

Logged By: Kate Franklin Reviewed By: Project Engineer: Nelson Ferreira



Sub-Surface Log

Test Hole TH25-22

1 of 1

Client: WSP

Project Number: 1000-043-30

Project Name: 2026-2028 Downtown Pavement Renewals

Location: UTM : 633142 E 5528140 N - Edmonton St

Contractor: Maple Leaf Drilling

Ground Elevation: Top of Pavement

Method: 125mm Solid Stem Auger, B40 Mobile Truck Mount

Date Drilled: October 7, 2025

Sample Type:

Grab (G)

Shelby Tube (T)

Split Spoon (SS) / SPT

Split Barrel (SB) / LPT

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)						Undrained Shear Strength (kPa)				
					16	17	18	19	20	21	Test Type				
					Particle Size (%)						Pocket Pen. $\oplus$				
					0	20	40	60	80	100	Qu $\boxtimes$				
					PL MC LL						Field Vane $\bigcirc$				
					0	20	40	60	80	100	0	50	100	150	200250
		ASPHALT													
		CONCRETE													
		CLAY - with silt, trace sand													
		- black													
		- moist, very stiff													
		- high plasticity													
		- AASHTO: A-7-6 (51)													
-0.5															
		- silty, grey below 1.1m													
-1.0															
-1.5															
		- brown, stiff below 1.5m													
-2.0															
-2.5															
-3.0															

END OF TEST HOLE AT 3.0m IN CLAY.

Notes:

- 1) Seepage and sloughing not observed.
- 2) Test hole dry and open to 3.0m depth immediately after drilling.
- 3) Test hole backfilled with cuttings and bentonite.
- 4) Bulk samples (B82 clay) collected between 0.8m and 2.0m.

Logged By: Kate Franklin

Reviewed By: N.J Ferreira

Project Engineer: Nelson Ferreira

GENERAL NOTES

- Classifications are based on the Unified Soil Classification System and include consistency, moisture, and color. Field descriptions have been modified to reflect results of laboratory tests where deemed appropriate.
- Descriptions on these test hole logs apply only at the specific test hole locations and at the time the test holes were drilled. Variability of soil and groundwater conditions may exist between test hole locations.
- When the following classification terms are used in this report or test hole logs, the primary and secondary soil fractions may be visually estimated.

Major Divisions			USCS Classification	Symbols	Typical Names	Laboratory Classification Criteria			Particle Size	Material
Coarse-Grained soils (More than half the material is larger than No. 200 sieve size)						ASTM Sieve sizes				
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 cases requiring dual symbols*	$C_u = \frac{D_{60}}{D_{10}}$ greater than 4; $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ between 1 and 3				
		GP		Poorly-graded gravels, gravel-sand mixtures, little or no fines		Not meeting all gradation requirements for GW				
		GM		Silty gravels, gravel-sand-silt mixtures		Atterberg limits below "A" line or P.I. less than 4	Above "A" line with P.I. between 4 and 7 are borderline cases requiring use of dual symbols			
		GC		Clayey gravels, gravel-sand-silt mixtures		Atterberg limits above "A" line or P.I. greater than 7				
	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				
		SM		Silty sands, sand-silt mixtures		Atterberg limits below "A" line or P.I. less than 4	Above "A" line with P.I. between 4 and 7 are borderline cases requiring use of dual symbols			
		SC		Clayey sands, sand-clay mixtures		Atterberg limits above "A" line or P.I. greater than 7				
Determine percentages of sand and gravel from grain size curve, depending on percentage of fines (fraction smaller than No. 200 sieve) coarse-grained soils are classified as follows: Less than 5 percent..... GW, GP, SW, SP More than 12 percent..... GM, GC, SM, SC 6 to 12 percent..... Borderline cases requiring dual symbols*										
Fine-Grained soils (More than half the material is smaller than No. 200 sieve size)						Plasticity Chart		Particle Size	Material	
Silt 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		ASTM Sieve Sizes					
		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				
	MH		Inorganic silts, micaceous or distomaceous fine sandy or silty soils, organic silts			mm	> 300			
		CH						Inorganic clays of high plasticity, fat clays	75 to 300	
		OH						Organic clays of medium to high plasticity, organic silts		19 to 75
	Pt		Peat and other highly organic soils			4.75 to 19				
	Highly Organic Soils						Strong colour or odour, and often fibrous texture			
Von Post Classification Limit										

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

Other Symbol Types

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

LEGEND OF ABBREVIATIONS AND SYMBOLS

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

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
with *	with silt, with sand	> 35 percent

* Used when the material is classified based on behaviour as a cohesive material

TERMS DESCRIBING CONSISTENCY OR COMPACTION CONDITION

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

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

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

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

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

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



**2026-2028 Downtown Pavement Renewals
Sub-Surface Investigation
Edmonton St - Broadway Ave to Portage Ave**

Test Hole No.	Test Hole Location	Pavement Surface		Pavement Structure Material		Subgrade Description	Sample Depth (m)		Moisture Content (%)	Grain Size Analysis				Atterberg Limits		
		Type	Thickness (mm)	Type	Thickness (mm)		Top (m)	Bottom (m)		Clay (%)	Silt (%)	Sand (%)	Gravel (%)	Plastic	Liquid	Plasticity Index
TH25-18	UTM : 5527742 N, 633296 E Located 24 m North of Broadway Ave intersection, Northbound curb lane, 2.0 m West of East curb.	Asphalt	80	Concrete	100	Clay, AASHTO: A-7-6 (39)	0.8	0.9	30	43	42	11	4	20	63	43
						Clay, AASHTO: A-7-6 (39)	1.1	1.2	31							
						Clay, AASHTO: A-7-6 (39)	1.4	1.5	33							
						Clay, AASHTO: A-7-6 (39)	1.8	1.9	42							
						Clay, AASHTO: A-7-6 (39)	2.1	2.3	47							
						Clay, AASHTO: A-7-6 (39)	2.7	2.8	48							
TH25-19	UTM : 5527831 N, 633254 E Located 30 m South of York Ave intersection, Northbound middle lane, 4.5 m East of West curb.	Asphalt	95	Concrete	125	Clay, AASHTO: A-7-6 (I)	0.2	0.4	13							
						Clay, AASHTO: A-7-6 (I)	0.8	0.9	34							
						Clay, AASHTO: A-7-6 (I)	1.1	1.2	31							
						Clay, AASHTO: A-7-6 (I)	1.4	1.5	29							
						Clay, AASHTO: A-6 (I)	1.8	1.9	23							
						Clay, AASHTO: A-6 (I)	2.1	2.3	21							
TH25-21	UTM : 5528053 N, 633177 E Located at #207 Edmonton St, Northbound curb lane, 3.5 m West of East curb.	Asphalt	120	Concrete	180	Clay, AASHTO: A-7-6 (I)	0.9	1.1	31							
						Clay, AASHTO: A-7-6 (I)	1.2	1.4	37							
						Clay, AASHTO: A-7-6 (I)	1.5	1.7	39							
						Clay, AASHTO: A-7-6 (I)	1.9	2.1	38							
						Clay, AASHTO: A-7-6 (I)	2.3	2.4	33							
						Clay, AASHTO: A-7-6 (I)	2.8	3.0	34							
TH25-22	UTM : 5528140 N, 633142 E Located at #236 Edmonton St, Northbound middle lane, 5.0 m West of East curb.	Asphalt	110	Concrete	170	Clay, AASHTO: A-7-6 (51)	0.8	0.9	34	54	42	3	0	24	70	46
						Clay, AASHTO: A-7-6 (51)	1.1	1.2	36							
						Clay, AASHTO: A-7-6 (51)	1.4	1.5	35							
						Clay, AASHTO: A-7-6 (51)	1.8	1.9	41							
						Clay, AASHTO: A-7-6 (51)	2.1	2.3	43							
						Clay, AASHTO: A-7-6 (51)	2.7	2.8	45							

Project No. 1000-043-30
Client WSP
Project 2026-2028 Downtown Pavement Renewals
Edmonton St - Broadway Ave to Portage Ave
Sample Date 07-Oct-25
Test Date 23-Oct-25
Technician Z. Dypiangco

Test Hole	TH25-18	TH25-18	TH25-18	TH25-18	TH25-18	TH25-18
Depth (m)	0.8 - 0.9	1.1 - 1.2	1.4 - 1.5	1.8 - 1.9	2.1 - 2.3	2.7 - 2.8
Sample #	G53	G54	G55	G56	G57	G58
Tare ID	QT85	W46	AA20	E67	N71	H20
Mass of tare	8.5	8.5	6.7	8.7	8.6	7.2
Mass wet + tare	432.9	211.0	216.4	216.5	214.5	210.3
Mass dry + tare	334.9	163.5	164.2	155.3	149.1	144.4
Mass water	98.0	47.5	52.2	61.2	65.4	65.9
Mass dry soil	326.4	155.0	157.5	146.6	140.5	137.2
Moisture %	30.0%	30.6%	33.1%	41.7%	46.5%	48.0%

Test Hole	TH25-19	TH25-19	TH25-19	TH25-19	TH25-19	TH25-19
Depth (m)	0.2 - 0.4	0.8 - 0.9	1.1 - 1.2	1.4 - 1.5	1.8 - 1.9	2.1 - 2.3
Sample #	G60	G61	G62	G63	G64	G65
Tare ID	E94	M46	D222	D211	C19	Q68
Mass of tare	8.6	6.8	6.7	7.1	8.7	7.0
Mass wet + tare	216.8	217.9	216.9	209.1	211.8	219.7
Mass dry + tare	192.2	164.9	167.4	164.2	173.5	182.2
Mass water	24.6	53.0	49.5	44.9	38.3	37.5
Mass dry soil	183.6	158.1	160.7	157.1	164.8	175.2
Moisture %	13.4%	33.5%	30.8%	28.6%	23.2%	21.4%

Test Hole	TH25-19	TH25-21	TH25-21	TH25-21	TH25-21	TH25-21
Depth (m)	2.7 - 2.8	0.9 - 1.1	1.2 - 1.4	1.5 - 1.7	1.9 - 2.1	2.3 - 2.4
Sample #	G66	G69	G70	G71	G72	G73
Tare ID	P24	F13	B2	QW7	ZD25	E87
Mass of tare	8.7	7.0	6.8	6.8	8.4	6.8
Mass wet + tare	213.7	177.8	219.4	212.3	216.7	211.7
Mass dry + tare	176.0	136.9	162.4	154.8	159.4	160.3
Mass water	37.7	40.9	57.0	57.5	57.3	51.4
Mass dry soil	167.3	129.9	155.6	148.0	151.0	153.5
Moisture %	22.5%	31.5%	36.6%	38.9%	37.9%	33.5%



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Moisture Content Report ASTM D2216-98

Project No. 1000-043-30
Client WSP
Project 2026-2028 Downtown Pavement Renewals
Edmonton St - Broadway Ave to Portage Ave
Sample Date 07-Oct-25
Test Date 23-Oct-25
Technician Z. Dypiangco

Test Hole	TH25-21	TH25-22	TH25-22	TH25-22	TH25-22	TH25-22
Depth (m)	2.8 - 3.0	0.8 - 0.9	1.1 - 1.2	1.4 - 1.5	1.8 - 1.9	2.1 - 2.3
Sample #	G74	G76	G77	G78	G79	G80
Tare ID	AA13	D229	AB	AA23	F89	AA10
Mass of tare	6.7	6.7	7.0	6.7	8.7	6.8
Mass wet + tare	215.9	429.3	220.1	213.4	212.0	208.3
Mass dry + tare	162.5	321.2	163.2	160.2	152.8	147.5
Mass water	53.4	108.1	56.9	53.2	59.2	60.8
Mass dry soil	155.8	314.5	156.2	153.5	144.1	140.7
Moisture %	34.3%	34.4%	36.4%	34.7%	41.1%	43.2%

Test Hole	TH25-22					
Depth (m)	2.7 - 2.8					
Sample #	G81					
Tare ID	Z139					
Mass of tare	9.1					
Mass wet + tare	212.6					
Mass dry + tare	149.3					
Mass water	63.3					
Mass dry soil	140.2					
Moisture %	45.1%					

Project No. 1000-043-30
Client WSP
Project 2026-2028 Downtown Pavement Renewals

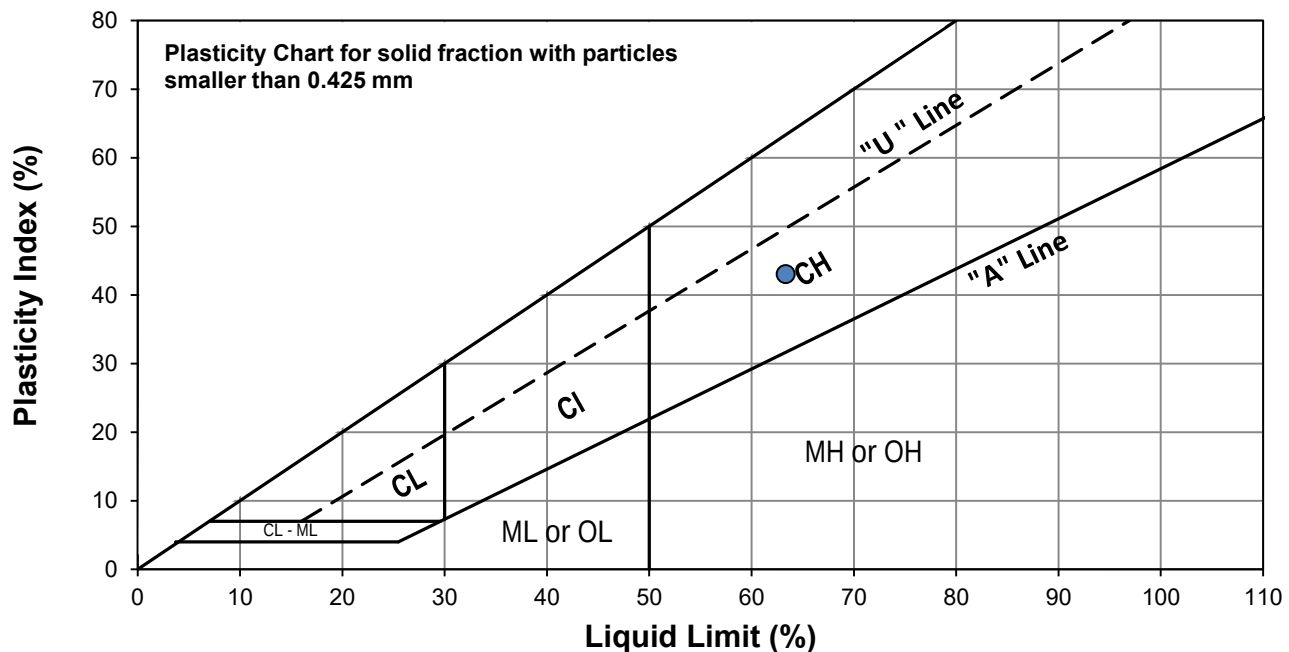


Test Hole TH25-25 (Edmonton St - Broadway Ave to Portage Ave)
Sample # G53
Depth (m) 0.8 - 0.9
Sample Date 07-Oct-25
Test Date 28-Oct-25
Technician D. Sellick

Liquid Limit	63
Plastic Limit	20
Plasticity Index	43

Liquid Limit

Trial #	1	2	3		
Number of Blows (N)	15	21	32		
Mass Tare (g)	13.823	14.093	13.912		
Mass Wet Soil + Tare (g)	22.010	22.730	23.531		
Mass Dry Soil + Tare (g)	18.744	19.349	19.854		
Mass Water (g)	3.266	3.381	3.677		
Mass Dry Soil (g)	4.921	5.256	5.942		
Moisture Content (%)	66.369	64.326	61.882		



Plastic Limit

Trial #	1	2	3	4	5
Mass Tare (g)	13.894	13.871			
Mass Wet Soil + Tare (g)	20.456	21.463			
Mass Dry Soil + Tare (g)	19.336	20.196			
Mass Water (g)	1.120	1.267			
Mass Dry Soil (g)	5.442	6.325			
Moisture Content (%)	20.581	20.032			

Note: Additional information recorded/measured for this test is available upon request.

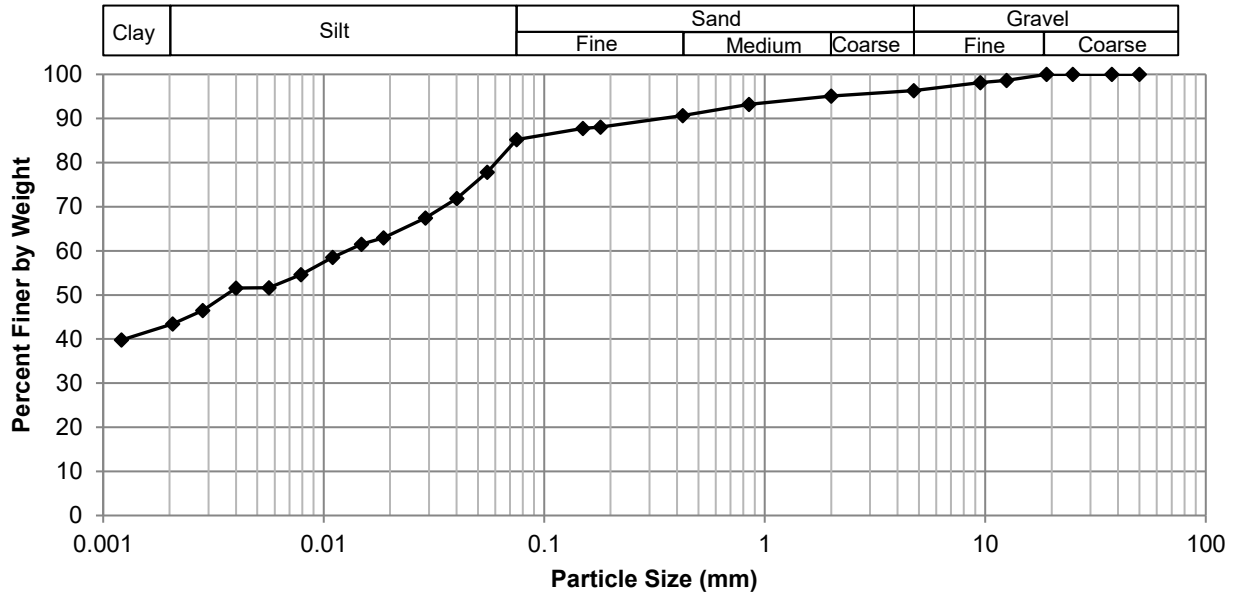
Project No. 1000-043-30
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Project 2026-2028 Downtown Pavement Renewals



Test Hole TH25-18 (Edmonton St - Broadway Ave to Portage Ave)
Sample # G53
Depth (m) 0.8 - 0.9
Sample Date 07-Oct-25
Test Date 27-Oct-25
Technician D.Sellick

Gravel	3.7%
Sand	11.1%
Silt	42.1%
Clay	43.2%

Particle Size Distribution Curve



Gravel		Sand		Silt and Clay	
Particle Size (mm)	Percent Passing	Particle Size (mm)	Percent Passing	Particle Size (mm)	Percent Passing
50.0	100.00	4.75	96.34	0.0750	85.24
37.5	100.00	2.00	95.07	0.0552	77.82
25.0	100.00	0.850	93.17	0.0402	71.87
19.0	100.00	0.425	90.66	0.0290	67.41
12.5	98.66	0.180	88.03	0.0187	62.96
9.50	98.10	0.150	87.72	0.0148	61.47
4.75	96.34	0.075	85.24	0.0110	58.50
				0.0079	54.60
				0.0056	51.62
				0.0040	51.55
				0.0028	46.47
				0.0021	43.46
				0.0012	39.79

Project No. 1000-043-30
Client WSP
Project 2026-2028 Downtown Pavement Renewals

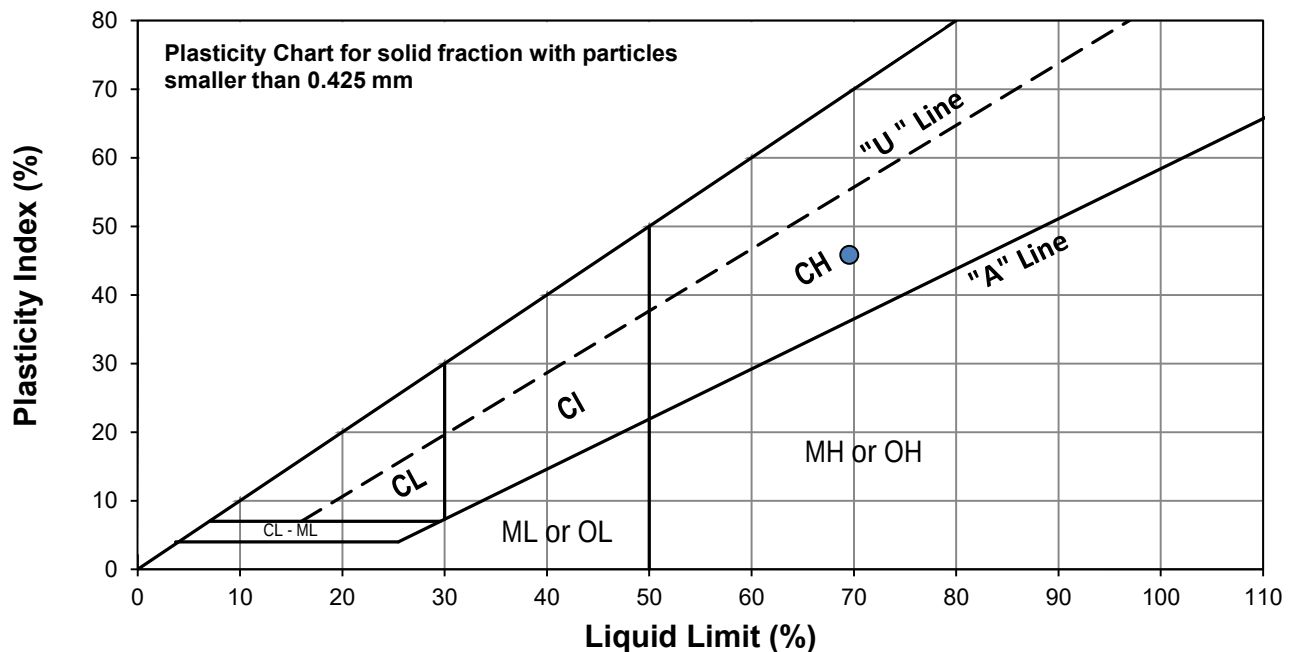


Test Hole TH25-22 (Edmonton St - Broadway Ave to Portage Ave)
Sample # G76
Depth (m) 0.8 - 0.9
Sample Date 07-Oct-25
Test Date 28-Oct-25
Technician D. Sellick

Liquid Limit	70
Plastic Limit	24
Plasticity Index	46

Liquid Limit

Trial #	1	2	3		
Number of Blows (N)	19	26	35		
Mass Tare (g)	13.986	13.911	13.861		
Mass Wet Soil + Tare (g)	22.449	21.752	23.675		
Mass Dry Soil + Tare (g)	18.914	18.539	19.749		
Mass Water (g)	3.535	3.213	3.926		
Mass Dry Soil (g)	4.928	4.628	5.888		
Moisture Content (%)	71.733	69.425	66.678		



Plastic Limit

Trial #	1	2	3	4	5
Mass Tare (g)	13.956	13.822			
Mass Wet Soil + Tare (g)	20.667	20.593			
Mass Dry Soil + Tare (g)	19.375	19.300			
Mass Water (g)	1.292	1.293			
Mass Dry Soil (g)	5.419	5.478			
Moisture Content (%)	23.842	23.604			

Note: Additional information recorded/measured for this test is available upon request.

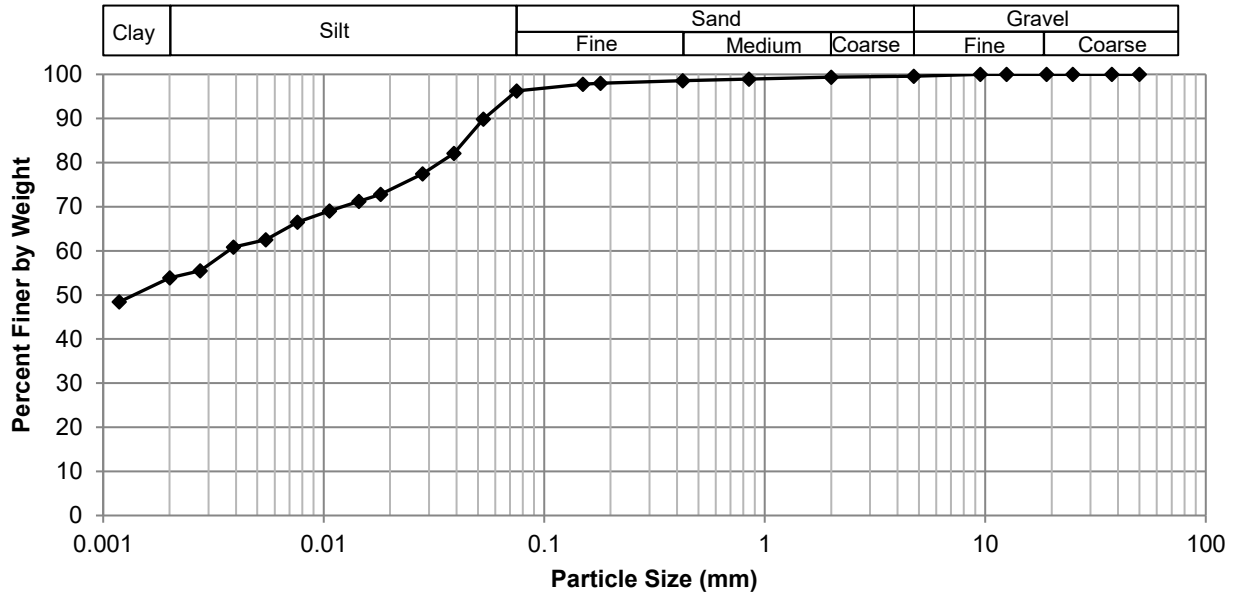
Project No. 1000-043-30
Client WSP
Project 2026-2028 Downtown Pavement Renewals



Test Hole TH25-22 (Edmonton St - Broadway Ave to Portage Ave)
Sample # G76
Depth (m) 0.8 - 0.9
Sample Date 07-Oct-25
Test Date 27-Oct-25
Technician D.Sellick

Gravel	0.4%
Sand	3.4%
Silt	42.4%
Clay	53.9%

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	99.58	0.0750	96.22
37.5	100.00	2.00	99.35	0.0531	89.89
25.0	100.00	0.850	98.91	0.0389	82.12
19.0	100.00	0.425	98.55	0.0281	77.46
12.5	100.00	0.180	97.95	0.0181	72.80
9.50	100.00	0.150	97.79	0.0144	71.25
4.75	99.58	0.075	96.22	0.0106	69.08
				0.0076	66.54
				0.0055	62.50
				0.0039	60.83
				0.0028	55.49
				0.0020	53.88
				0.0012	48.43



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Standard Proctor Compaction Test

ASTM D698-12e2

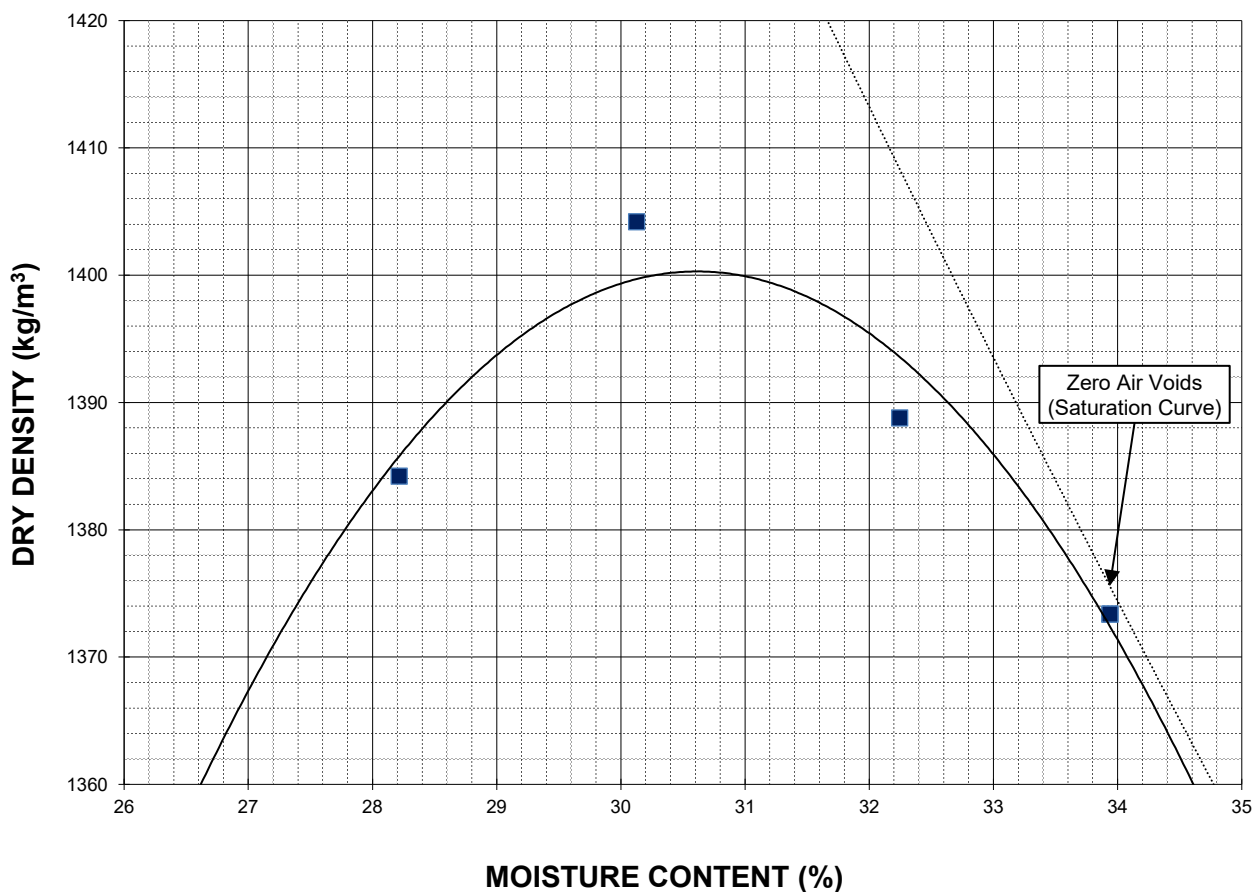
Project No. 1000-043-30
Client WSP
Project 2026-2028 Downtown Pavement Renewals



Sample # L25-443-03 (B59, 67 & B82)
Source Edmonton St (TH25-18, TH25-19 & TH25-22)
Material Clay
Sample Date 07-Oct-25
Test Date 10-Oct-25
Technician K. Desikan

Maximum Dry Density (kg/m³)	1400
Optimum Moisture (%)	30.6

Trial Number	1	2	3	4	
Wet Density (kg/m³)	1775	1827	1837	1839	
Dry Density (kg/m³)	1384	1404	1389	1373	
Moisture Content (%)	28.2	30.1	32.2	33.9	



Note: Additional information recorded/measured for this test is available upon request.



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California Bearing Ratio Test Data Sheet

ASTM D1883-21

Project No.	1000-043-30	Source	Edmonton St (TH25-18, TH25-19 & TH25-22)
Client	WSP	Material	Clay
Project	2026-2028 Downtown Pavement Renewals	Sample Date	06-Oct-25
Sample #	L25-443-03 (B59, 67 & B82)	Test Date	16-Oct-25
		Technician	A. Dustmamatov

Proctor Results (ASTM D698)

Maximum Dry Density	1400 kg/m ³
Optimum Moisture Content	30.6 %
Material Retained on 19 mm Sieve	0.0 %

CBR Sample Compaction

Dry Density	1325 kg/m ³
Initial Moisture Content	29.9 %
Relative Density	94.7 % SPMDD

Soaking Results

Surcharge	4.54 kg
Swell	6.5 %
Moisture Content in top 25 mm	49.1 %
Immersion Period	96 h

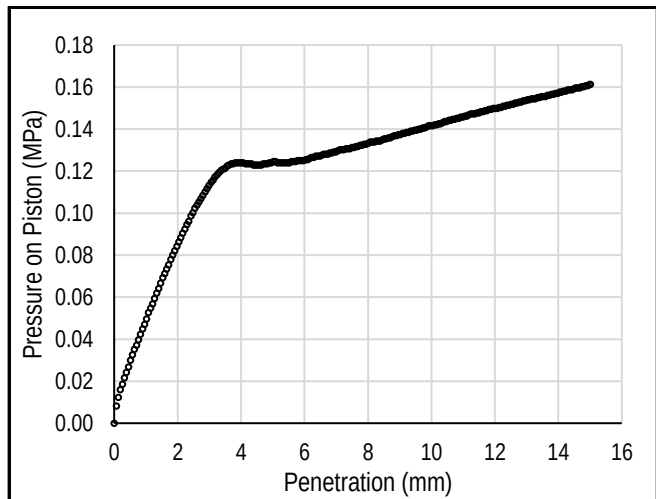
CBR Results

CBR at 2.54 mm	1.5 %
CBR at 5.08 mm	1.2 %
Zero Correction	0 mm

Test Data

Penetration (mm)	Measured Pressure (MPa)	Corrected Pressure (MPa)
0.64	0.04	0.04
1.27	0.06	0.06
1.91	0.08	0.08
2.54	0.10	0.10
3.18	0.12	0.12
3.81	0.12	0.12
4.45	0.12	0.12
5.08	0.12	0.12
7.62	0.13	0.13
10.16	0.14	0.14
12.70	0.15	0.15

Load/Penetration Curve



Comments:

Sample prepared in accordance with the City of Winnipeg guidelines.



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Standard Proctor Compaction Test

ASTM D698-12e2

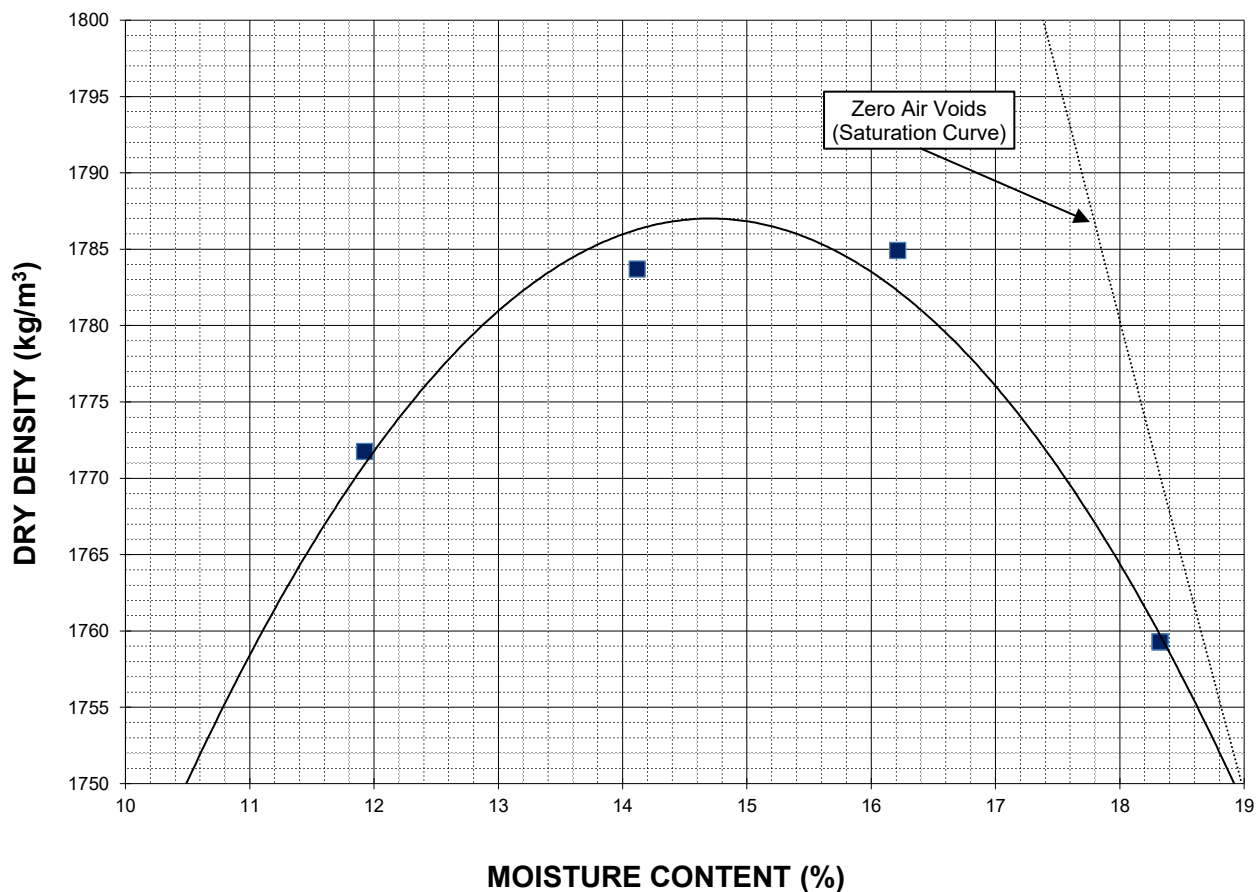
Project No. 1000-043-30
Client WSP
Project 2026-2028 Downtown Pavement Renewals



Sample # L25-443-05 (B68, B91 & B283)
Source Edmonton and York (TH25-19, TH25-34 & TH25-35)
Material Silt
Sample Date 07-Oct-25
Test Date 14-Oct-25
Technician I. Araquil

Maximum Dry Density (kg/m³)	1787
Optimum Moisture (%)	14.7

Trial Number	1	2	3	4	
Wet Density (kg/m ³)	1983	2036	2074	2082	
Dry Density (kg/m ³)	1772	1784	1785	1759	
Moisture Content (%)	11.9	14.1	16.2	18.3	



Note: Additional information recorded/measured for this test is available upon request.



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California Bearing Ratio Test Data Sheet

ASTM D1883-21

Project No.	1000-043-30	Source	Edmonton and York (TH25-19, TH25-34 & TH25-35)
Client	WSP	Material	Silt
Project	2026-2028 Downtown Pavement Renewals	Sample Date	07-Oct-25
Sample #	L25-443-05 (B68, B91 & B283)	Test Date	16-Oct-25
		Technician	A. Dustmamatov

Proctor Results (ASTM D698)

Maximum Dry Density	1787 kg/m ³
Optimum Moisture Content	14.7 %
Material Retained on 19 mm Sieve	0.0 %

CBR Sample Compaction

Dry Density	1696 kg/m ³
Initial Moisture Content	14.8 %
Relative Density	94.9 % SPMDD

Soaking Results

Surcharge	4.54 kg
Swell	3.1 %
Moisture Content in top 25 mm	26.5 %
Immersion Period	96 h

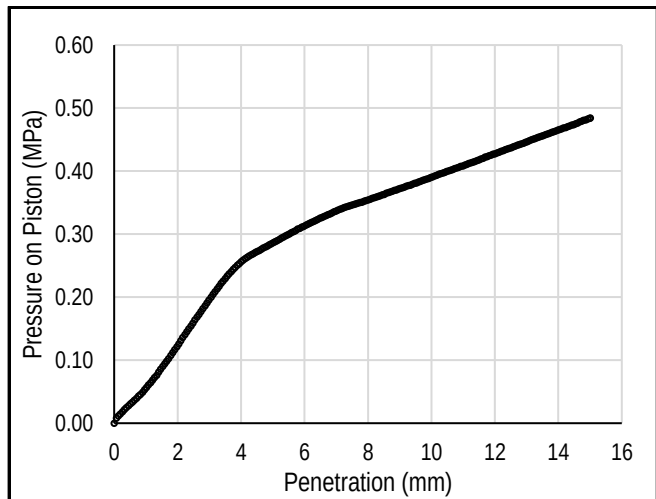
CBR Results

CBR at 2.54 mm	2.4 %
CBR at 5.08 mm	2.8 %
Zero Correction	0 mm

Test Data

Penetration (mm)	Measured Pressure (MPa)	Corrected Pressure (MPa)
0.64	0.04	0.04
1.27	0.07	0.07
1.91	0.12	0.12
2.54	0.16	0.16
3.18	0.21	0.21
3.81	0.25	0.25
4.45	0.27	0.27
5.08	0.29	0.29
7.62	0.35	0.35
10.16	0.39	0.39
12.70	0.44	0.44

Load/Penetration Curve



Comments:

Sample prepared in accordance with the City of Winnipeg guidelines.



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Standard Proctor Compaction Test

ASTM D698-12e2

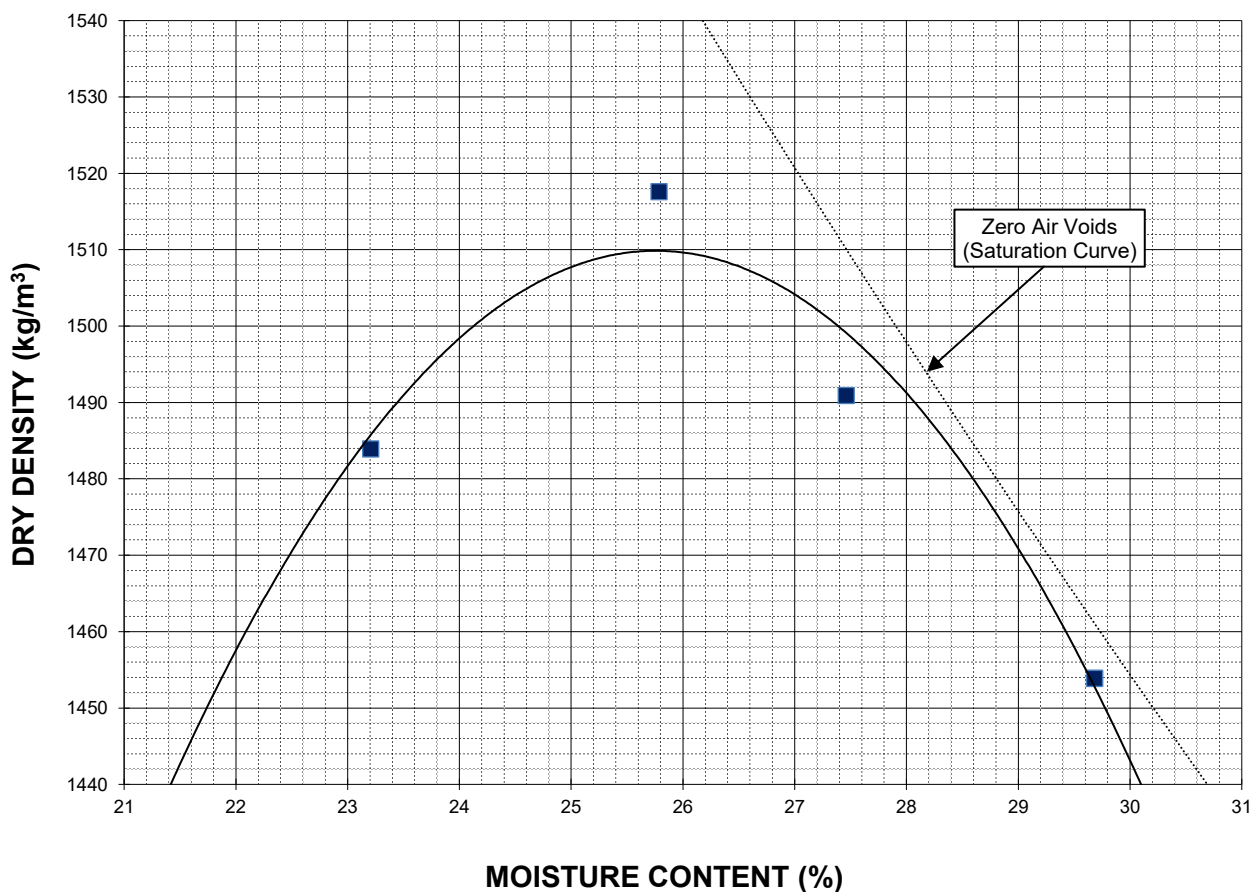
Project No. 1000-043-30
Client WSP
Project 2026-2028 Downtown Pavement Renewals



Sample # L25-443-06 (B75)
Source Edmonton St (TH25-21)
Material Clay (Fill)
Sample Date 07-Oct-25
Test Date 14-Oct-25
Technician A. Dustmamatov

Maximum Dry Density (kg/m³)	1510
Optimum Moisture (%)	25.8

Trial Number	1	2	3	4	
Wet Density (kg/m ³)	1828	1909	1900	1885	
Dry Density (kg/m ³)	1484	1518	1491	1454	
Moisture Content (%)	23.2	25.8	27.5	29.7	



Note: Additional information recorded/measured for this test is available upon request.



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California Bearing Ratio Test Data Sheet

ASTM D1883-21

Project No.	1000-043-30	Source	Edmonton St (TH25-21)
Client	WSP	Material	Clay (Fill)
Project	2026-2028 Downtown Pavement Renewals	Sample Date	07-Oct-25
Sample #	L24-443-06 (B75)	Test Date	16-Oct-25
		Technician	A. Dustmamatov

Proctor Results (ASTM D698)

Maximum Dry Density	1510 kg/m ³
Optimum Moisture Content	25.8 %
Material Retained on 19 mm Sieve	0.0 %

CBR Sample Compaction

Dry Density	1424 kg/m ³
Initial Moisture Content	26.8 %
Relative Density	94.3 % SPMDD

Soaking Results

Surcharge	4.54 kg
Swell	4.2 %
Moisture Content in top 25 mm	40.0 %
Immersion Period	96 h

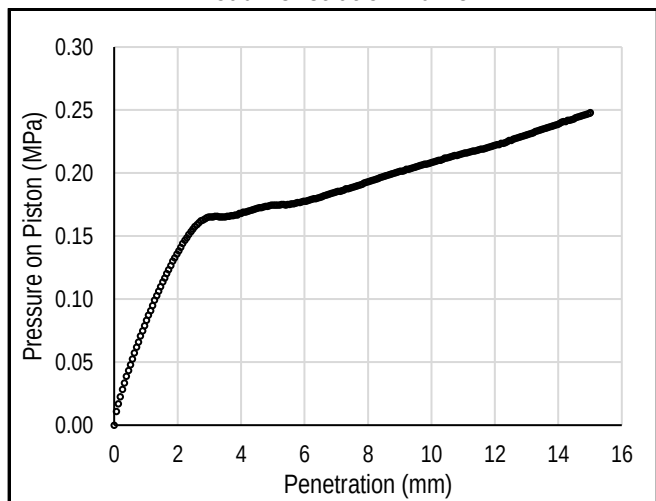
CBR Results

CBR at 2.54 mm	2.3 %
CBR at 5.08 mm	1.7 %
Zero Correction	0 mm

Test Data

Penetration (mm)	Measured Pressure (MPa)	Corrected Pressure (MPa)
0.64	0.06	0.06
1.27	0.10	0.10
1.91	0.13	0.13
2.54	0.16	0.16
3.18	0.17	0.17
3.81	0.17	0.17
4.45	0.17	0.17
5.08	0.17	0.17
7.62	0.19	0.19
10.16	0.21	0.21
12.70	0.23	0.23

Load/Penetration Curve



Comments:

Sample prepared in accordance with the City of Winnipeg guidelines.



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Concrete Core Compressive Strength Report

CSA A23.2-14C

Project No. 1000-043-30

Date November 3, 2025

Project 2026-2028 Downtown Pavement Renewals

Technician T. Green

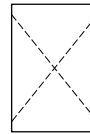
Client WSP Group Canada Inc.

Core Location	Core ID	Date Received	Date of Break	Age at Break	Diam. (mm)	Length (mm)	Moisture Conditioning	Compressive Strength (MPa)		Break Type	Correction Factors*				
								Uncorrected f_{conc}	Corrected* f_c		$F_{l/d}$	F_{dia}	F_{mc}	F_D	F_{reinf}
Edmonton St	PC25-30 ^{*2}	2025-10-16	2025-11-03	-	145	121	Soaked 48 h	59.04	58.55	1	0.8756	0.9802	1.0900	1.0600	1.0000
Edmonton St	PC25-31 ^{*2}	2025-10-16	2025-11-03	-	145	122	Soaked 48 h	46.48	45.78	1	0.8698	0.9802	1.0900	1.0600	1.0000
Edmonton St	PC25-32	2025-10-16	2025-10-29	-	145	160	Soaked 48 h	65.65	74.78	1	0.9286	0.9802	1.0900	1.0600	1.0832

Comments

*Correction factors $F_{l/d}$, F_{dia} , F_{mc} , and F_D calculated as per ACI 214.4R-03, and correction factor F_{reinf} calculated as per Khoury et al. (2014): $f_c = f_{conc} F_{l/d} F_{dia} F_{mc} F_D F_{reinf}$

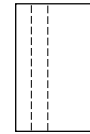
^{*2} Core length to diameter ratio is less than one.



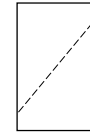
Type 1



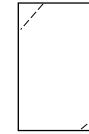
Type 2



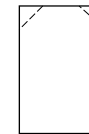
Type 3



Type 4



Type 5



Type 6

Reviewed by (print): Kate Franklin

Signature: Kate Franklin

Table 1 Factors involved in interpretation of core results by different codes.

List	Code/standard	Edition	Factors Considered					
			Aspect ratio	Diameter	Reinforcing	Moisture	Damage	Direction
1	Egyptian Code/Standard Specification	2008	✓		✓			✓
2	British Code/Standard Specification	2003	✓		✓			✓
3	American Concrete Institute ACI	1998	✓					
		2012	✓	✓		✓	✓	
4	European Standard Specification	1998	✓	✓	✓		✓	
		2009	✓		✓			
5	Japanese Standard	1998	✓					
6	Concrete Society	1987	✓		✓		✓	✓

In addition, for core specimen containing two bars no further apart than the diameter of the larger bar, only the bar corresponding to the higher value of $(\Phi_r * d)$ is considered. If the bars are further apart, their combined effect should be assessed by replacing the term $(\Phi_r * d)$ by the term $(\sum \Phi_r * d)$.

It should be pointed out that above equations used to interpret the core concrete strength to the in-situ concrete cube strength have been developed based on a set of assumptions and through many converting process. It is also of interest to note that the damage effect is considered in the development of the formulas in indirect way. The subject derivation and detailed formulas may be seen elsewhere [14].

3.2. American Concrete Institute (ACI)

3.2.1. Former ACI Code (2002) & Current ASTM (2009)

The methodology of core interpretation given in the former ACI code was remained without changes for decades and up to Year (2003). The in-place strength of concrete cylinder at the location from which a core test specimen was extracted can be computed using the equation:

$$f_{cy} = F_{l/d} \cdot f_{core} \quad (4)$$

where f_{cy} is the equivalent in-place concrete cylinder strength, f_{core} is concrete core strength, and $F_{l/d}$ is the strength correction factor for aspect ratio.

The former ACI code does not include any equation to calculate the correction factor ($F_{l/d}$); however, the code gives different values for this term that is associated with different aspect ratios (l/d) as given in Table 2. It should also be noted that the approach of current ASTM is similar to that mentioned above. The only considered variable is the aspect ratio (l/d). It should be noted that identical approach to that mentioned above is still effective in ASTM C42/C42M-03 [10].

3.2.2. Current ACI Code (2012) [15]

Starting from Year 2003, significant changes have been made to the relevant ACI Code provisions regarding the interpreta-

Table 2 Mean values for factor $F_{l/d}$ according to ACI Code (1998) and ASTM.

	Specimen length-to-diameter ratio, l/d			
	1.00	1.25	1.50	1.75
$F_{l/d}$	0.87	0.93	0.96	0.98

tion of core strength test results. New factors have been considered. These include core diameter, moisture content of core sample, core damage associated with drilling, in addition to the effect of aspect ratio that was previously considered in the former ACI edition (1998). According to the ACI 214.4R-03, the in-place concrete strength can be computed using the equation:

$$f_c = F_{l/d} \cdot F_{dia} \cdot F_{mc} \cdot F_D \cdot f_{core} \cdot \text{Front or cc. 12 or cc. 13} \quad (5)$$

where f_c is the equivalent in-place concrete cylinder strength, f_{core} is concrete core strength, $F_{l/d}$ is strength correction factor for aspect ratio, F_{dia} is strength correction factors for diameter, F_{mc} is strength correction factor for moisture condition of core sample, and F_D is the strength correction factor that accounts for effect of damage sustained during core drilling including micro-cracking and undulations at the drilled surface and cutting through coarse-aggregate particles that may subsequently pop out during testing.

The ACI committee considered the correction factors presented in Table 3 for converting core strengths into equivalent in-place strengths based on the work reported by Bartlett and MacGregor [6]. It should be noted that the magnitude of

Table 3 Strength correction factors according to ACI 214.4R-03.

List	Factors	Mean values
(1) ^b	$F_{l/d}$: l/d ratio	
	As-received	$1 - \{0.130 - \alpha f_{core}\} (2 - \frac{l}{d})^2$
	Soaked 48 h	$1 - \{0.117 - \alpha f_{core}\} (2 - \frac{l}{d})^2$
	Air dried ^a	$1 - \{0.144 - \alpha f_{core}\} (2 - \frac{l}{d})^2$
(2)	F_{dia} : core diameter	
	50 mm	1.06
	100 mm	1.00
	150 mm	0.98
(3)	F_{mc} : core moisture content	
	As-received	1.00
	Soaked 48 h	1.09
	Air dried ^a	0.96
(4)	F_D : damage due to drilling	1.06

^a Standard treatment specified in ASTM C 42/C 42M.

^b Constant α equals $4.3(10^{-4})$ 1/MPa for f_{core} in MPa.

Table 6 List of comparisons between tested cores to determine.

	A18	A17	A16	A15	A14	A13	A12	A11	A10	A9	A8	A7	A6	A5	A4	A3	A2	A1
A1	●	●	●	■	■		●				●			▲	▲	■	▲	
A2																		
A3						■				■								
A4																		
A5																		
A6								■	▲	■	▲		■	▲				
A7								■	▲	■	▲							
A8		●	◆	●	●													
A9																		
A10								■	▲									
A11																		
A12		●		●	●													
A13																		
A14		●		●														
A15		●																
A16	●	◆																
A17	◆																	
A18																		

- Diameter of steel bar.
- ▲ Distance of steel bar from nearly end of core.
- Number of steel bars and spacing between bars.
- ◆ Distance of steel bar from vertical axis of specimen.

This brief review indicated that the various proposed relationships for correction factors are all nonlinear. It should be noted that the equations given by the Egyptian Code takes into account most variables that may affect the interpretation of the results; however, the code ignores the deterioration of steel-concrete bond that may occur and also the position of the reinforcement from vertical axis of core specimens.

Weighted nonlinear regression analysis has been performed to determine the factor (F_{reinf}) with the use of the software "SAS" package and "Data Fit." This shows that the correction factor for reinforcement (F_{reinf}) is given by the following expression:

• For cores containing a single bar:

$$F_{\text{reinf}} = \left[1 + 1.5 \frac{[\Phi_r \times r + \Phi_r \times (S/10)]}{\Phi_c \times L} \right] \times \frac{1.13}{f_{\text{core}}^{0.015}} \quad (12)$$

- For core specimen containing two bars no further apart than the diameter of the larger bar, only the bar corresponding to the higher value of ($\Phi_r \times d$) is considered. If the bars are further apart, their combined effect is assessed by replacing the term ($\Phi_r \times r$) by ($\sum \Phi_r \times r$) as follows:

multiple bars

$$F_{\text{reinf}} = \left[1 + 1.5 \frac{\sum [\Phi_r \times r + \Phi_r \times (S/10)]}{\Phi_c \times L} \right] \times \frac{1.13}{f_{\text{core}}^{0.015}} \quad (13)$$

where F_{reinf} is the correction factor for reinforcement, Φ_r is the diameter of the reinforcement, Φ_c is the diameter of the concrete specimen, r is the distance of axis of bar from nearer end of specimen, S is the distance of axis of bar from axis of core specimen, L is the length of the specimen after end preparation by grinding or capping, and f_{core} is the concrete core strength (kg/cm^2).

6.1.6. Effect of moisture condition of core

Results of about 100 cores indicate that the strength of cores left to dry in air for 7 days is on average 13% greater than that of cores soaked at least 40 h before testing. The strength of cores with negligible moisture gradient and tested after cutting is found to be 7–9% larger than that of soaked cores as shown in Fig. 20. The authors strongly recommend to use a correction factor accounting for moisture condition (F_m) equals to 1.09 and 0.96, respectively, for cores tested after 48 h soaked in water and for those tested after 7 days dry in air.

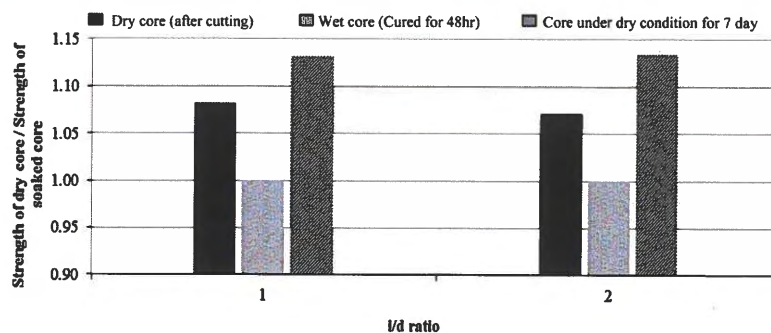
**Figure 20** Effect of core moisture condition on core strength for different aspect ratios (l/d).



Photo 1: Pavement Core Sample at TH25-18



Photo 2: Pavement Core Sample at TH25-19



Photo 3: Pavement Core Sample at TH25-21

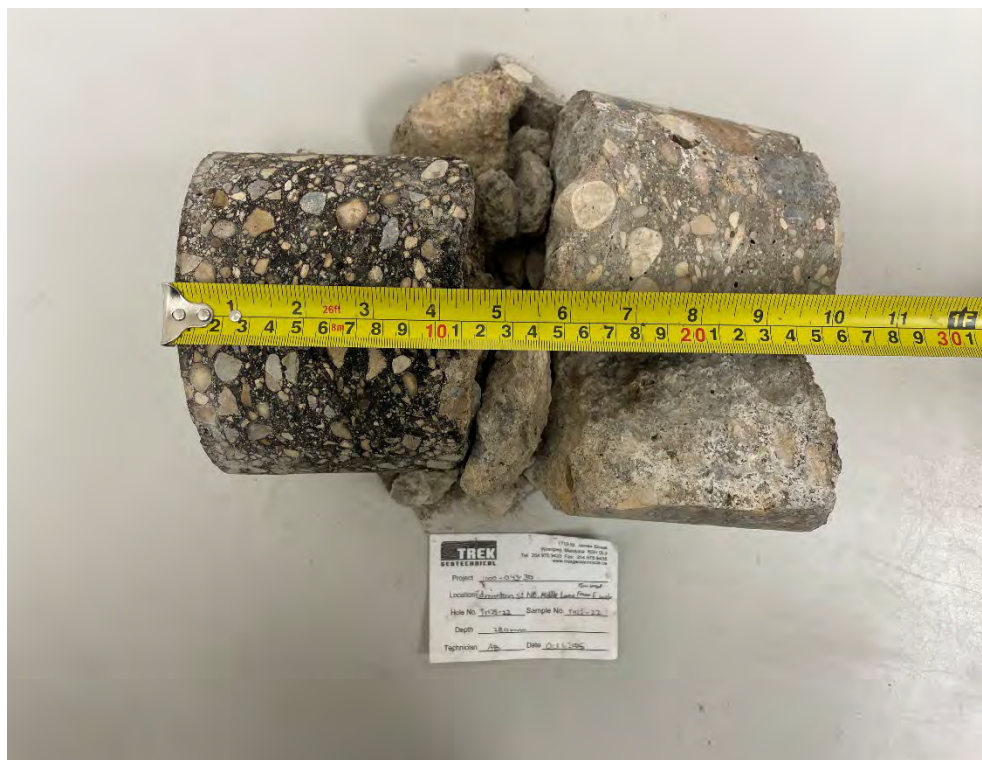


Photo 4: Pavement Core Sample at TH25-22



2026-2028 Downtown Pavement Renewals
Edmonton St - Broadway Ave to Portage Ave

Pavement Core No.	Pavement Core Location	Pavement Surface		Pavement Structure Material		Corrected Compressive Strength (Mpa)
		Type	Thickness (mm)	Type	Thickness (mm)	
PC25-30	UTM : 5528220 m N, 633114 m E; Located in front of #247 Edmonton St, Northbound curb lane, 2.0 m West of East curb.	Asphalt		Concrete	190	58.55
PC25-31	UTM : 5528251 m N, 633097 m E; Located in front of #270 Edmonton St, Northbound middle lane, 4.3 m East of West curb.	Asphalt		Concrete	200	45.78
PC25-32	UTM : 5528281 m N, 633084 m E; Located 2 m South of Portage Ave, Northbound curb lane, 2.0 m East of West curb.	Asphalt		Concrete	220	74.78

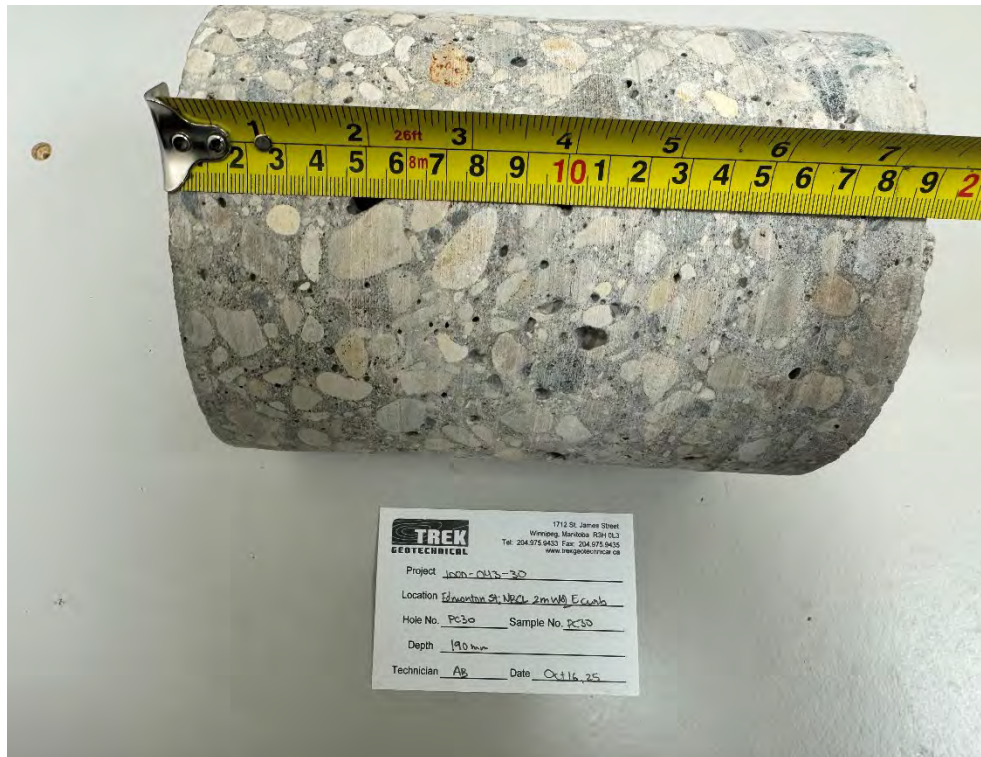


Photo 1: Pavement Core Sample at PC25-30

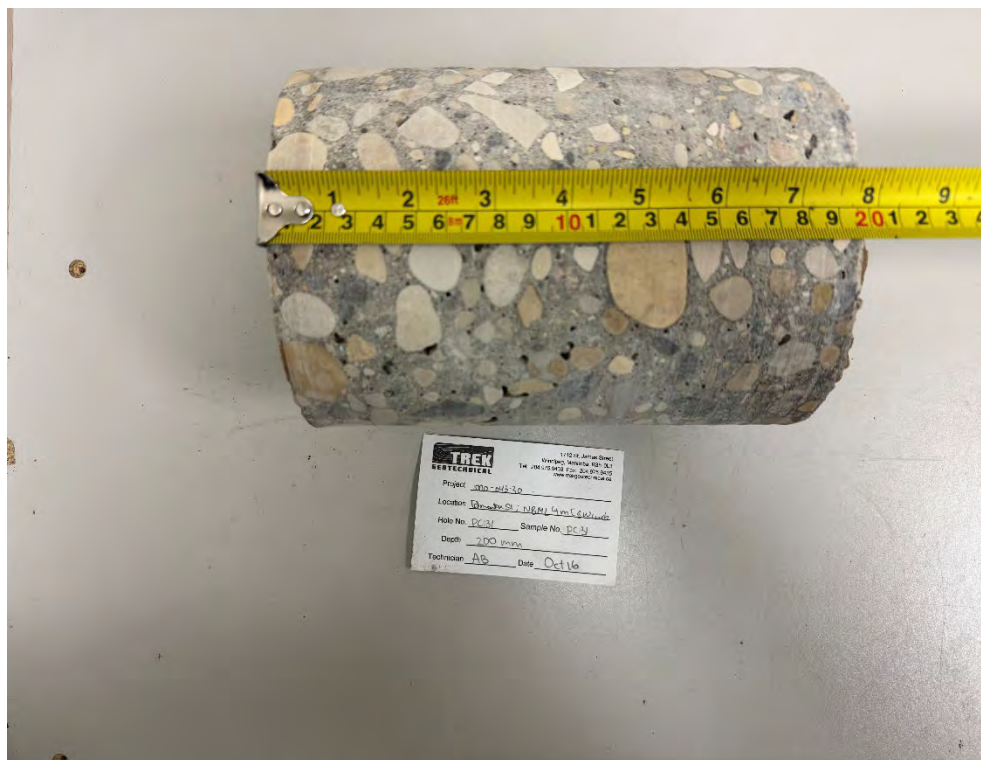


Photo 2: Pavement Core Sample at PC25-31



Photo 3: Pavement Core Sample at PC25-32

Appendix G
Test Hole Logs, Summary Tables, Lab Testing Results and
Photographs of Pavement Core Samples
St. Mary Ave – Memorial Blvd to Main St.



Sub-Surface Log

Test Hole TH25-30

1 of 1

Client: WSP

Project Number: 1000-043-30

Project Name: 2026-2028 Downtown Pavement Renewals

Location: UTM : 633132 E 5528003 N - St Mary Ave

Contractor: Maple Leaf Drilling

Ground Elevation: Top of Pavement

Method: 125mm Solid Stem Auger, B40 Mobile Truck Mount

Date Drilled: October 8, 2025

Sample Type:

Grab (G)

Shelby Tube (T)

Split Spoon (SS) / SPT

Split Barrel (SB) / LPT

Core (C)

Particle Size Legend:

Fines

Clay

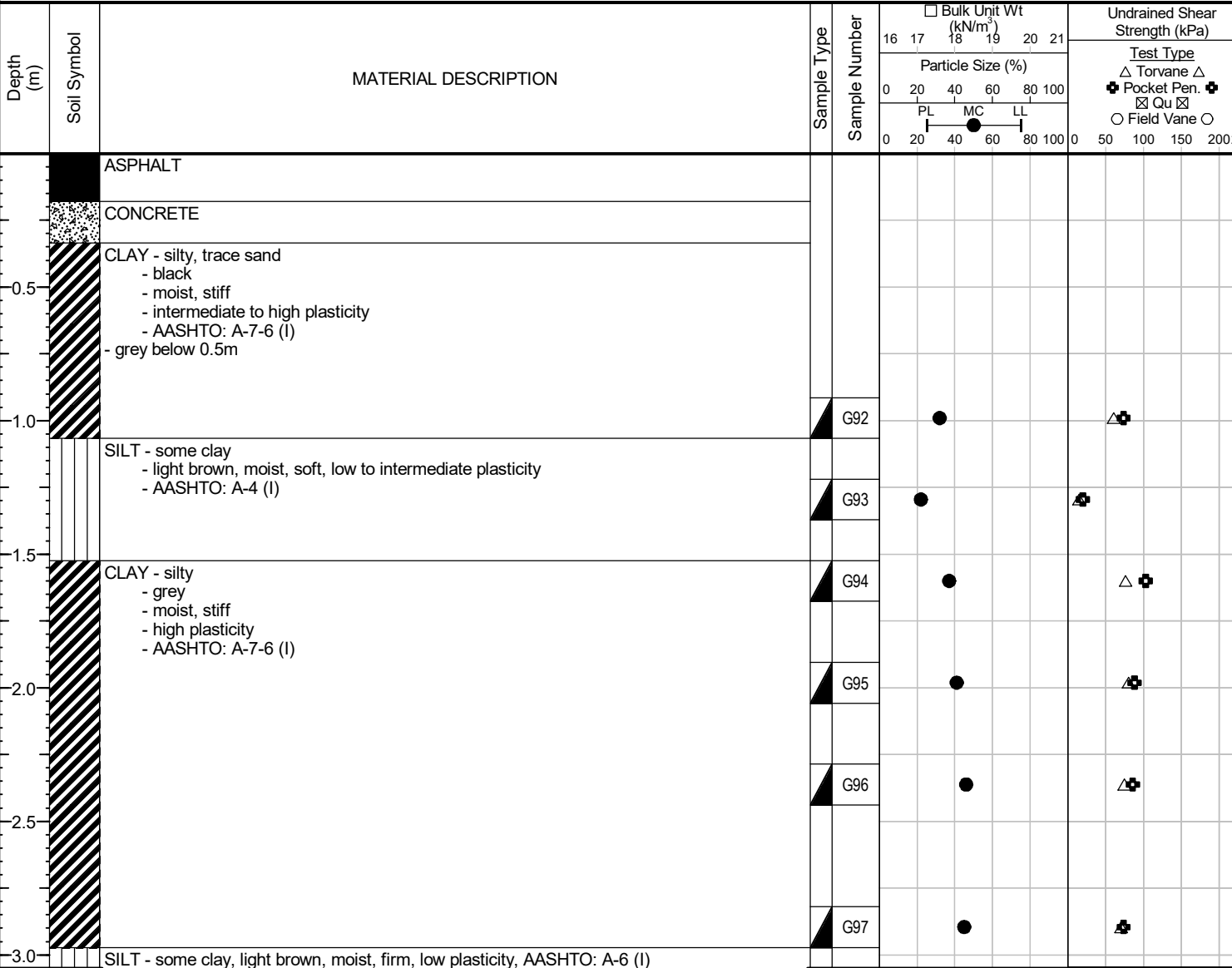
Silt

Sand

Gravel

Cobbles

Boulders



END OF TEST HOLE AT 3.0m IN SILT.

Notes:

- Seepage and sloughing not observed.
- Test hole dry and open to 3.0m depth immediately after drilling.
- Test hole backfilled with cuttings and bentonite.
- Bulk samples (B98 silt and B99 clay) collected between 0.8m and 2.0m.



Sub-Surface Log

Test Hole TH25-31

1 of 1

Client:WSP

Project Name:2026-2028 Downtown Pavement Renewals

Contractor:Maple Leaf Drilling

Method:125mm Solid Stem Auger, B40 Mobile Truck Mount

Project Number:1000-043-30

Location:UTM : 633028 E 5527960 N - St Mary Ave

Ground Elevation:Top of Pavement

Date Drilled:October 8, 2025

Sample Type:

Grab (G)Shelby Tube (T)Split Spoon (SS) / SPTSplit Barrel (SB) / LPTCore (C)

Particle Size Legend:

FinesClaySiltSandGravelCobblesBoulders

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)						Undrained Shear Strength (kPa)						
					Particle Size (%)						Test Type						
					PL MC LL						△ Torvane △ ⊕ Pocket Pen. ⊕ ⊠ Qu ⊠ ○ Field Vane ○						
					16	17	18	19	20	21	0	50	100	150	200		
						0	20	40	60	80	100	0	50	100	150	200	
		ASPHALT															
		CONCRETE															
-0.5		CLAY - silty, trace sand, black, moist, very stiff - intermediate plasticity - AASHTO: A-7-6 (I)															
-1.0		SILT - some clay, trace sand - light grey - moist, soft - low plasticity - AASHTO: A-4 (2) - light brown below 0.8m		G100													
-1.5				G101													
-2.0		CLAY - silty - brown - moist, stiff - high plasticity - AASHTO: A-7-6 (I)		G102													
-2.5				G103													
-3.0		- trace silt inclusions (<40mm diam.) between 2.4m and 2.7m		G104													
-3.5				G105													

END OF TEST HOLE AT 3.0m IN CLAY.
Notes:
1) Seepage and sloughing not observed.
2) Test hole dry and open to 3.0m depth immediately after drilling.
3) Test hole backfilled with cuttings and bentonite.
4) Bulk samples (B106 silt and B107 clay) collected between 0.8m and 2.0m.



Sub-Surface Log

Test Hole TH25-32

1 of 1

Client:WSP

Project Name:2026-2028 Downtown Pavement Renewals

Contractor:Maple Leaf Drilling

Method:125mm Solid Stem Auger, B40 Mobile Truck Mount

Project Number:1000-043-30

Location:UTM : 632963 E 5527939 N - St Mary Ave

Ground Elevation:Top of Pavement

Date Drilled:October 8, 2025

Sample Type:

Grab (G)

Shelby Tube (T)

Split Spoon (SS) / SPT

Split Barrel (SB) / LPT

Core (C)

Particle Size Legend:

Fines

Clay

Silt

Sand

Gravel

Cobbles

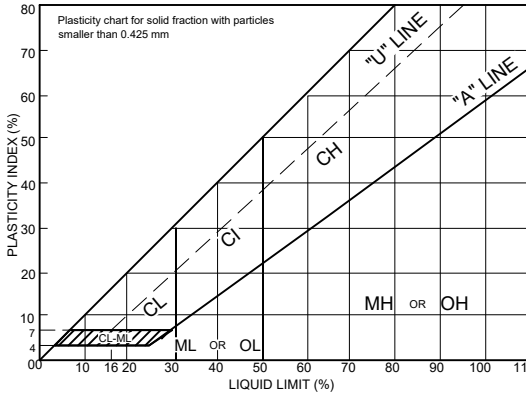
Boulders

Depth (m)	Soil Symbol	MATERIAL DESCRIPTION	Sample Type	Sample Number	Bulk Unit Wt (kN/m ³)						Undrained Shear Strength (kPa)																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																									
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END OF TEST HOLE AT 3.0m IN CLAY.
Notes:
1) Seepage and sloughing not observed.
2) Test hole dry and open to 3.0m depth immediately after drilling.
3) Test hole backfilled with cuttings and bentonite.
4) Bulk samples (B115 clay) collected between 0.8m and 2.0m.

GENERAL NOTES

- Classifications are based on the Unified Soil Classification System and include consistency, moisture, and color. Field descriptions have been modified to reflect results of laboratory tests where deemed appropriate.
- Descriptions on these test hole logs apply only at the specific test hole locations and at the time the test holes were drilled. Variability of soil and groundwater conditions may exist between test hole locations.
- When the following classification terms are used in this report or test hole logs, the primary and secondary soil fractions may be visually estimated.

Major Divisions			USCS Classification	Symbols	Typical Names	Laboratory Classification Criteria			Particle Size	ASTM Sieve sizes	#10 to #4 #40 to #10 #200 to #40 < #200			
(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	$C_u = \frac{D_{60}}{D_{10}}$ greater than 4; $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ between 1 and 3						
(More than half of coarse fraction is smaller than 4.75 mm)			Sands (More than half of coarse fraction is smaller than 4.75 mm)	Clean sands (Little or no fines)	GP		Poorly-graded gravels, gravel-sand mixtures, little or no fines	Not meeting all gradation requirements for GW						
(More than half the material is smaller than No. 200 sieve size)			Sands with fines (Appreciable amount of fines)	Gravel with fines (Appreciable amount of fines)	GM		Silty gravels, gravel-sand-silt mixtures	Atterberg limits below "A" line or P.I. less than 4	Above "A" line with P.I. between 4 and 7 are borderline cases requiring use of dual symbols					
(More than half the material is smaller than No. 200 sieve size)			Sands with fines (Appreciable amount of fines)	Clean sands (Little or no fines)	GC		Clayey gravels, gravel-sand-silt mixtures	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					
(More than half the material is smaller than No. 200 sieve size)			Sands with fines (Appreciable amount of fines)	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						
(More than half the material is smaller than No. 200 sieve size)			Sands with fines (Appreciable amount of fines)	Clean sands (Little or no fines)	SP		Poorly-graded sands, gravelly sands, little or no fines	Not meeting all gradation requirements for SW						
(More than half the material is smaller than No. 200 sieve size)			Sands with fines (Appreciable amount of fines)	Clean sands (Little or no fines)	SM		Silty sands, sand-silt mixtures	Atterberg limits below "A" line or P.I. less than 4	Above "A" line with P.I. between 4 and 7 are borderline cases requiring use of dual symbols					
(More than half the material is smaller than No. 200 sieve size)			Sands with fines (Appreciable amount of fines)	Clean sands (Little or no fines)	SC		Clayey sands, sand-clay mixtures	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					
(More than half the material is smaller than No. 200 sieve size)			Silt 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	Determine percentages of sand and gravel from grain size curve, depending on percentage of fines (fraction smaller than No. 200 sieve) coarse-grained soils are classified as follows: Less than 5 percent..... GW, GP, SW, SP More than 12 percent..... GM, GC, SM, SC 6 to 12 percent..... Borderline cases requiring dual symbols*		Particle Size	ASTM Sieve Sizes	#10 to #4 #40 to #10 #200 to #40 < #200			
			Silt and Clays (Liquid limit less than 50)			CL		Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays				Material	ASTM Sieve Sizes	#10 to #4 #40 to #10 #200 to #40 < #200
			Silt and Clays (Liquid limit greater than 50)			OL		Organic silts and organic silty clays of low plasticity				Material	ASTM Sieve Sizes	#10 to #4 #40 to #10 #200 to #40 < #200
Highly Organic Soils			MH		Inorganic silts, micaceous or distomaceous fine sandy or silty soils, organic silts				Material	ASTM Sieve Sizes	#10 to #4 #40 to #10 #200 to #40 < #200			
Highly Organic Soils			CH		Inorganic clays of high plasticity, fat clays				Material	ASTM Sieve Sizes	#10 to #4 #40 to #10 #200 to #40 < #200			
Highly Organic Soils			OH		Organic clays of medium to high plasticity, organic silts				Material	ASTM Sieve Sizes	#10 to #4 #40 to #10 #200 to #40 < #200			
Highly Organic Soils			Pt		Peat and other highly organic soils				Material	ASTM Sieve Sizes	#10 to #4 #40 to #10 #200 to #40 < #200			
Highly Organic Soils			Pt		Peat and other highly organic soils				Material	ASTM Sieve Sizes	#10 to #4 #40 to #10 #200 to #40 < #200			

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

Other Symbol Types

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

LEGEND OF ABBREVIATIONS AND SYMBOLS

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

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
with *	with silt, with sand	> 35 percent

* Used when the material is classified based on behaviour as a cohesive material

TERMS DESCRIBING CONSISTENCY OR COMPACTION CONDITION

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

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

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

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

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

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



**2026-2028 Downtown Pavement Renewals
Sub-Surface Investigation
St Mary Ave - Memorial Blvd to Main St**

Test Hole No.	Test Hole Location	Pavement Surface		Pavement Structure Material		Subgrade Description	Sample Depth (m)		Moisture Content (%)	Grain Size Analysis				Atterberg Limits		
		Type	Thickness (mm)	Type	Thickness (mm)		Top (m)	Bottom (m)		Clay (%)	Silt (%)	Sand (%)	Gravel (%)	Plastic	Liquid	Plasticity Index
TH25-30	UTM : 5528003 N, 633132 E Located at #400 St Mary Ave, Westbound curb lane, 1.5 m South of North curb.	Asphalt	180	Concrete	170	Clay, AASHTO: A-7-6 (I)	0.9	1.1	32							
						Silt, AASHTO: A-4 (I)	1.2	1.4	22							
						Clay, AASHTO: A-7-6 (I)	1.5	1.7	37							
						Clay, AASHTO: A-7-6 (I)	1.9	2.1	41							
						Clay, AASHTO: A-7-6 (I)	2.3	2.4	46							
						Clay, AASHTO: A-7-6 (I)	2.8	3.0	45							
TH25-31	UTM : 5527960 N, 633028 E Located at #444 St Mary Ave, Westbound curb lane, 3.0 m North of South curb.	Asphalt	80	Concrete	240	Clay, AASHTO: A-7-6 (I)	0.9	1.1	21	14	79	7	0	18	23	4
						Silt, AASHTO: A-4 (2)	1.2	1.4	26							
						Clay, AASHTO: A-7-6 (I)	1.5	1.7	38							
						Clay, AASHTO: A-7-6 (I)	1.9	2.1	36							
						Clay, AASHTO: A-7-6 (I)	2.3	2.4	45							
						Clay, AASHTO: A-7-6 (I)	2.8	3.0	47							
TH25-32	UTM : 5527939 N, 632963 E Located 29 m West of Vaughan , Westbound middle lane, 10 m South of North curb.	Asphalt	200	Concrete	200	Clay, AASHTO: A-7-6 (54)	0.6	0.8	10							
						Clay, AASHTO: A-7-6 (54)	0.9	1.1	33	67	31	3	0	23	71	48
						Clay, AASHTO: A-7-6 (54)	1.2	1.4	33							
						Clay, AASHTO: A-7-6 (54)	1.5	1.7	34							
						Clay, AASHTO: A-7-6 (54)	1.9	2.1	36							
						Clay, AASHTO: A-7-6 (54)	2.3	2.4	46							
						Clay, AASHTO: A-7-6 (54)	2.8	3.0	46							



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Moisture Content Report ASTM D2216-98

Project No. 1000-043-30
Client WSP
Project 2026-2028 Downtown Pavement Renewals
St Mary Ave - Memorial Blvd to Main st
Sample Date 08-Oct-25
Test Date 25-Oct-25
Technician D. Sellick

Test Hole	TH25-30	TH25-30	TH25-30	TH25-30	TH25-30	TH25-30
Depth (m)	0.9 - 1.1	1.2 - 1.4	1.5 - 1.7	1.9 - 2.1	2.3 - 2.4	2.8 - 3.0
Sample #	G92	G93	G94	G95	G96	G97
Tare ID	N02	QT28	W81	W55	P03	D23
Mass of tare	8.4	8.4	8.6	8.4	8.6	8.8
Mass wet + tare	277.4	261.2	221.0	240.6	252.2	275.6
Mass dry + tare	211.6	215.6	164.2	172.8	175.8	192.4
Mass water	65.8	45.6	56.8	67.8	76.4	83.2
Mass dry soil	203.2	207.2	155.6	164.4	167.2	183.6
Moisture %	32.4%	22.0%	36.5%	41.2%	45.7%	45.3%

Test Hole	TH25-31	TH25-31	TH25-31	TH25-31	TH25-31	TH25-31
Depth (m)	0.9 - 1.1	1.2 - 1.4	1.5 - 1.7	1.9 - 2.1	2.3 - 2.4	2.8 - 3.0
Sample #	G100	G101	G102	G103	G104	G105
Tare ID	D241	H21	AB94	M15	QT83	M14
Mass of tare	6.8	8.6	6.8	7.0	8.4	7.0
Mass wet + tare	433.6	312.2	258.0	314.0	266.6	277.6
Mass dry + tare	359.4	250.0	188.2	232.0	186.0	191.0
Mass water	74.2	62.2	69.8	82.0	80.6	86.6
Mass dry soil	352.6	241.4	181.4	225.0	177.6	184.0
Moisture %	21.0%	25.8%	38.5%	36.4%	45.4%	47.1%

Test Hole	TH25-32	TH25-32	TH25-32	TH25-32	TH25-32	TH25-32
Depth (m)	0.6 - 0.8	0.9 - 1.1	1.2 - 1.4	1.5 - 1.7	1.9 - 2.1	2.3 - 2.4
Sample #	G108	G109	G110	G111	G112	G113
Tare ID	D24	W97	AC10	W101	Z4	Z01
Mass of tare	8.6	8.6	6.6	8.6	6.8	8.6
Mass wet + tare	344.4	418.6	303.4	275.4	265.6	263.8
Mass dry + tare	314.0	317.2	229.0	207.4	197.4	183.6
Mass water	30.4	101.4	74.4	68.0	68.2	80.2
Mass dry soil	305.4	308.6	222.4	198.8	190.6	175.0
Moisture %	10.0%	32.9%	33.5%	34.2%	35.8%	45.8%



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Moisture Content Report ASTM D2216-98

Project No. 1000-043-30
Client WSP
Project 2026-2028 Downtown Pavement Renewals
St Mary Ave - Memorial Blvd to Main st
Sample Date 08-Oct-25
Test Date 25-Oct-25
Technician D. Sellick

Test Hole	TH25-32					
Depth (m)	2.8 - 3.0					
Sample #	G114					
Tare ID	E7					
Mass of tare	6.8					
Mass wet + tare	252.6					
Mass dry + tare	175.2					
Mass water	77.4					
Mass dry soil	168.4					
Moisture %	46.0%					

Project No. 1000-043-30
Client WSP
Project 2026-2028 Downtown Pavement Renewals

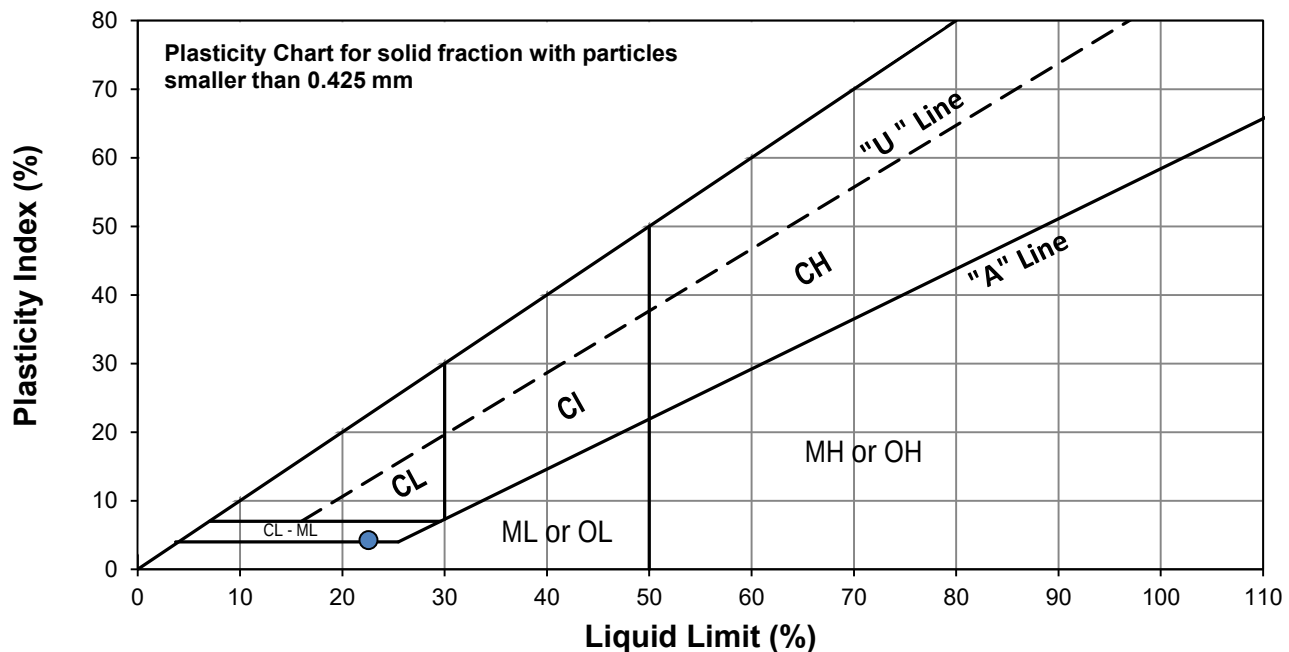


Test Hole TH25-31 (St Mary Ave - Memorial Blvd to Main st)
Sample # G100
Depth (m) 0.9 - 1.1
Sample Date 08-Oct-25
Test Date 28-Oct-25
Technician D. Sellick

Liquid Limit	23
Plastic Limit	18
Plasticity Index	4

Liquid Limit

Trial #	1	2	3		
Number of Blows (N)	16	25	31		
Mass Tare (g)	14.038	14.074	13.559		
Mass Wet Soil + Tare (g)	24.007	25.213	24.857		
Mass Dry Soil + Tare (g)	22.090	23.172	22.816		
Mass Water (g)	1.917	2.041	2.041		
Mass Dry Soil (g)	8.052	9.098	9.257		
Moisture Content (%)	23.808	22.434	22.048		



Plastic Limit

Trial #	1	2	3	4	5
Mass Tare (g)	13.776	14.029			
Mass Wet Soil + Tare (g)	22.543	22.840			
Mass Dry Soil + Tare (g)	21.183	21.477			
Mass Water (g)	1.360	1.363			
Mass Dry Soil (g)	7.407	7.448			
Moisture Content (%)	18.361	18.300			

Note: Additional information recorded/measured for this test is available upon request.

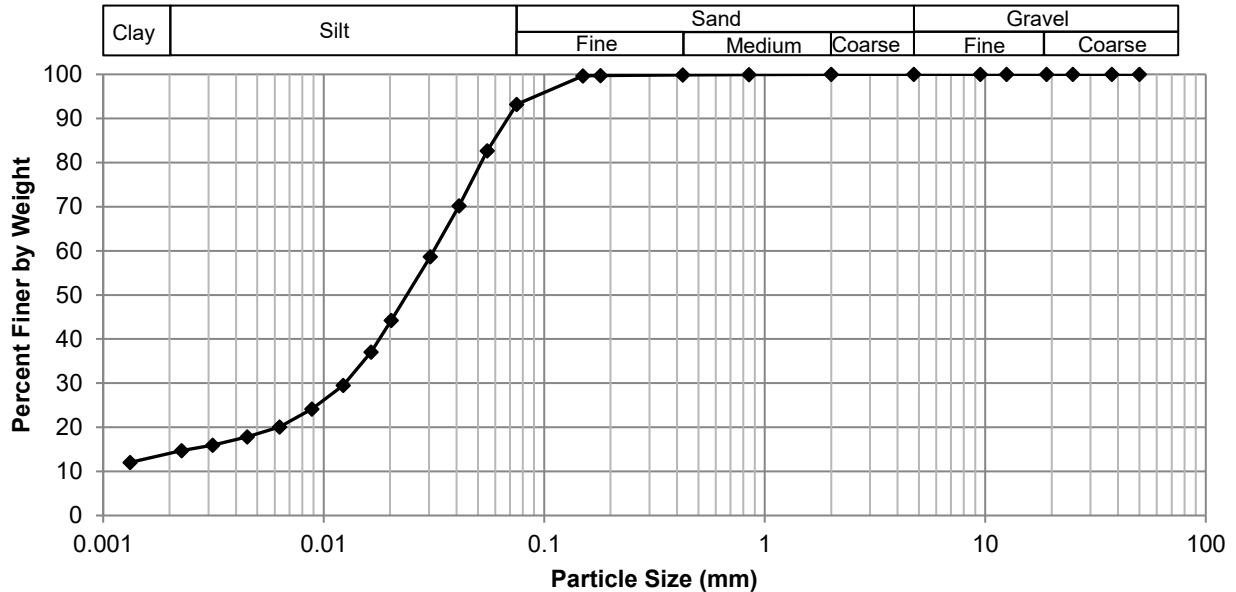
Project No. 1000-043-30
Client WSP
Project 2026-2028 Downtown Pavement Renewals



Test Hole TH25-31 (St Mary Ave - Memorial Blvd to Main st)
Sample # G100
Depth (m) 0.9 - 1.1
Sample Date 08-Oct-25
Test Date 27-Oct-25
Technician A.Fidler-Kliewer

Gravel	0.0%
Sand	6.8%
Silt	79.2%
Clay	14.0%

Particle Size Distribution Curve



Project No. 1000-043-30
Client WSP
Project 2026-2028 Downtown Pavement Renewals

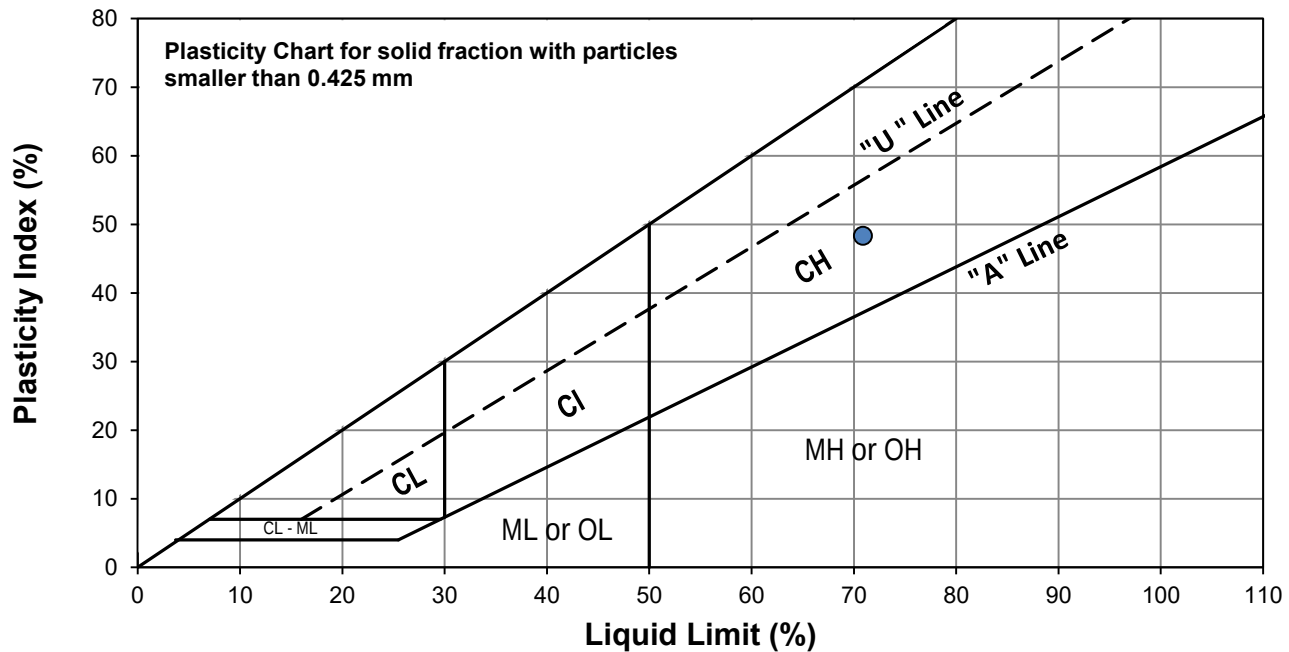


Test Hole TH25-32 (St Mary Ave - Memorial Blvd to Main st)
Sample # G109
Depth (m) 0.9 - 1.1
Sample Date 08-Oct-25
Test Date 30-Oct-25
Technician T.Green

Liquid Limit	71
Plastic Limit	23
Plasticity Index	48

Liquid Limit

Trial #	1	2	3		
Number of Blows (N)	17	23	33		
Mass Tare (g)	14.092	14.197	14.152		
Mass Wet Soil + Tare (g)	24.171	23.127	23.451		
Mass Dry Soil + Tare (g)	19.883	19.400	19.669		
Mass Water (g)	4.288	3.727	3.782		
Mass Dry Soil (g)	5.791	5.203	5.517		
Moisture Content (%)	74.046	71.632	68.552		



Plastic Limit

Trial #	1	2	3	4	5
Mass Tare (g)	14.068	14.008			
Mass Wet Soil + Tare (g)	23.383	21.285			
Mass Dry Soil + Tare (g)	21.659	19.950			
Mass Water (g)	1.724	1.335			
Mass Dry Soil (g)	7.591	5.942			
Moisture Content (%)	22.711	22.467			

Note: Additional information recorded/measured for this test is available upon request.

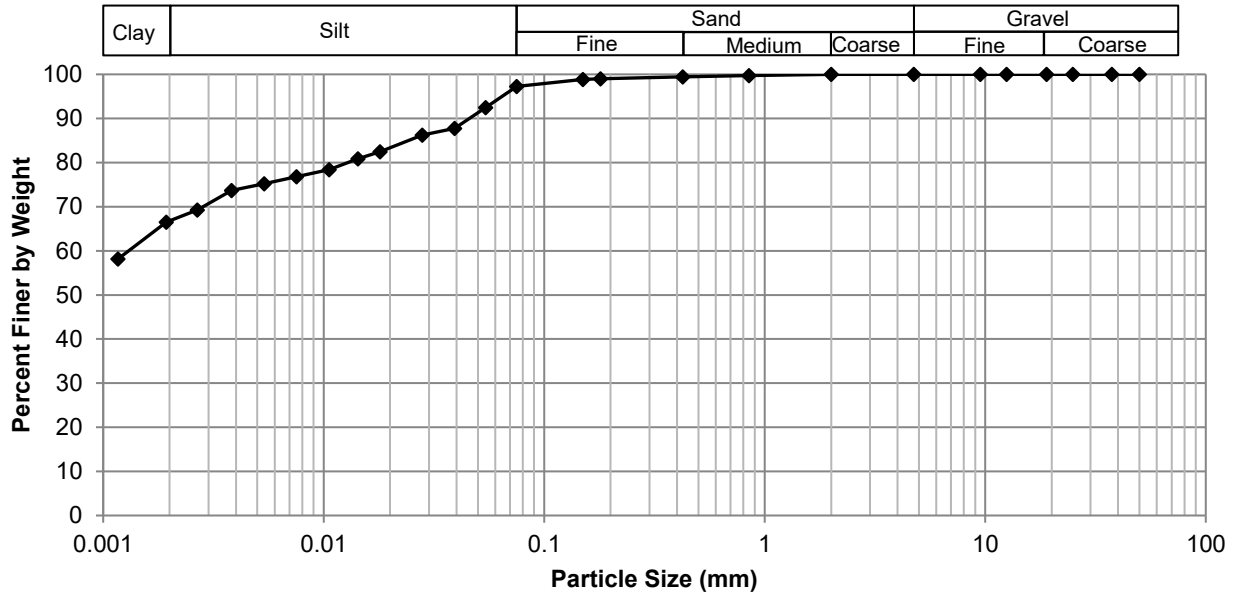
Project No. 1000-043-30
Client WSP
Project 2026-2028 Downtown Pavement Renewals



Test Hole TH25-32 (St Mary Ave - Memorial Blvd to Main st)
Sample # G109
Depth (m) 0.9 - 1.1
Sample Date 08-Oct-25
Test Date 29-Oct-25
Technician A.Fidler-Kliewer

Gravel	0.0%
Sand	2.8%
Silt	30.5%
Clay	66.7%

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	97.24
37.5	100.00	2.00	100.00	0.0542	92.47
25.0	100.00	0.850	99.72	0.0392	87.78
19.0	100.00	0.425	99.44	0.0280	86.22
12.5	100.00	0.180	98.98	0.0180	82.47
9.50	100.00	0.150	98.84	0.0143	80.90
4.75	100.00	0.075	97.24	0.0106	78.40
				0.0075	76.84
				0.0054	75.23
				0.0038	73.67
				0.0027	69.25
				0.0019	66.49
				0.0012	58.17



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Standard Proctor Compaction Test

ASTM D698-12e2

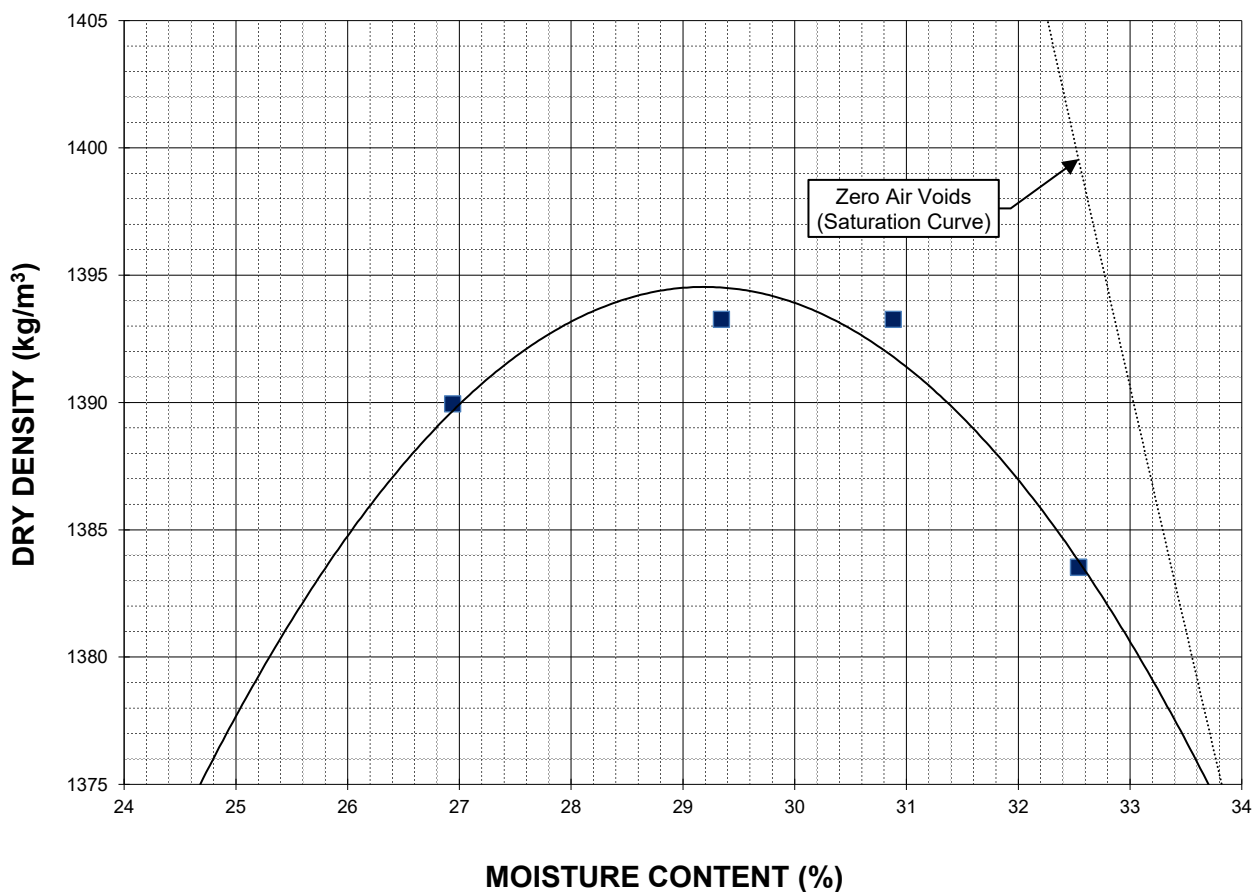
Project No. 1000-043-30
Client WSP
Project 2026-2028 Downtown Pavement Renewals



Sample # L25-443-07 (B99, B107 & B115)
Source St Mary Ave (TH25-30, TH25-31 & TH25-32)
Material Clay
Sample Date 08-Oct-25
Test Date 17-Oct-25
Technician A. Dustmamatov

Maximum Dry Density (kg/m³)	1395
Optimum Moisture (%)	29.2

Trial Number	1	2	3	4	
Wet Density (kg/m ³)	1764	1802	1824	1834	
Dry Density (kg/m ³)	1390	1393	1393	1384	
Moisture Content (%)	26.9	29.3	30.9	32.5	



Note: Additional information recorded/measured for this test is available upon request.



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California Bearing Ratio Test Data Sheet

ASTM D1883-21

Project No.	1000-043-30	Source	St Mary Ave (TH25-30, TH25-31 & TH25-32)
Client	WSP	Material	Clay
Project	2026-2028 Downtown Pavement Renewals	Sample Date	07-Oct-25
Sample #	L25-443-07 (B99, B107 & B115)	Test Date	16-Oct-25
		Technician	A. Dustmamatov

Proctor Results (ASTM D698)

Maximum Dry Density	1395 kg/m ³
Optimum Moisture Content	29.2 %
Material Retained on 19 mm Sieve	0.0 %

CBR Sample Compaction

Dry Density	1327 kg/m ³
Initial Moisture Content	30.1 %
Relative Density	95.1 % SPMDD

Soaking Results

Surcharge	4.54 kg
Swell	7.2 %
Moisture Content in top 25 mm	50.4 %
Immersion Period	96 h

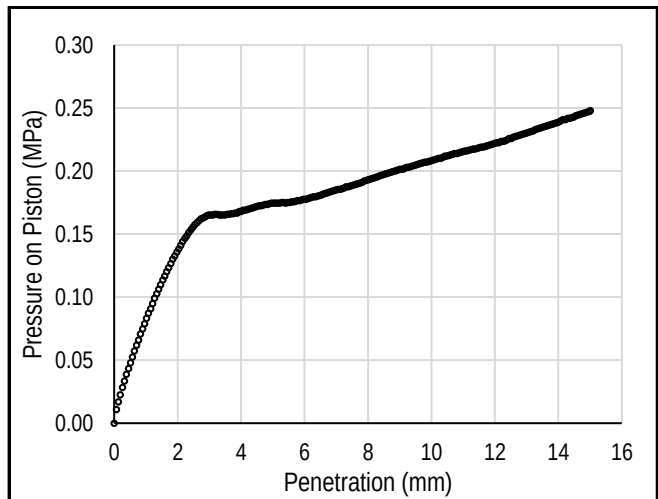
CBR Results

CBR at 2.54 mm	2.3 %
CBR at 5.08 mm	1.7 %
Zero Correction	0 mm

Test Data

Penetration (mm)	Measured Pressure (MPa)	Corrected Pressure (MPa)
0.64	0.06	0.06
1.27	0.10	0.10
1.91	0.13	0.13
2.54	0.16	0.16
3.18	0.17	0.17
3.81	0.17	0.17
4.45	0.17	0.17
5.08	0.17	0.17
7.62	0.19	0.19
10.16	0.21	0.21
12.70	0.23	0.23

Load/Penetration Curve



Comments:

Sample prepared in accordance with the City of Winnipeg guidelines.



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Standard Proctor Compaction Test

ASTM D698-12e2

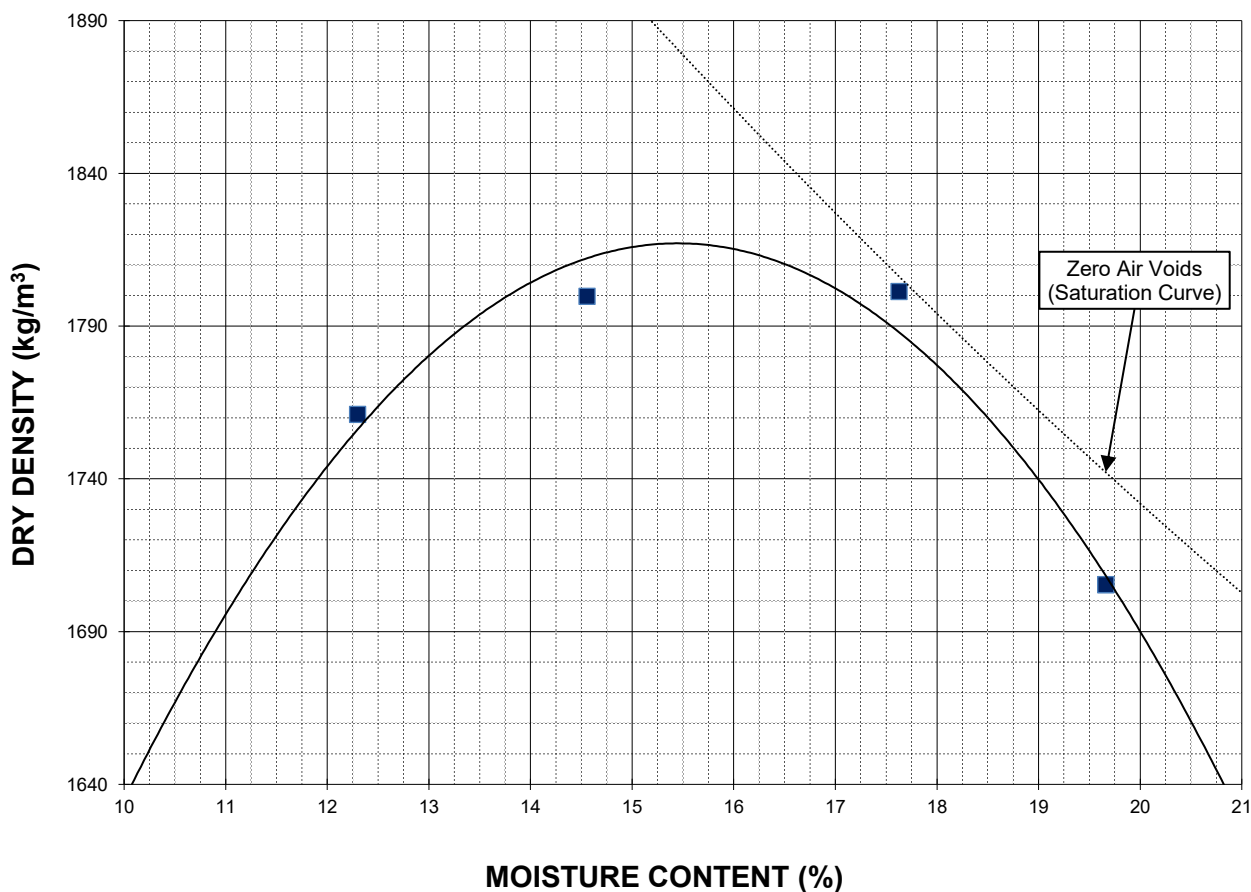
Project No. 1000-043-30
Client WSP
Project 2026-2028 Downtown Pavement Renewals



Sample # L25-443-08 (B98 & B106)
Source St Mary Ave (TH25-30 & TH25-31)
Material Silt
Sample Date 08-Oct-25
Test Date 17-Oct-25
Technician A. Dustmamatov

Maximum Dry Density (kg/m³)	1817
Optimum Moisture (%)	15.4

Trial Number	1	2	3	4	
Wet Density (kg/m ³)	1978	2062	2119	2041	
Dry Density (kg/m ³)	1761	1800	1801	1705	
Moisture Content (%)	12.3	14.6	17.6	19.7	



Note: Additional information recorded/measured for this test is available upon request.



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California Bearing Ratio Test Data Sheet

ASTM D1883-21

Project No.	1000-043-30	Source	St Mary Ave (TH25-30 & TH25-31)
Client	WSP	Material	Silt
Project	2026-2028 Downtown Pavement Renewals	Sample Date	08-Oct-25
Sample #	L25-443-08 (B98 & B106)	Test Date	23-Oct-25
		Technician	A. Dustmamatov

Proctor Results (ASTM D698)

Maximum Dry Density	1817 kg/m ³
Optimum Moisture Content	15.4 %
Material Retained on 19 mm Sieve	0.0 %

CBR Sample Compaction

Dry Density	1722 kg/m ³
Initial Moisture Content	15.4 %
Relative Density	94.8 % SPMDD

Soaking Results

Surcharge	4.54 kg
Swell	0.9 %
Moisture Content in top 25 mm	19.1 %
Immersion Period	96 h

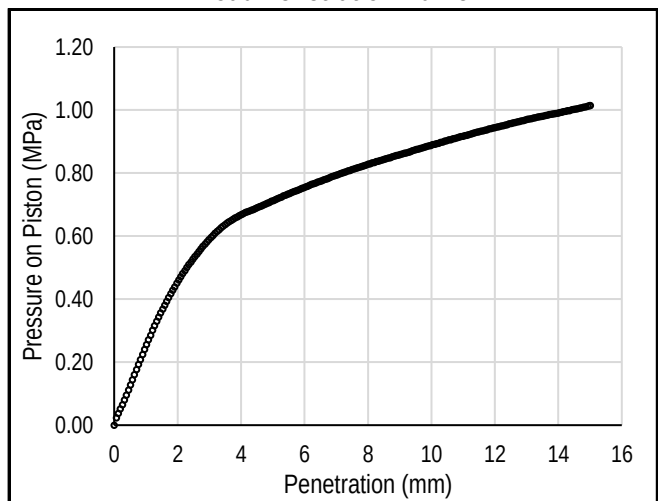
CBR Results

CBR at 2.54 mm	7.8 %
CBR at 5.08 mm	7.0 %
Zero Correction	0 mm

Test Data

Penetration (mm)	Measured Pressure (MPa)	Corrected Pressure (MPa)
0.64	0.16	0.16
1.27	0.32	0.32
1.91	0.44	0.44
2.54	0.54	0.54
3.18	0.61	0.61
3.81	0.66	0.66
4.45	0.69	0.69
5.08	0.72	0.72
7.62	0.82	0.82
10.16	0.89	0.89
12.70	0.96	0.96

Load/Penetration Curve



Comments:

Sample prepared in accordance with the City of Winnipeg guidelines.



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Concrete Core Compressive Strength Report

CSA A23.2-14C

Project No. 1000-043-30

Date October 29, 2025

Project 2026-2028 Downtown Pavement Renewals

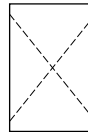
Technician T. Green

Client WSP Group Canada Inc.

Core Location	Core ID	Date Received	Date of Break	Age at Break	Diam. (mm)	Length (mm)	Moisture Conditioning	Compressive Strength (MPa)		Break Type	Correction Factors*				
								Uncorrected f_{conc}	Corrected* f_c		$F_{l/d}$	F_{dia}	F_{mc}	F_D	F_{reinf}
St Mary Ave	PC25-25	2025-10-15	2025-10-29	-	145	183	Soaked 48 h	71.36	77.01	1	0.9530	0.9802	1.0900	1.0600	1.0000

Comments

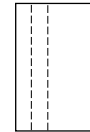
*Correction factors $F_{l/d}$, F_{dia} , F_{mc} , and F_D calculated as per ACI 214.4R-03, and correction factor F_{reinf} calculated as per Khoury et al. (2014): $f_c = f_{conc} F_{l/d} F_{dia} F_{mc} F_D F_{reinf}$



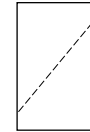
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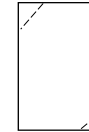
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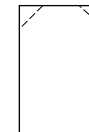
Type 3



Type 4



Type 5



Type 6

Reviewed by (print): Kate Franklin

Signature: Kate Franklin

Table 1 Factors involved in interpretation of core results by different codes.

List	Code/standard	Edition	Factors Considered					
			Aspect ratio	Diameter	Reinforcing	Moisture	Damage	Direction
1	Egyptian Code/Standard Specification	2008	✓		✓			✓
2	British Code/Standard Specification	2003	✓		✓			✓
3	American Concrete Institute ACI	1998	✓					
		2012	✓	✓		✓	✓	
4	European Standard Specification	1998	✓	✓	✓		✓	
		2009	✓		✓			
5	Japanese Standard	1998	✓					
6	Concrete Society	1987	✓		✓		✓	✓

In addition, for core specimen containing two bars no further apart than the diameter of the larger bar, only the bar corresponding to the higher value of $(\Phi_r * d)$ is considered. If the bars are further apart, their combined effect should be assessed by replacing the term $(\Phi_r * d)$ by the term $(\sum \Phi_r * d)$.

It should be pointed out that above equations used to interpret the core concrete strength to the in-situ concrete cube strength have been developed based on a set of assumptions and through many converting process. It is also of interest to note that the damage effect is considered in the development of the formulas in indirect way. The subject derivation and detailed formulas may be seen elsewhere [14].

3.2. American Concrete Institute (ACI)

3.2.1. Former ACI Code (2002) & Current ASTM (2009)

The methodology of core interpretation given in the former ACI code was remained without changes for decades and up to Year (2003). The in-place strength of concrete cylinder at the location from which a core test specimen was extracted can be computed using the equation:

$$f_{cy} = F_{l/d} \cdot f_{core} \quad (4)$$

where f_{cy} is the equivalent in-place concrete cylinder strength, f_{core} is concrete core strength, and $F_{l/d}$ is the strength correction factor for aspect ratio.

The former ACI code does not include any equation to calculate the correction factor ($F_{l/d}$); however, the code gives different values for this term that is associated with different aspect ratios (l/d) as given in Table 2. It should also be noted that the approach of current ASTM is similar to that mentioned above. The only considered variable is the aspect ratio (l/d). It should be noted that identical approach to that mentioned above is still effective in ASTM C42/C42M-03 [10].

3.2.2. Current ACI Code (2012) [15]

Starting from Year 2003, significant changes have been made to the relevant ACI Code provisions regarding the interpreta-

Table 2 Mean values for factor $F_{l/d}$ according to ACI Code (1998) and ASTM.

	Specimen length-to-diameter ratio, l/d			
	1.00	1.25	1.50	1.75
$F_{l/d}$	0.87	0.93	0.96	0.98

tion of core strength test results. New factors have been considered. These include core diameter, moisture content of core sample, core damage associated with drilling, in addition to the effect of aspect ratio that was previously considered in the former ACI edition (1998). According to the ACI 214.4R-03, the in-place concrete strength can be computed using the equation:

$$f_c = F_{l/d} \cdot F_{dia} \cdot F_{mc} \cdot F_D \cdot f_{core} \cdot \text{Front or cc. 12 or cc. 13} \quad (5)$$

where f_c is the equivalent in-place concrete cylinder strength, f_{core} is concrete core strength, $F_{l/d}$ is strength correction factor for aspect ratio, F_{dia} is strength correction factors for diameter, F_{mc} is strength correction factor for moisture condition of core sample, and F_D is the strength correction factor that accounts for effect of damage sustained during core drilling including micro-cracking and undulations at the drilled surface and cutting through coarse-aggregate particles that may subsequently pop out during testing.

The ACI committee considered the correction factors presented in Table 3 for converting core strengths into equivalent in-place strengths based on the work reported by Bartlett and MacGregor [6]. It should be noted that the magnitude of

Table 3 Strength correction factors according to ACI 214.4R-03.

List	Factors	Mean values
(1) ^b	$F_{l/d}$: l/d ratio	
	As-received	$1 - \{0.130 - \alpha f_{core}\} (2 - \frac{l}{d})^2$
	Soaked 48 h	$1 - \{0.117 - \alpha f_{core}\} (2 - \frac{l}{d})^2$
	Air dried ^a	$1 - \{0.144 - \alpha f_{core}\} (2 - \frac{l}{d})^2$
(2)	F_{dia} : core diameter	
	50 mm	1.06
	100 mm	1.00
	150 mm	0.98
(3)	F_{mc} : core moisture content	
	As-received	1.00
	Soaked 48 h	1.09
	Air dried ^a	0.96
(4)	F_D : damage due to drilling	1.06

^a Standard treatment specified in ASTM C 42/C 42M.

^b Constant α equals $4.3(10^{-4})$ 1/MPa for f_{core} in MPa.

Table 6 List of comparisons between tested cores to determine.

	A18	A17	A16	A15	A14	A13	A12	A11	A10	A9	A8	A7	A6	A5	A4	A3	A2	A1
A1	●	●	●	■	■		●				●			▲	▲	■	▲	
A2																		
A3						■				■								
A4																		
A5																		
A6								■	▲	■	▲		■	▲				
A7								■	▲	■	▲							
A8		●	◆	●	●													
A9																		
A10								■	▲									
A11																		
A12		●		●	●													
A13																		
A14		●		●														
A15		●																
A16	●	◆																
A17	◆																	
A18																		

- Diameter of steel bar.
- ▲ Distance of steel bar from nearly end of core.
- Number of steel bars and spacing between bars.
- ◆ Distance of steel bar from vertical axis of specimen.

This brief review indicated that the various proposed relationships for correction factors are all nonlinear. It should be noted that the equations given by the Egyptian Code takes into account most variables that may affect the interpretation of the results; however, the code ignores the deterioration of steel-concrete bond that may occur and also the position of the reinforcement from vertical axis of core specimens.

Weighted nonlinear regression analysis has been performed to determine the factor (F_{reinf}) with the use of the software "SAS" package and "Data Fit." This shows that the correction factor for reinforcement (F_{reinf}) is given by the following expression:

• For cores containing a single bar:

$$F_{\text{reinf}} = \left[1 + 1.5 \frac{[\Phi_r \times r + \Phi_r \times (S/10)]}{\Phi_c \times L} \right] \times \frac{1.13}{f_{\text{core}}^{0.015}} \quad (12)$$

- For core specimen containing two bars no further apart than the diameter of the larger bar, only the bar corresponding to the higher value of ($\Phi_r \times d$) is considered. If the bars are further apart, their combined effect is assessed by replacing the term ($\Phi_r \times r$) by ($\sum \Phi_r \times r$) as follows:

multiple bars

$$F_{\text{reinf}} = \left[1 + 1.5 \frac{\sum [\Phi_r \times r + \Phi_r \times (S/10)]}{\Phi_c \times L} \right] \times \frac{1.13}{f_{\text{core}}^{0.015}} \quad (13)$$

where F_{reinf} is the correction factor for reinforcement, Φ_r is the diameter of the reinforcement, Φ_c is the diameter of the concrete specimen, r is the distance of axis of bar from nearer end of specimen, S is the distance of axis of bar from axis of core specimen, L is the length of the specimen after end preparation by grinding or capping, and f_{core} is the concrete core strength (kg/cm^2).

6.1.6. Effect of moisture condition of core

Results of about 100 cores indicate that the strength of cores left to dry in air for 7 days is on average 13% greater than that of cores soaked at least 40 h before testing. The strength of cores with negligible moisture gradient and tested after cutting is found to be 7–9% larger than that of soaked cores as shown in Fig. 20. The authors strongly recommend to use a correction factor accounting for moisture condition (F_m) equals to 1.09 and 0.96, respectively, for cores tested after 48 h soaked in water and for those tested after 7 days dry in air.

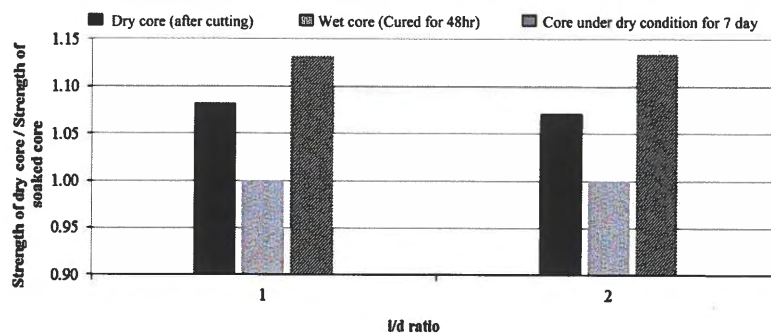
**Figure 20** Effect of core moisture condition on core strength for different aspect ratios (l/d).



Photo 1: Pavement Core Sample at TH25-30



Photo 2: Pavement Core Sample at TH25-31



Photo 3: Pavement Core Sample at TH25-32



2026-2028 Downtown Pavement Renewals
St Mary Ave - Memorial Blvd to Main St

Pavement Core No.	Pavement Core Location	Pavement Surface		Pavement Structure Material		Corrected Compressive Strength (Mpa)
		Type	Thickness (mm)	Type	Thickness (mm)	
PC25-21	UTM : 5528034 m N, 633207 m E; Located 10 m West of Edmonton St, Westbound curb lane, 2.1 m South of North curb.	Asphalt	220	Concrete	140	
PC25-22	UTM : 5528034 m N, 633207 m E; Located 5 m West of Hargrave St, Westbound curb lane, 2.1 m South of North curb.	Asphalt	100	Concrete	200	
PC25-23	UTM : 5528034 m N, 633207 m E; Located 20 m East of Hargrave St, Westbound curb lane, 2.0 m South of North curb.	Asphalt	100	Concrete	310	
PC25-25	UTM : 5528034 m N, 633207 m E; Located 5 m East of Smith St, Westbound curb lane, 2.1 m South of North curb.	Asphalt	70	Concrete	220	77.01



Photo 1: Pavement Core Sample at PC25-21



Photo 2: Pavement Core Sample at PC25-22



Photo 3: Pavement Core Sample at PC25-23



Photo 4: Pavement Core Sample at PC25-25

Appendix H
Test Hole Logs, Summary Tables, Lab Testing Results and
Photographs of Pavement Core Samples
York Ave – Memorial Blvd to Garry St.



Sub-Surface Log

Test Hole TH25-34

1 of 1

Client: WSP

Project Number: 1000-043-30

Project Name: 2026-2028 Downtown Pavement Renewals

Location: UTM : 633060 E 5527805 N - York Ave

Contractor: Maple Leaf Drilling

Ground Elevation: Top of Pavement

Method: 125mm Solid Stem Auger, B40 Mobile Truck Mount

Date Drilled: October 7, 2025

Sample Type:

Grab (G)

Shelby Tube (T)

Split Spoon (SS) / SPT

Split Barrel (SB) / LPT

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)						Undrained Shear Strength (kPa)				
					16	17	18	19	20	21	Test Type				
					Particle Size (%)						Pocket Pen. Qu				
					0	20	40	60	80	100	Field Vane				
		ASPHALT													
		CONCRETE													
-0.5		CLAY - silty, trace sand													
		- black													
		- moist, stiff													
		- intermediate to high plasticity													
		- AASHTO: A-7-6 (I)													
-1.0			G276												
		- brown below 1.2m													
-1.5			G277												
			G278												
-2.0		SILT - some clay													
		- light brown													
		- moist, soft													
		- low plasticity													
		- AASHTO: A-4 (I)													
-2.5			G279												
			G280												
-3.0		CLAY - silty													
		- brown													
		- moist, stiff													
		- high plasticity													
		- AASHTO: A-7-6 (I)													
			G281												

END OF TEST HOLE AT 3.0m IN CLAY.

Notes:

- Seepage and sloughing not observed.
- Test hole dry and open to 3.0m depth immediately after drilling.
- Test hole backfilled with cuttings and bentonite.
- Bulk samples (B283 silt and B282 clay) collected between 0.8m and 2.0m.



Sub-Surface Log

Test Hole TH25-35

1 of 1

Client:WSP

Project Number:1000-043-30

Project Name:2026-2028 Downtown Pavement Renewals

Location:UTM : 633206 E 5527851 N - York Ave

Contractor:Maple Leaf Drilling

Ground Elevation:Top of Pavement

Method:125mm Solid Stem Auger, B40 Mobile Truck Mount

Date Drilled:October 7, 2025

Sample Type:

Grab (G)

Shelby Tube (T)

Split Spoon (SS) / SPT

Split Barrel (SB) / LPT

Core (C)

Particle Size Legend:

Fines

Clay

Silt

Sand

Gravel

Cobbles

Boulders

Depth (m)	Soil Symbol	MATERIAL DESCRIPTION	Sample Type	Sample Number	Bulk Unit Wt (kN/m ³)						Undrained Shear Strength (kPa)					
					16	17	18	19	20	21	Test Type					
					Particle Size (%)						Torvane					
					PL MC LL						Pocket Pen.					
					0	20	40	60	80	100	0	50	100	150	200	

		ASPHALT														
		CONCRETE														
0.5		CLAY - silty, trace sand - black - moist, very stiff - intermediate plasticity - AASHTO: A-7-6 (I)														
1.0		SILT - some clay - light brown - moist, soft - low plasticity - AASHTO: A-4 (5)														
1.5		CLAY - silty - brown - moist, stiff - high plasticity - AASHTO: A-7-6 (I)														
2.0																
2.5																
3.0																

GENERAL NOTES

- Classifications are based on the Unified Soil Classification System and include consistency, moisture, and color. Field descriptions have been modified to reflect results of laboratory tests where deemed appropriate.
- Descriptions on these test hole logs apply only at the specific test hole locations and at the time the test holes were drilled. Variability of soil and groundwater conditions may exist between test hole locations.
- When the following classification terms are used in this report or test hole logs, the primary and secondary soil fractions may be visually estimated.

Major Divisions			USCS Classification	Symbols	Typical Names	Laboratory Classification Criteria			Particle Size		Material	
Coarse-Grained soils (More than half the material is larger than No. 200 sieve size)	Gravels (More than half of coarse fraction is larger than 4.75 mm)	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 cases requiring dual symbols*	$C_u = \frac{D_{60}}{D_{10}}$ greater than 4; $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ between 1 and 3					
			GP		Poorly-graded gravels, gravel-sand mixtures, little or no fines		Not meeting all gradation requirements for GW					
			GM		Silty gravels, gravel-sand-silt mixtures		Atterberg limits below "A" line or P.I. less than 4	Above "A" line with P.I. between 4 and 7 are borderline cases requiring use of dual symbols				
			GC		Clayey gravels, gravel-sand-silt mixtures		Atterberg limits above "A" line or P.I. greater than 7					
	Sands (More than half of coarse fraction is smaller than 4.75 mm)	Clean sands (Little or no fines)	SW		Well-graded sands, gravelly sands, little or no fines		$C_u = \frac{D_{60}}{D_{10}}$ greater than 6; $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ between 1 and 3					
			SP		Poorly-graded sands, gravelly sands, little or no fines		Not meeting all gradation requirements for SW					
			SM		Silty sands, sand-silt mixtures		Atterberg limits below "A" line or P.I. less than 4	Above "A" line with P.I. between 4 and 7 are borderline cases requiring use of dual symbols				
			SC		Clayey sands, sand-clay mixtures		Atterberg limits above "A" line or P.I. greater than 7					
	Fine-Grained soils (More than half the material is smaller than No. 200 sieve size)	Silty 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								
Silty 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		

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

Other Symbol Types

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

LEGEND OF ABBREVIATIONS AND SYMBOLS

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

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
with *	with silt, with sand	> 35 percent

* Used when the material is classified based on behaviour as a cohesive material

TERMS DESCRIBING CONSISTENCY OR COMPACTION CONDITION

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

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

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

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

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

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



**2026-2028 Downtown Pavement Renewals
Sub-Surface Investigation
York Ave - Memorial Blvd to Portage Ave**

Test Hole No.	Test Hole Location	Pavement Surface		Pavement Structure Material		Subgrade Description	Sample Depth (m)		Moisture Content (%)	Grain Size Analysis				Atterberg Limits		
		Type	Thickness (mm)	Type	Thickness (mm)		Top (m)	Bottom (m)		Clay (%)	Silt (%)	Sand (%)	Gravel (%)	Plastic	Liquid	Plasticity Index
TH25-33	UTM : 5527799 N, 633016 E Located 21 m East of Memorial Blvd, Eastbound curb lane, 2.0 m North of South curb.	Asphalt	110	Concrete	240	Clay, AASHTO: A-7-6 (72)	0.9	1.1	38	73	25	2	0	22	86	64
						Clay, AASHTO: A-7-6 (72)	1.2	1.4	36							
						Clay, AASHTO: A-7-6 (72)	1.5	1.7	39							
						Clay, AASHTO: A-7-6 (72)	1.9	2.1	44							
						Clay, AASHTO: A-7-6 (72)	2.3	2.4	44							
						Clay, AASHTO: A-7-6 (72)	2.8	3.0	47							
TH25-34	UTM : 5527805 N, 633060 E Located 47 m West of Kennedy St, Eastbound middle lane, 4.0 m North of South curb.	Asphalt	40	Concrete	240	Clay, AASHTO: A-7-6 (I)	0.8	0.9	37							
						Clay, AASHTO: A-7-6 (I)	1.1	1.2	37							
						Clay, AASHTO: A-7-6 (I)	1.4	1.5	30							
						Silt, AASHTO: A-4 (I)	1.8	1.9	25							
						Silt, AASHTO: A-4 (I)	2.1	2.3	27							
						Clay, AASHTO: A-7-6 (I)	2.7	2.8	41							
TH25-35	UTM : 5527851 N, 633206 E Located 31 m West of Edmonton St, Eastbound curb lane, 2.0 m South of North curb.	Asphalt	140	Concrete	130	Clay, AASHTO: A-7-6 (I)	0.8	0.9	33							
						Silt, AASHTO: A-4 (5)	1.1	1.2	22	15	81	4	0	18	25	7
						Silt, AASHTO: A-4 (5)	1.4	1.5	30							
						Clay, AASHTO: A-7-6 (I)	1.8	1.9	41							
						Clay, AASHTO: A-7-6 (I)	2.1	2.3	44							
						Clay, AASHTO: A-7-6 (I)	2.7	2.8	46							



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Moisture Content Report ASTM D2216-98

Project No. 1000-043-30
Client WSP
Project 2026-2028 Downtown Pavement Renewals
York Ave - Memorial Blvd to Portage Ave
Sample Date 07-Oct-25
Test Date 23-Oct-25
Technician D. Sellick

Test Hole	TH25-33	TH25-33	TH25-33	TH25-33	TH25-33	TH25-33
Depth (m)	0.9 - 1.1	1.2 - 1.4	1.5 - 1.7	1.9 - 2.1	2.3 - 2.4	2.8 - 3.0
Sample #	G269	G270	G271	G272	G273	G274
Tare ID	M42	W44	QT36	B21	AC34	ZD17
Mass of tare	7.0	8.6	8.2	7.0	6.6	8.4
Mass wet + tare	406.8	254.4	260.4	255.8	252.8	267.2
Mass dry + tare	297.4	190.0	189.8	179.8	177.0	184.4
Mass water	109.4	64.4	70.6	76.0	75.8	82.8
Mass dry soil	290.4	181.4	181.6	172.8	170.4	176.0
Moisture %	37.7%	35.5%	38.9%	44.0%	44.5%	47.0%

Test Hole	TH25-34	TH25-34	TH25-34	TH25-34	TH25-34	TH25-34
Depth (m)	0.8 - 0.9	1.1 - 1.2	1.4 - 1.5	1.8 - 1.9	2.1 - 2.3	2.7 - 2.8
Sample #	G276	G277	G278	G279	G280	G281
Tare ID	A104	E55	E51	Z121	A101	N96
Mass of tare	8.6	8.8	6.8	8.8	8.8	8.6
Mass wet + tare	256.0	270.8	237.4	277.0	242.0	252.8
Mass dry + tare	189.4	199.6	184.2	223.0	191.8	181.2
Mass water	66.6	71.2	53.2	54.0	50.2	71.6
Mass dry soil	180.8	190.8	177.4	214.2	183.0	172.6
Moisture %	36.8%	37.3%	30.0%	25.2%	27.4%	41.5%

Test Hole	TH25-35	TH25-35	TH25-35	TH25-35	TH25-35	TH25-35
Depth (m)	0.8 - 0.9	1.1 - 1.2	1.4 - 1.5	1.8 - 1.9	2.1 - 2.3	2.7 - 2.8
Sample #	G84	G85	G86	G87	G88	G89
Tare ID	D229	QT85	A3	E20	N14	N21
Mass of tare	6.6	8.4	8.4	6.8	8.6	8.8
Mass wet + tare	421.8	426.0	269.6	256.8	216.2	249.8
Mass dry + tare	318.0	351.8	208.6	184.6	153.2	173.4
Mass water	103.8	74.2	61.0	72.2	63.0	76.4
Mass dry soil	311.4	343.4	200.2	177.8	144.6	164.6
Moisture %	33.3%	21.6%	30.5%	40.6%	43.6%	46.4%

Project No. 1000-043-30
Client WSP
Project 2026-2028 Downtown Pavement Renewals

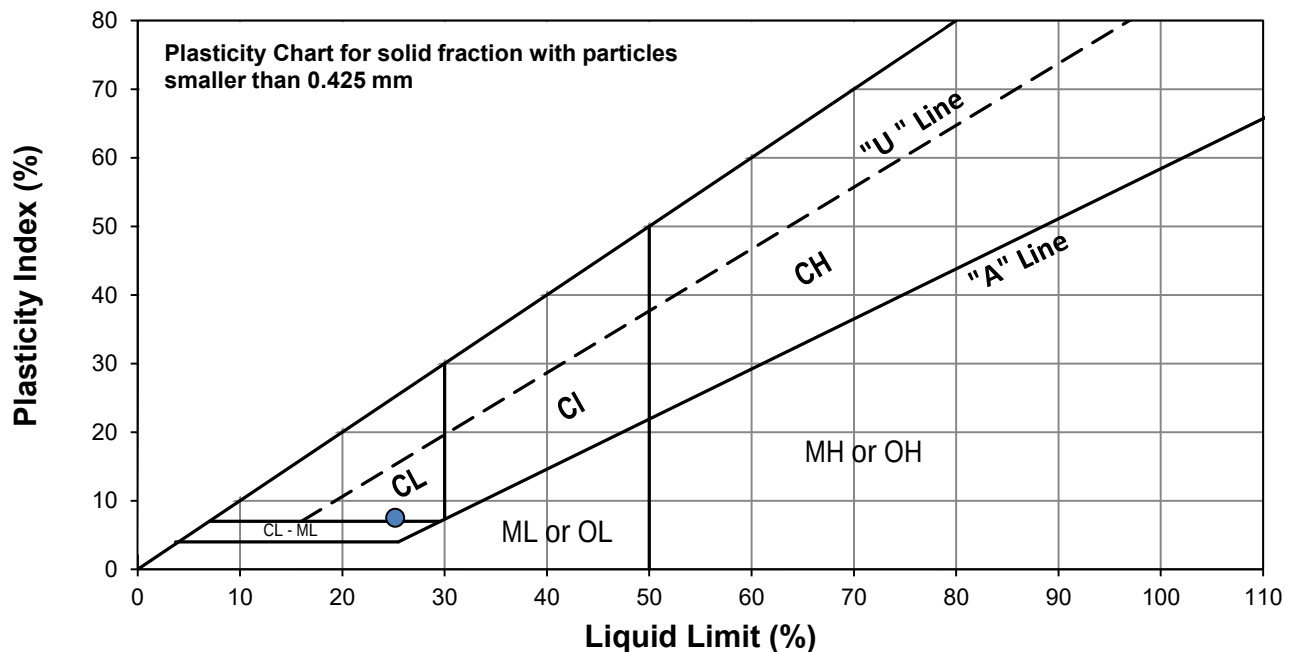


Test Hole TH25-35 (York Ave - Memorial Blvd to Portage Ave)
Sample # G85
Depth (m) 1.1 - 1.2
Sample Date 07-Oct-25
Test Date 28-Oct-25
Technician D. Sellick

Liquid Limit	25
Plastic Limit	18
Plasticity Index	7

Liquid Limit

Trial #	1	2	3		
Number of Blows (N)	15	29	35		
Mass Tare (g)	13.681	13.992	14.064		
Mass Wet Soil + Tare (g)	24.990	24.868	25.061		
Mass Dry Soil + Tare (g)	22.613	22.720	22.905		
Mass Water (g)	2.377	2.148	2.156		
Mass Dry Soil (g)	8.932	8.728	8.841		
Moisture Content (%)	26.612	24.610	24.386		



Plastic Limit

Trial #	1	2	3	4	5
Mass Tare (g)	14.074	13.957			
Mass Wet Soil + Tare (g)	21.073	20.514			
Mass Dry Soil + Tare (g)	20.015	19.534			
Mass Water (g)	1.058	0.980			
Mass Dry Soil (g)	5.941	5.577			
Moisture Content (%)	17.808	17.572			

Note: Additional information recorded/measured for this test is available upon request.

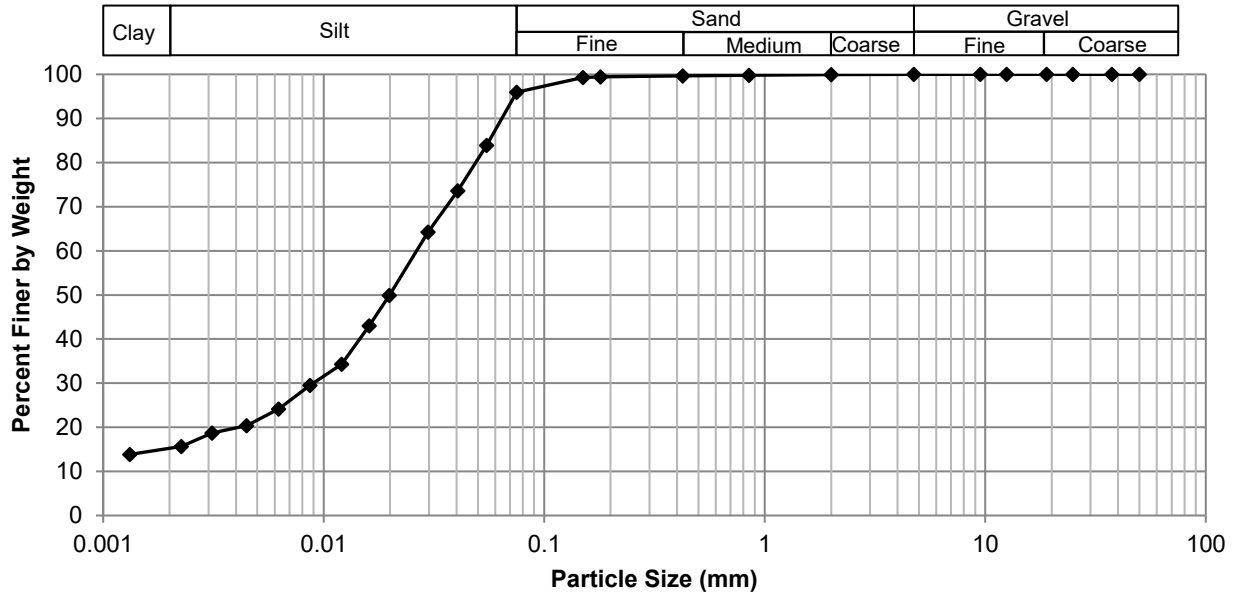
Project No. 1000-043-30
Client WSP
Project 2026-2028 Downtown Pavement Renewals



Test Hole TH25-35 (York Ave - Memorial Blvd to Portage Ave)
Sample # G85
Depth (m) 1.1 - 1.2
Sample Date 07-Oct-25
Test Date 27-Oct-25
Technician D.Sellick

Gravel	0.0%
Sand	4.0%
Silt	80.8%
Clay	15.1%

Particle Size Distribution Curve



Project No. 1000-043-30
Client WSP
Project 2026-2028 Downtown Pavement Renewals

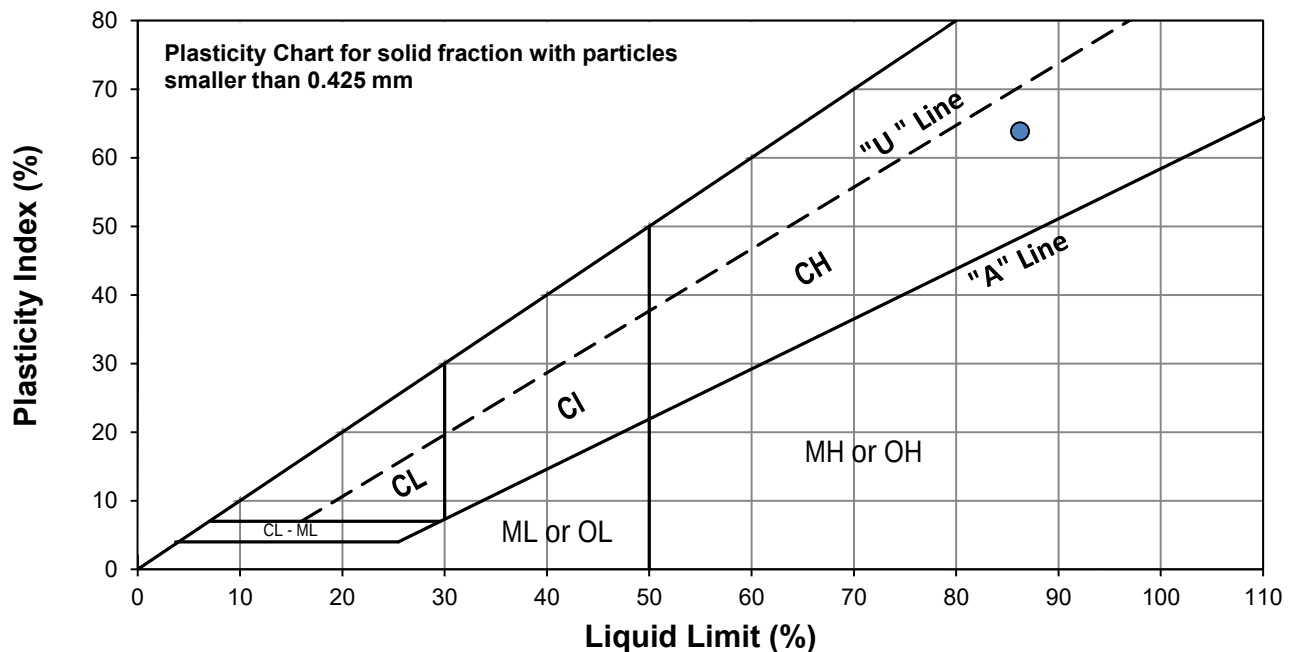


Test Hole TH25-33 (York Ave - Memorial Blvd to Portage Ave)
Sample # G269
Depth (m) 0.9 - 1.1
Sample Date 07-Oct-25
Test Date 29-Oct-25
Technician D. Sellick

Liquid Limit	86
Plastic Limit	22
Plasticity Index	64

Liquid Limit

Trial #	1	2	3		
Number of Blows (N)	15	28	33		
Mass Tare (g)	13.995	14.039	13.888		
Mass Wet Soil + Tare (g)	23.057	21.673	22.837		
Mass Dry Soil + Tare (g)	18.762	18.163	18.741		
Mass Water (g)	4.295	3.510	4.096		
Mass Dry Soil (g)	4.767	4.124	4.853		
Moisture Content (%)	90.099	85.112	84.401		



Plastic Limit

Trial #	1	2	3	4	5
Mass Tare (g)	13.950	13.913			
Mass Wet Soil + Tare (g)	21.322	21.732			
Mass Dry Soil + Tare (g)	19.972	20.301			
Mass Water (g)	1.350	1.431			
Mass Dry Soil (g)	6.022	6.388			
Moisture Content (%)	22.418	22.401			

Note: Additional information recorded/measured for this test is available upon request.

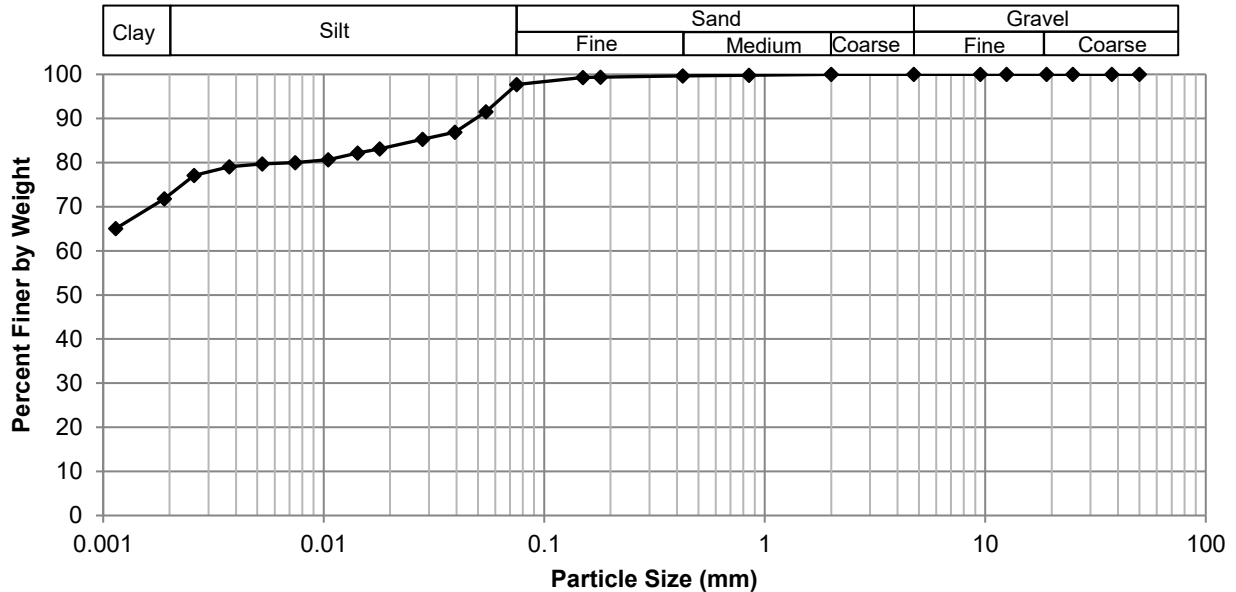
Project No. 1000-043-30
Client WSP
Project 2026-2028 Downtown Pavement Renewals



Test Hole TH25-33 (York Ave - Memorial Blvd to Portage Ave)
Sample # G269
Depth (m) 0.9 - 1.1
Sample Date 07-Oct-25
Test Date 29-Oct-25
Technician A.Fidler-Kliewer

Gravel	0.0%
Sand	2.3%
Silt	25.1%
Clay	72.6%

Particle Size Distribution Curve



Gravel		Sand		Silt and Clay	
Particle Size (mm)	Percent Passing	Particle Size (mm)	Percent Passing	Particle Size (mm)	Percent Passing
50.0	100.00	4.75	100.00	0.0750	97.67
37.5	100.00	2.00	100.00	0.0545	91.56
25.0	100.00	0.850	99.80	0.0394	86.87
19.0	100.00	0.425	99.66	0.0281	85.31
12.5	100.00	0.180	99.37	0.0179	83.12
9.50	100.00	0.150	99.28	0.0142	82.18
4.75	100.00	0.075	97.67	0.0105	80.62
				0.0074	80.00
				0.0053	79.68
				0.0037	79.06
				0.0026	77.12
				0.0019	71.78
				0.0011	65.03



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Standard Proctor Compaction Test

ASTM D698-12e2

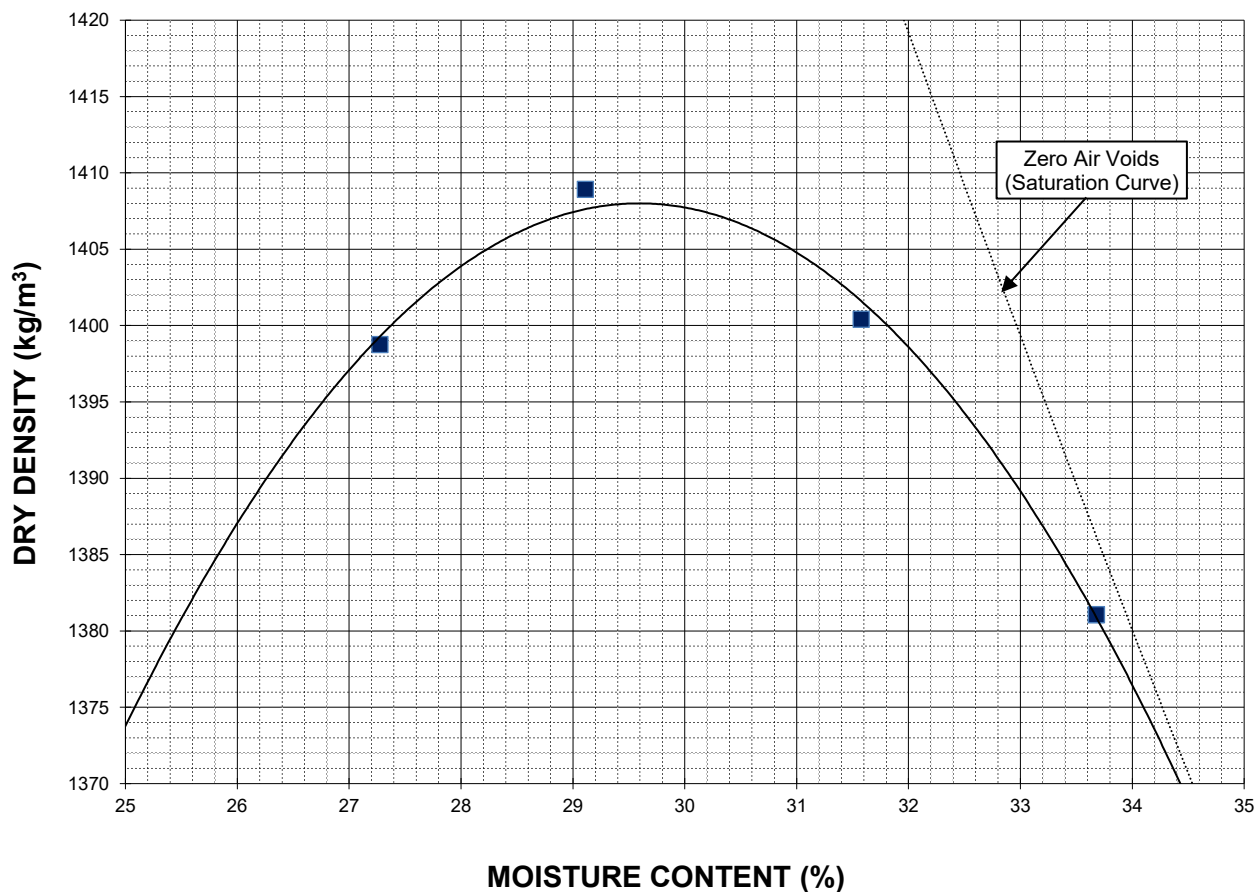
Project No. 1000-043-30
Client WSP
Project 2026-2028 Downtown Pavement Renewals



Sample # L25-443-04 (B275, B282 & B91)
Source York (TH25-33, TH25-34 & TH25-35)
Material Clay
Sample Date 07-Oct-25
Test Date 10-Oct-25
Technician K. Desikan

Maximum Dry Density (kg/m³)	1408
Optimum Moisture (%)	29.6

Trial Number	1	2	3	4	
Wet Density (kg/m ³)	1780	1819	1843	1846	
Dry Density (kg/m ³)	1399	1409	1400	1381	
Moisture Content (%)	27.3	29.1	31.6	33.7	



Note: Additional information recorded/measured for this test is available upon request.



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California Bearing Ratio Test Data Sheet

ASTM D1883-21

Project No.	1000-043-30	Source	York Ave (TH25-33, TH25-34 & TH25-35)
Client	WSP	Material	Clay
Project	2026-2028 Downtown Pavement Renewals	Sample Date	07-Oct-25
Sample #	L25-443-04 (B91, B282 & B275)	Test Date	16-Oct-25
		Technician	A. Dustmamatov

Proctor Results (ASTM D698)

Maximum Dry Density	1408 kg/m ³
Optimum Moisture Content	29.6 %
Material Retained on 19 mm Sieve	0.0 %

CBR Sample Compaction

Dry Density	1331 kg/m ³
Initial Moisture Content	29.3 %
Relative Density	94.5 % SPMDD

Soaking Results

Surcharge	4.54 kg
Swell	7.5 %
Moisture Content in top 25 mm	47.1 %
Immersion Period	96 h

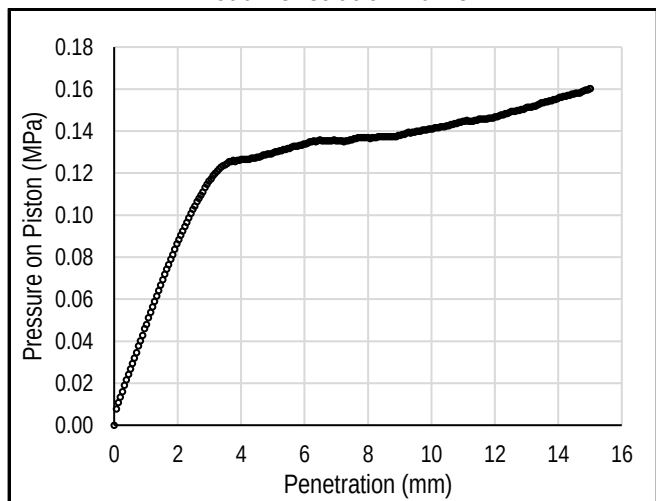
CBR Results

CBR at 2.54 mm	1.5 %
CBR at 5.08 mm	1.3 %
Zero Correction	0 mm

Test Data

Penetration (mm)	Measured Pressure (MPa)	Corrected Pressure (MPa)
0.64	0.03	0.03
1.27	0.06	0.06
1.91	0.08	0.08
2.54	0.10	0.10
3.18	0.12	0.12
3.81	0.13	0.13
4.45	0.13	0.13
5.08	0.13	0.13
7.62	0.14	0.14
10.16	0.14	0.14
12.70	0.15	0.15

Load/Penetration Curve



Comments:

Sample prepared in accordance with the City of Winnipeg guidelines.



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Standard Proctor Compaction Test

ASTM D698-12e2

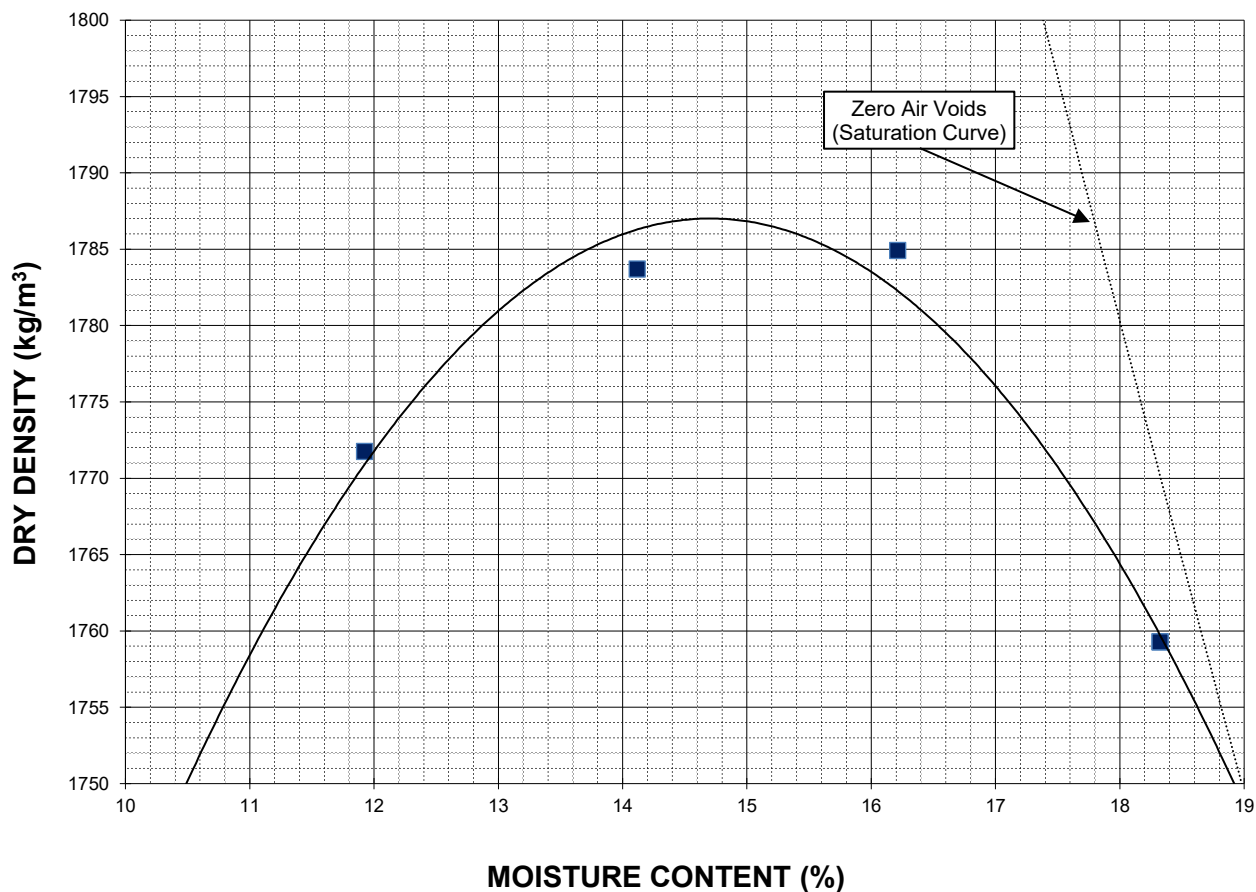
Project No. 1000-043-30
Client WSP
Project 2026-2028 Downtown Pavement Renewals



Sample # L25-443-05 (B68, B91 & B283)
Source Edmonton and York (TH25-19, TH25-34 & TH25-35)
Material Silt
Sample Date 07-Oct-25
Test Date 14-Oct-25
Technician I. Araquil

Maximum Dry Density (kg/m³)	1787
Optimum Moisture (%)	14.7

Trial Number	1	2	3	4	
Wet Density (kg/m ³)	1983	2036	2074	2082	
Dry Density (kg/m ³)	1772	1784	1785	1759	
Moisture Content (%)	11.9	14.1	16.2	18.3	



Note: Additional information recorded/measured for this test is available upon request.



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California Bearing Ratio Test Data Sheet

ASTM D1883-21

Project No.	1000-043-30	Source	Edmonton and York (TH25-19, TH25-34 & TH25-35)
Client	WSP	Material	Silt
Project	2026-2028 Downtown Pavement Renewals	Sample Date	07-Oct-25
Sample #	L25-443-05 (B68, B91 & B283)	Test Date	16-Oct-25
		Technician	A. Dustmamatov

Proctor Results (ASTM D698)

Maximum Dry Density	1787 kg/m ³
Optimum Moisture Content	14.7 %
Material Retained on 19 mm Sieve	0.0 %

CBR Sample Compaction

Dry Density	1696 kg/m ³
Initial Moisture Content	14.8 %
Relative Density	94.9 % SPMDD

Soaking Results

Surcharge	4.54 kg
Swell	3.1 %
Moisture Content in top 25 mm	26.5 %
Immersion Period	96 h

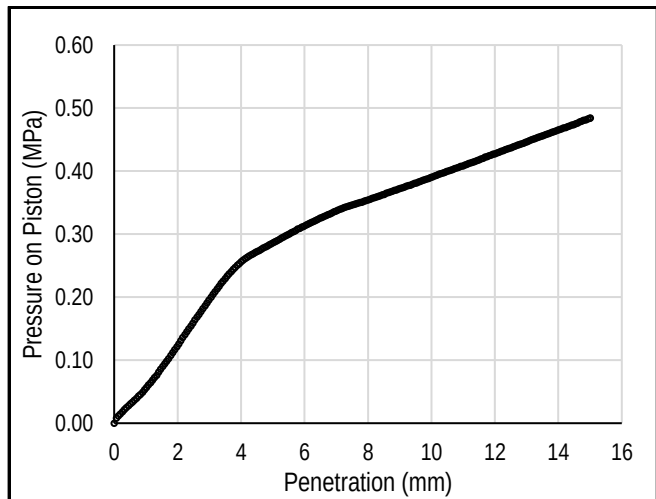
CBR Results

CBR at 2.54 mm	2.4 %
CBR at 5.08 mm	2.8 %
Zero Correction	0 mm

Test Data

Penetration (mm)	Measured Pressure (MPa)	Corrected Pressure (MPa)
0.64	0.04	0.04
1.27	0.07	0.07
1.91	0.12	0.12
2.54	0.16	0.16
3.18	0.21	0.21
3.81	0.25	0.25
4.45	0.27	0.27
5.08	0.29	0.29
7.62	0.35	0.35
10.16	0.39	0.39
12.70	0.44	0.44

Load/Penetration Curve



Comments:

Sample prepared in accordance with the City of Winnipeg guidelines.



Photo 1: Pavement Core Sample at TH25-33



Photo 2: Pavement Core Sample at TH25-34



Photo 3: Pavement Core Sample at TH25-35



2026-2028 Downtown Pavement Renewals
York Ave - Memorial Blvd to Garry St

Pavement Core No.	Pavement Core Location	Pavement Surface		Pavement Structure Material		Corrected Compressive Strength (Mpa)
		Type	Thickness (mm)	Type	Thickness (mm)	
PC25-13	UTM : 5528024 m N, 633688 m E; Located infront of #250 York Ave, Eastbound curb lane, 2.1 m North of South curb.	Asphalt	170	Concrete	140	
PC25-14	UTM : 5527992 m N, 633601 m E; Located 5 m West of Smith St, Eastbound curb lane, 2.2 m North of South curb.	Asphalt	100	Concrete	170	
PC25-15	UTM : 5527949 m N, 633491 m E; Located infront of #330 York Ave, Eastbound curb lane, 2.0 m North of South curb.	Asphalt	70	Concrete	210	
PC25-16	UTM : 5527913 m N, 633393 m E; Located infront of #349 York Ave, Eastbound curb lane, 2.0 m North of South curb.	Asphalt	100	Concrete	210	
PC25-17	UTM : 5527887 m N, 633270 m E; Located 4 m West of Carlton St, Eastbound curb lane, 2.0 m North of South curb.	Asphalt	160	Concrete	150	
PC25-18	UTM : 5527865 m N, 633250 m E; Located 14 m East of Edmonton St, Eastbound curb lane, 2 m North of South curb.	Asphalt	100	Concrete	160	



Photo 1: Pavement Core Sample at PC25-13



Photo 2: Pavement Core Sample at PC25-14



Photo 3: Pavement Core Sample at PC25-15



Photo 4: Pavement Core Sample at PC25-16



Photo 5: Pavement Core Sample at PC25-17

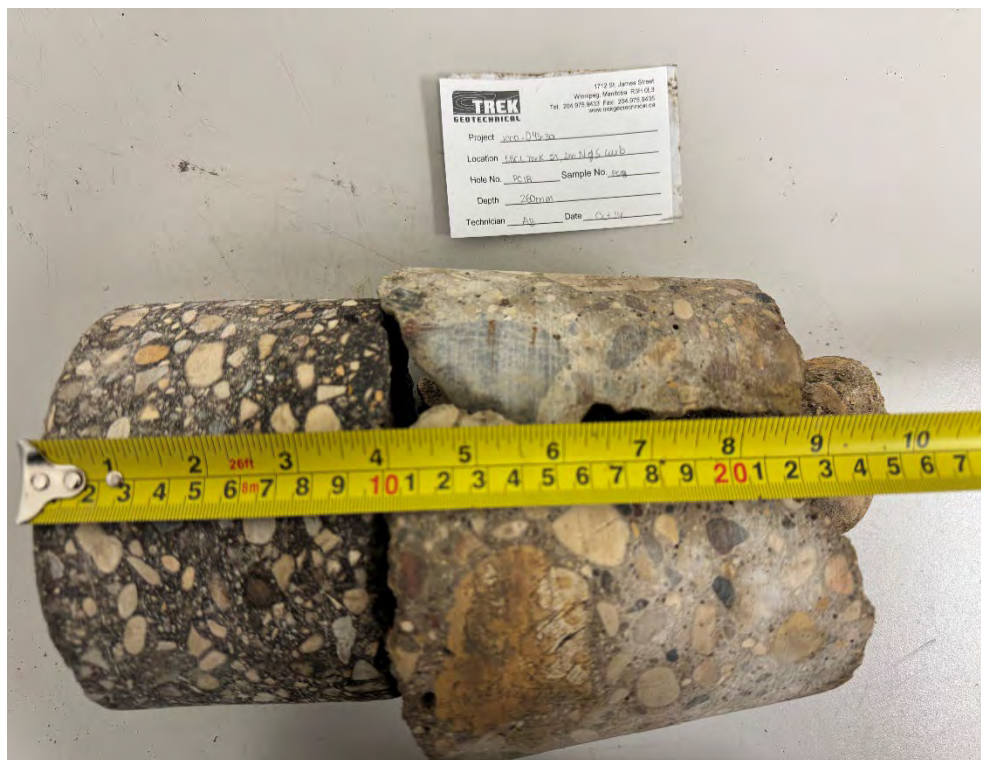


Photo 6: Pavement Core Sample at PC25-18

Appendix I
Summary Table and Photographs of Pavement Core Samples

Kennedy St. – Ellice Ave to Cumberland Ave



2026-2028 Downtown Pavement Renewals
Kennedy St - Ellice Ave to Cumberland Ave

Pavement Core No.	Pavement Core Location	Pavement Surface		Pavement Structure Material		Corrected Compressive Strength (Mpa)
		Type	Thickness (mm)	Type	Thickness (mm)	
PC25-01	UTM : 5528501 m N, 632901 m E; Located 15 m North of Ellice Ave, Northbound middle lane, 4.0 m West of East curb.	Asphalt	300	Concrete	260	
PC25-02	UTM : 5528586 m N, 632861 m E; Located 12 m South of Qu'Appelle St, Southbound curb lane, 1.5 m East of West curb.	Asphalt	150	Concrete	120	
PC25-04	UTM : 5528686 m N, 632816 m E; Located in front of #400 Kennedy St, Southbound curb lane, 2.0 m East of West curb.	Asphalt	100	Concrete	250	
PC25-05	UTM : 5528750 m N, 632807 m E; Located in intersection of Sargent Ave, Northbound curb lane, 1.5 m West of East curb.	Asphalt	120	Concrete		
PC25-06	UTM : 5528786 m N, 632779 m E; Located in front of #444 Kennedy St, Southbound middle lane, 5.0 m East of West curb.	Asphalt	80	Concrete	250	67.68
PC25-07	UTM : 5528865 m N, 632765 m E; Located in front of #469 Kennedy St, Northbound curb lane, 1.5 m West of East curb.	Asphalt	60	Concrete	320	



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Concrete Core Compressive Strength Report

CSA A23.2-14C

Project No. 1000-043-30

Date October 29, 2025

Project 2026-2028 Downtown Pavement Renewals

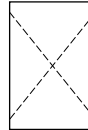
Technician T. Green

Client WSP Group Canada Inc.

Core Location	Core ID	Date Received	Date of Break	Age at Break	Diam. (mm)	Length (mm)	Moisture Conditioning	Compressive Strength (MPa)		Break Type	Correction Factors*				
								Uncorrected f_{conc}	Corrected* f_c		$F_{l/d}$	F_{dia}	F_{mc}	F_D	F_{reinf}
Kennedy St	PC25-06	2025-10-08	2025-10-29	-	145	195	Soaked 48 h	60.61	67.68	1	0.9610	0.9802	1.0900	1.0600	1.0262

Comments

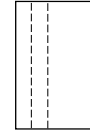
*Correction factors $F_{l/d}$, F_{dia} , F_{mc} , and F_D calculated as per ACI 214.4R-03, and correction factor F_{reinf} calculated as per Khoury et al. (2014): $f_c = f_{conc} F_{l/d} F_{dia} F_{mc} F_D F_{reinf}$



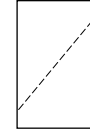
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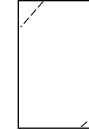
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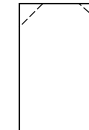
Type 3



Type 4



Type 5



Type 6

Reviewed by (print): Kate Franklin

Signature: Kate Franklin

Table 1 Factors involved in interpretation of core results by different codes.

List	Code/standard	Edition	Factors Considered					
			Aspect ratio	Diameter	Reinforcing	Moisture	Damage	Direction
1	Egyptian Code/Standard Specification	2008	✓		✓			✓
2	British Code/Standard Specification	2003	✓		✓			✓
3	American Concrete Institute ACI	1998	✓					
		2012	✓	✓		✓	✓	
4	European Standard Specification	1998	✓	✓	✓		✓	
		2009	✓		✓			
5	Japanese Standard	1998	✓					
6	Concrete Society	1987	✓		✓		✓	✓

In addition, for core specimen containing two bars no further apart than the diameter of the larger bar, only the bar corresponding to the higher value of $(\Phi_r * d)$ is considered. If the bars are further apart, their combined effect should be assessed by replacing the term $(\Phi_r * d)$ by the term $(\sum \Phi_r * d)$.

It should be pointed out that above equations used to interpret the core concrete strength to the in-situ concrete cube strength have been developed based on a set of assumptions and through many converting process. It is also of interest to note that the damage effect is considered in the development of the formulas in indirect way. The subject derivation and detailed formulas may be seen elsewhere [14].

3.2. American Concrete Institute (ACI)

3.2.1. Former ACI Code (2002) & Current ASTM (2009)

The methodology of core interpretation given in the former ACI code was remained without changes for decades and up to Year (2003). The in-place strength of concrete cylinder at the location from which a core test specimen was extracted can be computed using the equation:

$$f_{cy} = F_{l/d} \cdot f_{core} \quad (4)$$

where f_{cy} is the equivalent in-place concrete cylinder strength, f_{core} is concrete core strength, and $F_{l/d}$ is the strength correction factor for aspect ratio.

The former ACI code does not include any equation to calculate the correction factor ($F_{l/d}$); however, the code gives different values for this term that is associated with different aspect ratios (l/d) as given in Table 2. It should also be noted that the approach of current ASTM is similar to that mentioned above. The only considered variable is the aspect ratio (l/d). It should be noted that identical approach to that mentioned above is still effective in ASTM C42/C42M-03 [10].

3.2.2. Current ACI Code (2012) [15]

Starting from Year 2003, significant changes have been made to the relevant ACI Code provisions regarding the interpreta-

Table 2 Mean values for factor $F_{l/d}$ according to ACI Code (1998) and ASTM.

	Specimen length-to-diameter ratio, l/d			
	1.00	1.25	1.50	1.75
$F_{l/d}$	0.87	0.93	0.96	0.98

tion of core strength test results. New factors have been considered. These include core diameter, moisture content of core sample, core damage associated with drilling, in addition to the effect of aspect ratio that was previously considered in the former ACI edition (1998). According to the ACI 214.4R-03, the in-place concrete strength can be computed using the equation:

$$f_c = F_{l/d} \cdot F_{dia} \cdot F_{mc} \cdot F_D \cdot f_{core} \cdot \text{Front or cc. 12 or cc. 13} \quad (5)$$

where f_c is the equivalent in-place concrete cylinder strength, f_{core} is concrete core strength, $F_{l/d}$ is strength correction factor for aspect ratio, F_{dia} is strength correction factors for diameter, F_{mc} is strength correction factor for moisture condition of core sample, and F_D is the strength correction factor that accounts for effect of damage sustained during core drilling including micro-cracking and undulations at the drilled surface and cutting through coarse-aggregate particles that may subsequently pop out during testing.

The ACI committee considered the correction factors presented in Table 3 for converting core strengths into equivalent in-place strengths based on the work reported by Bartlett and MacGregor [6]. It should be noted that the magnitude of

Table 3 Strength correction factors according to ACI 214.4R-03.

List	Factors	Mean values
(1) ^b	$F_{l/d}$: l/d ratio	
	As-received	$1 - \{0.130 - \alpha f_{core}\} (2 - \frac{l}{d})^2$
	Soaked 48 h	$1 - \{0.117 - \alpha f_{core}\} (2 - \frac{l}{d})^2$
	Air dried ^a	$1 - \{0.144 - \alpha f_{core}\} (2 - \frac{l}{d})^2$
(2)	F_{dia} : core diameter	
	50 mm	1.06
	100 mm	1.00
	150 mm	0.98
(3)	F_{mc} : core moisture content	
	As-received	1.00
	Soaked 48 h	1.09
	Air dried ^a	0.96
(4)	F_D : damage due to drilling	1.06

^a Standard treatment specified in ASTM C 42/C 42M.

^b Constant α equals $4.3(10^{-4})$ 1/MPa for f_{core} in MPa.

Table 6 List of comparisons between tested cores to determine.

	A18	A17	A16	A15	A14	A13	A12	A11	A10	A9	A8	A7	A6	A5	A4	A3	A2	A1
A1	●	●	●	■	■		●				●			▲	▲	■	▲	
A2																		
A3						■				■								
A4																		
A5																		
A6								■	▲	■	▲		■	▲				
A7								■	▲	■	▲							
A8		●	◆	●	●													
A9																		
A10								■	▲									
A11																		
A12		●		●	●													
A13																		
A14		●		●														
A15		●																
A16	●	◆																
A17	◆																	
A18																		

- Diameter of steel bar.
- ▲ Distance of steel bar from nearly end of core.
- Number of steel bars and spacing between bars.
- ◆ Distance of steel bar from vertical axis of specimen.

This brief review indicated that the various proposed relationships for correction factors are all nonlinear. It should be noted that the equations given by the Egyptian Code takes into account most variables that may affect the interpretation of the results; however, the code ignores the deterioration of steel-concrete bond that may occur and also the position of the reinforcement from vertical axis of core specimens.

Weighted nonlinear regression analysis has been performed to determine the factor (F_{reinf}) with the use of the software "SAS" package and "Data Fit." This shows that the correction factor for reinforcement (F_{reinf}) is given by the following expression:

• For cores containing a single bar:

$$F_{\text{reinf}} = \left[1 + 1.5 \frac{[\Phi_r \times r + \Phi_r \times (S/10)]}{\Phi_c \times L} \right] \times \frac{1.13}{f_{\text{core}}^{0.015}} \quad (12)$$

- For core specimen containing two bars no further apart than the diameter of the larger bar, only the bar corresponding to the higher value of ($\Phi_r \times d$) is considered. If the bars are further apart, their combined effect is assessed by replacing the term ($\Phi_r \times r$) by ($\sum \Phi_r \times r$) as follows:

multiple bars

$$F_{\text{reinf}} = \left[1 + 1.5 \frac{\sum [\Phi_r \times r + \Phi_r \times (S/10)]}{\Phi_c \times L} \right] \times \frac{1.13}{f_{\text{core}}^{0.015}} \quad (13)$$

where F_{reinf} is the correction factor for reinforcement, Φ_r is the diameter of the reinforcement, Φ_c is the diameter of the concrete specimen, r is the distance of axis of bar from nearer end of specimen, S is the distance of axis of bar from axis of core specimen, L is the length of the specimen after end preparation by grinding or capping, and f_{core} is the concrete core strength (kg/cm^2).

6.1.6. Effect of moisture condition of core

Results of about 100 cores indicate that the strength of cores left to dry in air for 7 days is on average 13% greater than that of cores soaked at least 40 h before testing. The strength of cores with negligible moisture gradient and tested after cutting is found to be 7–9% larger than that of soaked cores as shown in Fig. 20. The authors strongly recommend to use a correction factor accounting for moisture condition (F_m) equals to 1.09 and 0.96, respectively, for cores tested after 48 h soaked in water and for those tested after 7 days dry in air.

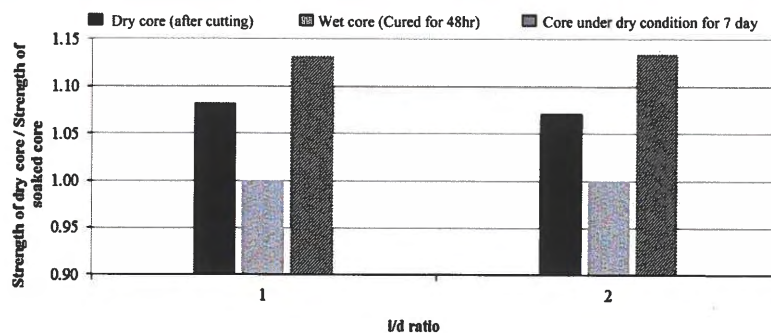
**Figure 20** Effect of core moisture condition on core strength for different aspect ratios (l/d).



Photo 1: Pavement Core Sample at PC25-01



Photo 2: Pavement Core Sample at PC25-02



Photo 3: Pavement Core Sample at PC25-04



Photo 4: Pavement Core Sample at PC25-05



Photo 5: Pavement Core Sample at PC25-06



Photo 6: Pavement Core Sample at PC25-07

Appendix J
Summary Table and Photographs of Pavement Core Samples
Qu'Appelle Ave – Kennedy St. to Hargrave St.



2026-2028 Downtown Pavement Renewals
Qu'Appelle Ave - Kennedy St to Hargrave St

Pavement Core No.	Pavement Core Location	Pavement Surface		Pavement Structure Material		Corrected Compressive Strength (Mpa)
		Type	Thickness (mm)	Type	Thickness (mm)	
PC25-03	UTM : 5528607 m N, 632873 m E; Located infront of #404 Qu'Appelle St, Eastbound curb lane, 2.0 m North of South curb.	Asphalt	70	Concrete	200	
PC25-08	UTM : 5528674 m N, 633020 m E; Located 12 m West of Carlton St, Eastbound curb lane, 2.0 m North of South curb.	Asphalt	70	Concrete	190	59.95
PC25-09	UTM : 5528681 m N, 633066 m E; Located 15 m East of Carlton St, 2.0 m North of South curb.	Asphalt		Concrete	160	70.54



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Concrete Core Compressive Strength Report

CSA A23.2-14C

Project No. 1000-043-30

Date November 3, 2025

Project 2026-2028 Downtown Pavement Renewals

Technician T. Green

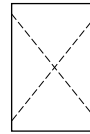
Client WSP Group Canada Inc.

Core Location	Core ID	Date Received	Date of Break	Age at Break	Diam. (mm)	Length (mm)	Moisture Conditioning	Compressive Strength (MPa)		Break Type	Correction Factors*				
								Uncorrected f_{conc}	Corrected* f_c		$F_{l/d}$	F_{dia}	F_{mc}	F_D	F_{reinf}
Qu'Appelle Ave	PC25-08 ^{*2}	2025-10-07	2025-11-03	-	145	125	Soaked 48 h	58.52	59.95	1	0.8811	0.9802	1.0900	1.0600	1.0267
Qu'Appelle Ave	PC25-09	2025-10-07	2025-10-29	-	145	147	Soaked 48 h	68.09	70.54	1	0.9147	0.9802	1.0900	1.0600	1.0000

Comments

*Correction factors $F_{l/d}$, F_{dia} , F_{mc} , and F_D calculated as per ACI 214.4R-03, and correction factor F_{reinf} calculated as per Khoury et al. (2014): $f_c = f_{conc} F_{l/d} F_{dia} F_{mc} F_D F_{reinf}$

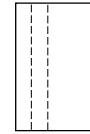
^{*2} Core length to diameter ratio is less than one.



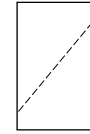
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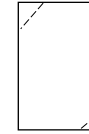
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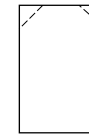
Type 3



Type 4



Type 5



Type 6

Reviewed by (print): Kate Franklin

Signature: Kate Franklin

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			Aspect ratio	Diameter	Reinforcing	Moisture	Damage	Direction
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3	American Concrete Institute ACI	1998	✓					
		2012	✓	✓		✓	✓	
4	European Standard Specification	1998	✓	✓	✓		✓	
		2009	✓		✓			
5	Japanese Standard	1998	✓					
6	Concrete Society	1987	✓		✓		✓	✓

In addition, for core specimen containing two bars no further apart than the diameter of the larger bar, only the bar corresponding to the higher value of $(\Phi_r * d)$ is considered. If the bars are further apart, their combined effect should be assessed by replacing the term $(\Phi_r * d)$ by the term $(\sum \Phi_r * d)$.

It should be pointed out that above equations used to interpret the core concrete strength to the in-situ concrete cube strength have been developed based on a set of assumptions and through many converting process. It is also of interest to note that the damage effect is considered in the development of the formulas in indirect way. The subject derivation and detailed formulas may be seen elsewhere [14].

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where f_{cy} is the equivalent in-place concrete cylinder strength, f_{core} is concrete core strength, and $F_{l/d}$ is the strength correction factor for aspect ratio.

The former ACI code does not include any equation to calculate the correction factor ($F_{l/d}$); however, the code gives different values for this term that is associated with different aspect ratios (l/d) as given in Table 2. It should also be noted that the approach of current ASTM is similar to that mentioned above. The only considered variable is the aspect ratio (l/d). It should be noted that identical approach to that mentioned above is still effective in ASTM C42/C42M-03 [10].

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Starting from Year 2003, significant changes have been made to the relevant ACI Code provisions regarding the interpreta-

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	Specimen length-to-diameter ratio, l/d			
	1.00	1.25	1.50	1.75
$F_{l/d}$	0.87	0.93	0.96	0.98

tion of core strength test results. New factors have been considered. These include core diameter, moisture content of core sample, core damage associated with drilling, in addition to the effect of aspect ratio that was previously considered in the former ACI edition (1998). According to the ACI 214.4R-03, the in-place concrete strength can be computed using the equation:

$$f_c = F_{l/d} \cdot F_{dia} \cdot F_{mc} \cdot F_D \cdot f_{core} \cdot \text{Front or cc. 12 or cc. 13} \quad (5)$$

where f_c is the equivalent in-place concrete cylinder strength, f_{core} is concrete core strength, $F_{l/d}$ is strength correction factor for aspect ratio, F_{dia} is strength correction factors for diameter, F_{mc} is strength correction factor for moisture condition of core sample, and F_D is the strength correction factor that accounts for effect of damage sustained during core drilling including micro-cracking and undulations at the drilled surface and cutting through coarse-aggregate particles that may subsequently pop out during testing.

The ACI committee considered the correction factors presented in Table 3 for converting core strengths into equivalent in-place strengths based on the work reported by Bartlett and MacGregor [6]. It should be noted that the magnitude of

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List	Factors	Mean values
(1) ^b	$F_{l/d}$: l/d ratio	
	As-received	$1 - \{0.130 - \alpha f_{core}\} (2 - \frac{l}{d})^2$
	Soaked 48 h	$1 - \{0.117 - \alpha f_{core}\} (2 - \frac{l}{d})^2$
	Air dried ^a	$1 - \{0.144 - \alpha f_{core}\} (2 - \frac{l}{d})^2$
(2)	F_{dia} : core diameter	
	50 mm	1.06
	100 mm	1.00
	150 mm	0.98
(3)	F_{mc} : core moisture content	
	As-received	1.00
	Soaked 48 h	1.09
	Air dried ^a	0.96
(4)	F_D : damage due to drilling	1.06

^a Standard treatment specified in ASTM C 42/C 42M.

^b Constant α equals $4.3(10^{-4})$ 1/MPa for f_{core} in MPa.

Table 6 List of comparisons between tested cores to determine.

	A18	A17	A16	A15	A14	A13	A12	A11	A10	A9	A8	A7	A6	A5	A4	A3	A2	A1
A1	●	●	●	■	■		●				●			▲	▲	■	▲	
A2																		
A3						■				■								
A4																		
A5																		
A6								■	▲	■	▲		■	▲				
A7								■	▲	■	▲							
A8		●	◆	●	●													
A9																		
A10								■	▲									
A11																		
A12		●		●	●													
A13																		
A14		●		●														
A15		●																
A16	●	◆																
A17	◆																	
A18																		

- Diameter of steel bar.
- ▲ Distance of steel bar from nearly end of core.
- Number of steel bars and spacing between bars.
- ◆ Distance of steel bar from vertical axis of specimen.

This brief review indicated that the various proposed relationships for correction factors are all nonlinear. It should be noted that the equations given by the Egyptian Code takes into account most variables that may affect the interpretation of the results; however, the code ignores the deterioration of steel-concrete bond that may occur and also the position of the reinforcement from vertical axis of core specimens.

Weighted nonlinear regression analysis has been performed to determine the factor (F_{reinf}) with the use of the software "SAS" package and "Data Fit." This shows that the correction factor for reinforcement (F_{reinf}) is given by the following expression:

• For cores containing a single bar:

$$F_{\text{reinf}} = \left[1 + 1.5 \frac{[\Phi_r \times r + \Phi_r \times (S/10)]}{\Phi_c \times L} \right] \times \frac{1.13}{f_{\text{core}}^{0.015}} \quad (12)$$

- For core specimen containing two bars no further apart than the diameter of the larger bar, only the bar corresponding to the higher value of ($\Phi_r \times d$) is considered. If the bars are further apart, their combined effect is assessed by replacing the term ($\Phi_r \times r$) by ($\sum \Phi_r \times r$) as follows:

$$F_{\text{reinf}} = \left[1 + 1.5 \frac{\sum [\Phi_r \times r + \Phi_r \times (S/10)]}{\Phi_c \times L} \right] \times \frac{1.13}{f_{\text{core}}^{0.015}} \quad (13)$$

where F_{reinf} is the correction factor for reinforcement, Φ_r is the diameter of the reinforcement, Φ_c is the diameter of the concrete specimen, r is the distance of axis of bar from nearer end of specimen, S is the distance of axis of bar from axis of core specimen, L is the length of the specimen after end preparation by grinding or capping, and f_{core} is the concrete core strength (kg/cm^2).

6.1.6. Effect of moisture condition of core

Results of about 100 cores indicate that the strength of cores left to dry in air for 7 days is on average 13% greater than that of cores soaked at least 40 h before testing. The strength of cores with negligible moisture gradient and tested after cutting is found to be 7–9% larger than that of soaked cores as shown in Fig. 20. The authors strongly recommend to use a correction factor accounting for moisture condition (F_m) equals to 1.09 and 0.96, respectively, for cores tested after 48 h soaked in water and for those tested after 7 days dry in air.

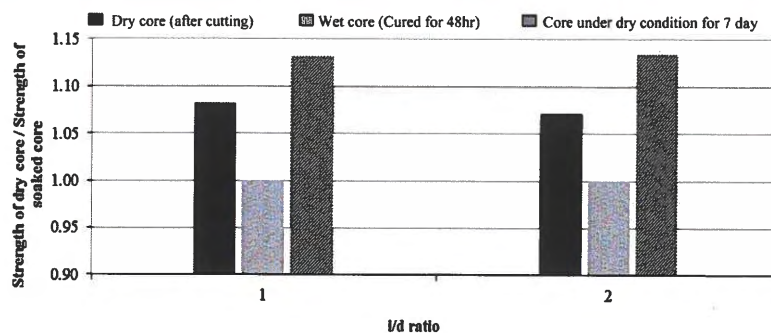
**Figure 20** Effect of core moisture condition on core strength for different aspect ratios (l/d).



Photo 1: Pavement Core Sample at PC25-03



Photo 2: Pavement Core Sample at PC25-08



Photo 3: Pavement Core Sample at PC25-09

Appendix K
Summary Table and Photographs of Pavement Core Samples

York Ave – Osbourne St. to Colony St.



2026-2028 Downtown Pavement Renewals
York Ave - Osborne St to Colony St

Pavement Core No.	Pavement Core Location	Pavement Surface		Pavement Structure Material		Corrected Compressive Strength (Mpa)
		Type	Thickness (mm)	Type	Thickness (mm)	
PC25-19	UTM : 5527754 m N, 632866 m E; Located 10 m West of Osborne St, Eastbound curb lane, 2.0 m North of South curb.	Asphalt	60	Concrete	250	75.95



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1712 St. James Street
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Tel: 204.975.9433 Fax: 204.975.9435

Concrete Core Compressive Strength Report

CSA A23.2-14C

Project No. 1000-043-30

Date October 29, 2025

Project 2026-2028 Downtown Pavement Renewals

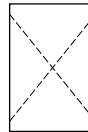
Technician T. Green

Client WSP Group Canada Inc.

Core Location	Core ID	Date Received	Date of Break	Age at Break	Diam. (mm)	Length (mm)	Moisture Conditioning	Compressive Strength (MPa)		Break Type	Correction Factors*				
								Uncorrected f_{conc}	Corrected* f_c		$F_{l/d}$	F_{dia}	F_{mc}	F_D	F_{reinf}
York Ave	PC25-19	2025-10-14	2025-10-29	-	145	184	Soaked 48 h	70.33	75.95	1	0.9536	0.9802	1.0900	1.0600	1.0000

Comments

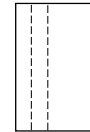
*Correction factors $F_{l/d}$, F_{dia} , F_{mc} , and F_D calculated as per ACI 214.4R-03, and correction factor F_{reinf} calculated as per Khoury et al. (2014): $f_c = f_{conc} F_{l/d} F_{dia} F_{mc} F_D F_{reinf}$



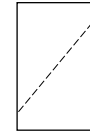
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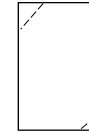
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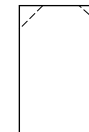
Type 3



Type 4



Type 5



Type 6

Reviewed by (print): Kate Franklin

Signature: Kate Franklin

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		2012	✓	✓		✓	✓	
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		2009	✓		✓			
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6	Concrete Society	1987	✓		✓		✓	✓

In addition, for core specimen containing two bars no further apart than the diameter of the larger bar, only the bar corresponding to the higher value of $(\Phi_r * d)$ is considered. If the bars are further apart, their combined effect should be assessed by replacing the term $(\Phi_r * d)$ by the term $(\sum \Phi_r * d)$.

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(2)	F_{dia} : core diameter	
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	100 mm	1.00
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A3						■				■								
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A8		●	◆	●	●													
A9																		
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A11																		
A12		●		●	●													
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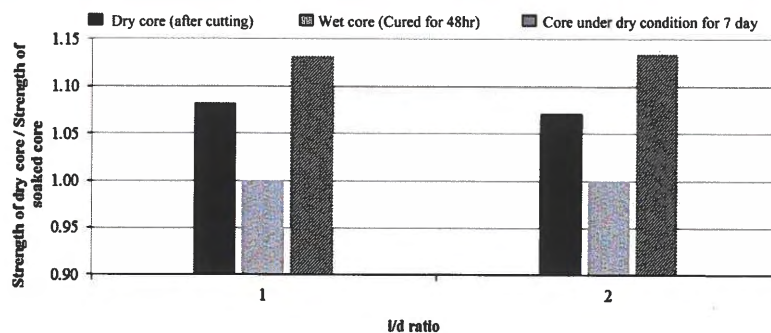
**Figure 20** Effect of core moisture condition on core strength for different aspect ratios (l/d).



Photo 1: Pavement Core Sample at PC25-19

Appendix L
Summary Table and Photographs of Pavement Core Samples

Colony St. – Cooper Ave to York Ave



2026-2028 Downtown Pavement Renewals
Colony St - Cooper Ave to York Ave

Pavement Core No.	Pavement Core Location	Pavement Surface		Pavement Structure Material		
		Type	Thickness (mm)	Type	Thickness (mm)	Corrected Compressive Strength (Mpa)
		Asphalt	180	Concrete	210	72.37
PC25-20	UTM : 5527829 m N, 632800 m E; Located infront of #250 Colony St, Southbound curb lane, 1.0 m East of West curb.					



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Concrete Core Compressive Strength Report

CSA A23.2-14C

Project No. 1000-043-30

Date October 29, 2025

Project 2026-2028 Downtown Pavement Renewals

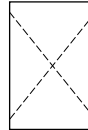
Technician T. Green

Client WSP Group Canada Inc.

Core Location	Core ID	Date Received	Date of Break	Age at Break	Diam. (mm)	Length (mm)	Moisture Conditioning	Compressive Strength (MPa)		Break Type	Correction Factors*				
								Uncorrected f_{conc}	Corrected* f_c		$F_{l/d}$	F_{dia}	F_{mc}	F_D	F_{reinf}
Colony St	PC25-20	2025-10-10	2025-10-29	-	145	169	Soaked 48 h	68.06	72.37	1	0.9389	0.9802	1.0900	1.0600	1.0000

Comments

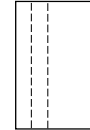
*Correction factors $F_{l/d}$, F_{dia} , F_{mc} , and F_D calculated as per ACI 214.4R-03, and correction factor F_{reinf} calculated as per Khoury et al. (2014): $f_c = f_{conc} F_{l/d} F_{dia} F_{mc} F_D F_{reinf}$



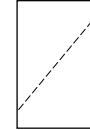
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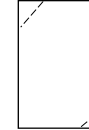
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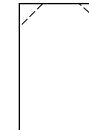
Type 3



Type 4



Type 5



Type 6

Reviewed by (print): Kate Franklin

Signature: Kate Franklin

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		2012	✓	✓		✓	✓	
4	European Standard Specification	1998	✓	✓	✓		✓	
		2009	✓		✓			
5	Japanese Standard	1998	✓					
6	Concrete Society	1987	✓		✓		✓	✓

In addition, for core specimen containing two bars no further apart than the diameter of the larger bar, only the bar corresponding to the higher value of $(\Phi_r * d)$ is considered. If the bars are further apart, their combined effect should be assessed by replacing the term $(\Phi_r * d)$ by the term $(\sum \Phi_r * d)$.

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Table 3 Strength correction factors according to ACI 214.4R-03.

List	Factors	Mean values
(1) ^b	$F_{l/d}$: l/d ratio	
	As-received	$1 - \{0.130 - \alpha f_{core}\} (2 - \frac{l}{d})^2$
	Soaked 48 h	$1 - \{0.117 - \alpha f_{core}\} (2 - \frac{l}{d})^2$
	Air dried ^a	$1 - \{0.144 - \alpha f_{core}\} (2 - \frac{l}{d})^2$
(2)	F_{dia} : core diameter	
	50 mm	1.06
	100 mm	1.00
	150 mm	0.98
(3)	F_{mc} : core moisture content	
	As-received	1.00
	Soaked 48 h	1.09
	Air dried ^a	0.96
(4)	F_D : damage due to drilling	1.06

^a Standard treatment specified in ASTM C 42/C 42M.

^b Constant α equals $4.3(10^{-4})$ 1/MPa for f_{core} in MPa.

Table 6 List of comparisons between tested cores to determine.

	A18	A17	A16	A15	A14	A13	A12	A11	A10	A9	A8	A7	A6	A5	A4	A3	A2	A1
A1	●	●	●	■	■		●				●			▲	▲	■	▲	
A2																		
A3						■				■								
A4																		
A5																		
A6								■	▲	■	▲		■	▲				
A7								■	▲	■	▲							
A8		●	◆	●	●													
A9																		
A10								■	▲									
A11																		
A12		●		●	●													
A13																		
A14		●		●														
A15		●																
A16	●	◆																
A17	◆																	
A18																		

- Diameter of steel bar.
- ▲ Distance of steel bar from nearly end of core.
- Number of steel bars and spacing between bars.
- ◆ Distance of steel bar from vertical axis of specimen.

This brief review indicated that the various proposed relationships for correction factors are all nonlinear. It should be noted that the equations given by the Egyptian Code takes into account most variables that may affect the interpretation of the results; however, the code ignores the deterioration of steel-concrete bond that may occur and also the position of the reinforcement from vertical axis of core specimens.

Weighted nonlinear regression analysis has been performed to determine the factor (F_{reinf}) with the use of the software "SAS" package and "Data Fit." This shows that the correction factor for reinforcement (F_{reinf}) is given by the following expression:

• For cores containing a single bar:

$$F_{\text{reinf}} = \left[1 + 1.5 \frac{[\Phi_r \times r + \Phi_r \times (S/10)]}{\Phi_c \times L} \right] \times \frac{1.13}{f_{\text{core}}^{0.015}} \quad (12)$$

- For core specimen containing two bars no further apart than the diameter of the larger bar, only the bar corresponding to the higher value of ($\Phi_r \times d$) is considered. If the bars are further apart, their combined effect is assessed by replacing the term ($\Phi_r \times r$) by ($\sum \Phi_r \times r$) as follows:

$$F_{\text{reinf}} = \left[1 + 1.5 \frac{\sum [\Phi_r \times r + \Phi_r \times (S/10)]}{\Phi_c \times L} \right] \times \frac{1.13}{f_{\text{core}}^{0.015}} \quad (13)$$

where F_{reinf} is the correction factor for reinforcement, Φ_r is the diameter of the reinforcement, Φ_c is the diameter of the concrete specimen, r is the distance of axis of bar from nearer end of specimen, S is the distance of axis of bar from axis of core specimen, L is the length of the specimen after end preparation by grinding or capping, and f_{core} is the concrete core strength (kg/cm^2).

6.1.6. Effect of moisture condition of core

Results of about 100 cores indicate that the strength of cores left to dry in air for 7 days is on average 13% greater than that of cores soaked at least 40 h before testing. The strength of cores with negligible moisture gradient and tested after cutting is found to be 7–9% larger than that of soaked cores as shown in Fig. 20. The authors strongly recommend to use a correction factor accounting for moisture condition (F_m) equals to 1.09 and 0.96, respectively, for cores tested after 48 h soaked in water and for those tested after 7 days dry in air.

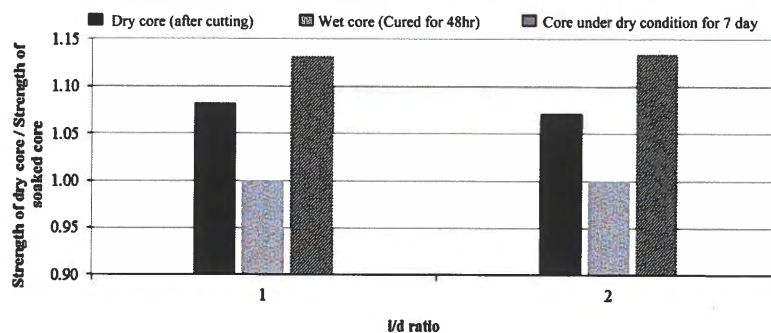
**Figure 20** Effect of core moisture condition on core strength for different aspect ratios (l/d).



Photo 1: Pavement Core Sample at PC25-20