Public Works and Government Services Canada (PWGSC)

Parking Lot Expansion and Secondary Fire Route Access, Millhaven Institution, 5775 Bath Road, Loyalist, Ontario
PWGSC Project #: R.043010.001 & R.043010.002

Geotechnical Investigation Report

Date: 2011-04-28
Ref. N°:038-P037950-0100-GE-0001-00

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Geotechnical Investigation Report

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Property and Confidentiality

If tests have been done, the results of these tests are valid only for the sample described in the present report.

Testing (either in the field or in laboratory) has been completed by sub-contractors duly qualified according to the purchasing procedure of our quality manual. For more information, please contact your project engineer.

Register of revisions and emissions

Revision No	Date	Description of the modification and/or of the emission
00	2011-04-28	Final Report

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INTRODUCTION

On March 2nd, 2011, Public Works and Government Services Canada (PWGSC) awarded a contract to Dessau to carry out a geotechnical investigation for a Parking Lot Expansion and Secondary Fire Route Access of the Millhaven Institution located at 5775 Bath Road, Loyalist, in Ontario.

The purpose of the investigation was to evaluate an existing roadway pavement structure and a new parking lot structure, and provide recommendations for construction and rehabilitation.

This report contains a description of the site, the fieldwork investigation program, as well as a detailed description of the nature and properties of the existing pavement materials and the underlying subsoil. The following sections address the results obtained and propose relevant recommendations from a geotechnical point-of-view.

The specific limitations of the investigation, outlined in Appendix 1, should be read jointly with this report.

1 SITE AND PROJECT DESCRIPTION

Based on the information provided from PWGSC, geotechnical services were required to investigate on different pavement structures at the Millhaven Institution.

The Millhaven Institution has two parking lots. One parking lot is reserved to institution staff and the other to visitors. The capacity of these parking lots is 180 spaces for staff and 15 spaces for visitors. Due to the increase of the planned inmate population which will result to an increase of the institution staff, Millhaven institution requires an increase of its parking lots capacity.

Figure 1 : Site location

2 INVESTIGATION PROCEDURES (FIELD WORK)

2.1 LOCATION OF THE BOREHOLES

The site survey to determine the borehole locations was carried out by DESSAU staff. The borehole locations are shown on the site plan included in Appendix 4.

2.2 FIELD WORK

The fieldwork was performed on March 21st, 2011. A total of six (6) borehole samples were carried out under the full time supervision of a geotechnical technician from DESSAU. The boreholes were identified from BH-01-11 to BH-06-11.

The boreholes were carried out using a CME-55 hydraulic auger drill. All boreholes were drilled to a depth between 1.09 m to 2.13 m. Soil sampling and Standard Penetration Testing was conducted by driving a 51 mm O.D. split spoon sampler in accordance with ASTM Standard D 1586-98.

The subsoil details are presented in the individual borehole logs in Appendix 2.

2.3 LABORATORY TESTING

All recovered samples were carefully preserved and transported to the DESSAU laboratory for identification, laboratory testing and classification. All soil samples were examined by a geotechnical engineer and were classified in accordance with the requirements specified in ASTM D2488. Representative soil samples from the boreholes were submitted for grain size analysis as indicated in Table 1. The complete laboratory test results are presented in Appendix 3 and are also included on the borehole logs in Appendix 2.

All geotechnical samples recovered from boreholes which were not consumed during laboratory analysis will be stored for a period of 6 months from the date of completion of the fieldwork; after which, they will be destroyed unless written instructions on the sample storage and/or disposition are received by DESSAU.

Table 1 : Laboratory Testing

Test	Quantity
Road structure	
▸ Grain size analysis	5
Natural soil	
▸ Grain size analysis	2

3 NATURE AND PROPERTIES OF SUBSOIL

This chapter of the report is a summary of the general data generated by the fieldwork and the laboratory tests.

It is important to mention that the roadway structure thickness, described below, was observed at the location of the boreholes. The thickness of material could vary along the road depending of the heterogeneity of the different layers.

3.1 SOIL CONDITIONS

The following paragraphs present a summary of the different soil layers encountered in the borehole. The locations of the six (6) boreholes are presented on the plan n° 038-P037950-0100-GE-0001-00 in Appendix 4. The detailed borehole logs are presented in Appendix 2.

Table 2: Borehole Summary

Borehole n°	Asphalt concrete (m)	Road Granular fill (m)		Fill (sandy silt) (m)	natural deposit (silty sand) (m)	End of borehole (m)
		Base	Subbase			
BH-01-11	*	*	*	0.00-0.76	0.76-1.09	1.09
BH-02-11	*	*	*	0.00-0.76	0.76-1.91	1.91
BH-03-11	0.00-0.05	0.05-0.76	*	*	0.76-1.29	1.29
BH-04-11	0.00-0.06	0.06-0.76	0.76-1.37	*	1.37-1.73	1.73
BH-05-11	*	0.00-0.61	0.61-1.52	*	1.52-1.80	1.80
BH-06-11	*	0.00-0.76	0.76-1.52	*	1.52-2.13	2.13
* Soil layer not intercepted						

3.1.1 Asphalt concrete

Directly on the surface of the borehole BH-03-11 and BH-04-11, a layer of asphalt concrete was intercepted with a thickness of 50 mm and 60 mm.

3.1.2 Road Granular fill

A road granular fill was intercepted under the bituminous material of boreholes BH-03-11 and BH-04-11 also directly on surface of BH-05-11 and BH-06-11. The thickness of this granular fill varies from 0.70 m to 1.52 m.

3.1.2.1 *Granular A type fill*

Three (3) sieve analyses were done based on representative samples. Table 3 shows the results of the analysis.

Table 3: Sieve Analysis of the granular A type fill

	Borehole n°	Depth (m)	Grain size (%)					
			26.5 mm	19 mm	13.2 mm	4.75 mm	300 µm	75µm
Base (Granular A)	BH-03-11	0.05 – 0.66	100	100	83	45	15	**10.4***
	BH-05-11	0.00 – 0.61	100	94	84	55	**30***	**21.0***
	BH-06-11	0.00 – 0.61	100	91	84	52	17	**10.9***
OPSS Standards (%)			**100**	**85-100**	**65-90**	**35-55**	**5-22**	**2-8**

* Percentage not complying with the OPSS standards for a granular A

The existing granular A material as presented in Table 3 shows that the average percentages passing the different control sieves respect the requirement of the OPSS, except for the sieves 300 µm and 80 µm which present a percentage passing higher than the allowed limit. In spite of this variation, because of the low traffic anticipated, this granular base could be preserved.

3.1.2.2 *Granular B type fill*

Two (2) sieve analyses were done based on representative samples. Table 4 shows the results of the analysis.

Table 4: Sieve Analysis of the granular B type fill

	Borehole n°	Depth (m)	Grain size (%)				
			26.5 mm	4.75 mm	1.18 mm	300 µm	75µm
Base (Granular B)	BH-04-11	0.76 – 1.37	100	46	32	23	**17.2***
	BH-06-11	0.76 – 1.37	100	61	52	41	**29.2***
OPSS Standards (%)			**50-100**	**20-100**	**10-100**	**2.-65**	**0-8**

* Percentage not complying with the OPSS standards for a granular B

The existing granular B material as presented in Table 3 shows that the average percentages passing the different control sieves respect the requirement of the OPSS, except for the sieve 80 µm which present a percentage passing higher than the allowed limit. In spite of this variation, because of the low traffic anticipated, this granular base could be preserved.

3.1.3 Fill

A fill constituted of silt was intercepted on surface at the location of boreholes BH-01-11 and BH-02-11. The thickness of this fill is approximately 0.76 m. One (1) sieve analysis was done based on a representative sample. Table 5 shows the results of the analysis.

Table 5 : Sieve Analysis of the fill

Borehole n°	Depth (m)	Gravel > 4.75 mm (%)	Sand < 4.75 mm et > 75 µm (%)	Silt and Clay < 75 µm (%)
BH-01-11	0.00 – 0.61	21	32	47

3.1.4 Silty sand deposit

A silty sand deposit was intercepted in all the boreholes immediately beneath the road granular fill and the fill. This deposit was intercepted on a thickness varying between 0.28 m and 1.15 m.

One (1) sieve analysis was done based on a representative sample. Table 6 shows the results of the analysis.

Table 6 : Sieve Analysis of natural deposit

Borehole n°	Depth (m)	Gravel > 4.75 mm (%)	Sand < 4.75 mm et > 75 µm (%)	Silt and Clay < 75 µm (%)
BH-02-11	0.76	7	14	79

4 DISCUSSION AND RECOMMENDATIONS

The comments and recommendations presented below are based on the fieldwork and laboratory tests as well as the information provided by the client.

4.1 PAVEMENT DESIGN CRITERIA

At the moment of the redaction of this report, there was no traffic data available and, for that reason, a 15 year pavement design life and 500 Annual Average Daily Traffic (AADT) were assumed for the pavement design. The pavement design was based on the American Association of State Highway and Transportation Officials (A.A.S.H.T.O.) (1993 edition) design method.

4.2 REHABILITATION FOR THE EXISTING ACCESS ROAD

Based on the assumed traffic and the acceptable quality of granular material of the existing pavement, the rehabilitation solution of this section will be a complete removal of the existing bituminous material and replace by new asphalt concrete.

This treatment consists of completely removing, the existing distressed asphalt surface. The required depth of asphalt removal is approximately 60 mm. The surfaces will be reconstructed by restoring the profiles of the existing road surface, and by eliminating all apparent imperfections from the surface. A new 70 mm layer of asphalt will be laid on the existing base surface, installed in one (1) layer. Since the entire existing asphalt will be removed, an additional granular base preparation will probably have to be done before installing the new bituminous material. The approximate grade raise between the existing surface and the new surface would be approximately 10 mm. Table 7 presents the proposed pavement structure.

Table 7 : Proposed Pavement Structure (existing access road)

Structure Item	Type of material	Thickness (mm)	Compaction (%)
▸ Asphaltic material	HL 3	70	92-98 %
Existing material	Granular A	(1)	(2)
	Total :	70	

Note 1: No modification on existing layer thickness.

Note 2: The granular base must be graded and prepared before installing the asphaltic material

4.3 PROPOSED STRUCTURE FOR THE NEW PARKING LOT

The pavement construction should be carried out as follows:

- Subexcavate to the depth required for pavement installation (770 mm);
- The subgrade should be carefully proof-rolled and any soft or wet spots properly repaired with approved material (Granular B type I);
- Construct the pavement subbase with 450 mm of granular subbase meeting OPSS 1010 Granular B type I specifications, placed in lifts not exceeding 150 mm loose thickness. Compact to 100 percent Standard Proctor Maximum Dry Density (SPMDD);
- Construct the pavement base with 250 mm of granular base meeting OPSS 1010 Granular A gradation. Compact to 100 percent Standard Proctor Maximum Dry Density (SPMDD); and
- Place a lift of 70 mm of OPSS 1150 HL 3 hot-mix asphalt, placed and compacted in conformance with OPSS 310 requirements.

The material placed in the frost zone should match the existing soil at the same level for frost heave compatibility; otherwise transition will have to be done.

Table 8 shows the proposed pavement structure based on subsoil analysis and conception traffic hypothesis.

Table 8: Proposed Pavement Structure for the New Parking Lot

Structure Item	Type of material	Thickness (mm)	Compaction (%)
▸ Asphaltic material	HL3	70	92-98 %
Base	Granular type A (1)	250	100 % min.
Subbase	Granular type B (1)	450	100 % min.
	Total :	770	
Note 1 :Excavated material could not be reused for the road structure			

4.4 PROPOSED STRUCTURE FOR THE EXISTING PARKING LOT OF GRAVEL

The pavement construction should be carried out as follows:

- Subexcavate to the depth required for the installation of a layer of granular A and a lift of hot-mix asphalt (320 mm).
- Construction of a new base with 250 mm of granular base meeting OPSS 1010 Granular A gradation. Compact to 100 percent Standard Proctor Maximum Dry Density (SPMDD); and
- Place a lift of 70 mm of OPSS 1150 HL 3 hot-mix asphalt, placed and compacted in conformance with OPSS 310 requirements.

Table 9 shows the proposed pavement structure based on subsoil analysis and conception traffic hypothesis.

Table 9: Proposed Pavement Structure for the Existing Parking Lot of Gravel

Structure Item	Type of material	Thickness (mm)	Compaction (%)
▸ Asphaltic material	HL3	70	92-98 %
Base	Granular type A (1) (2)	250	100 % min.
Note 1 :Excavated material could not be reused for the road structure Note 2 :The existing granular base has to be well prepared			

4.5 EXCAVATION

If there is sufficient space, the required excavation can be done by doing open trenches. Because the slopes are only temporary, the contractor will be responsible for their stability.

The excavations must be done in accordance to the specifications of the "Ontario Ministry of Labour". If excavations are to remain open without any support system for a long duration, it is recommended that frequent inspections be done by specialized geotechnical personnel in order to detect any risk of soil slippage and determine the measures to be taken to correct any anomalies.

It is recommended to avoid parking any vehicles at the top of the excavation at a distance less than the depth of the excavation. It is also suggested to avoid any vehicle circulation at the top of the excavation at a distance less than the depth of the excavation in order to minimize the vibrations.

It will be important to keep a distance of at least equal to the depth of the excavation between the top of the slope and the base of the excavated material pile on the site. This condition must be respected at all times, unless studies are carried out for any specific case.

Excavation could also be done using a fully braced steel trench box.

4.6 DEWATERING

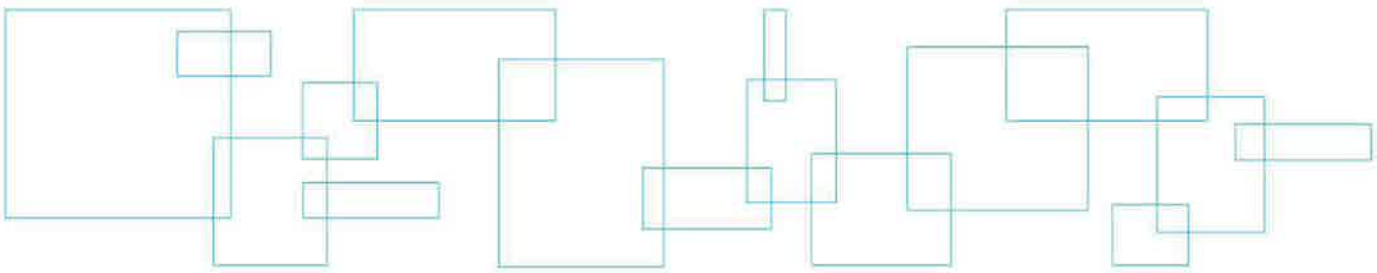
It is recommended that an adequate pumping system be available in order to evacuate surface run-off and infiltration water that could accumulate at the bottom of the excavations, depending on the weather conditions, to allow a dry working environment.

5 ADDITIONAL CONSIDERATIONS

During construction, material quality control verification must be provided in order to verify the actual soil conditions encountered on the site represent the ones stated in this report.

It is also important that soil compaction be verified during the complete duration of the backfill and road structure construction to ensure the long-term quality of the future road. All the unstable zones detected during the compaction work must be 1) corrected and/or 2) excavated, removed and replaced by similar material, and 3) compacted to the same level as surrounding material.

Appendix 1 Limitations of the Investigation



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SCOPE OF THE GEOTECHNICAL STUDY

1.0 Characteristics of soil and rock

The soil and rock characteristics described in this report originate from geotechnical investigations conducted within a given period and correspond to the nature of the terrain only at the specific locations where these investigations were carried out.

Soil and rock formations have natural variations. The limits between the different formations presented in the sounding logs must therefore be considered as transitions between the formations rather than set boundaries. The precision of these limits depends on the type and number of soundings, the sounding methods used, as well as sampling frequency and methods.

The descriptions of the samples taken are based on recognized identification and classification methods used in geotechnics. They can call into play the judgement and interpretation of the personnel who carried out the examination of materials and can be presumed to be accurate and correct in keeping with current best practices in the field of geotechnics. Finally, if tests were carried out, the results of these tests apply solely to the samples tested, as described in this report.

The properties of the soil and rock can undergo significant modifications in the wake of construction activities such as excavation, blasting, pile driving or drainage activities, carried out on the site under study or an adjacent site. They can also be indirectly modified by the exposure of the soil or rock to freezing or weather stresses.

2.0 Groundwater

The groundwater conditions presented in this report apply only to the site under study. The accuracy and representation of these conditions must be interpreted based on the type of instrumentation used, as well as the period, duration, and number of observations carried out. These conditions can vary depending on precipitation, the seasons and, ultimately, the tides. They can also vary as a result of construction activities or the modification of physical elements on the site under study or in its vicinity. The problematic of ferrous ochre and its effects is not covered in this report.

3.0 Use of the report

The comments and recommendations contained in this report are intended primarily for the project's design team. The number of soundings required to identify all of the underground conditions that could impact construction costs, techniques, the choice of equipment and planning of operations could be greater than the number required for design purposes. All contractors bidding on or carrying out the work on the site under study must undertake their own interpretation of the results of the soundings and, if need be, carry out their own investigations to determine how site conditions could influence their operations or work methods.

Any modifications to the design, position and elevation of the works must be quickly communicated to Dessau, allowing the validity of the recommendations presented to be verified. Complementary site or laboratory work could ultimately be required.

4.0 Project tracking

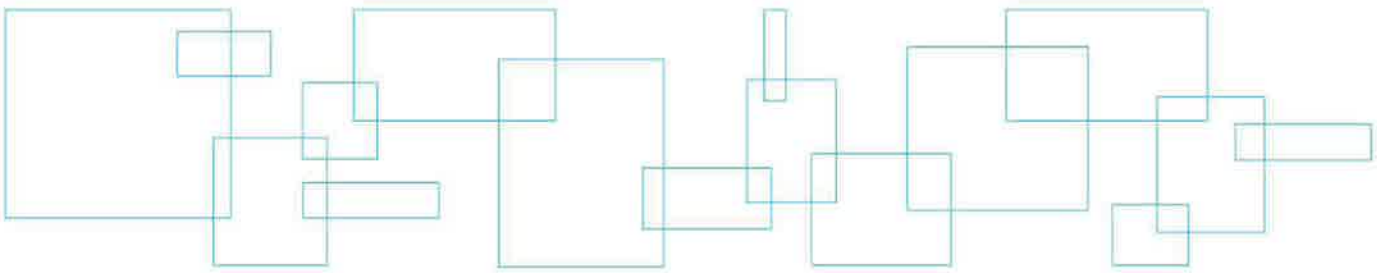
The interpretation of the on-site and laboratory results obtained, as well as the recommendations presented in this report, apply solely to the site under study and to the information available about the project at the time this report was drafted.

Information available concerning the site and groundwater conditions increases as construction work progresses. As site conditions were interpreted and correlated between sounding points, DESSAU should be allowed to verify these conditions, during site visits conducted as work progresses, in order to confirm the information provided by the drillings soundings. If it is not possible for us to conduct these verifications, DESSAU shall assume no responsibility for geotechnical interpretations by third parties concerning recommendations contained in this report, particularly if the design has been modified or if site conditions different from those described in this report are encountered. The identification of such changes requires experience and must be carried out by an experienced geotechnical engineer.

5.0 Environment

The information contained in this report does not cover the environmental aspects of the site conditions, as these aspects were not included in the study mandate.

Appendix 2 Explanation Notes on the Boring Log, Boring Logs



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EXPLANATION NOTE ON SOUNDING LOGS

The following sounding logs summarize soils and rock geotechnical properties as well as ground water conditions, as collected during field work and/or obtained from laboratory tests. This note explains the different symbols and abbreviations used in these logs.

STRATIGRAPHIC UNITS

Elevation/Depth: Reference to the geodesic elevation of the soil or to a bench mark of arbitrary elevation, at the location of the sounding. Depth of the different geological boundaries as measured from ground surface. On the left, the scale is in meters while on the right, it is in feet.

Description of the stratigraphic units: Every geological formation is detailed.

The proportion of the different elements of the soil, defined according to the size of the particles, is given following the classification hereafter. The relative compactness of cohesionless soils is defined by the "N" index of the Standard Penetration Test. The consistency of cohesive soils is defined by their shear resistance.

Classification	Particle size (mm)
Clay	< 0.002
Clay and silt (undifferentiated)	< 0.08
Sand	0.08 to 5
Gravel	5 to 80
Cobble	80 to 300
Boulder	> 300

Descriptive terminology	Proportion (%)
"Traces" (tr.)	1 to 10
"Some" (s.)	10 to 20
Adjective (ex.: sandy, silty)	20 to 35
"And" (ex.: sand and gravel)	35 to 50

Compactness of cohesionless soils	Standard Penetration Test index ("N" value), ASTM D-1586 (blows for a 300mm penetration)
Very loose	0 to 4
Loose	4 to 10
Compact	10 to 30
Dense	30 to 50
Very dense	> 50

Consistency of cohesive soils	Undrained shear strength (kPa)
Very soft	< 12
Soft	12 to 25
Firm	25 to 50
Stiff	50 to 100
Very stiff	100 to 200
Hard	> 200

Plasticity of cohesive soils	Liquid limit (%)
Low	< 30
Medium	30 to 50
High	> 50

Sensitivity of cohesive soils	$S_t = (C_u/C_{ur})$
Low	$S_t < 2$
Medium	$2 < S_t < 4$
High	$4 < S_t < 8$
Extra-sensitive	$8 < S_t < 16$
Quick (sensitive) clay	$S_t > 16$

Classification of rock	RQD (%)
Very poor quality	< 25
Poor quality	25 to 50
Fair quality	50 to 75
Good quality	75 to 90
Excellent quality	90 to 100

SYMBOLS

WATER LEVEL

This column shows the ground water level, as measured at a given time during the geotechnical investigation. The details of the installation (type and depth) are also illustrated in this column.

SAMPLES

Type and number: Each sample is labelled in accordance with the number of this column and the given notation refers to samples types.

Sub-sample: When a sample contains two or more different stratigraphic units, it is sometimes necessary to separate it and create sub-samples. This column allows for the identification of the latter and the association to *in situ* or laboratory measurements to these sub-samples.

Condition: The position, length and condition of each sample are shown in this column. The symbol shows the condition of the sample, following the legend given on the sounding log.

Size: This column indicates the split spoon sampler size.

"N" index The standard penetration index shown in this column is expressed with the letter "N". This index is obtained with the Standard Penetration Test. It corresponds to the number of blows required to drive the last 300mm of the split spoon, using a 622 Newton hammer falling freely from a height of 762mm (ASTM D-1586). For a 610mm long split spoon, the "N" index is obtained by adding the number of blows required for the driving of the 2nd and 3rd 150mm of the split spoon. Refusal (R) indicates a number of blows greater than 100. A set of numbers such as 28-30-50/60mm indicates that the number of blows required to drive the 1st and 2nd 150mm of the split spoon are respectively 28 and 30. Moreover, it indicates that 50 blows were necessary to get a penetration of 60mm, whereupon the test was suspended.

RQD index: Rock Quality Designation index: This index is defined as the ratio between the total length of all rock cores of 100mm and more in length over the total length of the core run. The RQD index is an indirect measurement of the number of "natural" fractures and of the amount of the alteration in a rock mass.

TESTS

Results: This column shows, for the corresponding depth, the results of tests carried out in the field or in the laboratory (shear strength, dynamic penetration, Atterberg limits with the cone, etc.). For more information, please refer to the legend in the upper part of the sounding log. However, an abbreviation indicating the type of analysis performed is shown next to the sample tested.

Graph: This graph shows the undrained shear strength resistance of cohesive soils, as measured *in situ* or in the laboratory (NQ 2501-200). It is also used to present the Dynamic Cone Penetration Test (NQ 2501-145) results.

Moreover, this graph is used for the representation of the water content and Atterberg limits test results.

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PUBLIC WORKS & GOVERNMENT SERVICES CANADA

BOREHOLE REPORT

File n°: **P037950-0100**
Borehole n°: **BH-01-11**
Date: **2011-03-21**

Project: **Geotechnical Studies**

Location: **Millhevan Institution, 5775 Bath Rd, Loyalist, On**

Coordinates (m): North (Y)
East (X)
Elevation **0.00 (Z)**
Bedrock: m End depth: 1.09 m

Sample condition
Intact | Remoulded | Lost | Core

Organoleptic soil examination:
Visual aspect: Non-existent(N); Disseminated(D); Soaked(S)
Odor: Non-existent(N); Light(L); Medium(M); Persistent(P)

Sample type

SS	Split Spoon
TM	Thin wall Tube
PS	Piston Tube
RC	Rock core
TA	Auger
MA	Bulk sample
PW	LVM Mega-Sampler
FG	Frozen ground

Tests

L	Consistency Limits	O.M.	Organic Matter (%)		Water Level
W_L	Liquid Limit (%)	K	Permeability (cm/s)	N	Std Penetration test (blows/150mm)
W_P	Plastic Limit (%)	UW	Unit Weight (kN/m³)	N_C	Dyn. Penetration test (blows/300mm)
I_P	Plasticity Index (%)	A	Absorption (l/min. m)	σ'_P	Preconsolidation Pressure (kPa)
I_L	Liquidity Index	U	Uniaxial Compressive strength (MPa)	SCI	Soil Corrosivity Index
W	Natural Water Content (%)	RQD	Rock Quality Designation (%)		
GS	Grain Size Analysis	AC	Chemical Analysis		Undrained shear strength (Field / Laboratory)
S	Hydrometer analysis	P_L	Limit Pressure (kPa)	C_U	Undisturbed (kPa)
R	Refusal	E_M	Pressuremeter Modulus (MPa)	C_{UR}	Remoulded (kPa)
VBS	Methylene Blue Value	E_r	Modulus of subgrade reaction (MPa)		
WR	Weight of Rods	SP_0	Segregation Potential (mm²/H °C)		

DEPTH - ft	DEPTH - m	LITHOLOGY: ELEVATION - m / DEPTH - m	SOIL OR BEDROCK DESCRIPTION	SYMBOLS	WATER LEVEL (m) / DATE	SAMPLES: TYPE AND NUMBER	SUB-SAMPLE	CONDITION	SIZE	RECOVERY %	Blows/150mm	"N" or RQD	Organo. Exam: Odor	Organo. Exam: Visual	FIELD AND LABORATORY TESTS: RESULTS
		0.00													
1		0.00	***Fill :*** Silt, sand and backfill (soil), brown, moist.			SS-1				17	3-10 17-8	27			AG
2		-0.76													
3	1	0.76	***Natural Soil :*** Silt, brown, a little moist. Refusal to SS at 1.02 m			SS-2				90	9-50 /10 cm	R			
		-1.09													
4		1.09	End of borehole, refusal to auger at 1.09 m												
5															
6	2														
7															
8															
9															

FIELD AND LABORATORY TESTS: NATURAL WATER CONTENT AND LIMITS (%) Wp W WL — 20 40 60 80 100 120
UNDRAINED SHEAR STRENGTH (kPa) OR DYNAMIC PENETRATION — 20 40 60 80 100 120

Remarks: Some boulders scattered near BH-01-11.

Borehole type: **Auger**

Boring equipment: **CME-55**

Prepared by: **K. Sodhi**

Approved by: **C. Perez, Jr. Eng.**

2011-04-25

Page: 1 of 1

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Client :

PUBLIC WORKS & GOVERNMENT SERVICES CANADA

BOREHOLE REPORT

File n°: **P037950-0100**
Borehole n°: **BH-02-11**
Date: **2011-03-21**

Project: **Geotechnical Studies**

Location: **Millhevan Institution, 5775 Bath Rd, Loyalist, On**

Coordinates (m): North (Y)
East (X)
Elevation **0.00 (Z)**
Bedrock: m End depth: 1.80 m

Sample condition

Intact | Remoulded | Lost | Core

Organoleptic soil examination:

Visual aspect: Non-existent(N); Disseminated(D); Soaked(S)
Odor: Non-existent(N); Light(L); Medium(M); Persistent(P)

Sample type

SS	Split Spoon
TM	Thin wall Tube
PS	Piston Tube
RC	Rock core
TA	Auger
MA	Bulk sample
PW	LVM Mega-Sampler
FG	Frozen ground

Tests

L	Consistency Limits	O.M.	Organic Matter (%)		Water Level
W_L	Liquid Limit (%)	K	Permeability (cm/s)	N	Std Penetration test (blows/150mm)
W_P	Plastic Limit (%)	UW	Unit Weight (kN/m³)	N_C	Dyn. Penetration test (blows/300mm)
I_P	Plasticity Index (%)	A	Absorption (l/min. m)	σ'_P	Preconsolidation Pressure (kPa)
I_L	Liquidity Index	U	Uniaxial Compressive strength (MPa)	SCI	Soil Corrosivity Index
W	Natural Water Content (%)	RQD	Rock Quality Designation (%)		
GS	Grain Size Analysis	AC	Chemical Analysis		Undrained shear strength (Field / Laboratory)
S	Hydrometer analysis	P_L	Limit Pressure (kPa)	C_U	Undisturbed (kPa)
R	Refusal	E_M	Pressuremeter Modulus (MPa)	C_{UR}	Remoulded (kPa)
VBS	Methylene Blue Value	E_r	Modulus of subgrade reaction (MPa)		
WR	Weight of Rods	SP_0	Segregation Potential (mm²/H °C)		

DEPTH - ft	DEPTH - m	ELEVATION - m / DEPTH - m	SOIL OR BEDROCK DESCRIPTION	SYMBOLS	WATER LEVEL (m) / DATE	TYPE AND NUMBER	SUB-SAMPLE	CONDITION	SIZE	RECOVERY %	Blows/150mm	"N" or RQD	Organo. Exam: Odor	Organo. Exam: Visual	RESULTS	NATURAL WATER CONTENT AND LIMITS (%) Wp W WL (20 40 60 80 100 120) / UNDRAINED SHEAR STRENGTH (kPa) OR DYNAMIC PENETRATION (20 40 60 80 100 120)
		0.00														
		0.00	***Fill :*** Silt, sand and backfill (soil), brown, moist			SS-1				33	1-3 10-7	13				
		-0.76														
	1	0.76	***Natural Soil :*** Silt with traces of clay, a little moist, brown. Refusal to SS at 1.8 m.			SS-2				100	1-3 7-9	10			AG	
						SS-3				100	5-50 /13 cm	R				
		-1.91														
	2	1.91	End of borehole, refusal to auger at 1.91 m.													

Vertical Scale = 1 : 25

Remarks:

Borehole type: **Auger**

Boring equipment: **CME-55**

Prepared by: **K. Sodhi**

Approved by: **C. Perez, Jr. Eng.**

2011-04-25

Page: 1 of 1

LVM

Client :

PUBLIC WORKS & GOVERNMENT SERVICES CANADA

BOREHOLE REPORT

File n°: **P037950-0100**
Borehole n°: **BH-03-11**
Date: **2011-03-21**

Project: **Geotechnical Studies**

Location: **Millhevan Institution, 5775 Bath Rd, Loyalist, On**

Coordinates (m): North (Y)
East (X)
Elevation **0.00 (Z)**
Bedrock: m End depth: 1.29 m

Sample condition
Intact | Remoulded | Lost | Core

Organoleptic soil examination:
Visual aspect: Non-existent(N); Disseminated(D); Soaked(S)
Odor: Non-existent(N); Light(L); Medium(M); Persistent(P)

Sample type

SS	Split Spoon
TM	Thin wall Tube
PS	Piston Tube
RC	Rock core
TA	Auger
MA	Bulk sample
PW	LVM Mega-Sampler
FG	Frozen ground

Tests

L	Consistency Limits	O.M.	Organic Matter (%)		Water Level
W_L	Liquid Limit (%)	K	Permeability (cm/s)	N	Std Penetration test (blows/150mm)
W_P	Plastic Limit (%)	UW	Unit Weight (kN/m³)	N_C	Dyn. Penetration test (blows/300mm)
I_P	Plasticity Index (%)	A	Absorption (l/min. m)	σ'_P	Preconsolidation Pressure (kPa)
I_L	Liquidity Index	U	Uniaxial Compressive strength (MPa)	SCI	Soil Corrosivity Index
W	Natural Water Content (%)	RQD	Rock Quality Designation (%)		
GS	Grain Size Analysis	AC	Chemical Analysis		Undrained shear strength (Field / Laboratory)
S	Hydrometer analysis	P_L	Limit Pressure (kPa)	C_U	Undisturbed (kPa)
R	Refusal	E_M	Pressuremeter Modulus (MPa)	C_{UR}	Remoulded (kPa)
VBS	Methylene Blue Value	E_r	Modulus of subgrade reaction (MPa)		
WR	Weight of Rods	SP_O	Segregation Potential (mm²/H °C)		

DEPTH - ft	DEPTH - m	LITHOLOGY: ELEVATION - m / DEPTH - m	SOIL OR BEDROCK DESCRIPTION	SYMBOLS	WATER LEVEL (m) / DATE	SAMPLES: TYPE AND NUMBER	SUB-SAMPLE	CONDITION	SIZE	RECOVERY %	Blows/150mm	"N" or RQD	Organo. Exam: Odor	Organo. Exam: Visual	FIELD AND LABORATORY TESTS: RESULTS	NATURAL WATER CONTENT AND LIMITS (%) Wp W WL 20 40 60 80 100 120 / UNDRAINED SHEAR STRENGTH (kPa) OR DYNAMIC PENETRATION 20 40 60 80 100 120
		0.00														
		0.00 / -0.05	Asphalt													
		0.05	***Fill :*** Sand and gravel gran "A", brown, wet.													
1						SS-1				25	5-6 6-5	12			AG	
2		-0.76														
		0.76	***Natural Soil :*** Silt, brown, dry. Refusal to SS à 1.24 m.													
3	1					SS-2				95	2-7 11-50 /3 cm	18				
4		-1.29														
		1.29	End of borehole. Refusal to auger at 1.3 m.													
5																
6	2															
7																
8																
9																

Vertical Scale = 1 : 25

Remarks:

Borehole type: **Auger**

Boring equipment: **CME-55**

Prepared by: **K. Sodhi**

Approved by: **C. Perez, Jr. Eng.**

2011-04-25

Page: 1 of 1

LVM

Client :

PUBLIC WORKS & GOVERNMENT SERVICES CANADA

BOREHOLE REPORT

File n°: **P037950-0100**
Borehole n°: **BH-04-11**
Date: **2011-03-21**

Project: **Geotechnical Studie**

Location: **Millhevan Institution, 5775 Bath Rd, Loyalist, On**

Coordinates (m): North (Y)
East (X)
Elevation **0.00 (Z)**
Bedrock: m End depth: 1.73 m

Sample condition

Intact | Remoulded | Lost | Core

Organoleptic soil examination:

Visual aspect: Non-existent(N); Disseminated(D); Soaked(S)
Odor: Non-existent(N); Light(L); Medium(M); Persistent(P)

Sample type

SS	Split Spoon
TM	Thin wall Tube
PS	Piston Tube
RC	Rock core
TA	Auger
MA	Bulk sample
PW	LVM Mega-Sampler
FG	Frozen ground

Tests

L	Consistency Limits	O.M.	Organic Matter (%)		Water Level
W_L	Liquid Limit (%)	K	Permeability (cm/s)	N	Std Penetration test (blows/150mm)
W_P	Plastic Limit (%)	UW	Unit Weight (kN/m³)	N_C	Dyn. Penetration test (blows/300mm)
I_P	Plasticity Index (%)	A	Absorption (l/min. m)	σ'_P	Preconsolidation Pressure (kPa)
I_L	Liquidity Index	U	Uniaxial Compressive strength (MPa)	SCI	Soil Corrosivity Index
W	Natural Water Content (%)	RQD	Rock Quality Designation (%)		
GS	Grain Size Analysis	AC	Chemical Analysis		Undrained shear strength (Field / Laboratory)
S	Hydrometer analysis	P_L	Limit Pressure (kPa)	C_U	Undisturbed (kPa)
R	Refusal	E_M	Pressuremeter Modulus (MPa)	C_{UR}	Remoulded (kPa)
VBS	Methylene Blue Value	E_r	Modulus of subgrade reaction (MPa)		
WR	Weight of Rods	SP_0	Segregation Potential (mm²/H °C)		

DEPTH - ft	DEPTH - m	ELEVATION - m / DEPTH - m	SOIL OR BEDROCK DESCRIPTION	SYMBOLS	WATER LEVEL (m) / DATE	TYPE AND NUMBER	SUB-SAMPLE	CONDITION	SIZE	RECOVERY %	Blows/150mm	"N" or RQD	Organo. Exam: Odor	Organo. Exam: Visual	RESULTS	NATURAL WATER CONTENT AND LIMITS (%) Wp W WL (20 40 60 80 100 120) / UNDRAINED SHEAR STRENGTH (kPa) OR DYNAMIC PENETRATION (20 40 60 80 100 120)
		0.00														
		0.00	Asphalt													
		-0.06	***Fill:*** Sand and gravel, some silt, brown, dry.													
		0.06														
3	1					SS-1				83	9-22 22-34	44				
4						SS-2				33	13-15 14-9	29			AG	
		-1.52														
5		1.52	***Natural Soil :*** Limestone chips. Refusal to SS at 1.6 m			SS-3				33	50 /3 cm	R				
		-1.73														
6		1.73	End of borehole, refusal to auger at 1.73 m													
	2															
7																
8																
9																

Vertical Scale = 1 : 25

Remarks:

Borehole type: **Auger**

Boring equipment: **CME-55**

Prepared by: **K. Sodhi**

Approved by: **C. Perez, Jr. Eng.**

2011-04-25

Page: 1 of 1

LVM

Client :

PUBLIC WORKS & GOVERNMENT SERVICES CANADA

BOREHOLE REPORT

File n°: **P037950-0100**
Borehole n°: **BH-05-11**
Date: **2011-03-21**

Project: **Geotechnical Studies**

Location: **Millhevan Institution, 5775 Bath Rd, Loyalist, On**

Coordinates (m): North (Y)
East (X)
Elevation **0.00 (Z)**
Bedrock: m End depth: 1.80 m

Sample condition

Intact | Remoulded | Lost | Core

Organoleptic soil examination:

Visual aspect: Non-existent(N); Disseminated(D); Soaked(S)
Odor: Non-existent(N); Light(L); Medium(M); Persistent(P)

Sample type

SS	Split Spoon
TM	Thin wall Tube
PS	Piston Tube
RC	Rock core
TA	Auger
MA	Bulk sample
PW	LVM Mega-Sampler
FG	Frozen ground

Tests

L	Consistency Limits	O.M.	Organic Matter (%)		Water Level
W_L	Liquid Limit (%)	K	Permeability (cm/s)	N	Std Penetration test (blows/150mm)
W_P	Plastic Limit (%)	UW	Unit Weight (kN/m³)	N_C	Dyn. Penetration test (blows/300mm)
I_P	Plasticity Index (%)	A	Absorption (l/min. m)	σ'_P	Preconsolidation Pressure (kPa)
I_L	Liquidity Index	U	Uniaxial Compressive strength (MPa)	SCI	Soil Corrosivity Index
W	Natural Water Content (%)	RQD	Rock Quality Designation (%)		
GS	Grain Size Analysis	AC	Chemical Analysis		Undrained shear strength (Field / Laboratory)
S	Hydrometer analysis	P_L	Limit Pressure (kPa)	C_U	Undisturbed (kPa)
R	Refusal	E_M	Pressuremeter Modulus (MPa)	C_{UR}	Remoulded (kPa)
VBS	Methylene Blue Value	E_r	Modulus of subgrade reaction (MPa)		
WR	Weight of Rods	SP_0	Segregation Potential (mm²/H °C)		

DEPTH - ft	DEPTH - m	LITHOLOGY: ELEVATION - m / DEPTH - m	SOIL OR BEDROCK DESCRIPTION	SYMBOLS	WATER LEVEL (m) / DATE	SAMPLES: TYPE AND NUMBER	SUB-SAMPLE	CONDITION	SIZE	RECOVERY %	Blows/150mm	"N" or RQD	Organo. Exam: Odor	Organo. Exam: Visual	FIELD AND LABORATORY TESTS: RESULTS
		0.00													
1		0.00	***Fill:*** Sand and gravel with crushed stone, dry, grey and brown.			SS-1				92	9-7 7-19	14			AG
2															
3	1					SS-2				12	13-11 11-7	22			
4															
5		-1.52 1.52	Silty clay, brown, a little moist. Refusal to SS at 1.7 m			SS-3					4-50 /8 cm	R			
6		-1.80 1.80	End of borehole, refusal to auger at 1.8 m												
7	2														
8															
9															

NATURAL WATER CONTENT AND LIMITS (%) — Wp W WL — 20 40 60 80 100 120

UNDRAINED SHEAR STRENGTH (kPa) OR DYNAMIC PENETRATION — 20 40 60 80 100 120

Vertical Scale = 1 : 25

Remarks:

Borehole type: **Auger**

Boring equipment: **CME-55**

Prepared by: **K. Sodhi**

Approved by: **C. Perez, Jr. Eng.**

2011-04-25

Page: 1 of 1

LVM

Client :

PUBLIC WORKS & GOVERNMENT SERVICES CANADA

BOREHOLE REPORT

File n°: **P037950-0100**
Borehole n°: **BH-04-11**
Date: **2011-03-21**

Project: **Geotechnical Studies**

Location: **Millhevan Institution, 5775 Bath Rd, Loyalist, On**

Coordinates (m): North (Y)
East (X)
Elevation **0.00 (Z)**
Bedrock: m End depth: 1.73 m

Sample condition

Intact | Remoulded | Lost | Core

Organoleptic soil examination:

Visual aspect: Non-existent(N); Disseminated(D); Soaked(S)
Odor: Non-existent(N); Light(L); Medium(M); Persistent(P)

Sample type

SS	Split Spoon
TM	Thin wall Tube
PS	Piston Tube
RC	Rock core
TA	Auger
MA	Bulk sample
PW	LVM Mega-Sampler
FG	Frozen ground

Tests

L	Consistency Limits	O.M.	Organic Matter (%)		Water Level
W_L	Liquid Limit (%)	K	Permeability (cm/s)	N	Std Penetration test (blows/150mm)
W_P	Plastic Limit (%)	UW	Unit Weight (kN/m³)	N_C	Dyn. Penetration test (blows/300mm)
I_P	Plasticity Index (%)	A	Absorption (l/min. m)	σ'_P	Preconsolidation Pressure (kPa)
I_L	Liquidity Index	U	Uniaxial Compressive strength (MPa)	SCI	Soil Corrosivity Index
W	Natural Water Content (%)	RQD	Rock Quality Designation (%)		
GS	Grain Size Analysis	AC	Chemical Analysis		Undrained shear strength (Field / Laboratory)
S	Hydrometer analysis	P_L	Limit Pressure (kPa)	C_U	Undisturbed (kPa)
R	Refusal	E_M	Pressuremeter Modulus (MPa)	C_{UR}	Remoulded (kPa)
VBS	Methylene Blue Value	E_r	Modulus of subgrade reaction (MPa)		
WR	Weight of Rods	SP_0	Segregation Potential (mm²/H °C)		

DEPTH - ft	DEPTH - m	ELEVATION - m / DEPTH - m	SOIL OR BEDROCK DESCRIPTION	SYMBOLS	WATER LEVEL (m) / DATE	TYPE AND NUMBER	SUB-SAMPLE	CONDITION	SIZE	RECOVERY %	Blows/150mm	"N" or RQD	Organo. Exam: Odor	Organo. Exam: Visual	RESULTS	NATURAL WATER CONTENT AND LIMITS (%) Wp W WL (20 40 60 80 100 120) / UNDRAINED SHEAR STRENGTH (kPa) OR DYNAMIC PENETRATION (20 40 60 80 100 120)
		0.00														
		0.00	Asphalt													
		-0.06	***Fill:*** Sand and gravel, some silt, brown, dry.													
		0.06														
	1					SS-1				83	9-22 22-34	44				
	2															
	3															
	4	-1				SS-2				33	13-15 14-9	29			AG	
	5	-1.52														
		1.52	***Natural Soil :*** Limestone chips. Refusal to SS at 1.6 m			SS-3				33	50 /3 cm	R				
	6	-1.73														
		1.73	End of borehole, refusal to auger at 1.73 m													
	7	2														
	8															
	9															

Vertical Scale = 1 : 25

Remarks:

Borehole type: **Auger**

Boring equipment: **CME-55**

Prepared by: **K. Sodhi**

Approved by: **C. Perez, Jr. Eng.**

2011-04-25

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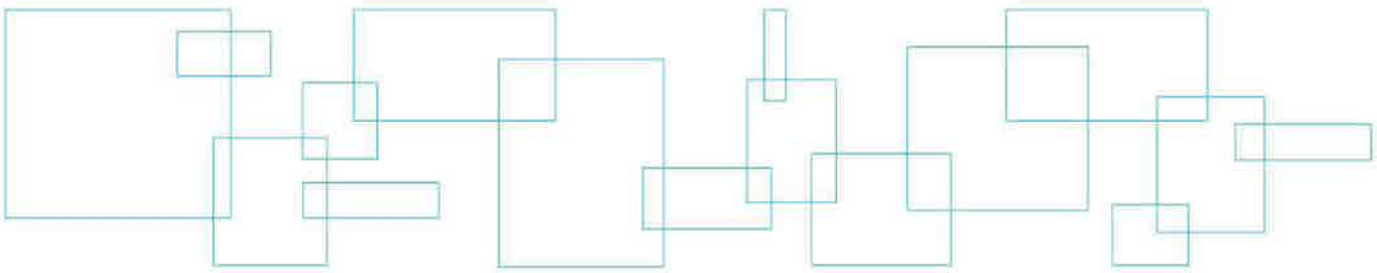
Appendix 3 Laboratory Tests



DESSAU

LVM 1961 2011
900, boul. de la Carrière, bur. 100
Gatineau, J8Y 6T5
Téléphone: (819) 778-3143

Testing on Soils, Aggregates and Other Materials

Client : Dessau
Project : Expertises diverses; Parking Lot Expansion and Secondary Fire Route Access
Location : Millhaven Institution, 5775 Bath Road, Loyalist, On

Project # : P038081-0101
Client ref. :
Report # : 1 **Rev.** 0
Page 1 **of** 1

Sampling

Sampling #	:	1
Your sampling #	:	
Material	:	
Source; location	:	From borehole
Sampling location	:	BH-01-11, SS-01; 0.00 - 0.61 m

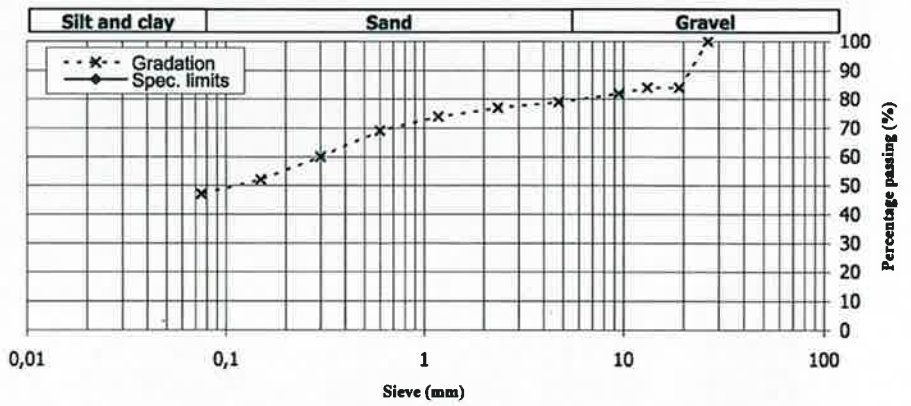
Specification # 2

Reference	:	
Use	:	
Calibre	:	
Class	:	

Sampling date	:	2011-03-21
By	:	Kuljit Sodhi
Date received	:	2011-03-25

Sieve analysis (ASTM C136)

SIEVE (mm)	% PASSING REQUIREMENTS	% PASSING RESULT
106		
75		
50		
37,5		
26,5		100
19		84
13,2		84
9,5		82
4,75		79
2,36		77
1,18		74
0,600		69
0,300		60
0,150		52
0,075		46,5



Cu : Cc : FM : 1,41 D_{10} : D_{30} : D_{60} : 0,293

Maximum dry density kg/m³	Optimum moisture %	Retained 5 mm %

Proportions from sieve analysis (%)

Cobble :	0,0	Sand :	31,9
Gravel :	21,2	Silt and clay :	46,9

Other testing	Required	Result

Remarks

RESULTS WITH AN ASTERISK DO NOT MEET REQUIREMENTS.

Prepared by : Jean-Pierre Lavoie, chef d'équipe **Date :** 2011-04-04

Approved by : Camilo Perez, Ing. Jr **Date :** 2011-04-29

LVM 1961 50 2011

900, boul. de la Carrière, bur. 100
Gatineau, J8Y 6T5
Téléphone: (819) 778-3143

Testing on Soils, Aggregates and Other Materials

Client : Dessau
Project : Expertises diverses; Parking Lot Expansion and Secondary Fire Route Access
Location : Millhaven Institution, 5775 Bath Road, Loyalist, On

Project # : P038081-0101
Client ref. :
Report # : 2 **Rev.** 0
Page 1 **of** 1

Sampling

Sampling #	:	2
Your sampling #	:	
Material	:	
Source; location	:	From borehole
Sampling location	:	BH-02-11, SS-02; 0.76 - 1.37 m

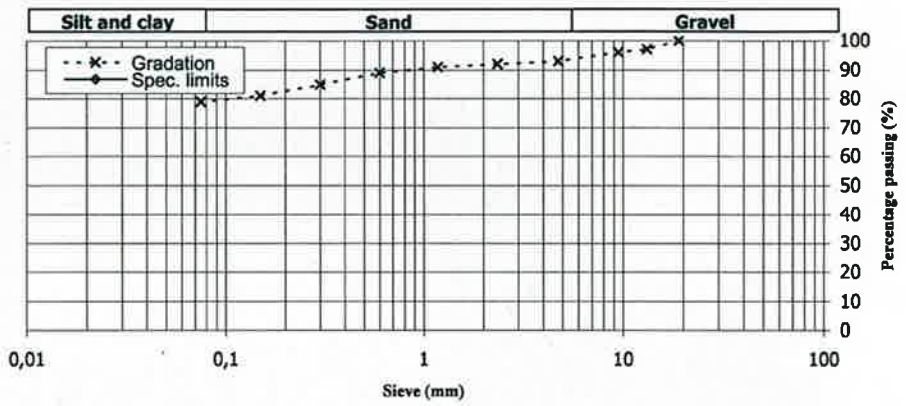
Specification # 2

Reference	:	
Use	:	
Calibre	:	
Class	:	

Sampling date	:	2011-03-21
By	:	Kuljit Sodhi
Date received	:	2011-03-25

Sieve analysis (ASTM C136)

SIEVE (mm)	% PASSING REQUIREMENTS	% PASSING RESULT
106		
75		
50		
37,5		
26,5		
19		100
13,2		97
9,5		96
4,75		93
2,36		92
1,18		91
0,600		89
0,300		85
0,150		81
0,075		78,7



Cu : Cc : FM : 0,51 D_{10} : D_{30} : D_{60} :

Maximum dry density kg/m³	Optimum moisture %	Retained 5 mm %

Proportions from sieve analysis (%)

Cobble :	0,0	Sand :	13,9
Gravel :	7,2	Silt and clay :	78,9

Other testing	Required	Result

Remarks

RESULTS WITH AN ASTERISK DO NOT MEET REQUIREMENTS.

Prepared by : Jean-Pierre Lavoie, chef d'équipe **Date :** 2011-04-04

Approved by : Camilo Perez, ing. jr **Date :** 2011-04-28

LVM 1961 50 2011

900, boul. de la Carrière, bur. 100
Gatineau, J8Y 6T5
Téléphone: (819) 778-3143

Testing on Soils, Aggregates and Other Materials

Client : Dessau
Project : Expertises diverses; Parking Lot Expansion and Secondary Fire Route Access
Location : Millhaven Institution, 5775 Bath Road, Loyalist, On

Project # : P038081-0101
Client ref. :
Report # : 3 **Rev.** 0
Page 1 **of** 1

Sampling

Sampling #	:	3
Your sampling #	:	
Material	:	
Source; location	:	From borehole
Sampling location	:	BH-03-11, SS-01; 0.05 - 0.66 m

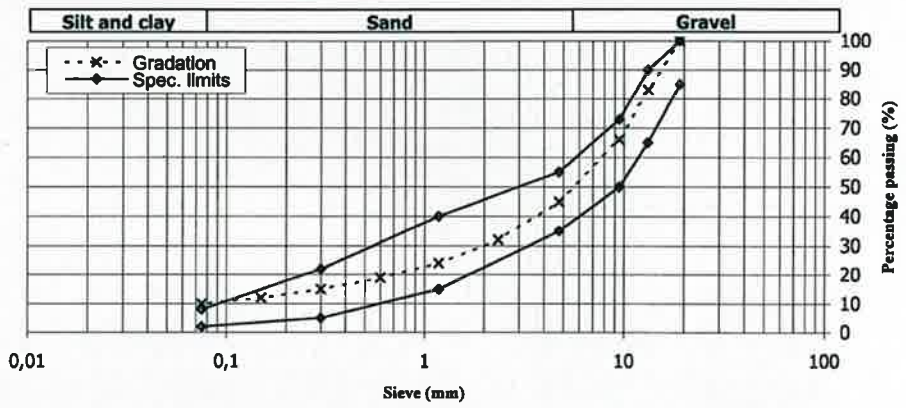
Specification # 1

Reference	:	OPSS
Use	:	Granular base
Calibre	:	Granular A
Class	:	

Sampling date	:	2011-03-21
By	:	Kuljit Sodhi
Date received	:	2011-03-25

Sieve analysis (ASTM C136)

SIEVE (mm)	% PASSING REQUIREMENTS	% PASSING RESULT
106		
75		
50		
37,5		
26,5		
19	85 - 100	100
13,2	65 - 90	83
9,5	50 - 73	66
4,75	35 - 55	45
2,36		32
1,18	15 - 40	24
0,600		19
0,300	5 - 22	15
0,150		12
0,075	2,0 - 8,0	10,4 *



Cu : Cc : FM : 3,65 D_{10} : D_{30} : 1,936 D_{60} : 7,709

Maximum dry density kg/m³	Optimum moisture %	Retained 5 mm %

Proportions from sieve analysis (%)

Cobble :	0,0	Sand :	36,0
Gravel :	53,5	Silt and clay :	10,5

Other testing	Required	Result

Remarks

RESULTS WITH AN ASTERISK DO NOT MEET REQUIREMENTS.

Prepared by : Jean-Pierre Lavoie, chef d'équipe **Date :** 2011-04-04

Approved by : Camilo Perez, ing. jr **Date :** 2011-04-28

LVM 1961 50 2011

900, boul. de la Carrière, bur. 100
Gatineau, J8Y 6T5
Téléphone: (819) 778-3143

Testing on Soils, Aggregates and Other Materials

Client : Dessau
Project : Expertises diverses; Parking Lot Expansion and Secondary Fire Route Access
Location : Millhaven Institution, 5775 Bath Road, Loyalist, On

Project # : P038081-0101
Client ref. :
Report # : 4 **Rev.** 0
Page 1 **of** 1

Sampling

Sampling #	:	4
Your sampling #	:	
Material	:	
Source; location	:	From borehole
Sampling location	:	BH-04-11, SS-02; 0.76 - 1.37 m

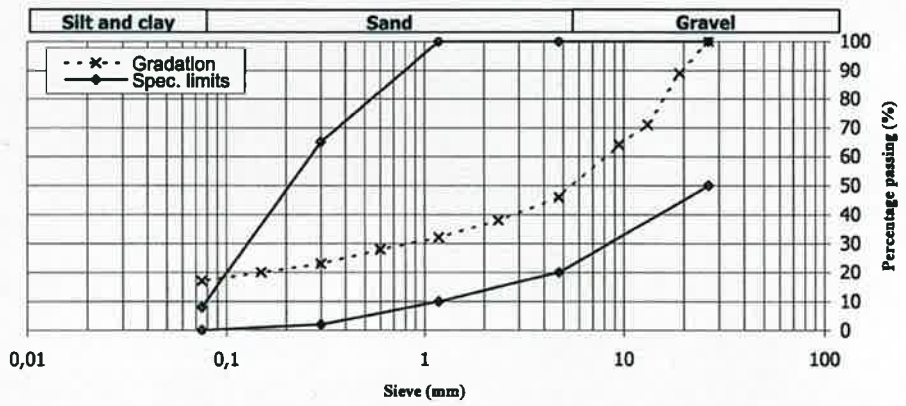
Specification # 3

Reference	:	OPPS
Use	:	Granular subbase
Calibre	:	Granular B type I
Class	:	

Sampling date	:	2011-03-21
By	:	Kuljit Sodhi
Date received	:	2011-03-25

Sieve analysis (ASTM C136)

SIEVE (mm)	% PASSING REQUIREMENTS	% PASSING RESULT
106		
75		
50		
37,5		
26,5	50 - 100	100
19		89
13,2		71
9,5		64
4,75	20 - 100	46
2,36		38
1,18	10 - 100	32
0,600		28
0,300	2 - 65	23
0,150		20
0,075	0,0 - 8,0	17,2 *



Cu : Cc : FM : 3,33 | D_{10} : D_{30} : 0,881 D_{60} : 8,161

Maximum dry density kg/m³	Optimum moisture %	Retained 5 mm %

Proportions from sieve analysis (%)

Cobble :	0,0	Sand :	29,7
Gravel :	53,0	Silt and clay :	17,4

Other testing	Required	Result

Remarks

RESULTS WITH AN ASTERISK DO NOT MEET REQUIREMENTS.

Prepared by : Jean-Pierre Lavoie, chef d'équipe — **Date :** 2011-04-04

Approved by : Camilo Perez, ing. jr — **Date :** 2011-04-28

LVM 1961 50 2011

900, boul. de la Carrière, bur. 100
Gatineau, J8Y 6T5
Téléphone: (819) 778-3143

Testing on Soils, Aggregates and Other Materials

Client : Dessau
Project : Expertises diverses; Parking Lot Expansion and Secondary Fire Route Access
Location : Millhaven Institution, 5775 Bath Road, Loyalist, On

Project # : P038081-0101
Client ref. :
Report # : 5 **Rev.** 0
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Sampling

Sampling #	:	5
Your sampling #	:	
Material	:	
Source; location	:	From borehole
Sampling location	:	BH-05-11, SS-01; 0.00 - 0.61 m

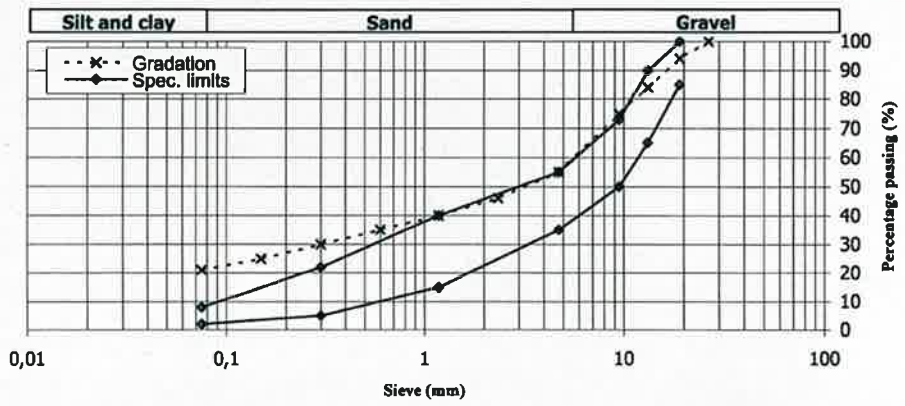
Specification # 1

Reference	:	OPSS
Use	:	Granular base
Calibre	:	Granular A
Class	:	

Sampling date	:	2011-03-21
By	:	Kuljit Sodhi
Date received	:	2011-03-25

Sieve analysis (ASTM C136)

SIEVE (mm)	% PASSING REQUIREMENTS	RESULT	
106			
75			
50			
37,5			
26,5		100	
19	85 - 100	94	
13,2	65 - 90	84	
9,5	50 - 73	75	*
4,75	35 - 55	55	
2,36		46	
1,18	15 - 40	40	
0,600		35	
0,300	5 - 22	30	*
0,150		25	
0,075	2,0 - 8,0	21,0	*



Cu : Cc : FM : 2,94 | D_{10} : D_{30} : 0,296 D_{60} : 5,668

Maximum dry density kg/m³	Optimum moisture %	Retained 5 mm %

Proportions from sieve analysis (%)

Cobble :	0,0	Sand :	34,6
Gravel :	44,1	Silt and clay :	21,3

Other testing	Required	Result

Remarks

RESULTS WITH AN ASTERISK DO NOT MEET REQUIREMENTS.

Prepared by : Jean-Pierre Lavoie, chef d'équipe **Date :** 2011-04-04

Approved by : Camilo Perez, ing. jr **Date :** 2011-04-28

LVM 1961 50 2011

900, boul. de la Carrière, bur. 100
Gatineau, J8Y 6T5
Téléphone: (819) 778-3143

Testing on Soils, Aggregates and Other Materials

Client : Dessau
Project : Expertises diverses; Parking Lot Expansion and Secondary Fire Route Access
Location : Millhaven Institution, 5775 Bath Road, Loyalist, On

Project # : P038081-0101
Client ref. :
Report # : 6 **Rev.** 0
Page 1 of 1

Sampling

Sampling #	:	6
Your sampling #	:	
Material	:	
Source; location	:	From borehole
Sampling location	:	BH-06-11, SS-02; 0.76 - 1.37 m

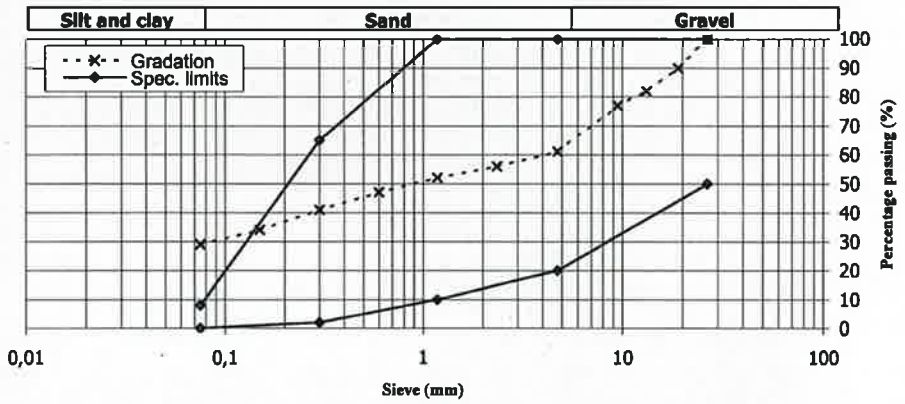
Specification # 3

Reference	:	OPPS
Use	:	Granular subbase
Calibre	:	Granular B type I
Class	:	

Sampling date	:	2011-03-21
By	:	Kuljit Sodhi
Date received	:	2011-03-25

Sieve analysis (ASTM C136)

SIEVE (mm)	% PASSING REQUIREMENTS	RESULT	
106			
75			
50			
37,5			
26,5	50 - 100	100	
19		90	
13,2		82	
9,5		77	
4,75	20 - 100	61	
2,36		56	
1,18	10 - 100	52	
0,600		47	
0,300	2 - 65	41	
0,150		34	
0,075	0,0 - 8,0	29,2	*



Cu : Cc : FM : 2,43 | D_{10} : D_{30} : 0,085 D_{60} : 4,206

Maximum dry density kg/m³	Optimum moisture %	Retained 5 mm %

Proportions from sieve analysis (%)

Cobble :	0,0	Sand :	32,2
Gravel :	38,3	Silt and clay :	29,5

Other testing	Required	Result

Remarks

RESULTS WITH AN ASTERISK DO NOT MEET REQUIREMENTS.

Prepared by : Jean-Pierre Lavoie, chef d'équipe **Date :** 2011-04-04

Approved by : Camilo Perez, ing. jr **Date :** 2011-04-28

LVM 1961 50 2011

900, boul. de la Carrière, bur. 100
Gatineau, J8Y 6T5
Téléphone: (819) 778-3143

Testing on Soils, Aggregates and Other Materials

Client : Dessau
Project : Expertises diverses; Parking Lot Expansion and Secondary Fire Route Access
Location : Millhaven Institution, 5775 Bath Road, Loyalist, On

Project # : P038081-0101
Client ref. :
Report # : 7 **Rev.** 0
Page 1 **of** 1

Sampling

Sampling #	:	7
Your sampling #	:	
Material	:	
Source; location	:	From borehole
Sampling location	:	BH-06-11, SS-01; 0.00 - 0.61 m

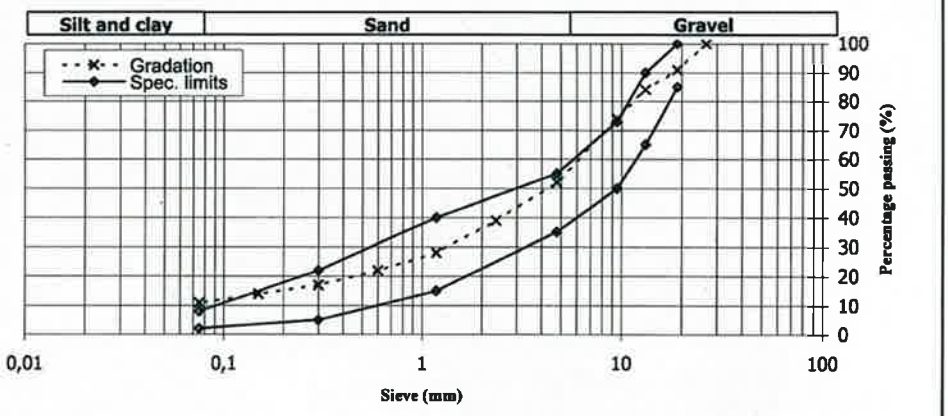
Specification # 1

Reference	:	OPSS
Use	:	Granular base
Calibre	:	Granular A
Class	:	

Sampling date	:	2011-03-21
By	:	Kuljit Sodhi
Date received	:	2011-04-06

Sieve analysis (ASTM C136)

SIEVE (mm)	% PASSING REQUIREMENTS	RESULT	
106			
75			
50			
37,5			
26,5		100	
19	85 - 100	91	
13,2	65 - 90	84	
9,5	50 - 73	74	*
4,75	35 - 55	52	
2,36		39	
1,18	15 - 40	28	
0,600		22	
0,300	5 - 22	17	
0,150		14	
0,075	2,0 - 8,0	10,9	*



Cu : Cc : FM : 3,43 | D_{10} : D_{30} : 1,317 D_{60} : 6,160

Maximum dry density kg/m³	Optimum moisture %	Retained 5 mm %

Proportions from sieve analysis (%)

Cobble : 0,0 Sand : 42,0
Gravel : 47,0 Silt and clay : 11,1

Other testing	Required	Result

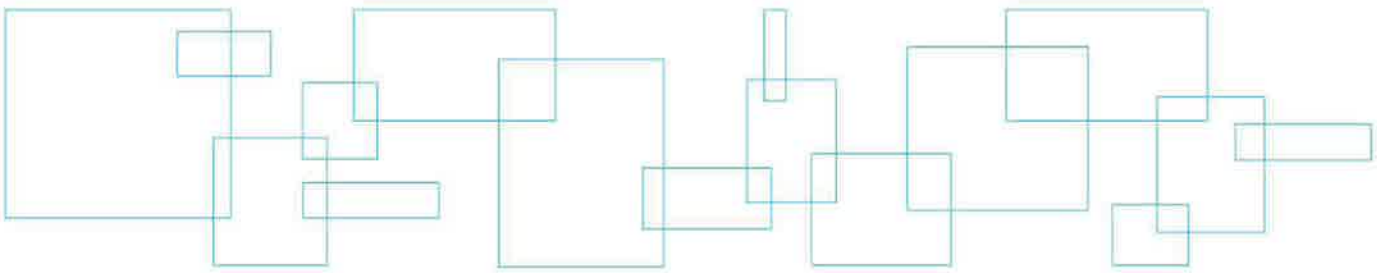
Remarks

RESULTS WITH AN ASTERISK DO NOT MEET REQUIREMENTS.

Prepared by : Jean-Pierre Lavoie, chef d'équipe **Date :** 2011-04-11

Approved by : Camilo Perez, ing. jr **Date :** 2011-04-28

Appendix 4 Plan of Borehole Locations



DESSAU