SOIL-MAT ENGINEERS & CONSULTANTS LTD.

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PROJECT NO.: SM 156048-G June 22, 2015

Niagara College of Applied Arts and Technology
Niagara-on-the-Lake Campus
135 Taylor Road
Niagara-on-the-Lake, Ontario
L0S 1J0

Attention: Ralph Scholz, Director FMS

GEOTECHNICAL INVESTIGATION
PROPOSED PARKING LOT RECONSTRUCTION PROJECT
NIAGARA COLLEGE NIAGARA-ON-THE-LAKE CAMPUS
NIAGARA-ON-THE-LAKE, ONTARIO

Dear Mr. Scholz

We have completed the fieldwork, laboratory testing and report preparation in connection with the above noted project. The investigation and reporting was undertaken in general accordance with our proposal P5665 dated March 3, 2015. Our comments and recommendations, based on our findings at the fifteen borehole locations are presented in the following paragraphs.

1. INTRODUCTION

We understand that the project will consist of the reconstruction/rehabilitation of the parking lot east of the main building, including its entrance driveways and associated roadways. The purpose of this geotechnical investigation work was to determine subsurface soils information at fifteen [15] borehole locations, and to provide comments and recommendations with respect to the design and construction of the proposed parking lot rehabilitation and related earthworks, from a geotechnical point of view.

This report is based on the above summarised project description and on the assumption that the design and construction will be performed in accordance with applicable codes and standards. Any significant deviations from the proposed may void the recommendations give in this report. If significant changes are made to the proposed design, this office must be consulted to review the new design with respect to the results of this investigation. The information contained in this report does not reflect upon the environmental aspects of the site, which therefore have not been addressed in this document.

2. PROCEDURE

A total of fifteen [15] sampled boreholes were advanced at the locations illustrated in the attached Drawing No. 1, Borehole Location Plan. The borings were put down uncased using solid stem continuous flight auger equipment on March 31 and April 1, 2015 under the direction and supervision of a staff member of SOIL-MAT ENGINEERS & CONSULTANTS LTD. All of the boreholes were advanced using a truck-mounted drill to depths of between approximately 1.7 to 2.0 metres below existing ground surface. Upon completion of drilling all of the boreholes were backfilled in general accordance with Ontario Regulation 903 and the surface reinstated with a pre-mixed 'cold-patch' asphalt product.

Representative samples of the subsoils were recovered from the borings at selected depth intervals using split barrel sampling equipment driven in accordance with the requirements of the ASTM test specification D1586, Standard Penetration Resistance Testing. After undergoing a general field examination, the soil samples were preserved and transported to the SOIL-MAT laboratory for visual, tactile, and olfactory classifications. Routine moisture content tests were performed on all soil samples recovered from the borings.

The boreholes were located in the field by a representative of SOIL-MAT ENGINEERS. The ground surface elevation at each of the borehole locations were surveyed by the project surveyors, Chambers and associates Surveying Ltd., and was provided to this office.

Details of the conditions encountered in the boreholes, together with the results of the field and laboratory tests, are presented in Borehole Log Nos. 6 to 20, inclusive, following the text of this report. We note that Borehole Nos. 1 to 5 were advanced within the area of the proposed athletic building addition and are not presented in this report. It is noted that the boundaries of soil types indicated on the borehole logs are inferred from non-continuous soil sampling and observations made during drilling. These boundaries are intended to reflect transition zones for the purpose of geotechnical design and therefore should not be construed as the exact planes of geological change.

3. SITE DESCRIPTION AND SUBSURFACE CONDITIONS

The scope of this investigation includes the driveways, roadways, and parking lot area associated with the parking lot at the Niagara College campus in Niagara-on-the-Lake, Ontario. The parking lot area is to the east of the main building and is relatively flat and even, with an overall gentle downwards slope to the east and north. The existing asphaltic concrete pavement was generally found to be in a poor to fair condition. There was noted to be occasional patches from previous repair work, and both age and subgrade related distress including alligator cracking, transverse and longitudinal cracking, etc.

The subsurface conditions encountered at the borehole locations are summarised as follows:

Existing Pavement Structure

The existing pavement structure at the borehole locations was found to consist of approximately 40 to 75 millimetres [average of 60 millimetres] of asphaltic concrete over approximately 200 to 350 millimetres [average of 270 millimetres] of granular base material. The details of the pavement structure encountered at each borehole location are outlined in Table A below.

TABLE A
EXISTING PAVEMENT STRUCTURE

Borehole	6	7	8	9	10	11	12	13
Asphaltic Concrete	65	75	50	40	50	50	75	65
Granular Base	300	200	250	250	250	250	250	300

Borehole	14	15	16	17	18	19	20
Asphaltic Concrete	65	50	65	65	50	65	50
Granular Base	225	350	300	200	350	250	300

Silty Clay Fill

A layer of silty clay fill was encountered beneath the pavement structure in Borehole No. 14. This fill material is brown, with trace gravel and organics, and is generally stiff in consistency. The silty clay fill was encountered to an approximate depth of 1.0 metre below the existing grade.

Silty Clay

Native silty clay was found beneath the fill in Borehole No. 14, and beneath the pavement structure in all other borehole locations. This cohesive soil is brown, with trace fine gravel, sand, and shale fragments, and is generally stiff to hard in consistency. The upper levels of the native soil exhibit a 'reworked' appearance in some areas, likely the result of grading activities during initial construction. The native silty clay was proven to termination in all boreholes.

4. DISCUSSIONS AND PAVEMENT STRUCTURE DESIGN CONSIDERATIONS

As noted above the existing pavement structure is considered to be in poor to fair condition. The condition of the asphaltic concrete pavement surface is consistent with failure/distress of both the constructed pavement structure [age related distress] and support failure of the subgrade soils [subgrade related distress]. The fifteen boreholes encountered a somewhat consistent pavement structure, as seen in Table A above. This average pavement structure is somewhat typical of a light duty pavement structure, though with slightly less granular base thickness.

Given the condition of the pavement structure and the subgrade soils, either a partial depth reconstruction scheme and/or a full depth reconstruction operation of the existing pavement structure may be considered.

PARTIAL DEPTH RECONSTRUCTION

The partial depth reconstruction scheme, which may be considered to accommodate budget constraints, would consist of the removal of the existing asphaltic concrete materials, followed with the placement and compaction of additional granular base material [to the final design levels], followed with the placement of new binder and surface course asphaltic concrete. Ideally the existing grades would allow for the finished grade of the parking lot areas to be raised as much as possible to accommodate

additional granular materials and asphalt layers consistent with the pavement structures recommended below. For example, considering an average existing pavement structure of approximately 60 millimetres of asphalt over approximately 270 millimetres of granular base material, a raise in the finished grade of approximately 85 millimetres would allow for a light duty pavement structure as outlined below [270 mm of existing plus 80 mm of new granular and 65mm of asphalt]. Alternatively, where the grade cannot be raised sufficiently and/or the existing granular base thickness is more limited, it would be prudent to provide an increased asphalt structure of 50 millimetres of HL8 binder course and 40 millimetres of HL3 surface course.

The exposed existing granular base material in areas of partial depth reconstruction should be proof-rolled with a loaded dump truck, as described below. Any areas of distress identified by this or other means should have remedial measures taken, such as sub-excavation and replacement with quality OPSS Granular B, Type II, material.

The provision of additional granular material would serve to provide a longer lifespan of the new pavement versus simply replacing the asphalt layers on the existing granular base (i.e. 'peel and pave'). However it is cautioned that a partial depth reconstruction will not address areas exhibiting subgrade failure and may have a lesser lifespan and increased maintenance requirements.

FULL DEPTH RECONSTRUCTION

Full depth pavement reconstruction would incorporate either the removal of the existing asphalt concrete material from the project site or alternatively pulverisation of the existing asphaltic concrete. The pulverised asphalt may be 'mixed' into the existing granular base material with the addition of 'new' imported granular material, to produce a well-graded granular product [meeting the required Ontario Provincial Standard Specification requirements] for use as Granular 'B' sub-base material. Select portions of the existing granular base, primarily within the areas that have not experienced subgrade failure, may be able to be reused on the project site as sub-base material, however, this is best assessed in the field at the time of construction. The existing granular base materials should be sub-excavated and stockpiled to allow for an assessment for reuse as either a part of the sub-base course or as a subgrade fill.

Depending upon the final design grades, the subgrade level may need to be lowered to accommodate the depth of the new pavement structure. The exposed subgrade must be free of any organic or otherwise unsuitable materials and proof rolled with 3 to 4 passes of a fully-loaded tandem axle truck in the presence of a representative of SOIL-

MAT ENGINEERS & CONSULTANTS LTD., immediately prior to the placement of the sub-base material. Any areas of distress revealed by this or other means should be sub-excavated and replaced with suitable backfill material. Alternatively, the soft areas may be repaired by punching a coarse aggregate, such as 50 millimetre clear stone, into the soft areas. The need for sub-excavations of softened subgrade materials will be reduced if construction is undertaken during dry periods of the year and careful attention is paid to the compaction operations. It is noted that the subgrade soils are sensitive to disturbance and moisture and may present difficulty for subgrade preparation during 'wet' periods of the year. Should pavement construction be undertaken during 'wet' periods of the year it should be anticipated that additional subgrade stabilisation measures and/or greater depth of Granular B sub-base course material may be required.

GENERAL ASPHALT PAVEMENT CONSIDERATIONS

The final pavement rehabilitation scheme could consist of a combination of the two schemes, such as partial depth within the parking lot areas and full depth within the driveways/emergency access routes requiring a heavy duty pavement structure or in areas the grade cannot be raised or where significant subgrade distress is noted. The delineation of the full depth and partial depth reconstruction areas could be undertaken at the time of construction, with unit rates provided in the tender document to accommodate the actual quantities employed by the contractor.

The suggested pavement structures outlined in Table B are based on the subgrade parameters estimated on the basis of visual and tactile examinations of the on-site soils and past experience. The outlined pavement structures may be expected to have an approximate fifteen-year life, assuming that regular maintenance is performed, or greater depending on the tolerance of the owner to damage and distress of the pavement. Where garbage trucks, delivery trucks, etc. are routinely required the recommended heavy duty pavement structure should be provided. Where only light vehicle traffic is to be supported then the recommended light duty pavement structure would be appropriate. Should a move detailed pavement structure design be required, site specific traffic information would be needed, together with detailed laboratory testing of the subgrade soils.

TABLE B
RECOMMENDED PAVEMENT STRUCTURES

LAYER DESCRIPTION	COMPACTION REQUIREMENTS	LIGHT DUTY SECTIONS	HEAVY DUTY [TRUCK ROUTE]
Asphaltic Concrete Wearing course OPSS HL 3	97 percent Marshall	65 millimetres	40 millimetres
Binder Course OPSS HL 8	97 percent Marshall		80 millimetres
Base Course OPSS Granular A	100% SPMDD	150 millimetres	150 millimetres
Sub-base Course OPSS Granular B Type II	100% SPMDD	200 millimetres	350 millimetres

* SPMDD denotes Standard Proctor Maximum Dry Density, ASTM-D698.

Depending on the arrangement of light duty and heavy duty pavement sections, the transition between sections may present some difficulty for contractors. In this regard, consideration might be given to a slightly increased light duty pavement structure consisting of 50 millimetres of HL8 binder course and 40 millimetres of HL3 surface course asphaltic concrete. This structure will provide for a continuous depth of surface course asphalt allowing for ease of construction. As well such a structure would have an improved performance over an increased design life. Such an arrangement of asphalt layers would also allow for future rehabilitation with a 'mill and pave' type operation.

Good drainage provisions will optimise the long-term performance of the pavement structure. The subgrade must be properly crowned and shaped to promote drainage to the subdrain system. Subdrains should be installed to intercept excess subsurface water and direct drainage to the existing catch basins or side ditches to prevent softening of the subgrade material. Surface water should not be allowed to pond adjacent to the outer limits of the paved areas.

The most severe loading conditions on the subgrade typically occur during the course of construction; therefore precautionary measures may have to be taken to ensure that the subgrade is not unduly disturbed by construction traffic. SOIL-MAT should be given the opportunity to review the final pavement structure design and subdrain scheme prior to construction to ensure that they are consistent with the recommendations of this report.

To minimise segregation of the finished asphalt mat, the asphalt temperature must be maintained uniform, between 120 to 150 degrees C, throughout the mat during placement and compaction. All too often, significant temperature gradients exist in the delivered and placed asphalt with the cooler portions of the mat resisting compaction and presenting a 'honeycomb' surface. As the spreader moves forward, a responsible member of the paving crew should monitor the pavement surface, to ensure a smooth uniform surface. The contractor can mitigate the surface segregation by 'back-casting' or scattering shovels of the full mix material over the segregated areas and raking out the coarse particles during compaction operations. Of course, the above assumes that the asphalt mix is sufficiently hot to allow the 'back-casting' to be performed.

A representative of SOIL-MAT should be retained to the site to perform subgrade evaluation, and compaction testing of the granular base materials to monitor uniform compaction to project specification requirements. As well, a SOIL-MAT representative should be on-site during the paving operations to monitor the placement temperatures, collect asphalt samples for laboratory Marshall testing and conduct field density measurements for comparison to the Marshall Test results. Prior to the paving operations our office should be provided with the proposed asphaltic concrete mix designs to allow for a conformance check with the recommendations of this report and the OPSS requirements.

5. GENERAL COMMENTS

The comments provided in this document are intended only for the guidance of the design team. The subsoil descriptions and borehole information are intended to describe conditions at the borehole locations only. It is the contractors' responsibility to determine how these conditions will effect the scheduling and methods of construction for the project.

We trust that this geotechnical report is sufficient for your present requirements. Should you require any additional information or clarification as to the contents of this document, please do not hesitate to contact the undersigned.

Yours very truly,
SOIL-MAT ENGINEERS & CONSULTANTS LTD.

Matt LiVecchi, B. Eng., EIT.

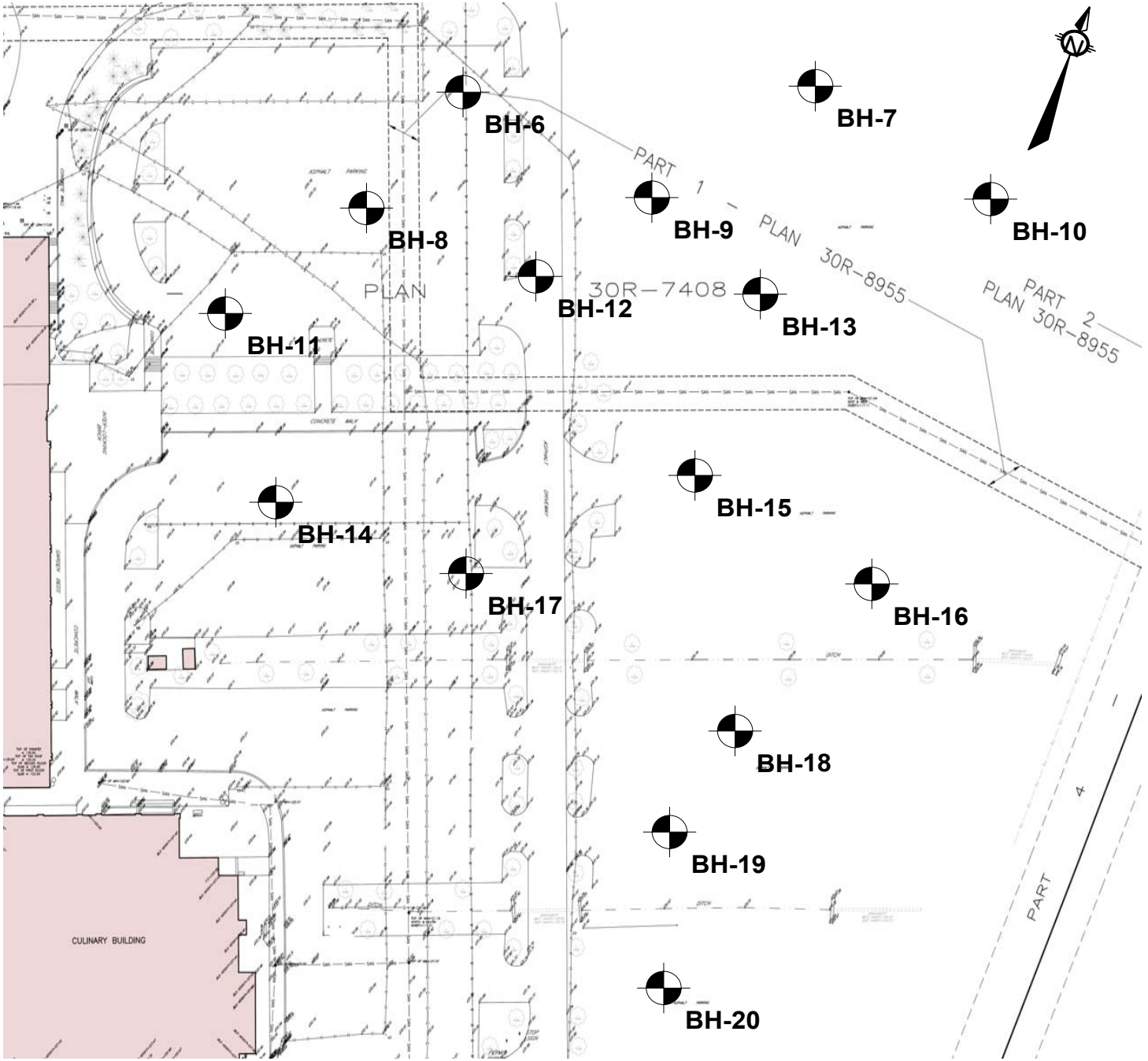
Kyle Richardson, B.Eng., EIT



Ian Shaw, P. Eng.
Project Engineer

Enclosures: Drawing No.1, Borehole Location Plan
Borehole Logs 6 to 20, inclusive

Distribution: Niagara College of Applied Arts and Technology [2, plus pdf]



LEGEND

BH-# Borehole

NOTES:

1. This drawing should be read in conjunction with Soil-Mat Engineers & Consultants Ltd. Report No.: SM 156048-G.
2. Soil samples will be discarded after 3 months unless directed otherwise by client.
3. Borehole locations are approximate.

Soil-Mat
Engineers & Consultants Ltd.

CLIENT
Niagara College

PROJECT TITLE
Geotechnical Investigation
Proposed CFWI Expansion
Niagara College Niagara-on-the-Lake Campus
Niagara-on-the-Lake, Ontario

DRAWING TITLE
Borehole Location Plan

PROJECT No.	SM 156048-G
SCALE	N.T.S.
DATE	April 2015
CHECKED	IS
DRAWN	ML

FILENAME
SM 156048-G Borehole Location Plan (CFWI).kcw

DRAWING No. 1

Project No: SM 156048-G

Project: Niagara College NOTL Campus

Location: Niagara-on-the-Lake, Ontario

Client: Niagara College

Log of Borehole No. 6

Project Manager: Ian Shaw, P. Eng.

Borehole Location: See Drawing No. 1

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SUBSURFACE PROFILE

SAMPLE

Depth (ft)	Depth (m)	Elevation [m]	Description	Well Data	Type	Number	Blow Counts	Blows/300mm	Recovery	PP (kgf/cm2)	U.Wt.(kN/m3)
		0.00	Ground Surface								
0	0		***Pavement Structure*** Approximately 65 millimetres of asphalt over 300 millimetres of compact granular base.		SS	1	15,13,20, 38	33			
		-0.36	***Silty Clay*** Brown, trace fine gravel, shale fragments, and sand, hard.		SS	2	8,11,19	30			
		-1.70			SS	3	50/6"	100			
			End of Borehole								

Moisture Content w% 10 20 30 40

Standard Penetration Test blows/300mm 20 40 60 80

NOTES:

1. Borehole was advanced using solid stem auger equipment on April 1, 2015 to termination at a depth of 1.7 metres.

2. Borehole was recorded as 'dry' upon completion of drilling and backfilled as per Ontario Regulation 903.

3. Soil samples will be discarded after 3 months unless otherwise directed by our client.

Drill Method: Solid Stem Augers

Drill Date: April 1, 2015

Hole Size: 150mm

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Sheet: 1 of 1

Project No: SM 156048-G

Project: Niagara College NOTL Campus

Location: Niagara-on-the-Lake, Ontario

Client: Niagara College

Log of Borehole No. 7

Project Manager: Ian Shaw, P. Eng.

Borehole Location: See Drawing No. 1

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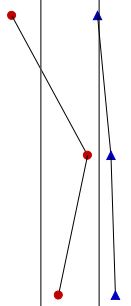
SUBSURFACE PROFILE

SAMPLE

Depth (ft)	Depth (m)	Elevation [m]	Description	Well Data	Type	Number	Blow Counts	Blows/300mm	Recovery	PP (kgf/cm2)	U.Wt.(kN/m3)
		0.00	Ground Surface								
0	0	-0.28	**Pavement Structure** Approximately 75 millimetres of asphalt over 200 millimetres of compact granular base.		SS	1	5,5,5	10			
			Silty Clay Brown, trace fine gravel and shale fragments, with some sand, stiff to hard.		SS	2	6,12,24	36			
					SS	3	7,11,15	26			
6	2	-2.00	End of Borehole								

Moisture Content w% (10, 20, 30, 40)

Standard Penetration Test blows/300mm (20, 40, 60, 80)



NOTES:

1. Borehole was advanced using solid stem auger equipment on March 31, 2015 to termination at a depth of 2.0 metres.

2. Borehole was recorded as 'dry' upon completion of drilling and backfilled as per Ontario Regulation 903.

3. Soil samples will be discarded after 3 months unless otherwise directed by our client.

Drill Method: Solid Stem Augers

Drill Date: March 31, 2015

Hole Size: 150mm

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Sheet: 1 of 1

Project No: SM 156048-G

Project: Niagara College NOTL Campus

Location: Niagara-on-the-Lake, Ontario

Client: Niagara College

Log of Borehole No. 8

Project Manager: Ian Shaw, P. Eng.

Borehole Location: See Drawing No. 1

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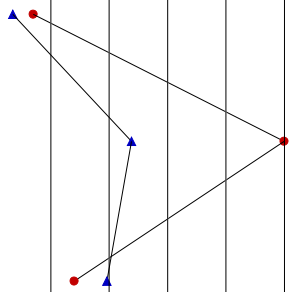
SUBSURFACE PROFILE

SAMPLE

Depth (ft)	Depth (m)	Elevation [m]	Symbol	Description	Well Data	Type	Number	Blow Counts	Blows/300mm	Recovery	PP (kgf/cm2)	U.Wt.(kN/m3)
		0.00		Ground Surface								
0	0	-0.30		**Pavement Structure** Approximately 50 millimetres of asphalt over 250 millimetres of compact granular base.		SS	1	10,8,6,8	14			
2				**Silty Clay** Brown, trace fine gravel, shale fragments, and sand, stiff to hard.		SS	2	12,25, 50/5"	100			
4												
6		-2.00				SS	3	8,12,16	28			
	2			End of Borehole								
8												
10												
12												
	4											
14				NOTES: 1. Borehole was advanced using solid stem auger equipment on April 1, 2015 to termination at a depth of 2.0 metres. 2. Borehole was recorded as 'dry' upon completion of drilling and backfilled as per Ontario Regulation 903. 3. Soil samples will be discarded after 3 months unless otherwise directed by our client.								
16												
18												
	6											

Moisture Content w% 10 20 30 40

Standard Penetration Test blows/300mm 20 40 60 80



Drill Method: Solid Stem Augers

Drill Date: April 1, 2015

Hole Size: 150mm

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Sheet: 1 of 1

Project No: SM 156048-G

Project: Niagara College NOTL Campus

Location: Niagara-on-the-Lake, Ontario

Client: Niagara College

Log of Borehole No. 9

Project Manager: Ian Shaw, P. Eng.

Borehole Location: See Drawing No. 1

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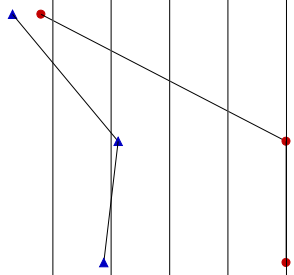
SUBSURFACE PROFILE

SAMPLE

Depth (ft)	Depth (m)	Elevation [m]	Symbol	Description	Well Data	Type	Number	Blow Counts	Blows/300mm	Recovery	PP (kgf/cm2)	U.Wt.(kN/m3)
		0.00		Ground Surface								
0	0	-0.29		***Pavement Structure*** Approximately 40 millimetres of asphalt over 250 millimetres of compact granular base.		SS	1	8,8,8,10	16			
2				***Silty Clay*** Brown, trace fine gravel, shale fragments, and sand, very stiff to hard.		SS	2	10,25, 50/5"	100			
4		-1.80				SS	3	18,50/6"	100			
6	2			End of Borehole								
8												
10												
12	4											
14												
16												
18	6											

Moisture Content w% 10 20 30 40

Standard Penetration Test blows/300mm 20 40 60 80



NOTES:

1. Borehole was advanced using solid stem auger equipment on March 31, 2015 to termination at a depth of 1.8 metres.

2. Borehole was recorded as 'dry' upon completion of drilling and backfilled as per Ontario Regulation 903.

3. Soil samples will be discarded after 3 months unless otherwise directed by our client.

Drill Method: Solid Stem Augers

Drill Date: March 31, 2015

Hole Size: 150mm

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Sheet: 1 of 1

Project No: SM 156048-G

Project: Niagara College NOTL Campus

Location: Niagara-on-the-Lake, Ontario

Client: Niagara College

Log of Borehole No. 10

Project Manager: Ian Shaw, P. Eng.

Borehole Location: See Drawing No. 1

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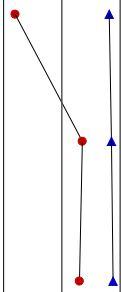
SUBSURFACE PROFILE

SAMPLE

Depth (ft)	Depth (m)	Elevation [m]	Description	Well Data	Type	Number	Blow Counts	Blows/300mm	Recovery	PP (kgf/cm2)	U.Wt.(kN/m3)
		0.00	Ground Surface								
0	0	-0.30	**Pavement Structure** Approximately 50 millimetres of asphalt over 250 millimetres of compact granular base.		SS	1	3,2,2,4	4			
2			**Silty Clay** Brown, trace fine gravel and shale fragments, with some sand, reworked in the upper level, firm to hard.		SS	2	7,11,16	27			
4											
6		-2.00			SS	3	5,11,15	26			
	2		End of Borehole								
8											
10											
12											
	4										
14			NOTES: 1. Borehole was advanced using solid stem auger equipment on March 31, 2015 to termination at a depth of 2.0 metres. 2. Borehole was recorded as 'dry' upon completion of drilling and backfilled as per Ontario Regulation 903. 3. Soil samples will be discarded after 3 months unless otherwise directed by our client.								
16											
18											
	6										

Moisture Content w% 10 20 30 40

Standard Penetration Test blows/300mm 20 40 60 80



Drill Method: Solid Stem Augers

Drill Date: March 31, 2015

Hole Size: 150mm

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Sheet: 1 of 1

Project No: SM 156048-G

Project: Niagara College NOTL Campus

Location: Niagara-on-the-Lake, Ontario

Client: Niagara College

Log of Borehole No. 11

Project Manager: Ian Shaw, P. Eng.

Borehole Location: See Drawing No. 1

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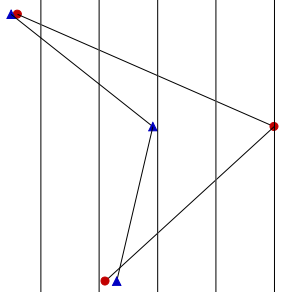
SUBSURFACE PROFILE

SAMPLE

Depth (ft)	Depth (m)	Elevation [m]	Symbol	Description	Well Data	Type	Number	Blow Counts	Blows/300mm	Recovery	PP (kgf/cm2)	U.Wt.(kN/m3)
		0.00		Ground Surface								
0	0			***Pavement Structure*** Approximately 50 millimetres of asphalt over 250 millimetres of compact granular base.								
		-0.30		***Silty Clay*** Brown, trace fine gravel, shale fragments, and sand, stiff to hard.		SS	1	6,6,6,7	12			
2						SS	2	15,50/6"	100			
4						SS	3	9,19,23	42			
6	2	-2.00		End of Borehole								
8												
10												
12	4											
14				NOTES: 1. Borehole was advanced using solid stem auger equipment on April 1, 2015 to termination at a depth of 2.0 metres. 2. Borehole was recorded as 'dry' upon completion of drilling and backfilled as per Ontario Regulation 903. 3. Soil samples will be discarded after 3 months unless otherwise directed by our client.								
16												
18	6											

Moisture Content w% 10 20 30 40

Standard Penetration Test blows/300mm 20 40 60 80



Drill Method: Solid Stem Augers

Drill Date: April 1, 2015

Hole Size: 150mm

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Project No: SM 156048-G

Project: Niagara College NOTL Campus

Location: Niagara-on-the-Lake, Ontario

Client: Niagara College

Log of Borehole No. 12

Project Manager: Ian Shaw, P. Eng.

Borehole Location: See Drawing No. 1

: ::

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SUBSURFACE PROFILE

SAMPLE

Depth (ft)	Depth (m)	Elevation [m]	Symbol	Description	Well Data	Type	Number	Blow Counts	Blows/300mm	Recovery	PP (kgf/cm2)	U.Wt.(kN/m3)
		0.00		Ground Surface								
0	0			**Pavement Structure** Approximately 75 millimetres of asphalt over 250 millimetres of compact granular base.		SS	1	50/3"	100			
		-0.33		**Silty Clay** Brown, trace fine gravel, shale fragments, and sand, organic staining in the upper level, hard.		SS	2	12,50, 50/5"	100			
		-1.80		End of Borehole		SS	3	30,50/5"	100			

Moisture Content w% (10, 20, 30, 40)

Standard Penetration Test blows/300mm (20, 40, 60, 80)

NOTES:

1. Borehole was advanced using solid stem auger equipment on April 1, 2015 to termination at a depth of 1.8 metres.

2. Borehole was recorded as 'dry' upon completion of drilling and backfilled as per Ontario Regulation 903.

3. Soil samples will be discarded after 3 months unless otherwise directed by our client.

Drill Method: Solid Stem Augers

Drill Date: April 1, 2015

Hole Size: 150mm

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Sheet: 1 of 1

Project No: SM 156048-G

Project: Niagara College NOTL Campus

Location: Niagara-on-the-Lake, Ontario

Client: Niagara College

Log of Borehole No. 13

Project Manager: Ian Shaw, P. Eng.

Borehole Location: See Drawing No. 1

: ::

Soil-Mat

SUBSURFACE PROFILE

SAMPLE

Depth (ft / m)	Elevation [m]	Description	Type	Number	Blow Counts	Blows/300mm	Recovery	PP (kgf/cm2)	U.Wt.(kN/m3)
0 / 0	0.00	Ground Surface							
	-0.36	***Pavement Structure*** Approximately 65 millimetres of asphalt over 300 millimetres of compact granular base.	SS	1	8,7,5,5	10			
		Silty Clay Brown, trace fine gravel and shale fragments, stiff to hard.	SS	2	6,12,16	36			
			SS	3	10,17,22	26			
	-2.00	End of Borehole							

Moisture Content w% 10 20 30 40

Standard Penetration Test blows/300mm 20 40 60 80

NOTES:

1. Borehole was advanced using solid stem auger equipment on March 31, 2015 to termination at a depth of 2.0 metres.

2. Borehole was recorded as 'dry' upon completion of drilling and backfilled as per Ontario Regulation 903.

3. Soil samples will be discarded after 3 months unless otherwise directed by our client.

Drill Method: Solid Stem Augers

Drill Date: March 31, 2015

Hole Size: 150mm

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Sheet: 1 of 1

Project No: SM 156048-G

Project: Niagara College NOTL Campus

Location: Niagara-on-the-Lake, Ontario

Client: Niagara College

Log of Borehole No. 14

Project Manager: Ian Shaw, P. Eng.

Borehole Location: See Drawing No. 1

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Soil-Mat

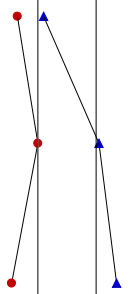
SUBSURFACE PROFILE

SAMPLE

Depth (ft)	Depth (m)	Elevation [m]	Description	Well Data	Type	Number	Blow Counts	Blows/300mm	Recovery	PP (kgf/cm2)	U.Wt.(kN/m3)
		0.00	Ground Surface								
0	0	-0.29	**Pavement Structure** Approximately 65 millimetres of asphalt over 225 millimetres of compact granular base.		SS	1	7,7,6,6	13			
2		-1.00	**Silty Clay Fill** Brown, with trace gravel and organics, stiff.		SS	2	2,6,14	20			
4			**Silty Clay** Brown, trace fine gravel and shale fragments, stiff to very stiff.		SS	3	2,5,6	11			
6	2	-2.00	End of Borehole								
8											
10											
12	4										
14			NOTES: 1. Borehole was advanced using solid stem auger equipment on April 1, 2015 to termination at a depth of 2.0 metres. 2. Borehole was recorded as 'dry' upon completion of drilling and backfilled as per Ontario Regulation 903. 3. Soil samples will be discarded after 3 months unless otherwise directed by our client.								
16											
18	6										

Moisture Content w% 10 20 30 40

Standard Penetration Test blows/300mm 20 40 60 80



Drill Method: Solid Stem Augers

Drill Date: April 1, 2015

Hole Size: 150mm

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Sheet: 1 of 1

Project No: SM 156048-G

Project: Niagara College NOTL Campus

Location: Niagara-on-the-Lake, Ontario

Client: Niagara College

Log of Borehole No. 15

Project Manager: Ian Shaw, P. Eng.

Borehole Location: See Drawing No. 1

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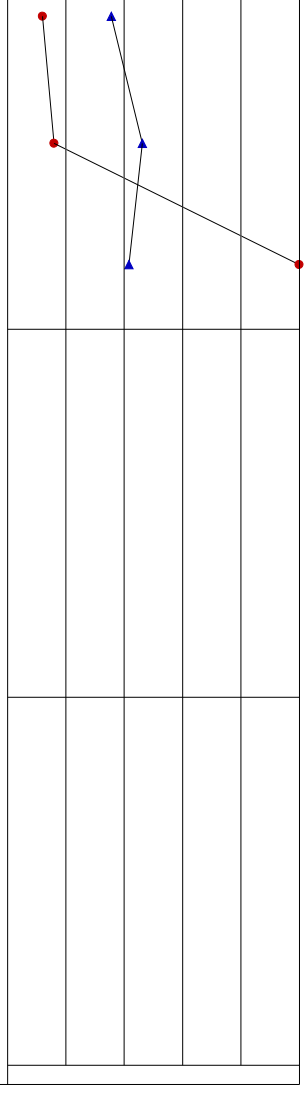
SUBSURFACE PROFILE

SAMPLE

Depth (ft)	Depth (m)	Elevation [m]	Symbol	Description	Well Data	Type	Number	Blow Counts	Blows/300mm	Recovery	PP (kgf/cm2)	U.Wt.(kN/m3)
		0.00		Ground Surface								
0	0			**Pavement Structure** Approximately 50 millimetres of asphalt over 350 millimetres of compact granular base.								
		-0.40		**Silty Clay** Brown, trace fine gravel, shale fragments, and sand, stiff to hard.		SS	1	5,6,6,8	12			
2												
						SS	2	4,6,10	16			
4												
						SS	3	20,50/6"	100			
6	2	-1.80		End of Borehole								
8												
10												
12	4											
14				NOTES: 1. Borehole was advanced using solid stem auger equipment on March 31, 2015 to termination at a depth of 1.8 metres. 2. Borehole was recorded as 'dry' upon completion of drilling and backfilled as per Ontario Regulation 903. 3. Soil samples will be discarded after 3 months unless otherwise directed by our client.								
16												
18	6											

Moisture Content w% 10 20 30 40

Standard Penetration Test blows/300mm 20 40 60 80



Drill Method: Solid Stem Augers

Drill Date: March 31, 2015

Hole Size: 150mm

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Sheet: 1 of 1

Project No: SM 156048-G

Project: Niagara College NOTL Campus

Location: Niagara-on-the-Lake, Ontario

Client: Niagara College

Log of Borehole No. 16

Project Manager: Ian Shaw, P. Eng.

Borehole Location: See Drawing No. 1

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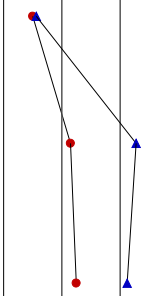
SUBSURFACE PROFILE

SAMPLE

Depth (ft / m)	Elevation [m]	Symbol	Description	Well Data	Type	Number	Blow Counts	Blows/300mm	Recovery	PP (kgf/cm2)	U.Wt.(kN/m3)
	0.00		Ground Surface								
0	-0.36		***Pavement Structure*** Approximately 65 millimetres of asphalt over 300 millimetres of compact granular base.		SS	1	4,5,5,5	10			
2			***Silty Clay*** Brown, trace fine gravel and shale fragments, stiff to very stiff.		SS	2	5,10,13	23			
4											
6	-2.00				SS	3	6,10,15	25			
2			End of Borehole								
8											
10											
12											
4											
14			NOTES:								
16			1. Borehole was advanced using solid stem auger equipment on March 31, 2015 to termination at a depth of 2.0 metres.								
18			2. Borehole was recorded as 'dry' upon completion of drilling and backfilled as per Ontario Regulation 903.								
6			3. Soil samples will be discarded after 3 months unless otherwise directed by our client.								

Moisture Content w%: 10 20 30 40

Standard Penetration Test blows/300mm: 20 40 60 80



Drill Method: Solid Stem Augers

Drill Date: March 31, 2015

Hole Size: 150mm

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Sheet: 1 of 1

Project No: SM 156048-G

Project: Niagara College NOTL Campus

Location: Niagara-on-the-Lake, Ontario

Client: Niagara College

Log of Borehole No. 17

Project Manager: Ian Shaw, P. Eng.

Borehole Location: See Drawing No. 1

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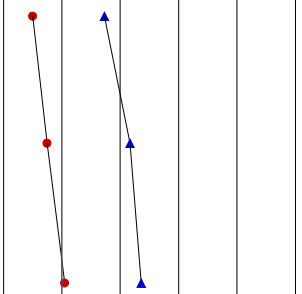
SUBSURFACE PROFILE

SAMPLE

Depth (ft)	Depth (m)	Elevation [m]	Symbol	Description	Well Data	Type	Number	Blow Counts	Blows/300mm	Recovery	PP (kgf/cm2)	U.Wt.(kN/m3)
		0.00		Ground Surface								
0	0	-0.27		***Pavement Structure*** Approximately 65 millimetres of asphalt over 200 millimetres of compact granular base.		SS	1	3,5,5,8	10			
2				***Silty Clay*** Brown, trace fine gravel, shale fragments, and sand, reworked in the upper level, stiff to very stiff.		SS	2	3,6,9	15			
6	2	-2.00				SS	3	5,10,11	21			
				End of Borehole								
8												
10												
12	4											
14				NOTES: 1. Borehole was advanced using solid stem auger equipment on April 1, 2015 to termination at a depth of 2.0 metres. 2. Borehole was recorded as 'dry' upon completion of drilling and backfilled as per Ontario Regulation 903. 3. Soil samples will be discarded after 3 months unless otherwise directed by our client.								
16												
18	6											

Moisture Content w% 10 20 30 40

Standard Penetration Test blows/300mm 20 40 60 80



Drill Method: Solid Stem Augers

Drill Date: April 1, 2015

Hole Size: 150mm

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Project No: SM 156048-G

Project: Niagara College NOTL Campus

Location: Niagara-on-the-Lake, Ontario

Client: Niagara College

Log of Borehole No. 19

Project Manager: Ian Shaw, P. Eng.

Borehole Location: See Drawing No. 1

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SUBSURFACE PROFILE

Depth (ft)	Depth (m)	Elevation [m]	Description
0	0	0.00	Ground Surface
		-0.40	**Pavement Structure** Approximately 50 millimetres of asphalt over 350 millimetres of compact granular base.
			Silty Clay Brown, trace fine gravel and shale fragments, stiff to hard.
		-1.75	End of Borehole

NOTES:

1. Borehole was advanced using solid stem auger equipment on March 31, 2015 to termination at a depth of 1.75 metres.

2. Borehole was recorded as 'dry' upon completion of drilling and backfilled as per Ontario Regulation 903.

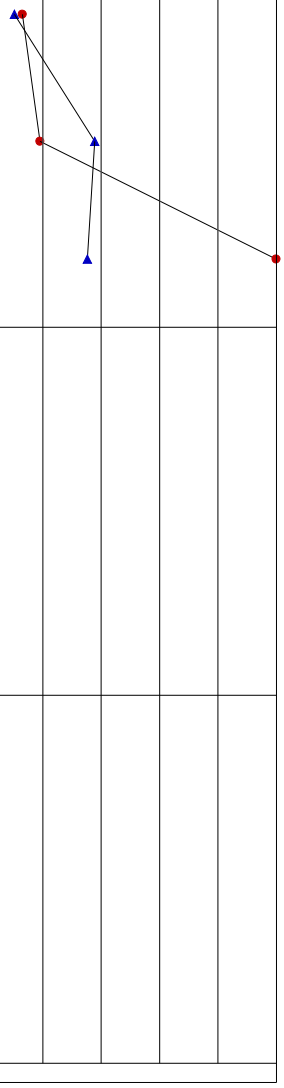
3. Soil samples will be discarded after 3 months unless otherwise directed by our client.

SAMPLE

Type	Number	Blow Counts	Blows/300mm	Recovery	PP (kgf/cm2)	U.Wt.(kN/m3)
SS	1	8,6,7,8	13			
SS	2	4,8,11	19			
SS	3	15,50/3"	100			

Moisture Content w% (10, 20, 30, 40)

Standard Penetration Test blows/300mm (20, 40, 60, 80)



Drill Method: Solid Stem Augers

Drill Date: March 31, 2015

Hole Size: 150mm

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Sheet: 1 of 1

Project No: SM 156048-G

Project: Niagara College NOTL Campus

Location: Niagara-on-the-Lake, Ontario

Client: Niagara College

Log of Borehole No. 19

Project Manager: Ian Shaw, P. Eng.

Borehole Location: See Drawing No. 1

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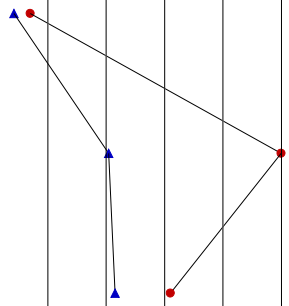
SUBSURFACE PROFILE

SAMPLE

Depth (ft)	Depth (m)	Elevation [m]	Symbol	Description	Well Data	Type	Number	Blow Counts	Blows/300mm	Recovery	PP (kgf/cm2)	U.Wt.(kN/m3)
		0.00		Ground Surface								
0	0	-0.32		**Pavement Structure** Approximately 65 millimetres of asphalt over 250 millimetres of compact granular base.		SS	1	8,7,7	14			
2				**Silty Clay** Brown, trace fine gravel and shale fragments, stiff to hard.		SS	2	8,50/6"	100			
4						SS	3	10,29,33	62			
6	2	-2.00		End of Borehole								
8												
10												
12	4											
14				NOTES: 1. Borehole was advanced using solid stem auger equipment on March 31, 2015 to termination at a depth of 2.0 metres. 2. Borehole was recorded as 'dry' upon completion of drilling and backfilled as per Ontario Regulation 903. 3. Soil samples will be discarded after 3 months unless otherwise directed by our client.								
16												
18	6											

Moisture Content
w%
10 20 30 40

Standard Penetration Test
blows/300mm
20 40 60 80



Drill Method: Solid Stem Augers

Drill Date: March 31, 2015

Hole Size: 150mm

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Sheet: 1 of 1

Project No: SM 156048-G

Project: Niagara College NOTL Campus

Location: Niagara-on-the-Lake, Ontario

Client: Niagara College

Log of Borehole No. 20

Project Manager: Ian Shaw, P. Eng.

Borehole Location: See Drawing No. 1

: ::

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SUBSURFACE PROFILE

SAMPLE

Depth (ft)	Depth (m)	Elevation [m]	Symbol	Description	Well Data	Type	Number	Blow Counts	Blows/300mm	Recovery	PP (kgf/cm2)	U.Wt.(kN/m3)
		0.00		Ground Surface								
0	0			**Pavement Structure** Approximately 50 millimetres of asphalt over 300 millimetres of compact granular base.								
		-0.35		**Silty Clay** Brown, trace fine to medium gravel and shale fragments, stiff to very stiff.		SS	1	11,7,6	13			
2												
						SS	2	7,10,14	24			
4												
						SS	3	8,13,15	28			
6	2	-2.00		End of Borehole								
8												
10												
12												
	4											
14				NOTES: 1. Borehole was advanced using solid stem auger equipment on March 31, 2015 to termination at a depth of 2.0 metres. 2. Borehole was recorded as 'dry' upon completion of drilling and backfilled as per Ontario Regulation 903. 3. Soil samples will be discarded after 3 months unless otherwise directed by our client.								
16												
18												
	6											

Moisture Content w%: 10 20 30 40

Standard Penetration Test blows/300mm: 20 40 60 80

Drill Method: Solid Stem Augers

Drill Date: March 31, 2015

Hole Size: 150mm

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