APPENDIX 'A'

GEOTECHNICAL REPORT

Environment

City of Winnipeg

2010 Residential Street Renewals, Package #2: Ridley Place, Country Club Blvd., Assiniboine Avenue and Donnington Road

Prepared by:

AECOM
99 Commerce Drive
Winnipeg, MB, Canada R3P 0Y7
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204 477 5381 tel
204 284 2040 fax

Project Number:

60144310 (4.2.1.1)

Date:

February 2010

Statement of Qualifications and Limitations

The attached Report (the "Report") has been prepared by AECOM Canada Ltd. ("Consultant") for the benefit of the client ("Client") in accordance with the agreement between Consultant and Client, including the scope of work detailed therein (the "Agreement").

The information, data, recommendations and conclusions contained in the Report:

- are subject to the scope, schedule, and other constraints and limitations in the Agreement and the qualifications contained in the Report (the "Limitations")
- represent Consultant's professional judgement in light of the Limitations and industry standards for the preparation of similar reports
- may be based on information provided to Consultant which has not been independently verified
- have not been updated since the date of issuance of the Report and their accuracy is limited to the time period and circumstances in which they were collected, processed, made or issued
- must be read as a whole and sections thereof should not be read out of such context
- were prepared for the specific purposes described in the Report and the Agreement
- in the case of subsurface, environmental or geotechnical conditions, may be based on limited testing and on the assumption that such conditions are uniform and not variable either geographically or over time

Unless expressly stated to the contrary in the Report or the Agreement, Consultant:

- shall not be responsible for any events or circumstances that may have occurred since the date on which the Report was prepared or for any inaccuracies contained in information that was provided to Consultant
- agrees that the Report represents its professional judgement as described above for the specific purpose described in the Report and the Agreement, but Consultant makes no other representations with respect to the Report or any part thereof
- in the case of subsurface, environmental or geotechnical conditions, is not responsible for variability in such conditions geographically or over time

The Report is to be treated as confidential and may not be used or relied upon by third parties, except:

- as agreed by Consultant and Client
- as required by law
- for use by governmental reviewing agencies

Any use of this Report is subject to this Statement of Qualifications and Limitations. Any damages arising from improper use of the Report or parts thereof shall be borne by the party making such use.

This Statement of Qualifications and Limitations is attached to and forms part of the Report.

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February 8, 2010

Mr. Ron Bruce, P.Eng.
AECOM Canada Ltd.
99 Commerce Drive
Winnipeg, Manitoba
R3P 0Y7

Dear Sir:

Project No: **60144310 (4.2.1.1)**

Regarding: **2010 Residential Street Renewals, Package #2**
Ridley Place, Country Club Blvd., Assiniboine Avenue and Donnington Road

AECOM Canada Ltd. (AECOM) is pleased to present our report on the above referenced project. If you have any questions, please do not hesitate to contact Stephen Petsche directly.

Sincerely,
AECOM Canada Ltd.

Ron Typliski, P.Eng.
Vice-President, Manitoba District
Canada West Region

SP:dh

Distribution List

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4	0	Ron Bruce, AECOM

Revision Log

Revision #	Revised By	Date	Issue / Revision Description
1	S. Petsche	February 8/2010	Final

AECOM Signatures

Report Prepared By:

Stephen Petsche, C.E.T.
Coordinator, Lab & Technical Services

Report Reviewed By:

Gil Robinson, P.Eng., M.Sc.
Manager, Geotechnical Engineering

APEGM
Certificate of Authorization
AECOM Canada Ltd. (MB)
No. 4671 Date: 2010/02/08

Table of Contents

Appendices

1. Summary

This report summarizes the results of the geotechnical investigation completed for the proposed 2010 Residential Street Renewals on Ridley Place, Country Club Boulevard between Portage Avenue and McBey Avenue, Assiniboine Avenue from Glendale Boulevard to Ashcroft Point and Donnington Road south of Eldridge Avenue. At each test hole location a core of the surface pavement was obtained and a test hole was drilled to determine the pavement base and subgrade materials. The scope of work was provided in the Quotation Outline for the 2010 Street Renewals Package.

2. Field Investigation and Laboratory Program

The field and laboratory programs were conducted in accordance with the Public Works Department guidelines for Geotechnical Investigations for Street Reconstruction dated October 28, 2008. The general location and number of test holes drilled on each street were provided in the Quotation Outline. The final test hole locations were established based on the location of underground utilities.

A total of sixteen (16) test holes were drilled of which six (6) test hole were located on Ridley Place, three (3) test holes on Country Club Boulevard, four (4) test holes on Assiniboine Avenue and three (3) on Donnington Road. Appendices A, B, C and D contain test hole location plans, test hole logs, pavement core photographs and a tabular summary of the laboratory testing results for Ridley Place, Country Club Boulevard, Assiniboine Avenue and Donnington Road, respectively. Test hole locations noted on the test hole location plans and logs are based on measured distances from the nearest curb and associated house number.

The field investigation was conducted between January 12 and 18, 2010 and consisted of two stages. Stage one involved coring of the existing concrete and/or asphalt pavement surface which was followed by test hole drilling. The pavement surface materials were cored by AECOM on Ridley Place, Country Club Boulevard and Donnington Road on January 12, 2010 and Assiniboine Avenue and Parkside Drive on January 13, 2010 using a portable coring drill equipped with a hollow 150 mm diameter core barrel. The pavement cores were returned to AECOM's Materials Testing Laboratory to classify the material type, measure the thickness of the pavement and photograph each core.

All test holes were drilled on January 18, 2010 by Paddock Drilling Ltd. using a truck mounted Brat 22 drill rig equipped with 125 mm diameter solid stem augers. The test holes were drilled to a depth of 2.5 m below road surface, with the exception of the test holes on Assiniboine Avenue which was drilled to a depth of 3.2 m. General site supervision and visual test hole logging was performed by Stephen Petsche, C.E.T. of AECOM. Other pertinent information such as groundwater seepage and drilling conditions observed during drilling are included on the test hole logs. Representative soil samples (auger cuttings) were collected in accordance with the City's Guidelines for Street Reconstruction Geotechnical Investigations and were transported to AECOM's Materials Laboratory for further testing. The test holes were backfilled with auger cuttings and silica sand and the pavement surface was patched with cold mix asphalt.

The pavement structure materials and subgrade soils were classified in accordance with the City's Guidelines for Street Reconstruction Geotechnical Investigations. A copy of the Guideline is included with the test hole logs. The laboratory testing program consisted of moisture content determination, Atterberg Limits and Hydrometer tests. The test results can be found on the test hole logs and summary tables.

Appendix A

Ridley Place,
Test Hole Location Plan,
Test Hole Logs,
Core Photographs,
Lab Testing Summary

B SIZE 11" x 17" (279.4mm x 431.8mm)

PLOT: 10/02/08 2:00:02 PM

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AECOM

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City of Winnipeg
2010 Residential Package #2
Test Hole Locations

Ridley Place East and West Legs

Figure - 1

Winnipeg

PUBLIC WORKS DEPARTMENT • SERVICE DES TRAVAUX PUBLICS

Engineering Division • Division de l'ingénierie

GEOTECHNICAL INVESTIGATION

STREET RECONSTRUCTION

Revised October 28th, 2008

Fieldwork

1. Clear all underground services at each testhole location.
2. Test holes required every **50** m with a minimum of **3** test holes per street.
3. Record location of testhole (offset from curb, distance from cross street and house number).
4. Drill 150 mm-diameter core in pavement.
5. Drill 125 mm-diameter testhole into fill materials and subgrade
6. If a service trench backfilled with granular materials is encountered, another hole shall be drilled to define the existing sub-surface conditions.
7. Testhole to be drilled to depth of 2 m ± 150 mm below surface of the pavement.
8. Recover pavement core sample and representative samples of soil (fill materials, pavement structure materials and subgrade).
9. Measure and record pavement section exposed in the testhole (thickness of concrete or asphalt and different types of pavement structure materials).
10. Pavement structure materials to be identified as crushed limestone or granular fill and the maximum aggregate size of the material (20 mm, 50 mm or 150 mm).
11. Log soil profile for the subgrade.
12. Representative samples of soil must be obtained at the following depths below the bottom of the pavement structure materials - 0.1 m, 0.4 m, 0.7 m, 1.0 m, 1.3 m, 1.6 m, etc. Ensure a sample is obtained from each soil type encountered in the testhole.
13. Make note of any water seepage into the testhole.
14. Backfill testhole with native materials and additional granular fill, if required. Patch pavement surface with hot mix asphalt or high strength durable concrete mix.
15. Return core sample from the pavement and soil samples to the laboratory.

Lab Work

1. Test all soil samples for moisture content.
2. Photograph core samples recovered from the pavement surface.
3. Conduct tests for plasticity index and hydrometer analysis on selected soil samples which are between 0.5 m and 1 m below top of pavement (this is the sub-grade on which the pavement and sub-base will be built). The selection will be based upon visual classification and moisture content test results, with a minimum of one sample of each soil type per street to be tested.
4. Prepare testhole logs and classify subgrade (based on hydrometer) as follows;

< 30% silt -	classify as clay
30% - 50% silt -	classify as silty clay
50% - 70% silt -	classify as clayey silt
> 70% silt -	classify as silt

Prepared by: The National Testing Laboratories Limited and Eng-Tech Consulting

Embrace the Spirit • Vivez l'esprit

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AECOM Canada Ltd.

GENERAL STATEMENT

NORMAL VARIABILITY OF SUBSURFACE CONDITIONS

The scope of the investigation presented herein is limited to an investigation of the subsurface conditions as to suitability for the proposed project. This report has been prepared to aid in the evaluation of the site and to assist the engineer in the design of the facilities. Our description of the project represents our understanding of the significant aspects of the project relevant to the design and construction of earth work, foundations and similar. In the event of any changes in the basic design or location of the structures as outlined in this report or plan, we should be given the opportunity to review the changes and to modify or reaffirm in writing the conclusions and recommendations of this report.

The analysis and recommendations presented in this report are based on the data obtained from the borings and test pit excavations made at the locations indicated on the site plans and from other information discussed herein. This report is based on the assumption that the subsurface conditions everywhere are not significantly different from those disclosed by the borings and excavations. However, variations in soil conditions may exist between the excavations and, also, general groundwater levels and conditions may fluctuate from time to time. The nature and extent of the variations may not become evident until construction. If subsurface conditions differ from those encountered in the exploratory borings and excavations, are observed or encountered during construction, or appear to be present beneath or beyond excavations, we should be advised at once so that we can observe and review these conditions and reconsider our recommendations where necessary.

Since it is possible for conditions to vary from those assumed in the analysis and upon which our conclusions and recommendations are based, a contingency fund should be included in the construction budget to allow for the possibility of variations which may result in modification of the design and construction procedures.

In order to observe compliance with the design concepts, specifications or recommendations and to allow design changes in the event that subsurface conditions differ from those anticipated, we recommend that all construction operations dealing with earth work and the foundations be observed by an experienced soils engineer. We can be retained to provide these services for you during construction. In addition, we can be retained to review the plans and specifications that have been prepared to check for substantial conformance with the conclusions and recommendations contained in our report.

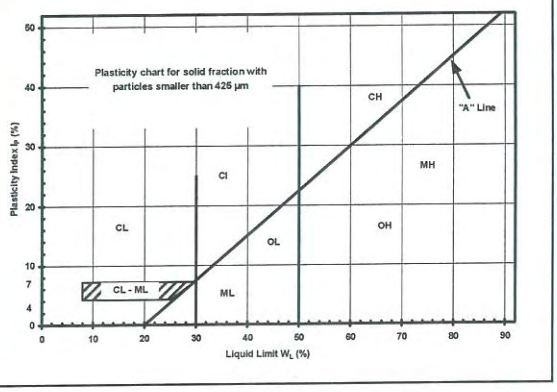
EXPLANATION OF FIELD & LABORATORY TEST DATA

Description				UMA Log Symbols	USCS Classification	Laboratory Classification Criteria			
						Fines (%)	Grading	Plasticity	Notes
COARSE GRAINED SOILS	GRAVELS (More than 50% of coarse fraction of gravel size)	CLEAN GRAVELS (Little or no fines)	Well graded gravels, sandy gravels, with little or no fines		GW	0-5	$C_U > 4$ $1 < C_C < 3$		Dual symbols if 5-12% fines. Dual symbols if above "A" line and $4<W_P<7$ $C_U = \frac{D_{60}}{D_{10}}$ $C_C = \frac{(D_{30})^2}{D_{10} x D_{60}}$
			Poorly graded gravels, sandy gravels, with little or no fines		GP	0-5	Not satisfying GW requirements		
		DIRTY GRAVELS (With some fines)	Silty gravels, silty sandy gravels		GM	> 12		Atterberg limits below "A" line or $W_P<4$	
			Clayey gravels, clayey sandy gravels		GC	> 12		Atterberg limits above "A" line or $W_P<7$	
	SANDS (More than 50% of coarse fraction of sand size)	CLEAN SANDS (Little or no fines)	Well graded sands, gravelly sands, with little or no fines		SW	0-5	$C_U > 6$ $1 < C_C < 3$		
			Poorly graded sands, gravelly sands, with little or no fines		SP	0-5	Not satisfying SW requirements		
		DIRTY SANDS (With some fines)	Silty sands, sand-silt mixtures		SM	> 12		Atterberg limits below "A" line or $W_P<4$	
			Clayey sands, sand-clay mixtures		SC	> 12		Atterberg limits above "A" line or $W_P<7$	
FINE GRAINED SOILS	SILTS (Below 'A' line negligible organic content)	$W_L<50$	Inorganic silts, silty or clayey fine sands, with slight plasticity		ML			Classification is Based upon Plasticity Chart	
		$W_L>50$	Inorganic silts of high plasticity		MH				
	CLAYS (Above 'A' line negligible organic content)	$W_L<30$	Inorganic clays, silty clays, sandy clays of low plasticity, lean clays		CL				
		$30<W_L<50$	Inorganic clays and silty clays of medium plasticity		CI				
		$W_L>50$	Inorganic clays of high plasticity, fat clays		CH				
	ORGANIC SILTS & CLAYS (Below 'A' line)	$W_L<50$	Organic silts and organic silty clays of low plasticity		OL				
		$W_L>50$	Organic clays of high plasticity		OH				
HIGHLY ORGAINIC SOILS			Peat and other highly organic soils		Pt	Von Post Classification Limit		Strong colour or odour, and often fibrous texture	

	Asphalt		Till		AECOM
	Concrete		Bedrock (Undifferentiated)		
	Fill		Bedrock (Limestone)		

When the above classification terms are used in this report or test hole logs, the designated fractions may be visually estimated and not measured.

Not used. Refer to City of Winnipeg's Specs for Geotechnical Investigation Street Reconstruction Oct 28, 08



FRACTION		SEIVE SIZE (mm)		DEFINING RANGES OF PERCENTAGE BY WEIGHT OF MINOR COMPONENTS	
		Passing	Retained	Percent	Identifier
Gravel	Coarse	76	19	35-50	and
	Fine	19	4.75		
Sand	Coarse	4.75	2.00	20-35	"y" or "ey" *
	Medium	2.00	0.425		
	Fine	0.425	0.075	10-20	some
Silt (non-plastic) or Clay (plastic)		< 0.075 mm		1-10	trace

* for example: gravelly, sandy clayey, silty

Definition of Oversize Material

COBBLES: 76mm to 300mm diameter
BOULDERS: >300mm diameter

LEGEND OF SYMBOLS

Laboratory and field tests are identified as follows:

- q_u - undrained shear strength (kPa) derived from unconfined compression testing.
- T_v - undrained shear strength (kPa) measured using a torvane
- pp - undrained shear strength (kPa) measured using a pocket penetrometer.
- L_v - undrained shear strength (kPa) measured using a lab vane.
- F_v - undrained shear strength (kPa) measured using a field vane.
- γ - bulk unit weight (kN/m^3).
- SPT - Standard Penetration Test. Recorded as number of blows (N) from a 63.5 kg hammer dropped 0.76 m (free fall) which is required to drive a 51 mm O.D. Raymond type sampler 0.30 m into the soil.
- DPPT - Drive Point Pentrometer Test. Recorded as number of blows from a 63.5 kg hammer dropped 0.76 m (free fall) which is required to drive a 50 mm drive point 0.30 m into the soil.
- w - moisture content (W_L, W_P)

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

Su (kPa)	CONSISTENCY
<12	very soft
12 – 25	soft
25 – 50	medium or firm
50 – 100	stiff
100 – 200	very stiff
200	hard

The resistance (N) of a non-cohesive soil can be related to compactness condition as follows

N – BLOWS/0.30 m	COMPACTNESS
0 - 4	very loose
4 - 10	loose
10 - 30	compact
30 - 50	dense
50	very dense

PROJECT: 2010 Residential Streets Package #2	CLIENT: City of Winnipeg	TESTHOLE NO: **TH1**
LOCATION: Ridley Place, Westbound Lane, Between 104 Ridley Place and 178 Ridley Street, 2.0 m S of Curb		PROJECT NO.: 60144310.1001
CONTRACTOR: Paddock Drilling Ltd.	METHOD: 125 mm SSA with 150 mm Coring	ELEVATION (m):

SAMPLE TYPE ■ GRAB ▥ SHELBY TUBE ☒ SPLIT SPOON ▤ BULK ▨ NO RECOVERY ◧ CORE

DEPTH (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	PENETRATION TESTS / UNDRAINED SHEAR STRENGTH	COMMENTS	DEPTH
0		ASPHALT (thickness = 30 mm) CONCRETE (thickness = 150 mm)					
		CLAY - black - frozen to 0.7 m, moist when thawed - high plasticity		G1			
				G2			
		- below 0.7 m, some silt, trace gravel, brown, moist and stiff		G3			
1				G4		Gradation: Silt = 14.8% and Clay = 85.1%	1
				G5			
				G6			
2				G7			2
				G8			
3		End of test hole at 2.5 m in clay Notes: 1) No sloughing 2) No seepage 3) Backfilled with auger cuttings to 0.2 m below top of pavement, sand to 0.15 m below top of pavement and asphalt cold patch to top of pavement					

PENETRATION TESTS: ✳ Becker ✳ ◇ Dynamic Cone ◇ ◆ SPT (Standard Pen Test) ◆ (Blows/300mm) 0 20 40 60 80 100 ■ Total Unit Wt ■ (kN/m³) 16 17 18 19 20 21 Plastic MC Liquid 20 40 60 80 100

UNDRAINED SHEAR STRENGTH + Torvane + × QU × □ Lab Vane □ △ Pocket Pen. △ ◆ Field Vane ◆ (kPa) 50 100 150 200

LOG OF TEST HOLE TEST HOLE LOGS RIDLEY.GPJ UMA WINN.GDT 2/8/10

AECOM

LOGGED BY: Stephen Petsche	COMPLETION DEPTH: 2.50 m
REVIEWED BY: Gil Robinson	COMPLETION DATE: 1/18/10
PROJECT ENGINEER: Gil Robinson	Page 1 of 1

PROJECT: 2010 Residential Streets Package #2	CLIENT: City of Winnipeg	TESTHOLE NO: **TH2**
LOCATION: Ridley Place, Southbound Lane, In front of House #116, 2.0 m E of Curb		PROJECT NO.: 60144310.1001
CONTRACTOR: Paddock Drilling Ltd.	METHOD: 125 mm SSA with 150 mm Coring	ELEVATION (m):

SAMPLE TYPE ■ GRAB ▥ SHELBY TUBE ⊠ SPLIT SPOON ▤ BULK ⊘ NO RECOVERY ◧ CORE

PENETRATION TESTS: ✳ Becker ✳ ◇ Dynamic Cone ◇ ◆ SPT (Standard Pen Test) ◆ (Blows/300mm) 0 20 40 60 80 100 ■ Total Unit Wt ■ (kN/m^3) 16 17 18 19 20 21 Plastic MC Liquid 20 40 60 80 100

UNDRAINED SHEAR STRENGTH: + Torvane + × QU × ☐ Lab Vane ☐ △ Pocket Pen. △ ◓ Field Vane ◓ (kPa) 50 100 150 200

DEPTH (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	COMMENTS	DEPTH
0		CONCRETE (thickness = 145 mm)				
		GRANULAR FILL - brown, frozen, wet when thawed, well graded sand and gravel (< 20 mm)	■	G9		
		CLAY - possible fill - trace sand - black - frozen, moist when thawed - high plasticity				
		CLAY - mottled black and brown - frozen to 0.7 m, moist when thawed - high plasticity	■	G10		
		- below 0.7 m, trace silt, brown, moist and stiff	■	G11		
1			■	G12		1
			■	G13		
			■	G14		
2			■	G15		2
			■	G16		
3		End of test hole at 2.5 m in clay Notes: 1) No sloughing 2) No seepage 3) Backfilled with auger cuttings to 0.2 m below top of pavement, sand to 0.15 m below top of pavement and asphalt cold patch to top of pavement				

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LOGGED BY: Stephen Petsche	COMPLETION DEPTH: 2.50 m
REVIEWED BY: Gil Robinson	COMPLETION DATE: 1/18/10
PROJECT ENGINEER: Gil Robinson	Page 1 of 1

LOG OF TEST HOLE TEST HOLE LOGS RIDLEY.GPJ UMA WINN.GDT 2/8/10

PROJECT: 2010 Residential Streets Package #2	CLIENT: City of Winnipeg	TESTHOLE NO: **TH3**
LOCATION: Ridley Place, Westbound Lane, Between House #130 and 134, 2.0 m S of Curb		PROJECT NO.: 60144310.1001
CONTRACTOR: Paddock Drilling Ltd.	METHOD: 125 mm SSA with 150 mm Coring	ELEVATION (m):

SAMPLE TYPE ■ GRAB ▥ SHELBY TUBE ☒ SPLIT SPOON ▤ BULK ⊘ NO RECOVERY ◧ CORE

DEPTH (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	PENETRATION TESTS: ✳ Becker ✳, ◇ Dynamic Cone ◇, ◆ SPT (Standard Pen Test) ◆ (Blows/300mm) 0 20 40 60 80 100; ■ Total Unit Wt ■ (kN/m³) 16 17 18 19 20 21; Plastic MC Liquid 20 40 60 80 100	UNDRAINED SHEAR STRENGTH: + Torvane +, × QU ×, □ Lab Vane □, △ Pocket Pen. △, ⊕ Field Vane ⊕ (kPa) 50 100 150 200	COMMENTS	DEPTH
0		CONCRETE (thickness = 170 mm)					
		CLAY - possible fill - with gravel (<20 mm) - black - frozen, moist when thawed - high plasticity		G17			
		CLAY - some silt, trace sand - mottled grey and black - frozen to 0.7 m, moist when thawed - high plasticity		G18			
				G19			
1		- below 1.0 m, trace silt, brown, moist and firm		G20		Gradation: Sand = 5.9%, Silt = 22.6% and Clay = 71.6%	1
		-0.1 m thick silt and sand layer between 1.4 and 1.5 m		G21			
				G22			
2		-below 2.1 m, stiff		G23			2
		-below 2.4 m, firm		G24			
3		End of test hole at 2.5 m in clay Notes: 1) No sloughing 2) No seepage 3) Backfilled with auger cuttings to 0.2 m below top of pavement, sand to 0.15 m below top of pavement and asphalt cold patch to top of pavement					

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LOGGED BY: Stephen Petsche	COMPLETION DEPTH: 2.50 m
REVIEWED BY: Gil Robinson	COMPLETION DATE: 1/18/10
PROJECT ENGINEER: Gil Robinson	Page 1 of 1

LOG OF TEST HOLE TEST HOLE LOGS RIDLEY.GPJ UMA WINN.GDT 2/8/10

PROJECT: 2010 Residential Streets Package #2	CLIENT: City of Winnipeg	TESTHOLE NO: **TH4**
LOCATION: Ridley Place, Eastbound Lane, At west edge of House #146, 2.0 m N of Curb		PROJECT NO.: 60144310.1001
CONTRACTOR: Paddock Drilling Ltd.	METHOD: 125 mm SSA with 150 mm Coring	ELEVATION (m):

SAMPLE TYPE ■ GRAB ▥ SHELBY TUBE ⊠ SPLIT SPOON ▤ BULK ⊘ NO RECOVERY ◧ CORE

DEPTH (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	PENETRATION TESTS ✳ Becker ✳ ◇ Dynamic Cone ◇ ◆ SPT (Standard Pen Test) ◆ (Blows/300mm) 0 20 40 60 80 100 ■ Total Unit Wt ■ (kN/m³) 16 17 18 19 20 21 Plastic MC Liquid 20 40 60 80 100	UNDRAINED SHEAR STRENGTH + Torvane + × QU × □ Lab Vane □ △ Pocket Pen. △ ◉ Field Vane ◉ (kPa) 50 100 150 200	COMMENTS	DEPTH
0		CONCRETE (thickness = 165 mm)						
		GRANULAR FILL - brown, frozen, wet when thawed, well graded sand and gravel (< 20 mm)						
		CLAY - dark grey - frozen to 0.7 m, moist when thawed - high plasticity		G25				
		- below 0.5 m, trace silt, brown		G26				
				G27				
1								1
				G28				
		- below 1.4 m, trace silt, moist and stiff		G29		+ △	Gradation: Silt = 8.6% and Clay = 91.4%	
				G30				
2								2
		- silt inclusions (6 mm diameter) below 2.1 m		G31				
				G32				
		End of test hole at 2.5 m in clay Notes: 1) No sloughing 2) No seepage 3) Backfilled with auger cuttings to 0.2 m below top of pavement, sand to 0.15 m below top of pavement and asphalt cold patch to top of pavement						
3								

AECOM

LOGGED BY: Stephen Petsche	COMPLETION DEPTH: 2.50 m
REVIEWED BY: Gil Robinson	COMPLETION DATE: 1/18/10
PROJECT ENGINEER: Gil Robinson	Page 1 of 1

LOG OF TEST HOLE TEST HOLE LOGS RIDLEY.GPJ UMA WINN.GDT 2/8/10

PROJECT: 2010 Residential Streets Package #2	CLIENT: City of Winnipeg	TESTHOLE NO: **TH5**
LOCATION: Ridley Place, Northbound Lane, In front of House #162, 2.0 m W of Curb		PROJECT NO.: 60144310.1001
CONTRACTOR: Paddock Drilling Ltd.	METHOD: 125 mm SSA with 150 mm Coring	ELEVATION (m):

SAMPLE TYPE ■ GRAB ▥ SHELBY TUBE ⊠ SPLIT SPOON ▤ BULK ⊘ NO RECOVERY ▮ CORE

PENETRATION TESTS: ✳ Becker ✳ ◇ Dynamic Cone ◇ ◆ SPT (Standard Pen Test) ◆ (Blows/300mm) 0 20 40 60 80 100 ■ Total Unit Wt ■ (kN/m^3) 16 17 18 19 20 21 Plastic MC Liquid 20 40 60 80 100

UNDRAINED SHEAR STRENGTH (kPa): + Torvane + × QU × ☐ Lab Vane ☐ △ Pocket Pen. △ ● Field Vane ● 50 100 150 200

DEPTH (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	COMMENTS	DEPTH
0		CONCRETE (thickness = 165 mm)				
		GRANULAR FILL - brown, frozen, wet when thawed, well graded sand and gravel (< 20 mm)				
		CLAY - possible fill - trace sand - frozen, moist when thawed - black - high plasticity	■	G33		
		CLAY - some silt - brown - moist and firm to stiff - high plasticity	■	G34		
			■	G35		
1			■	G36	Gradation: Silt = 26.7% and Clay = 73.3%	1
		- below 1.5 m, stiff	■	G37		
			■	G38		
2			■	G39		2
		- below 2.3 m, firm, trace gypsum	■	G40		
3		End of test hole at 2.5 m in clay Notes: 1) No sloughing 2) No seepage 3) Backfilled with auger cuttings to 0.2 m below top of pavement, sand to 0.15 m below top of pavement and asphalt cold patch to top of pavement				

AECOM

LOGGED BY: Stephen Petsche	COMPLETION DEPTH: 2.50 m
REVIEWED BY: Gil Robinson	COMPLETION DATE: 1/18/10
PROJECT ENGINEER: Gil Robinson	Page 1 of 1

LOG OF TEST HOLE TEST HOLE LOGS RIDLEY.GPJ UMA WINN.GDT 2/8/10

PROJECT: 2010 Residential Streets Package #2	CLIENT: City of Winnipeg	TESTHOLE NO: **TH6**
LOCATION: Ridley Place, Westbound Lane, In front of House #172, 2.0 m S of Curb		PROJECT NO.: 60144310.1001
CONTRACTOR: Paddock Drilling Ltd.	METHOD: 125 mm SSA with 150 mm Coring	ELEVATION (m):

SAMPLE TYPE ■ GRAB ▥ SHELBY TUBE ⊠ SPLIT SPOON ▤ BULK ⊘ NO RECOVERY ◧ CORE

DEPTH (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	PENETRATION TESTS / UNDRAINED SHEAR STRENGTH	COMMENTS	DEPTH
0		CONCRETE (thickness = 160 mm)					
		GRANULAR FILL - brown, frozen, wet when thawed, well graded sand and gravel (< 20 mm)					
		CLAY - possible fill - with gravel, with sand - black - frozen, moist when thawed - high plasticity		G41			
		CLAY - dark grey - frozen to 0.7 m, moist when thawed - high plasticity		G42			
		- below 0.7 m, trace silt, brown, moist and firm		G43			
1				G44			1
		- below 1.4 m, stiff		G45			
		- below 1.7 m, trace gypsum		G46			
2		- below 2.0 m, silt inclusions (5 mm in diameter)		G47			2
				G48			
3		End of test hole at 2.5 m in clay Notes: 1) No sloughing 2) No seepage 3) Backfilled with auger cuttings to 0.2 m below top of pavement, sand to 0.15 m below top of pavement and asphalt cold patch to top of pavement					

PENETRATION TESTS: ✳ Becker ✳ ◇ Dynamic Cone ◇ ◆ SPT (Standard Pen Test) ◆ (Blows/300mm) 0 20 40 60 80 100; ■ Total Unit Wt ■ (kN/m³) 16 17 18 19 20 21; Plastic MC Liquid 20 40 60 80 100

UNDRAINED SHEAR STRENGTH: + Torvane + × QU × ☐ Lab Vane ☐ △ Pocket Pen. △ ◓ Field Vane ◓ (kPa) 50 100 150 200

AECOM	LOGGED BY: Stephen Petsche	COMPLETION DEPTH: 2.50 m
	REVIEWED BY: Gil Robinson	COMPLETION DATE: 1/18/10
	PROJECT ENGINEER: Gil Robinson	Page 1 of 1

LOG OF TEST HOLE TEST HOLE LOGS RIDLEY.GPJ UMA WINN.GDT 2/8/10

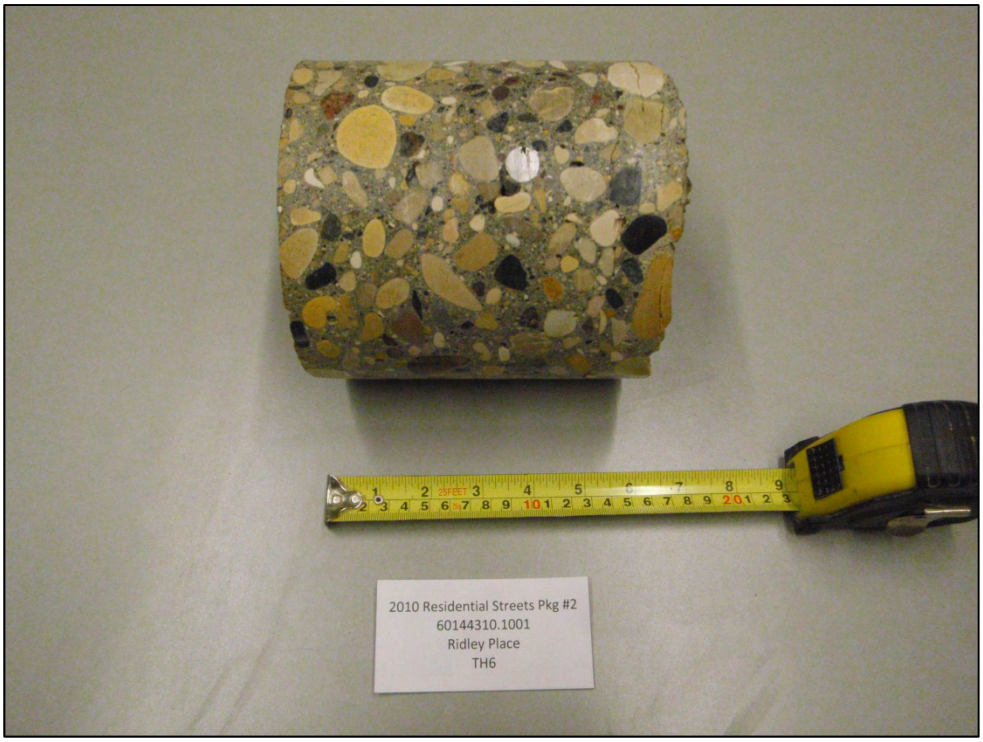
Photograph 1. Ridley Place – TH1

Photograph 2. Ridley Place – TH2

Photograph 3. Ridley Place – TH3

Photograph 4. Ridley Place – TH4

Photograph 5. Ridley Place – TH5



Photograph 6. Ridley Place – TH6

City of Winnipeg
2010 Residential Streets Package #2
Geotechnical Investigation

Test Hole No.	Testhole Location	House No.	Pavement Surface		Pavement Structure Material		Subgrade Description	Sample Depth (m)	Moisture Content (%)	Hydrometer Analysis				Atterberg Limits		
			Type	Thickness (mm)	Type	Thickness (mm)				Gravel (%)	Sand (%)	Silt (%)	Clay (%)	Plastic Limit	Liquid Limit	Plasticity Index
TH1	Ridley Place, Westbound Lane, 2.0 m S of Curb	Between 104 Ridley Pl and 178 Ridley St	Asphalt	30	None	n/a	Clay	0.3	35.3							
							Clay	0.6	36.3							
							Clay	0.9	33.8							
							Clay	1.2	40.5	0.0	0.0	14.8	85.1	33.1	98.8	65.7
			Concrete	150			Clay	1.5	43.9							
							Clay	1.8	42.0							
							Clay	2.1	46.6							
							Clay	2.4	50.1							
TH2	Ridley Place, Southbound Lane, 2.0 m E of Curb	116	Concrete	145	Granular Fill (< 20 mm)	50	Clay	0.2	22.5							
							Clay	0.6	33.9							
							Clay	0.9	35.4							
							Clay	1.2	36.4							
							Clay	1.5	40.3							
							Clay	1.8	45.5							
							Clay	2.1	47.9							
							Clay	2.4	45.3							
TH3	Ridley Place, Westbound Lane, 2.0 m S of Curb	Between 130 and 134	Concrete	170	None	n/a	Clay	0.2	30.8							
							Clay	0.6	34.9							
							Clay	0.9	35.4							
							Clay	1.1	34.7	0.0	5.9	22.6	71.6	30.0	69.5	39.5
							Clay	1.5	32.0							
							Clay	1.8	38.5							
							Clay	2.1	45.4							
							Clay	2.4	50.9							

City of Winnipeg
2010 Residential Streets Package #2
Geotechnical Investigation

Test Hole No.	Testhole Location	House No.	Pavement Surface		Pavement Structure Material		Subgrade Description	Sample Depth (m)	Moisture Content (%)	Hydrometer Analysis				Atterberg Limits		
			Type	Thickness (mm)	Type	Thickness (mm)				Gravel (%)	Sand (%)	Silt (%)	Clay (%)	Plastic Limit	Liquid Limit	Plasticity Index
TH4	Ridley Place, Eastbound Lane, 2.0 m N of Curb	146	Concrete	165	Granular Fill (< 20 mm)	50	Clay	0.3	37.1							
							Clay	0.6	40.4							
							Clay	0.9	38.4							
							Clay	1.1	37.4							
							Clay	1.5	40.6	0.0	0.0	8.6	91.4	31.6	92.5	60.9
							Clay	1.8	43.2							
							Clay	2.1	46.2							
							Clay	2.4	48.6							
TH5	Ridley Place, Northbound Lane, 2.0 m W of Curb	162	Concrete	165	Granular Fill (< 20 mm)	50	Clay	0.3	34.6							
							Clay	0.6	36.9							
							Clay	0.9	39.4							
							Clay	1.2	38.5	0.0	0.0	26.7	73.3	34.1	87.1	53.0
							Clay	1.5	40.4							
							Clay	1.8	44.4							
							Clay	2.1	45.7							
							Clay	2.4	49.4							
TH6	Ridley Place, Westbound Lane, 2.0 m S of Curb	172	Concrete	160	Granular Fill (< 20 mm)	50	Clay	0.3	31.5							
							Clay	0.6	37.3							
							Clay	0.9	38.5							
							Clay	1.2	38.2							
							Clay	1.5	44.3							
							Clay	1.8	45.3							
							Clay	2.1	43.2							
							Clay	2.4	48.5							

Appendix B

Country Club Blvd.,
Test Hole Location Plan,
Test Hole Logs,
Core Photographs,
Lab Testing Summary

B SIZE 11" x 17" (279.4mm x 431.8mm)

PLOT: 10/02/08 2:04:33 PM

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GREENACRE BLVD

COUNTRY CLUB BLVD

McBEY AVE

PORTAGE AVE

WOODLANDS CR

MTS DUCTS

TH1

TH2

TH3

100m

75m

15.240

4.877 wide

AECOM

SCALE 1:1000

0 10 20 m

City of Winnipeg
2010 Residential Package #2
Test Hole Locations

Country Club Boulevard
From McBey Avenue to Portage Avenue
Figure - 2

Winnipeg

PUBLIC WORKS DEPARTMENT • SERVICE DES TRAVAUX PUBLICS

Engineering Division • Division de l'ingénierie

GEOTECHNICAL INVESTIGATION

STREET RECONSTRUCTION

Revised October 28th, 2008

Fieldwork

1. Clear all underground services at each testhole location.
2. Test holes required every **50** m with a minimum of **3** test holes per street.
3. Record location of testhole (offset from curb, distance from cross street and house number).
4. Drill 150 mm-diameter core in pavement.
5. Drill 125 mm-diameter testhole into fill materials and subgrade
6. If a service trench backfilled with granular materials is encountered, another hole shall be drilled to define the existing sub-surface conditions.
7. Testhole to be drilled to depth of 2 m ± 150 mm below surface of the pavement.
8. Recover pavement core sample and representative samples of soil (fill materials, pavement structure materials and subgrade).
9. Measure and record pavement section exposed in the testhole (thickness of concrete or asphalt and different types of pavement structure materials).
10. Pavement structure materials to be identified as crushed limestone or granular fill and the maximum aggregate size of the material (20 mm, 50 mm or 150 mm).
11. Log soil profile for the subgrade.
12. Representative samples of soil must be obtained at the following depths below the bottom of the pavement structure materials - 0.1 m, 0.4 m, 0.7 m, 1.0 m, 1.3 m, 1.6 m, etc. Ensure a sample is obtained from each soil type encountered in the testhole.
13. Make note of any water seepage into the testhole.
14. Backfill testhole with native materials and additional granular fill, if required. Patch pavement surface with hot mix asphalt or high strength durable concrete mix.
15. Return core sample from the pavement and soil samples to the laboratory.

Lab Work

1. Test all soil samples for moisture content.
2. Photograph core samples recovered from the pavement surface.
3. Conduct tests for plasticity index and hydrometer analysis on selected soil samples which are between 0.5 m and 1 m below top of pavement (this is the sub-grade on which the pavement and sub-base will be built). The selection will be based upon visual classification and moisture content test results, with a minimum of one sample of each soil type per street to be tested.
4. Prepare testhole logs and classify subgrade (based on hydrometer) as follows;

< 30% silt -	classify as clay
30% - 50% silt -	classify as silty clay
50% - 70% silt -	classify as clayey silt
> 70% silt -	classify as silt

Prepared by: The National Testing Laboratories Limited and Eng-Tech Consulting

Embrace the Spirit • Vivez l'esprit

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AECOM Canada Ltd.

GENERAL STATEMENT

NORMAL VARIABILITY OF SUBSURFACE CONDITIONS

The scope of the investigation presented herein is limited to an investigation of the subsurface conditions as to suitability for the proposed project. This report has been prepared to aid in the evaluation of the site and to assist the engineer in the design of the facilities. Our description of the project represents our understanding of the significant aspects of the project relevant to the design and construction of earth work, foundations and similar. In the event of any changes in the basic design or location of the structures as outlined in this report or plan, we should be given the opportunity to review the changes and to modify or reaffirm in writing the conclusions and recommendations of this report.

The analysis and recommendations presented in this report are based on the data obtained from the borings and test pit excavations made at the locations indicated on the site plans and from other information discussed herein. This report is based on the assumption that the subsurface conditions everywhere are not significantly different from those disclosed by the borings and excavations. However, variations in soil conditions may exist between the excavations and, also, general groundwater levels and conditions may fluctuate from time to time. The nature and extent of the variations may not become evident until construction. If subsurface conditions differ from those encountered in the exploratory borings and excavations, are observed or encountered during construction, or appear to be present beneath or beyond excavations, we should be advised at once so that we can observe and review these conditions and reconsider our recommendations where necessary.

Since it is possible for conditions to vary from those assumed in the analysis and upon which our conclusions and recommendations are based, a contingency fund should be included in the construction budget to allow for the possibility of variations which may result in modification of the design and construction procedures.

In order to observe compliance with the design concepts, specifications or recommendations and to allow design changes in the event that subsurface conditions differ from those anticipated, we recommend that all construction operations dealing with earth work and the foundations be observed by an experienced soils engineer. We can be retained to provide these services for you during construction. In addition, we can be retained to review the plans and specifications that have been prepared to check for substantial conformance with the conclusions and recommendations contained in our report.

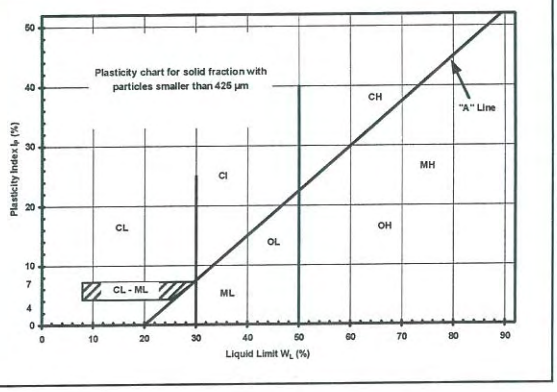
EXPLANATION OF FIELD & LABORATORY TEST DATA

Description				UMA Log Symbols	USCS Classification	Laboratory Classification Criteria			
						Fines (%)	Grading	Plasticity	Notes
COARSE GRAINED SOILS	GRAVELS (More than 50% of coarse fraction of gravel size)	CLEAN GRAVELS (Little or no fines)	Well graded gravels, sandy gravels, with little or no fines		GW	0-5	$C_U > 4$ $1 < C_C < 3$		Dual symbols if 5-12% fines. Dual symbols if above "A" line and $4<W_P<7$ $C_U = \frac{D_{60}}{D_{10}}$ $C_C = \frac{(D_{30})^2}{D_{10} x D_{60}}$
			Poorly graded gravels, sandy gravels, with little or no fines		GP	0-5	Not satisfying GW requirements		
		DIRTY GRAVELS (With some fines)	Silty gravels, silty sandy gravels		GM	> 12		Atterberg limits below "A" line or $W_P<4$	
			Clayey gravels, clayey sandy gravels		GC	> 12		Atterberg limits above "A" line or $W_P<7$	
	SANDS (More than 50% of coarse fraction of sand size)	CLEAN SANDS (Little or no fines)	Well graded sands, gravelly sands, with little or no fines		SW	0-5	$C_U > 6$ $1 < C_C < 3$		
			Poorly graded sands, gravelly sands, with little or no fines		SP	0-5	Not satisfying SW requirements		
		DIRTY SANDS (With some fines)	Silty sands, sand-silt mixtures		SM	> 12		Atterberg limits below "A" line or $W_P<4$	
			Clayey sands, sand-clay mixtures		SC	> 12		Atterberg limits above "A" line or $W_P<7$	
FINE GRAINED SOILS	SILTS (Below 'A' line negligible organic content)	$W_L<50$	Inorganic silts, silty or clayey fine sands, with slight plasticity		ML			Classification is Based upon Plasticity Chart	
		$W_L>50$	Inorganic silts of high plasticity		MH				
	CLAYS (Above 'A' line negligible organic content)	$W_L<30$	Inorganic clays, silty clays, sandy clays of low plasticity, lean clays		CL				
		$30<W_L<50$	Inorganic clays and silty clays of medium plasticity		CI				
		$W_L>50$	Inorganic clays of high plasticity, fat clays		CH				
	ORGANIC SILTS & CLAYS (Below 'A' line)	$W_L<50$	Organic silts and organic silty clays of low plasticity		OL				
		$W_L>50$	Organic clays of high plasticity		OH				
HIGHLY ORGAINIC SOILS			Peat and other highly organic soils		Pt	Von Post Classification Limit		Strong colour or odour, and often fibrous texture	

	Asphalt		Till		AECOM
	Concrete		Bedrock (Undifferentiated)		
	Fill		Bedrock (Limestone)		

When the above classification terms are used in this report or test hole logs, the designated fractions may be visually estimated and not measured.

Not used. Refer to City of Winnipeg's Specs for Geotechnical Investigation Street Reconstruction Oct 28, 08



FRACTION		SEIVE SIZE (mm)		DEFINING RANGES OF PERCENTAGE BY WEIGHT OF MINOR COMPONENTS	
		Passing	Retained	Percent	Identifier
Gravel	Coarse	76	19	35-50	and
	Fine	19	4.75		
Sand	Coarse	4.75	2.00	20-35	"y" or "ey" *
	Medium	2.00	0.425		
	Fine	0.425	0.075	10-20	some
Silt (non-plastic) or Clay (plastic)		< 0.075 mm		1-10	trace

* for example: gravelly, sandy clayey, silty

Definition of Oversize Material

COBBLES: 76mm to 300mm diameter
BOULDERS: >300mm diameter

LEGEND OF SYMBOLS

Laboratory and field tests are identified as follows:

- q_u - undrained shear strength (kPa) derived from unconfined compression testing.
- T_v - undrained shear strength (kPa) measured using a torvane
- pp - undrained shear strength (kPa) measured using a pocket penetrometer.
- L_v - undrained shear strength (kPa) measured using a lab vane.
- F_v - undrained shear strength (kPa) measured using a field vane.
- γ - bulk unit weight (kN/m^3).
- SPT - Standard Penetration Test. Recorded as number of blows (N) from a 63.5 kg hammer dropped 0.76 m (free fall) which is required to drive a 51 mm O.D. Raymond type sampler 0.30 m into the soil.
- DPPT - Drive Point Pentrometer Test. Recorded as number of blows from a 63.5 kg hammer dropped 0.76 m (free fall) which is required to drive a 50 mm drive point 0.30 m into the soil.
- w - moisture content (W_L, W_P)

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

Su (kPa)	CONSISTENCY
<12	very soft
12 – 25	soft
25 – 50	medium or firm
50 – 100	stiff
100 – 200	very stiff
200	hard

The resistance (N) of a non-cohesive soil can be related to compactness condition as follows

N – BLOWS/0.30 m	COMPACTNESS
0 - 4	very loose
4 - 10	loose
10 - 30	compact
30 - 50	dense
50	very dense

PROJECT: 2010 Residential Streets Package #2	CLIENT: City of Winnipeg	TESTHOLE NO: **TH1**
LOCATION: Country Club Blvd, Southbound Curb Lane, Between House #496 and 500, 2.0 m E of Curb		PROJECT NO.: 60144310.1001
CONTRACTOR: Paddock Drilling Ltd.	METHOD: 125 mm SSA with 150 mm Coring	ELEVATION (m):

SAMPLE TYPE ■ GRAB ▥ SHELBY TUBE ⊠ SPLIT SPOON ▤ BULK ⊘ NO RECOVERY ◧ CORE

DEPTH (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	PENETRATION TESTS / UNDRAINED SHEAR STRENGTH	COMMENTS	DEPTH
0		ASPHALT (thickness = 80 mm)					
		CRUSHED LIMESTONE - frozen, wet when thawed, well graded gravel (< 20 mm)					
		CLAY - possible fill - with gravel - dark grey - frozen, moist when thawed - high plasticity		G65			
		CLAY - trace silt - grey - frozen to 0.7 m, moist when thawed - high plasticity		G66			
				G67			
1		- below 1.0 m, trace silt, brown, firm		G68		Gradation: Silt = 14.8% and Clay = 85.1%	1
				G69			
				G70			
2				G71			2
				G72			
		End of test hole at 2.5 m in clay Notes: 1) No sloughing 2) No seepage 3) Backfilled with auger cuttings to 0.2 m below top of pavement, sand to 0.15 m below top of pavement and asphalt cold patch to top of pavement					
3							

PENETRATION TESTS: ✳ Becker ✳ ◇ Dynamic Cone ◇ ◆ SPT (Standard Pen Test) ◆ (Blows/300mm) 0 20 40 60 80 100; ■ Total Unit Wt ■ (kN/m³) 16 17 18 19 20 21; Plastic MC Liquid 20 40 60 80 100

UNDRAINED SHEAR STRENGTH: + Torvane + × QU × □ Lab Vane □ △ Pocket Pen. △ ⊕ Field Vane ⊕ (kPa) 50 100 150 200

LOGGED BY: Stephen Petsche	COMPLETION DEPTH: 2.50 m
REVIEWED BY: Gil Robinson	COMPLETION DATE: 1/18/10
PROJECT ENGINEER: Gil Robinson	Page 1 of 1

AECOM

LOG OF TEST HOLE TEST HOLE LOGS COUNTRY CLUB.GPJ UMA WINN.GDT 2/8/10

PROJECT: 2010 Residential Streets Package #2	CLIENT: City of Winnipeg	TESTHOLE NO: **TH2**
LOCATION: Country Club Blvd, Southbound Median Lane, In front of House #526, 2.0 m W of Curb		PROJECT NO.: 60144310.1001
CONTRACTOR: Paddock Drilling Ltd.	METHOD: 125 mm SSA with 150 mm Coring	ELEVATION (m):

SAMPLE TYPE ■ GRAB ▥ SHELBY TUBE ⊠ SPLIT SPOON ▤ BULK ⊘ NO RECOVERY ◧ CORE

DEPTH (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	PENETRATION TESTS / UNDRAINED SHEAR STRENGTH	COMMENTS	DEPTH
0		ASPHALT (thickness = 80 mm)					
		CRUSHED LIMESTONE - frozen, wet when thawed, well graded gravel (< 20 mm)					
		CLAY - possible fill - black - frozen, moist when thawed - high plasticity	■	G57			
		CLAY - trace gravel - brown - frozen to 0.8 m, moist when thawed - high plasticity	■	G58			
			■	G59			
1		- below 1.0 m, trace silt, trace sulphates, moist and stiff	■	G60			1
			■	G61			
			■	G62			
2			■	G63			2
			■	G64			
3		End of test hole at 2.5 m in clay Notes: 1) No sloughing 2) No seepage 3) Backfilled with auger cuttings to 0.2 m below top of pavement, sand to 0.15 m below top of pavement and asphalt cold patch to top of pavement					

PENETRATION TESTS: ✳ Becker ✳ ◇ Dynamic Cone ◇ ◆ SPT (Standard Pen Test) ◆ (Blows/300mm) 0 20 40 60 80 100; ■ Total Unit Wt ■ (kN/m³) 16 17 18 19 20 21; Plastic MC Liquid 20 40 60 80 100

UNDRAINED SHEAR STRENGTH: + Torvane + × QU × ☐ Lab Vane ☐ △ Pocket Pen. △ ◉ Field Vane ◉ (kPa) 50 100 150 200

AECOM	LOGGED BY: Stephen Petsche	COMPLETION DEPTH: 2.50 m
	REVIEWED BY: Gil Robinson	COMPLETION DATE: 1/18/10
	PROJECT ENGINEER: Gil Robinson	Page 1 of 1

LOG OF TEST HOLE TEST HOLE LOGS COUNTRY CLUB.GPJ UMA WINN.GDT 2/8/10

PROJECT: 2010 Residential Streets Package #2	CLIENT: City of Winnipeg	TESTHOLE NO: **TH3**
LOCATION: Country Club Blvd, Southbound Curb Lane, East of Midas building, 2.0 m E of Curb		PROJECT NO.: 60144310.1001
CONTRACTOR: Paddock Drilling Ltd.	METHOD: 125 mm SSA with 150 mm Coring	ELEVATION (m):

SAMPLE TYPE ■ GRAB ▥ SHELBY TUBE ☒ SPLIT SPOON ▤ BULK ⁄ NO RECOVERY ◧ CORE

DEPTH (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	PENETRATION TESTS / UNDRAINED SHEAR STRENGTH	COMMENTS	DEPTH
0		ASPHALT (thickness = 80 mm)					
		CRUSHED LIMESTONE - frozen, wet when thawed, well graded gravel (< 20 mm)					
		CLAY - possible fill - trace sand, trace gravel - dark grey - frozen, moist when thawed - high plasticity	■	G49			
		CLAY - with silt - dark grey - frozen to 0.8 m, moist when thawed - high plasticity	■	G50			
			■	G51			
1		SILTY CLAY - some sand - dark grey and light brown - moist and firm - intermediate plasticity	■	G52		Gradation: Sand = 21.7%, Silt = 30.4% and Clay = 47.8%	1
		SANDY SILT - some clay - light brown - moist and loose - low plasticity	■	G53		Gradation: Sand = 36.4%, Silt = 47.5 and Clay = 16.2%	
		CLAY - trace silt, trace sand - brown - moist and stiff - trace sulphates - high plasticity	■	G54		Gradation: Sand = 1.5%, Silt = 8.7% and Clay = 89.8%	
2			■	G55			2
			■	G56			
		End of test hole at 2.5 m in clay Notes: 1) No sloughing 2) No seepage 3) Backfilled with auger cuttings to 0.2 m below top of pavement, sand to 0.15 m below top of pavement and asphalt cold patch to top of pavement					
3							

PENETRATION TESTS: ✳ Becker ✳ ◇ Dynamic Cone ◇ ◆ SPT (Standard Pen Test) ◆ (Blows/300mm) 0 20 40 60 80 100; ■ Total Unit Wt ■ (kN/m³) 16 17 18 19 20 21; Plastic MC Liquid 20 40 60 80 100

UNDRAINED SHEAR STRENGTH: + Torvane + × QU × ☐ Lab Vane ☐ △ Pocket Pen. △ ◓ Field Vane ◓ (kPa) 50 100 150 200

LOG OF TEST HOLE TEST HOLE LOGS COUNTRY CLUB.GPJ UMA WINN.GDT 2/9/10

AECOM

LOGGED BY: Stephen Petsche	COMPLETION DEPTH: 2.50 m
REVIEWED BY: Gil Robinson	COMPLETION DATE: 1/18/10
PROJECT ENGINEER: Gil Robinson	Page 1 of 1

Photograph 1. Country Club Blvd – TH1

Photograph 2. Country Club Blvd – TH2

Photograph 3. Country Club Blvd – TH3

City of Winnipeg
2010 Residential Streets Package #2
Geotechnical Investigation

Test Hole No.	Testhole Location	House No.	Pavement Surface		Pavement Structure Material		Subgrade Description	Sample Depth (m)	Moisture Content (%)	Hydrometer Analysis				Atterberg Limits		
			Type	Thickness (mm)	Type	Thickness (mm)				Gravel (%)	Sand (%)	Silt (%)	Clay (%)	Plastic Limit	Liquid Limit	Plasticity Index
TH1	Country Club Blvd, Southbound Curb Lane, 2.0 m E of Curb	Between 496 and 500	Asphalt	80	Crushed Limestone (< 20 mm)	80	Clay	0.3	22.7							
							Clay	0.6	29.4							
							Clay	0.9	38.0							
							Clay	1.2	35.1	0.0	0.0	25.3	74.7	29.0	83.7	54.7
							Clay	1.5	40.4							
							Clay	1.8	45.1							
							Clay	2.1	51.6							
							Clay	2.4	52.8							
TH2	Country Club Blvd, Southbound Median Lane, 2.0 m W of Curb	526	Asphalt	80	Crushed Limestone (< 20 mm)	75	Clay	0.2	31.7							
							Clay	0.5	34.0							
							Clay	0.8	36.7							
							Clay	1.1	35.6							
							Clay	1.4	35.0							
							Clay	1.7	41.0							
							Clay	2.0	43.1							
							Clay	2.3	45.1							
TH3	Country Club Blvd, Southbound Curb Lane, 2.0 m E of Curb	East of Midas building	Asphalt	80	Crushed Limestone (< 20 mm)	75	Clay	0.3	29.9							
							Clay	0.6	26.9							
							Clay	0.9	43.6							
							Silty Clay	1.2	32.3	0.0	21.7	30.4	47.8	18.2	49.0	30.8
							Sandy Silt	1.5	19.5	0.0	36.4	47.5	16.2	16.2	22.4	6.2
							Clay	1.8	37.5	0.0	1.5	8.7	89.8	29.3	83.2	54.0
							Clay	2.1	41.0							
							Clay	2.4	47.6							

Appendix C

Assiniboine Avenue,
Test Hole Location Plan,
Test Hole Logs,
Core Photographs,
Lab Testing Summary

B SIZE 11" x 17" (279.4mm x 431.8mm)

PLOT: 10/02/08 2:02:39 PM

Saved By: cloustonc

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City of Winnipeg
2010 Residential Package #2
Test Hole Locations

Assiniboine Avenue
Glendale Boulevard to Ashcroft Point
Figure - 3

Winnipeg

PUBLIC WORKS DEPARTMENT • SERVICE DES TRAVAUX PUBLICS

Engineering Division • Division de l'ingénierie

GEOTECHNICAL INVESTIGATION

STREET RECONSTRUCTION

Revised October 28th, 2008

Fieldwork

1. Clear all underground services at each testhole location.
2. Test holes required every **50** m with a minimum of **3** test holes per street.
3. Record location of testhole (offset from curb, distance from cross street and house number).
4. Drill 150 mm-diameter core in pavement.
5. Drill 125 mm-diameter testhole into fill materials and subgrade
6. If a service trench backfilled with granular materials is encountered, another hole shall be drilled to define the existing sub-surface conditions.
7. Testhole to be drilled to depth of 2 m ± 150 mm below surface of the pavement.
8. Recover pavement core sample and representative samples of soil (fill materials, pavement structure materials and subgrade).
9. Measure and record pavement section exposed in the testhole (thickness of concrete or asphalt and different types of pavement structure materials).
10. Pavement structure materials to be identified as crushed limestone or granular fill and the maximum aggregate size of the material (20 mm, 50 mm or 150 mm).
11. Log soil profile for the subgrade.
12. Representative samples of soil must be obtained at the following depths below the bottom of the pavement structure materials - 0.1 m, 0.4 m, 0.7 m, 1.0 m, 1.3 m, 1.6 m, etc. Ensure a sample is obtained from each soil type encountered in the testhole.
13. Make note of any water seepage into the testhole.
14. Backfill testhole with native materials and additional granular fill, if required. Patch pavement surface with hot mix asphalt or high strength durable concrete mix.
15. Return core sample from the pavement and soil samples to the laboratory.

Lab Work

1. Test all soil samples for moisture content.
2. Photograph core samples recovered from the pavement surface.
3. Conduct tests for plasticity index and hydrometer analysis on selected soil samples which are between 0.5 m and 1 m below top of pavement (this is the sub-grade on which the pavement and sub-base will be built). The selection will be based upon visual classification and moisture content test results, with a minimum of one sample of each soil type per street to be tested.
4. Prepare testhole logs and classify subgrade (based on hydrometer) as follows;

< 30% silt -	classify as clay
30% - 50% silt -	classify as silty clay
50% - 70% silt -	classify as clayey silt
> 70% silt -	classify as silt

Prepared by: The National Testing Laboratories Limited and Eng-Tech Consulting

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AECOM Canada Ltd.

GENERAL STATEMENT

NORMAL VARIABILITY OF SUBSURFACE CONDITIONS

The scope of the investigation presented herein is limited to an investigation of the subsurface conditions as to suitability for the proposed project. This report has been prepared to aid in the evaluation of the site and to assist the engineer in the design of the facilities. Our description of the project represents our understanding of the significant aspects of the project relevant to the design and construction of earth work, foundations and similar. In the event of any changes in the basic design or location of the structures as outlined in this report or plan, we should be given the opportunity to review the changes and to modify or reaffirm in writing the conclusions and recommendations of this report.

The analysis and recommendations presented in this report are based on the data obtained from the borings and test pit excavations made at the locations indicated on the site plans and from other information discussed herein. This report is based on the assumption that the subsurface conditions everywhere are not significantly different from those disclosed by the borings and excavations. However, variations in soil conditions may exist between the excavations and, also, general groundwater levels and conditions may fluctuate from time to time. The nature and extent of the variations may not become evident until construction. If subsurface conditions differ from those encountered in the exploratory borings and excavations, are observed or encountered during construction, or appear to be present beneath or beyond excavations, we should be advised at once so that we can observe and review these conditions and reconsider our recommendations where necessary.

Since it is possible for conditions to vary from those assumed in the analysis and upon which our conclusions and recommendations are based, a contingency fund should be included in the construction budget to allow for the possibility of variations which may result in modification of the design and construction procedures.

In order to observe compliance with the design concepts, specifications or recommendations and to allow design changes in the event that subsurface conditions differ from those anticipated, we recommend that all construction operations dealing with earth work and the foundations be observed by an experienced soils engineer. We can be retained to provide these services for you during construction. In addition, we can be retained to review the plans and specifications that have been prepared to check for substantial conformance with the conclusions and recommendations contained in our report.

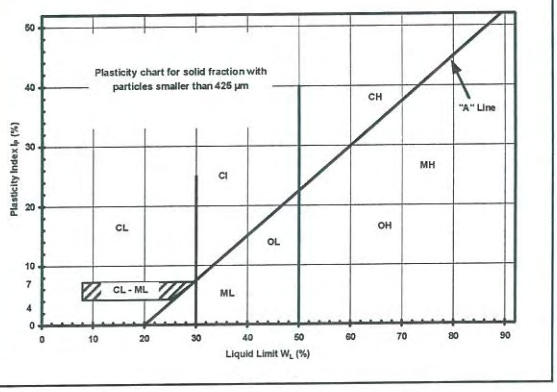
EXPLANATION OF FIELD & LABORATORY TEST DATA

Description				UMA Log Symbols	USCS Classification	Laboratory Classification Criteria			
						Fines (%)	Grading	Plasticity	Notes
COARSE GRAINED SOILS	GRAVELS (More than 50% of coarse fraction of gravel size)	CLEAN GRAVELS (Little or no fines)	Well graded gravels, sandy gravels, with little or no fines		GW	0-5	$C_U > 4$ $1 < C_C < 3$		Dual symbols if 5-12% fines. Dual symbols if above "A" line and $4<W_P<7$ $C_U = \frac{D_{60}}{D_{10}}$ $C_C = \frac{(D_{30})^2}{D_{10} x D_{60}}$
			Poorly graded gravels, sandy gravels, with little or no fines		GP	0-5	Not satisfying GW requirements		
		DIRTY GRAVELS (With some fines)	Silty gravels, silty sandy gravels		GM	> 12		Atterberg limits below "A" line or $W_P<4$	
			Clayey gravels, clayey sandy gravels		GC	> 12		Atterberg limits above "A" line or $W_P<7$	
	SANDS (More than 50% of coarse fraction of sand size)	CLEAN SANDS (Little or no fines)	Well graded sands, gravelly sands, with little or no fines		SW	0-5	$C_U > 6$ $1 < C_C < 3$		
			Poorly graded sands, gravelly sands, with little or no fines		SP	0-5	Not satisfying SW requirements		
		DIRTY SANDS (With some fines)	Silty sands, sand-silt mixtures		SM	> 12		Atterberg limits below "A" line or $W_P<4$	
			Clayey sands, sand-clay mixtures		SC	> 12		Atterberg limits above "A" line or $W_P<7$	
FINE GRAINED SOILS	SILTS (Below 'A' line negligible organic content)	$W_L<50$	Inorganic silts, silty or clayey fine sands, with slight plasticity		ML			Classification is Based upon Plasticity Chart	
		$W_L>50$	Inorganic silts of high plasticity		MH				
	CLAYS (Above 'A' line negligible organic content)	$W_L<30$	Inorganic clays, silty clays, sandy clays of low plasticity, lean clays		CL				
		$30<W_L<50$	Inorganic clays and silty clays of medium plasticity		CI				
		$W_L>50$	Inorganic clays of high plasticity, fat clays		CH				
	ORGANIC SILTS & CLAYS (Below 'A' line)	$W_L<50$	Organic silts and organic silty clays of low plasticity		OL				
		$W_L>50$	Organic clays of high plasticity		OH				
HIGHLY ORGAINIC SOILS			Peat and other highly organic soils		Pt	Von Post Classification Limit		Strong colour or odour, and often fibrous texture	

	Asphalt		Till		AECOM
	Concrete		Bedrock (Undifferentiated)		
	Fill		Bedrock (Limestone)		

When the above classification terms are used in this report or test hole logs, the designated fractions may be visually estimated and not measured.

Not used. Refer to City of Winnipeg's Specs for Geotechnical Investigation Street Reconstruction Oct 28, 08



FRACTION		SEIVE SIZE (mm)		DEFINING RANGES OF PERCENTAGE BY WEIGHT OF MINOR COMPONENTS	
		Passing	Retained	Percent	Identifier
Gravel	Coarse	76	19	35-50	and
	Fine	19	4.75		
Sand	Coarse	4.75	2.00	20-35	"y" or "ey" *
	Medium	2.00	0.425		
	Fine	0.425	0.075	10-20	some
Silt (non-plastic) or Clay (plastic)		< 0.075 mm		1-10	trace

* for example: gravelly, sandy clayey, silty

Definition of Oversize Material

COBBLES: 76mm to 300mm diameter
BOULDERS: >300mm diameter

LEGEND OF SYMBOLS

Laboratory and field tests are identified as follows:

- q_u - undrained shear strength (kPa) derived from unconfined compression testing.
- T_v - undrained shear strength (kPa) measured using a torvane
- pp - undrained shear strength (kPa) measured using a pocket penetrometer.
- L_v - undrained shear strength (kPa) measured using a lab vane.
- F_v - undrained shear strength (kPa) measured using a field vane.
- γ - bulk unit weight (kN/m^3).
- SPT - Standard Penetration Test. Recorded as number of blows (N) from a 63.5 kg hammer dropped 0.76 m (free fall) which is required to drive a 51 mm O.D. Raymond type sampler 0.30 m into the soil.
- DPPT - Drive Point Pentrometer Test. Recorded as number of blows from a 63.5 kg hammer dropped 0.76 m (free fall) which is required to drive a 50 mm drive point 0.30 m into the soil.
- w - moisture content (W_L, W_P)

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

Su (kPa)	CONSISTENCY
<12	very soft
12 – 25	soft
25 – 50	medium or firm
50 – 100	stiff
100 – 200	very stiff
200	hard

The resistance (N) of a non-cohesive soil can be related to compactness condition as follows

N – BLOWS/0.30 m	COMPACTNESS
0 - 4	very loose
4 - 10	loose
10 - 30	compact
30 - 50	dense
50	very dense

PROJECT: 2010 Residential Streets Package #2	CLIENT: City of Winnipeg	TESTHOLE NO: **TH1**
LOCATION: Assiniboine Ave, Westbound Lane, In front of House #2744, 2.0 m S of edge of street		PROJECT NO.: 60144310.1001
CONTRACTOR: Paddock Drilling Ltd.	METHOD: 125 mm SSA with 150 mm Coring	ELEVATION (m):

SAMPLE TYPE ■ GRAB ▥ SHELBY TUBE ⊠ SPLIT SPOON ▤ BULK ⊘ NO RECOVERY ◧ CORE

DEPTH (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	PENETRATION TESTS ✳ Becker ✳ ◇ Dynamic Cone ◇ ◆ SPT (Standard Pen Test) ◆ (Blows/300mm) 0 20 40 60 80 100 ■ Total Unit Wt ■ (kN/m^3) 16 17 18 19 20 21 Plastic MC Liquid 20 40 60 80 100	UNDRAINED SHEAR STRENGTH + Torvane + × QU × □ Lab Vane □ △ Pocket Pen. △ ◒ Field Vane ◒ (kPa) 50 100 150 200	COMMENTS	DEPTH
0		ASPHALT (thickness = 65 mm)					
		GRANULAR FILL - light brown, frozen, wet when thawed, well graded sand and gravel (< 20 mm)		G73			
		CLAY - possible fill - trace silt - frozen, moist when thawed - mottled black and brown - high plasticty		G74			
		CLAY - trace silt - brown - moist and stiff - high plasticity		G75			
1		- below 1.1 m, trace sand, trace gravel, trace sulphates, moist and stiff		G76			1
				G77		Gradation: Silt = 11.9% and Clay = 88.1%	
				G78			
2		- below 1.9 m, firm to stiff		G79			2
				G80			
				G81			
3		- below 2.9 m, trace sand, firm		G82			3
		End of test hole at 3.2 m in clay Notes: 1) No sloughing 2) No seepage 3) Backfilled with auger cuttings to 0.2 m below top of pavement, sand to 0.15 m below top of pavement and asphalt cold patch to top of pavement					
4							

LOG OF TEST HOLE TEST HOLE LOGS ASSINIBOINE.GPJ UMA WINN.GDT 2/9/10

AECOM

LOGGED BY: Stephen Petsche	COMPLETION DEPTH: 3.20 m
REVIEWED BY: Gil Robinson	COMPLETION DATE: 1/18/10
PROJECT ENGINEER: Gil Robinson	Page 1 of 1

PROJECT: 2010 Residential Streets Package #2	CLIENT: City of Winnipeg	TESTHOLE NO: **TH2**
LOCATION: Assiniboine Ave, Westbound Lane, In front of House #2724, 2.0 m S of edge of street		PROJECT NO.: 60144310.1001
CONTRACTOR: Paddock Drilling Ltd.	METHOD: 125 mm SSA with 150 mm Coring	ELEVATION (m):

SAMPLE TYPE ■ GRAB ▥ SHELBY TUBE ☒ SPLIT SPOON ▤ BULK ⊘ NO RECOVERY ▮ CORE

DEPTH (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #
0		ASPHALT (thickness = 145 mm)		
		GRANULAR MATERIAL - brown, frozen, wet when thawed, well graded sand and gravel (< 20 mm)		G83
		CLAY - possible fill - some gravel - black - frozen, moist when thawed - high plasticity		G84
		CLAY - trace silt, trace gravel - dark brown - frozen to 0.8 m, moist when thawed - high plasticity		
		- below 0.9 m, trace silt, brown, moist and stiff		G85
1				
		- below 1.3 m, silt lense 2 mm thick, stiff		G86
				G87
				G88
2				
		- below 2.2 m, trace sulphates		G89
				G90
		- below 2.8 m, firm		G91
3		- below 3.0 m, trace oxides		
				G92
		End of test hole at 3.2 m in clay Notes: 1) No sloughing 2) No seepage 3) Backfilled with auger cuttings to 0.2 m below top of pavement, sand to 0.15 m below top of pavement and asphalt cold patch to top of pavement		
4				

PENETRATION TESTS
✳ Becker ✳
◇ Dynamic Cone ◇
◆ SPT (Standard Pen Test) ◆
(Blows/300mm)
0 20 40 60 80 100
■ Total Unit Wt ■
(kN/m³)
16 17 18 19 20 21
Plastic MC Liquid
20 40 60 80 100

UNDRAINED SHEAR STRENGTH
+ Torvane +
× QU ×
□ Lab Vane □
△ Pocket Pen. △
◓ Field Vane ◓
(kPa)
50 100 150 200

COMMENTS

DEPTH
1
2
3

LOG OF TEST HOLE TEST HOLE LOGS ASSINIBOINE.GPJ UMA WINN.GDT 2/9/10

AECOM

LOGGED BY: Stephen Petsche	COMPLETION DEPTH: 3.20 m
REVIEWED BY: Gil Robinson	COMPLETION DATE: 1/18/10
PROJECT ENGINEER: Gil Robinson	Page 1 of 1

PROJECT: 2010 Residential Streets Package #2	CLIENT: City of Winnipeg	TESTHOLE NO: **TH3**
LOCATION: Assiniboine Ave, Westbound Lane, In front of House #2700, 2.0 m S of edge of street		PROJECT NO.: 60144310.1001
CONTRACTOR: Paddock Drilling Ltd.	METHOD: 125 mm SSA with 150 mm Coring	ELEVATION (m):

SAMPLE TYPE ■ GRAB ▥ SHELBY TUBE ⊠ SPLIT SPOON ▤ BULK ⊘ NO RECOVERY ◧ CORE

DEPTH (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #
0		ASPHALT (thickness = 115 mm)		
		GRANULAR FILL - brown, frozen, wet when thawed, well graded sand and gravel (< 20 mm)		G93
		CLAY - possible fill - trace sand, trace gravel - grey - frozen, moist when thawed - high plasticity		G94
		CLAY - some silt, some sand - black - frozen to 0.9 m, moist when thawed - intermediate plasticity		G95
1				G96
				G97
		- below 1.7 m, trace sand, stiff		G98
		CLAY - trace silt - brown - moist and firm to stiff - trace oxides and sulphates - high plasticity		G99
2				G100
		- below 2.4 m, trace sand		G101
3				G102
		End of test hole at 3.2 m in clay Notes: 1) No sloughing 2) No seepage 3) Backfilled with auger cuttings to 0.2 m below top of pavement, sand to 0.15 m below top of pavement and asphalt cold patch to top of pavement		
4				

PENETRATION TESTS
✳ Becker ✳
◇ Dynamic Cone ◇
◆ SPT (Standard Pen Test) ◆
(Blows/300mm)
0 20 40 60 80 100
■ Total Unit Wt ■
(kN/m^3)
16 17 18 19 20 21
Plastic MC Liquid
20 40 60 80 100

UNDRAINED SHEAR STRENGTH
+ Torvane +
× QU ×
□ Lab Vane □
△ Pocket Pen. △
● Field Vane ●
(kPa)
50 100 150 200

COMMENTS

Gradation:
Sand = 12.2%, Silt = 29.8%, Clay = 58.0%

DEPTH

1
2
3

LOG OF TEST HOLE TEST HOLE LOGS ASSINIBOINE.GPJ UMA WINN.GDT 2/8/10

AECOM

LOGGED BY: Stephen Petsche	COMPLETION DEPTH: 3.20 m
REVIEWED BY: Gil Robinson	COMPLETION DATE: 1/18/10
PROJECT ENGINEER: Gil Robinson	Page 1 of 1

PROJECT: 2010 Residential Streets Package #2	CLIENT: City of Winnipeg	TESTHOLE NO: **TH4**
LOCATION: Assiniboine Ave, Centre of cul-de-sac at Ashcroft Point		PROJECT NO.: 60144310.1001
CONTRACTOR: Paddock Drilling Ltd.	METHOD: 125 mm SSA with 150 mm Coring	ELEVATION (m):

SAMPLE TYPE ■ GRAB ▥ SHELBY TUBE ⊠ SPLIT SPOON ▤ BULK ⊘ NO RECOVERY ◧ CORE

DEPTH (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	PENETRATION TESTS ✳ Becker ✳ ◇ Dynamic Cone ◇ ◆ SPT (Standard Pen Test) ◆ (Blows/300mm) 0 20 40 60 80 100 ■ Total Unit Wt ■ (kN/m³) 16 17 18 19 20 21 Plastic MC Liquid 20 40 60 80 100	UNDRAINED SHEAR STRENGTH + Torvane + × QU × □ Lab Vane □ △ Pocket Pen. △ ⊕ Field Vane ⊕ (kPa) 50 100 150 200	COMMENTS	DEPTH
0		ASPHALT (thickness = 125 mm)						
		GRANULAR FILL - with clay, light brown, frozen, wet when thawed, well graded sand and gravel (< 20 mm)		G103				
		CLAY - black - frozen, moist when thawed - intermediate plasticity		G104				
		CLAY - with silt, trace sand - brown - frozen to 0.9 m, moist when thawed - high plasticity		G105				
1				G106			Gradation: Gravel = 0.7%, Sand = 6.7%, Silt = 24.8% and Clay = 67.8%	1
		- below 1.25 m, trace sand, moist and stiff		G107				
				G108				
2								2
				G109				
		- silt lense 2 mm thick at 2.5 m		G110				
				G111				
3								3
				G112				
		End of test hole at 3.2 m in clay Notes: 1) No sloughing 2) No seepage 3) Backfilled with auger cuttings to 0.2 m below top of pavement, sand to 0.15 m below top of pavement and asphalt cold patch to top of pavement						
4								

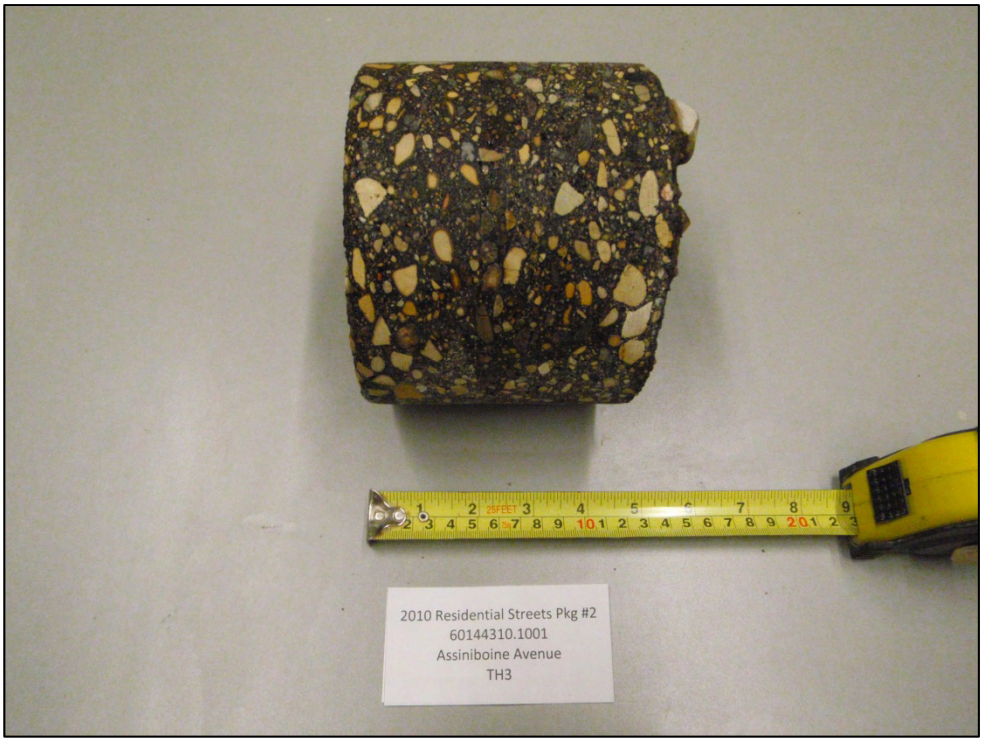
AECOM

LOGGED BY: Stephen Petsche	COMPLETION DEPTH: 3.20 m
REVIEWED BY: Gil Robinson	COMPLETION DATE: 1/18/10
PROJECT ENGINEER: Gil Robinson	Page 1 of 1

LOG OF TEST HOLE TEST HOLE LOGS ASSINIBOINE.GPJ UMA WINN.GDT 2/8/10

Photograph 1. Assiniboine Avenue – TH1

Photograph 2. Assiniboine Avenue – TH2



Photograph 3. Assiniboine Avenue – TH3

Photograph 4. Assiniboine Avenue – TH4

AECOM

City of Winnipeg
2010 Residential Streets Package #2
Geotechnical Investigation

Test Hole No.	Testhole Location	House No.	Pavement Surface		Pavement Structure Material		Subgrade Description	Sample Depth (m)	Moisture Content (%)	Hydrometer Analysis				Atterberg Limits		
			Type	Thickness (mm)	Type	Thickness (mm)				Gravel (%)	Sand (%)	Silt (%)	Clay (%)	Plastic Limit	Liquid Limit	Plasticity Index
TH1	Assiniboine Avenue, Westbound Lane, 2.0 m S of edge of street	2744	Asphalt	65	Granular Fill (< 20 mm)	0.2 m	Granular Fill	0.2	5.6							
							Clay	0.5	36.6							
							Clay	0.8	40.3							
							Clay	1.1	40.7							
							Clay	1.4	39.3	0.0	0.0	11.9	88.1	32.9	84.8	52.0
							Clay	1.7	40.4							
							Clay	2.0	48.0							
							Clay	2.4	43.4							
							Clay	2.8	44.3							
							Clay	3.1	44.0							
TH2	Assiniboine Avenue, Westbound Lane, 2.0 m S of edge of street	2724	Asphalt	145	Granular Fill (< 20 mm)	50	Clay	0.2	18.7							
							Clay	0.5	36.7							
							Clay	0.9	40.2							
							Clay	1.3	34.8							
							Clay	1.6	36.3							
							Clay	1.9	39.1							
							Clay	2.2	41.1							
							Clay	2.5	43.6							
							Clay	2.8	52.6							
							Clay	3.1	52.2							
TH3	Assiniboine Avenue, Westbound Lane, 2.0 m S of edge of street	2700	Asphalt	115	Granular Fill (< 20 mm)	50	Clay	0.2	33.1							
							Clay	0.5	28.5							
							Clay	0.9	31.5							
							Clay	1.2	40.7							
							Clay	1.5	41.7	0.0	12.2	29.8	58.0	33.1	62.4	29.3
							Clay	1.8	33.7							
							Clay	2.1	41.1							
							Clay	2.4	40.9							
							Clay	2.8	50.7							
							Clay	3.1	52.0							
TH4	Assiniboine Avenue at Ashcroft Point, Centre of Cul-de-sac	n/a	Asphalt	125	None	n/a	Granular Fill	0.2	9.3							
							Clay	0.5	37.8							
							Clay	0.8	35.9							
							Clay	1.1	32.4	0.7	6.7	24.8	67.8	29.1	86.3	57.3
							Clay	1.5	30.2							
							Clay	1.9	32.1							
							Clay	2.3	32.6							
							Clay	2.6	37.2							
							Clay	2.9	36.7							
							Clay	3.1	41.8							

Appendix D

Donnington Road,
Test Hole Location Plan,
Test Hole Logs,
Core Photographs,
Lab Testing Summary

ELDRIDGE AVE

CATHURST PL

DONNINGTON RD

375 CONC 1962 WWS 7.6

375 *UNK 1986 WWS 9.1

250 PVC 1987 4.3

600 CONC 1978 LDS 4.3

600 PCP 1958

300 CONC 1978 LDS 4.3

250 CONC 1978 WWS 3.4

250 CONC 1978 WWS 3.0

250 CONC 1975 WWS 11.6

1050 CONC 1975 LDS 7.6

300 AC 1972 2.1

300 AC 1972 4.4

300 CONC 1966 WWS 7.6

375 *UNK 1986 WWS 9.1

250 CONC 1978 WWS 4.9

250 CONC 1975 WWS 3.0

600 CONC 1978 LDS 4.9

150 AC 1978 3.0

250 CONC 1975 WWS 4.6

250 AC 1973 4.3

150 AC 1977 4.3

750 CONC 1975 LDS 4.9

300 CONC 1978 LDS 4.3

250 AC 1974 4.3

TH1

TH2

TH3

15m

30m

32m

R=15.24

0.64 Wide

N

0 10 20 m

SCALE 1:1000

AECOM

City of Winnipeg
2010 Residential Package #2
Test Hole Locations

Donnington Road

From Eldridge Avenue to 100M South

Figure - 4

Winnipeg

PUBLIC WORKS DEPARTMENT • SERVICE DES TRAVAUX PUBLICS

Engineering Division • Division de l'ingénierie

GEOTECHNICAL INVESTIGATION

STREET RECONSTRUCTION

Revised October 28th, 2008

Fieldwork

1. Clear all underground services at each testhole location.
2. Test holes required every **50** m with a minimum of **3** test holes per street.
3. Record location of testhole (offset from curb, distance from cross street and house number).
4. Drill 150 mm-diameter core in pavement.
5. Drill 125 mm-diameter testhole into fill materials and subgrade
6. If a service trench backfilled with granular materials is encountered, another hole shall be drilled to define the existing sub-surface conditions.
7. Testhole to be drilled to depth of 2 m ± 150 mm below surface of the pavement.
8. Recover pavement core sample and representative samples of soil (fill materials, pavement structure materials and subgrade).
9. Measure and record pavement section exposed in the testhole (thickness of concrete or asphalt and different types of pavement structure materials).
10. Pavement structure materials to be identified as crushed limestone or granular fill and the maximum aggregate size of the material (20 mm, 50 mm or 150 mm).
11. Log soil profile for the subgrade.
12. Representative samples of soil must be obtained at the following depths below the bottom of the pavement structure materials - 0.1 m, 0.4 m, 0.7 m, 1.0 m, 1.3 m, 1.6 m, etc. Ensure a sample is obtained from each soil type encountered in the testhole.
13. Make note of any water seepage into the testhole.
14. Backfill testhole with native materials and additional granular fill, if required. Patch pavement surface with hot mix asphalt or high strength durable concrete mix.
15. Return core sample from the pavement and soil samples to the laboratory.

Lab Work

1. Test all soil samples for moisture content.
2. Photograph core samples recovered from the pavement surface.
3. Conduct tests for plasticity index and hydrometer analysis on selected soil samples which are between 0.5 m and 1 m below top of pavement (this is the sub-grade on which the pavement and sub-base will be built). The selection will be based upon visual classification and moisture content test results, with a minimum of one sample of each soil type per street to be tested.
4. Prepare testhole logs and classify subgrade (based on hydrometer) as follows;

< 30% silt -	classify as clay
30% - 50% silt -	classify as silty clay
50% - 70% silt -	classify as clayey silt
> 70% silt -	classify as silt

Prepared by: The National Testing Laboratories Limited and Eng-Tech Consulting

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AECOM Canada Ltd.

GENERAL STATEMENT

NORMAL VARIABILITY OF SUBSURFACE CONDITIONS

The scope of the investigation presented herein is limited to an investigation of the subsurface conditions as to suitability for the proposed project. This report has been prepared to aid in the evaluation of the site and to assist the engineer in the design of the facilities. Our description of the project represents our understanding of the significant aspects of the project relevant to the design and construction of earth work, foundations and similar. In the event of any changes in the basic design or location of the structures as outlined in this report or plan, we should be given the opportunity to review the changes and to modify or reaffirm in writing the conclusions and recommendations of this report.

The analysis and recommendations presented in this report are based on the data obtained from the borings and test pit excavations made at the locations indicated on the site plans and from other information discussed herein. This report is based on the assumption that the subsurface conditions everywhere are not significantly different from those disclosed by the borings and excavations. However, variations in soil conditions may exist between the excavations and, also, general groundwater levels and conditions may fluctuate from time to time. The nature and extent of the variations may not become evident until construction. If subsurface conditions differ from those encountered in the exploratory borings and excavations, are observed or encountered during construction, or appear to be present beneath or beyond excavations, we should be advised at once so that we can observe and review these conditions and reconsider our recommendations where necessary.

Since it is possible for conditions to vary from those assumed in the analysis and upon which our conclusions and recommendations are based, a contingency fund should be included in the construction budget to allow for the possibility of variations which may result in modification of the design and construction procedures.

In order to observe compliance with the design concepts, specifications or recommendations and to allow design changes in the event that subsurface conditions differ from those anticipated, we recommend that all construction operations dealing with earth work and the foundations be observed by an experienced soils engineer. We can be retained to provide these services for you during construction. In addition, we can be retained to review the plans and specifications that have been prepared to check for substantial conformance with the conclusions and recommendations contained in our report.

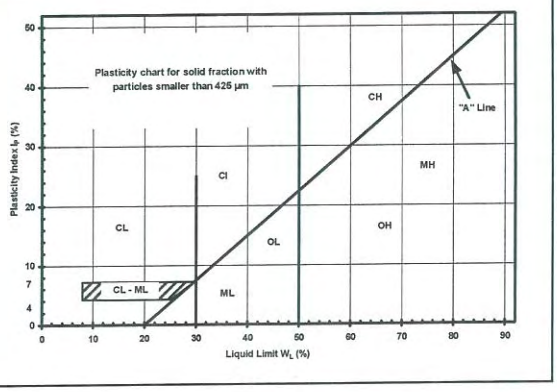
EXPLANATION OF FIELD & LABORATORY TEST DATA

Description				UMA Log Symbols	USCS Classification	Laboratory Classification Criteria			
						Fines (%)	Grading	Plasticity	Notes
COARSE GRAINED SOILS	GRAVELS (More than 50% of coarse fraction of gravel size)	CLEAN GRAVELS (Little or no fines)	Well graded gravels, sandy gravels, with little or no fines		GW	0-5	$C_U > 4$ $1 < C_C < 3$		Dual symbols if 5-12% fines. Dual symbols if above "A" line and $4<W_P<7$ $C_U = \frac{D_{60}}{D_{10}}$ $C_C = \frac{(D_{30})^2}{D_{10} x D_{60}}$
			Poorly graded gravels, sandy gravels, with little or no fines		GP	0-5	Not satisfying GW requirements		
		DIRTY GRAVELS (With some fines)	Silty gravels, silty sandy gravels		GM	> 12		Atterberg limits below "A" line or $W_P<4$	
			Clayey gravels, clayey sandy gravels		GC	> 12		Atterberg limits above "A" line or $W_P<7$	
	SANDS (More than 50% of coarse fraction of sand size)	CLEAN SANDS (Little or no fines)	Well graded sands, gravelly sands, with little or no fines		SW	0-5	$C_U > 6$ $1 < C_C < 3$		
			Poorly graded sands, gravelly sands, with little or no fines		SP	0-5	Not satisfying SW requirements		
		DIRTY SANDS (With some fines)	Silty sands, sand-silt mixtures		SM	> 12		Atterberg limits below "A" line or $W_P<4$	
			Clayey sands, sand-clay mixtures		SC	> 12		Atterberg limits above "A" line or $W_P<7$	
FINE GRAINED SOILS	SILTS (Below 'A' line negligible organic content)	$W_L<50$	Inorganic silts, silty or clayey fine sands, with slight plasticity		ML			Classification is Based upon Plasticity Chart	
		$W_L>50$	Inorganic silts of high plasticity		MH				
	CLAYS (Above 'A' line negligible organic content)	$W_L<30$	Inorganic clays, silty clays, sandy clays of low plasticity, lean clays		CL				
		$30<W_L<50$	Inorganic clays and silty clays of medium plasticity		CI				
		$W_L>50$	Inorganic clays of high plasticity, fat clays		CH				
	ORGANIC SILTS & CLAYS (Below 'A' line)	$W_L<50$	Organic silts and organic silty clays of low plasticity		OL				
		$W_L>50$	Organic clays of high plasticity		OH				
HIGHLY ORGAINIC SOILS			Peat and other highly organic soils		Pt	Von Post Classification Limit		Strong colour or odour, and often fibrous texture	

	Asphalt		Till		AECOM
	Concrete		Bedrock (Undifferentiated)		
	Fill		Bedrock (Limestone)		

When the above classification terms are used in this report or test hole logs, the designated fractions may be visually estimated and not measured.

Not used. Refer to City of Winnipeg's Specs for Geotechnical Investigation Street Reconstruction Oct 28, 08



FRACTION		SEIVE SIZE (mm)		DEFINING RANGES OF PERCENTAGE BY WEIGHT OF MINOR COMPONENTS	
		Passing	Retained	Percent	Identifier
Gravel	Coarse	76	19	35-50	and
	Fine	19	4.75		
Sand	Coarse	4.75	2.00	20-35	"y" or "ey" *
	Medium	2.00	0.425		
	Fine	0.425	0.075	10-20	some
Silt (non-plastic) or Clay (plastic)		< 0.075 mm		1-10	trace

* for example: gravelly, sandy clayey, silty

Definition of Oversize Material

COBBLES: 76mm to 300mm diameter
BOULDERS: >300mm diameter

LEGEND OF SYMBOLS

Laboratory and field tests are identified as follows:

- q_u - undrained shear strength (kPa) derived from unconfined compression testing.
- T_v - undrained shear strength (kPa) measured using a torvane
- pp - undrained shear strength (kPa) measured using a pocket penetrometer.
- L_v - undrained shear strength (kPa) measured using a lab vane.
- F_v - undrained shear strength (kPa) measured using a field vane.
- γ - bulk unit weight (kN/m^3).
- SPT - Standard Penetration Test. Recorded as number of blows (N) from a 63.5 kg hammer dropped 0.76 m (free fall) which is required to drive a 51 mm O.D. Raymond type sampler 0.30 m into the soil.
- DPPT - Drive Point Pentrometer Test. Recorded as number of blows from a 63.5 kg hammer dropped 0.76 m (free fall) which is required to drive a 50 mm drive point 0.30 m into the soil.
- w - moisture content (W_L, W_P)

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

Su (kPa)	CONSISTENCY
<12	very soft
12 – 25	soft
25 – 50	medium or firm
50 – 100	stiff
100 – 200	very stiff
200	hard

The resistance (N) of a non-cohesive soil can be related to compactness condition as follows

N – BLOWS/0.30 m	COMPACTNESS
0 - 4	very loose
4 - 10	loose
10 - 30	compact
30 - 50	dense
50	very dense

PROJECT: 2010 Residential Streets Package #2	CLIENT: City of Winnipeg	TESTHOLE NO: **TH1**
LOCATION: Donnington Road, Southbound Lane, Between House #19 and 23, 2.0 m E of Curb		PROJECT NO.: 60144310.1001
CONTRACTOR: Paddock Drilling Ltd.	METHOD: 125 mm SSA with 150 mm Coring	ELEVATION (m):

SAMPLE TYPE ■ GRAB ▥ SHELBY TUBE ☒ SPLIT SPOON ▤ BULK ⁄ NO RECOVERY ▮ CORE

DEPTH (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #
0		CONCRETE (thickness = 155 mm)		
		GRANULAR FILL - brown, frozen, wet when thawed, well graded sand and gravel (< 20 mm)		G129
		CLAY - possible fill - trace gravel - brown - frozen, moist when thawed - high plasticity		
		CLAY - dark grey - frozen to 0.7 m, moist when thawed - high plasticity		G130
				G131
1		- below 1.0 m, trace sand, trace silt, brown, moist and firm, trace sulphates		G132
		- below 1.4 m, trace silt, trace gravel, stiff		G133
				G134
2				G135
				G136
3		End of test hole at 2.5 m in clay Notes: 1) No sloughing 2) No seepage 3) Backfilled with auger cuttings to 0.2 m below top of pavement, sand to 0.15 m below top of pavement and asphalt cold patch to top of pavement		

PENETRATION TESTS
✳ Becker ✳
◇ Dynamic Cone ◇
◆ SPT (Standard Pen Test) ◆
(Blows/300mm)
0 20 40 60 80 100
■ Total Unit Wt ■
(kN/m³)
16 17 18 19 20 21
Plastic MC Liquid
20 40 60 80 100

UNDRAINED SHEAR STRENGTH
+ Torvane +
× QU ×
□ Lab Vane □
△ Pocket Pen. △
● Field Vane ●
(kPa)
50 100 150 200

COMMENTS	DEPTH
Gradation: Sand = 2.5%, Silt = 9.8% and Clay = 87.7%	1
	2

LOG OF TEST HOLE TEST HOLE LOGS DONNINGTON.GPJ UMA WINN.GDT 2/8/10

AECOM

LOGGED BY: Stephen Petsche	COMPLETION DEPTH: 2.50 m
REVIEWED BY: Gil Robinson	COMPLETION DATE: 1/18/10
PROJECT ENGINEER: Gil Robinson	Page 1 of 1

PROJECT: 2010 Residential Streets Package #2	CLIENT: City of Winnipeg	TESTHOLE NO: **TH2**
LOCATION: Donnington Road, Northbound Lane, Between House #10 and 14, 2.0 m W of Curb		PROJECT NO.: 60144310.1001
CONTRACTOR: Paddock Drilling Ltd.	METHOD: 125 mm SSA with 150 mm Coring	ELEVATION (m):

SAMPLE TYPE ■ GRAB ▥ SHELBY TUBE ☒ SPLIT SPOON ▤ BULK ⊘ NO RECOVERY ◧ CORE

PENETRATION TESTS: ✳ Becker ✳ ◇ Dynamic Cone ◇ ◆ SPT (Standard Pen Test) ◆ (Blows/300mm) 0 20 40 60 80 100 ■ Total Unit Wt ■ (kN/m³) 16 17 18 19 20 21 Plastic MC Liquid 20 40 60 80 100

UNDRAINED SHEAR STRENGTH: + Torvane + × QU × □ Lab Vane □ △ Pocket Pen. △ ⊕ Field Vane ⊕ (kPa) 50 100 150 200

DEPTH (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	COMMENTS	DEPTH
0		CONCRETE (thickness = 150 mm)				
		GRANULAR FILL - brown, frozen, wet when thawed, well graded sand and gravel (< 20 mm)				
		CLAY - trace gravel - brown - frozen, moist when thawed - intermediate plasticity	■	G121		
		CLAY - dark grey - frozen to 0.7 m, moist when thawed - high plasticity	■	G122		
			■	G123		
1		- below 1.0 m, trace silt, trace sand, dark brown, moist and firm	■	G124		1
		- from 1.4 to 1.9 m, trace silt, trace sulphates	■	G125		
			■	G126		
2			■	G127		2
			■	G128		
		End of test hole at 2.5 m in clay Notes: 1) No sloughing 2) No seepage 3) Backfilled with auger cuttings to 0.2 m below top of pavement, sand to 0.15 m below top of pavement and asphalt cold patch to top of pavement				
3						

AECOM

LOGGED BY: Stephen Petsche	COMPLETION DEPTH: 2.50 m
REVIEWED BY: Gil Robinson	COMPLETION DATE: 1/18/10
PROJECT ENGINEER: Gil Robinson	Page 1 of 1

LOG OF TEST HOLE TEST HOLE LOGS DONNINGTON.GPJ UMA WINN.GDT 2/8/10

PROJECT: 2010 Residential Streets Package #2	CLIENT: City of Winnipeg	TESTHOLE NO: **TH3**
LOCATION: Donnington Road, Southbound Lane, Between House #3 and 7, 2.0 m E of Curb		PROJECT NO.: 60144310.1001
CONTRACTOR: Paddock Drilling Ltd.	METHOD: 125 mm SSA with 150 mm Coring	ELEVATION (m):

SAMPLE TYPE ■ GRAB ▥ SHELBY TUBE ⊠ SPLIT SPOON ▤ BULK ⊘ NO RECOVERY ◧ CORE

DEPTH (m)	SOIL SYMBOL	SOIL DESCRIPTION	SAMPLE TYPE	SAMPLE #	PENETRATION TESTS / UNDRAINED SHEAR STRENGTH	COMMENTS	DEPTH
0		CONCRETE (thickness = 165 mm)					
		GRANULAR FILL - some clay, brown, frozen, wet when thawed, well graded sand and gravel (< 20 mm)		G113			
		CLAY - dark grey - frozen to 0.7 m, moist when thawed - high plasticity		G114			
				G115			
1		- below 1.1 m, trace sand, trace gravel		G116			1
		- below 1.3 m, trace sand, trace silt, brown, moist and stiff, becoming firm at 2.5 m depth		G117		Gradation: Silt = 11.9 % and Clay = 88.1%	
		- sand lense 4 mm thick at 1.7 m depth		G118			
2				G119			2
				G120			
				G121			
3		End of test hole at 2.8 m in clay Notes: 1) No sloughing 2) No seepage 3) Backfilled with auger cuttings to 0.2 m below top of pavement, sand to 0.15 m below top of pavement and asphalt cold patch to top of pavement					3
3.5							

PENETRATION TESTS: ✳ Becker ✳ ◇ Dynamic Cone ◇ ◆ SPT (Standard Pen Test) ◆ (Blows/300mm) 0 20 40 60 80 100 ■ Total Unit Wt ■ (kN/m³) 16 17 18 19 20 21 Plastic MC Liquid 20 40 60 80 100

UNDRAINED SHEAR STRENGTH: + Torvane + × QU × □ Lab Vane □ △ Pocket Pen. △ ⊕ Field Vane ⊕ (kPa) 50 100 150 200

AECOM	LOGGED BY: Stephen Petsche	COMPLETION DEPTH: 2.80 m
	REVIEWED BY: Gil Robinson	COMPLETION DATE: 1/18/10
	PROJECT ENGINEER: Gil Robinson	Page 1 of 1

LOG OF TEST HOLE TEST HOLE LOGS DONNINGTON.GPJ UMA WINN.GDT 2/9/10

Photograph 1. Donnington Road – TH1

Photograph 2. Donnington Road – TH2

Photograph 3. Donnington Road – TH3

City of Winnipeg
2010 Residential Streets Package #2
Geotechnical Investigation

Test Hole No.	Testhole Location	House No.	Pavement Surface		Pavement Structure Material		Subgrade Description	Sample Depth (m)	Moisture Content (%)	Hydrometer Analysis				Atterberg Limits		
			Type	Thickness (mm)	Type	Thickness (mm)				Gravel (%)	Sand (%)	Silt (%)	Clay (%)	Plastic Limit	Liquid Limit	Plasticity Limit
TH1	Donnington Road, Southbound Lane	Between 19 and 23	Concrete	155	Granular Fill (< 20 mm)	50	Clay	0.2	38.5							
							Clay	0.5	35.9							
							Clay	0.8	37.2							
							Clay	1.1	38.8	0.0	2.5	9.8	87.7	25.6	92.5	66.9
							Clay	1.4	41.3							
							Clay	1.7	44.7							
							Clay	2.0	53.0							
							Clay	2.3	54.0							
TH2	Donnington Road, Northbound Lane	Between 10 and 14	Concrete	150	Granular Fill (< 20 mm)	75	Clay	0.3	34.0							
							Clay	0.6	33.3							
							Clay	0.8	36.0							
							Clay	1.1	35.9							
							Clay	1.4	41.7							
							Clay	1.7	45.2							
							Clay	2.0	50.7							
							Clay	2.3	54.3							
TH3	Donnington Road, Southbound Lane	Between 3 and 7	Concrete	165	Granular Fill (< 20 mm)	150	Granular Fill	0.2	12.8							
							Clay	0.5	37.1							
							Clay	0.8	36.2							
							Clay	1.1	37.8							
							Clay	1.4	36.4	0.0	0.0	11.9	88.1	25.3	86.3	61.1
							Clay	1.7	37.8							
							Clay	2.0	41.3							
							Clay	2.3	42.2							
							Clay	2.6	50.0							