May 2nd, 2007

Mr. Éric Boucher
EMS Ingénierie
945, Newton st.
Quebec (Quebec) G1P 4M3

Subject : ***Concrete slab repair***
Quebec Armoury, Wilfrid-Laurier Ave.
Concrete slab inspection and verification of the swelling potential of the bedrock
N/Ref : EM071072-1001-1002

Mr Boucher,

You will find in the following text, our report regarding the project mentioned in the subject.

1.0 Mandat

Our mandate consisted in both coring the concrete slab in order to define its stratigraphy and sampling the rock underneath to determine the swelling potential of the bedrock in order to make recommendations for the concrete slab repair.

…2

2.0 Field work

The field works were realised on March 15, and April 11, 2007. They consisted in a concrete slab inspection, of five core sampling and three boreholes.

2.1 Concrete slab inspection

We've visited the site on March 15, 2007, in order to observe the concrete slab condition and obtain information concerning its historic. The visit was realised in presence of Sergeant Paul Gagnon, representative of the Armoury.

2.2 Core sampling

The core sampling took place on March 15, 2007 and the choice of the coring locations was carried out following the inspection of the slab and also to cover the entire area.

The core samples, identified CR-1, CR-3 to CR-5 and CR-8, were collected by our subcontractor Sciage et Forage under the direction of our technician. The core samples CR-1 and CR-8 were realised with a 10.0 centimeter diamond core barrel while core samples CR-3 to CR-5 have been performed with a 15.0 centimeter diamond core barrel.

Following the completion of the core sampling, the drilling holes were filled with a fast setting concrete. The core samples were then sent to our laboratory where a visual description was performed. The localisation of each core samples is shown in the sketch presented in Appendix "A".

2.3 Boreholes

Three boreholes, identified F-1 to F-3, were performed on April 11, 2007. Their localisation is shown on the sketch in Appendix "A". The boreholes have reached depths ranging from 1.40 to 1.50 m below the top of the floor slab.

Each boreholes consisted of coring the concrete slab with a diamond bit, then the soils underneath the slab were sampled, in boreholes F-1 and F-3, with a normalized "B" caliber split spoon sampler that permits to simultaneously retrieve a soil sample and measure the "N" value from the standard penetration test (SPT), according to the BNQ 2501-140 standard. The bedrock was sampled with a "NQ" caliber double-walled diamond core barrel.

Following the boreholes realisation, the drilling holes were immediately filled with a fast setting concrete. The bedrock cores were then sent to our laboratory where a visual description was performed.

Three bedrock samples have been subjected to a petrographic exam and a chemical analysis in order to verify their swelling potential.

3.0 Observations and results

3.1 Concrete slab condition

We've observed cracks on the surface of the entire slab. There is no pattern in the orientation, step or dimensions of the cracks.

3.2 Visual description of the core samples

The visual description report realised on each core samples are presented in Appendix "B".

Each report presents a photo of the core sample and a detailed description of the different observation made.

Table 1 : Stratigraphy of the different layers (m)

Core sample N°	***CR-1***	***CR-3***	***CR-4***	***CR-5***	***CR-8***
Material description	***Depth (m) (tickness (m))***				
Asphalt pavement	0,00 – 0,020 (0,020)	0,00 – 0,02 (0,020)	0,00 – 0,02 (0,020)	0,00 – 0,025 (0,025)	0,00 – 0,024 (0,024)
Concrete screed	0,020 – 0,064 (0,044)	0,020 – 0,078 (0,058)	0,020 – 0,085 (0,065)	0,025 – 0,065 (0,040)	0,024 – 0,094 (0,070)
Structural Concrete Slab	0,064 – 0,200 (0,136)	0,078 – 0,210 (0,132)	0,085 – 0,180 (0,095)	0,065 – 0,200 (0,135)	0,094 – 0,220 (0,126)
Leveling concrete	0,200 – 0,370 (0,170)	0,210 – 0,350 (0,140)	0,180 – 0,370 (0,190)	0,200 – 0,450 (0,250)	0,220 – 0,430 (0,210)

3.3 Soils

The following text resume the soil stratigraphy, whereas you should refer to the borehole reports placed in Appendix "C" for a detailed description of the materials encountered.

At the three locations investigated under the slab, we've encountered probable backfill material (rock excavation) or weathered rock on about 0.45 to 0.81 meter thick. Those materials are composed of a compact to dense, sand and gravel with traces of silt. We then find the bedrock that is weathered at the surface and then fractured up to the end of the boreholes, which is between 1.40 and 1.50 meter deep under the concrete slab. The rock is described as a gray argillaceous limestone.

The swelling potential of the bedrock was verified on three core samples that are, sample CR-2 from borehole F-1, taken between 1.20 and 1.50 meter under the concrete slab and samples CR-2 and CR-3 from borehole F-3, taken respectively, between 1.20 and 1.50 meter and 1.20 and 1.50 meter under the concrete slab.

The rock presents a swelling potential qualify as low to moderate. However, the residual pyrite level within the rock is considered extremely high. Therefore we believe that mitigation measures must be applied according to the NQ 2560-510 standard in order to control the heaving risk of the rock before it can be used as a foundation under a slab. The results are presented in Appendix “D”.

3.4 Groundwater

The groundwater level was not attained in the boreholes which ended between 1.40 and 1.50 meter under the concrete slab. However, it does not represent the stabilized groundwater level considering our short intervention.

4.0 Conclusion and recommendations

Based on our visual of the core samples, a concrete screed was placed on the structural concrete slab followed by a top layer of asphalt pavement. The asphalt layer seems to have been used to correct the cracking problem.

Based on the chemical analysis made on the rock and on the probable backfill or weathered rock, we notice, as stated previously, that the level of pyrite contained in the samples is considered extremely high. We believe that the soils supporting the concrete slab are not adequate and probably the source of its cracking problem. We also believe that surface corrections for this type of repair are not adequate. Surface corrections will give a decent aspect on the short term, however, they will not prevent the differential heaving caused by the potentially swelling rock. The ideal case scenario would be to demolish the existing slab and to redo it with a mitigation measure to control the risk of swelling according to the NQ 2560-510 standard.

Two alternatives are presented, in the following text, to protect the concrete slab resting on a swelling rock.

The first procedure to protect the rock beneath the slab is as follows:

1. Clean the rock surface from loose particles or soil. It may be necessary to use a vacuum to clean the rock.

2. Apply a BAKOR Aqua-Bloc 720-33 waterproofing layer or equivalent on the clean rock. The layer must be placed within a period of 24 hours after the final exposure of the rock.

3. Install over the waterproofing membrane a protective layer of Class "A" sand, free of particles with a diameter greater than 5 mm. The layer should be 100 mm thick and should be placed **without compaction**.

The backfill under the slab should be done with a non-swelling Class "A" or "B" granular material, free of particles larger than 150 mm and having a particle size and moisture content allowing an easy and efficient compaction. The material should be placed in layers with a maximum thickness of 300 mm and compacted to at least 95 percent of the modified Proctor.

The alternative would be to excavate to a depth of 1.80 meter the materials (soil and rock) underlying the slab. This procedure should be used to remove the swelling material that causes damages to the slab. We consider that a thickness equivalent to 1.80 meter of a non-swelling material added to the live loads and dead loads on the slab is sufficient to control the lift produced by the swelling rock.

The excavation should reach a depth of 1.8 meters below the level of the floor slab. It must be verified and approved by a geotechnical engineer or his representative.

The backfill needed until 150 millimeters under the slab should be done with a non-swelling Class "A" or "B" granular material, free of particles larger than 100 mm and having a particle size and moisture content allowing an easy and efficient compaction. The material should be placed in layers with a maximum thickness of 300 mm and compacted to at least 95 percent of the modified Proctor.

For both alternatives, a 150 millimeters thick layer of a non-swelling 20-0 millimeters crushed aggregate shall be placed directly under the slab. This material will be compacted to at least 95 percent of its modified Proctor

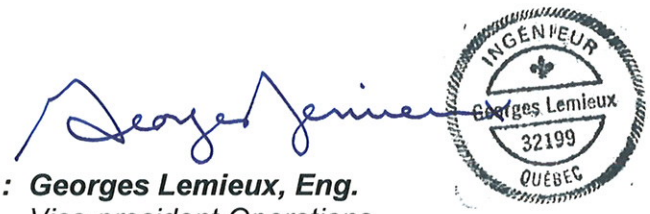
The slab shall be separated from structural elements to avoid detrimental fissuring.

Ultimately, the chosen solution to counter the swelling rock problem should be based on economic criteria.

We hope that the information contained in this report will be useful to you. Please do not hesitate to contact us if you have any questions concerning this study.

Prepared by : ***Simon Malenfant, jr. Eng.***
Geotechnical Project Manager

Reviewed by : ***David Boily, Eng. M.Sc.***
Geotechnical Project Manager



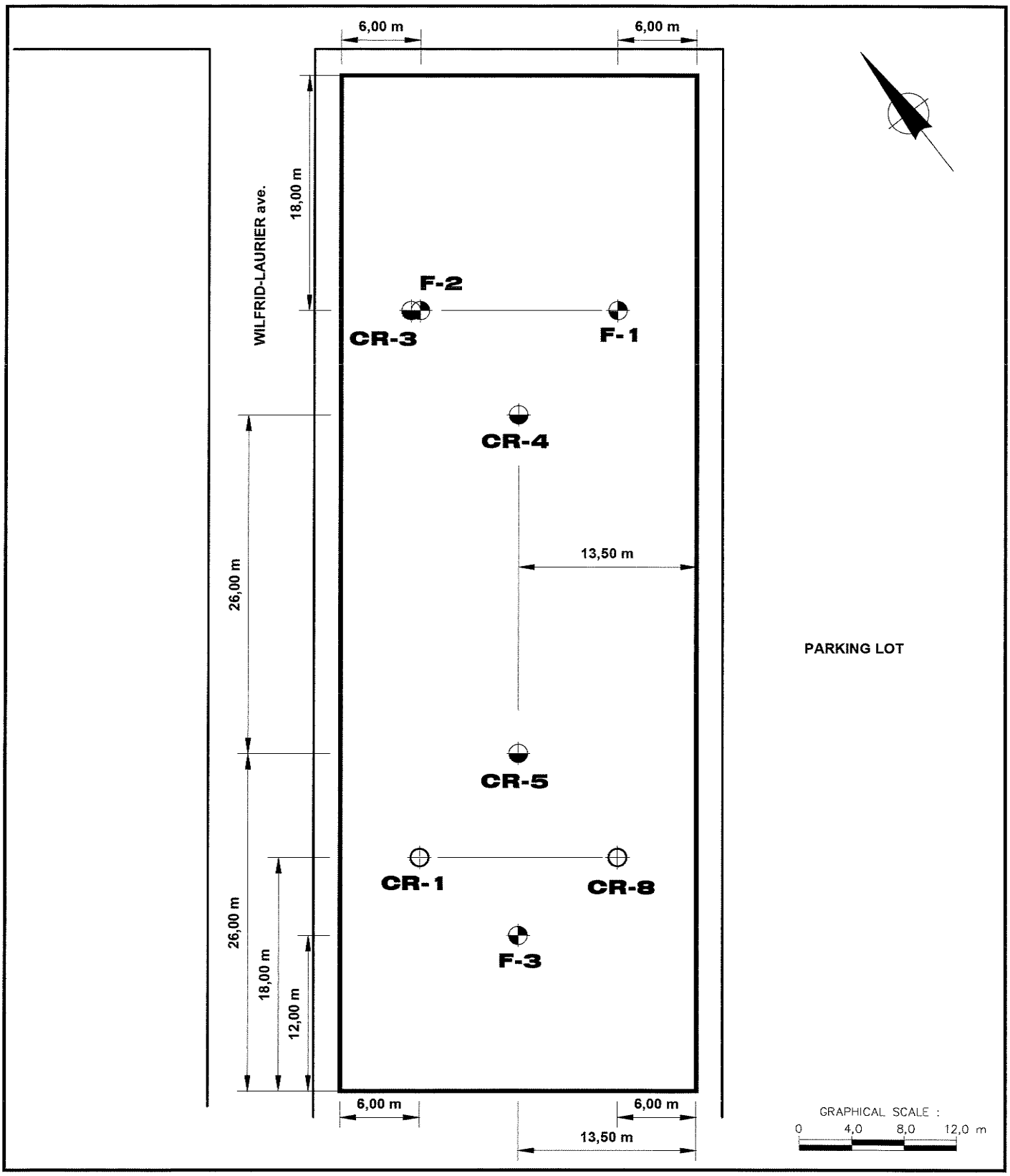
Reviewed by : ***Georges Lemieux, Eng.***
Vice-president Operations

SM/DB/GL/kd

2007/Projets/em071072-1001/RAP1072100101_ang

APPENDIX A

Location Sketch



TECHNISOL

CLIENT: **EMS INGÉNIERIE**

PROJECT: **CONCRETE SLAB REPAIR**
QUEBEC ARMOURY
WILFRID-LAURIER, AVENUE, QUÉBEC

TITLE: **FIGURE 1**
BOREHOLE AND CORE SAMPLING LOCATION

LEGEND
- BOREHOLE
- CORE SAMPLING 10 cm Ø
- CORE SAMPLING 15 cm Ø

SCHETCH:	APPROUVED:	SCALE:	DATE:
J.M. BLANCHET	D. BOILY, ING.	1 : 400	17-04-2007

FILE NO.:	MOD.:	PLAN No.:	REV.:
EM071072 1001	000	01	00

D:\ANNEE2005\A-GEO\A4-fig1.DWG

APPENDIX B

Core Sampling Reports

The reports can be found in the French version of this report

APPENDIX C

Borehole Reports

TECHNISOL

BOREHOLE REPORT

FILE: EM071072-1001 AND EM071072-1002
PROJECT: CONCRETE SLAB REPAIR
LOCATION: QUEBEC ARMOURY, WILFRID-LAURIER AVENUE

BOREHOLE NO.: F-1
DATE: 11 AVRIL 2007
PAGE: 1 OF: 1

SAMPLE TYPE
SS : SPLIT SPOON — SIZE B
TM : THIN WALL TUBE
PS : PISTON TUBE
WS : WASH SAMPLE
AS : AUGER
RC : ROCK CORE — SIZE NQ

SAMPLE CONDITION
INTACT | REMOULDED | LOST | CORE

FIELD TEST
N : STD PENETRATION TEST ■
Cu : UNDRAINED SHEAR STRENGTH UNDISTRUBED △
Cur : UNDRAINED SHEAR STRENGTH REMOULED ▲
K : PERMEABILITY
PI : LIMIT PRESSURE
E : PRESSUREMETER MODULUS
WL : WATER LEVEL ▽
: WATER LEVEL WITH IRIDESCENCE ▽IR
: HYDROCARBON LEVEL ▼

LABORATORY TEST
GS : GRAIN SIZE ANALYSIS
W_L : LIQUID LIMIT (%) ⊣
W_P : PLASTIC LIMIT (%) ⊢
W : NATURAL WATER CONTENT (%) ⊙
UW : UNIT WEIGHT
U : UNIAXIAL COMPRESSIVE STRENGHT
T : TRIAXIAL
St : SENSITIVITY
C : CONSOLIDATION
S : HYDROMETER ANALYSIS

CHEMICAL ANALYSIS
a : PHCs (Petroleum Hydrocarbon)
b : MAHs
c : PAHs
d : METALS
z : OTHER (S)

ORGANOLEPTIC SOIL EXAMINATION
N : NON-EXISTENT
D : DISSEMINATED
S : SOAKED
} VISUAL

HYDROCARBON FUMES
☐ GASTECHTOR ☐ PHOTOVAC

ELEV.(m)	DEPTH(m)	DESCRIPTION	SAMPLES COND.	SAMPLES TYPE-NO.	SAMPLES REC. (%)	TEST AND ANALYSIS	ORGANO. EXAM VISUAL N	D	S	HYDROC. FUMES	WELL CONSTRUCTION	UNDRAINED SHEAR STRENGH Cu Cur (kPa) 25 50
	0,00	START OF BOREHOLE										
	0,02	Asphalt.										
	0,075	Concrete without adherance (aggregate max. ø = 10 mm).		RC-1								
	0,25	Concrete without adherance (aggregate max. ø = 20 mm).										
	0,45 0,50	Highly altered concrete.										
		Probable backfill or weathered rock : dark grey, compact to dense, sand and gravel (shale) with traces of silt.		SS-2	60	N: 39						
	0,90 1,00	Bedrock : dark grey, calcareous shale, fractured to very fractured.		RC-3	36							
	1,40 1,50	End of borehole at a depth of 1,40 m. WL > 1,40 m, 2007-04-11, unstabilized level.										
	2,00											
	2,50											
	3,00											
	3,50											
	4,00											
	4,50											

94-240MULTI (01-07)

Prepared by : S. Malenfant, Eng. Jr
Approved by: S. Malenfant, Eng. Jr

TECHNISOL — BOREHOLE REPORT

FILE: EM071072-1001 AND EM071072-1002
PROJECT: CONCRETE SLAB REPAIR
LOCATION: QUEBEC ARMOURY, WILFRID-LAURIER AVENUE

BOREHOLE NO.: F-2
DATE: 11 AVRIL 2007
PAGE: 1 OF: 1

SAMPLE TYPE
SS : SPLIT SPOON — SIZE: B
TM : THIN WALL TUBE
PS : PISTON TUBE
WS : WASH SAMPLE
AS : AUGER
RC : ROCK CORE — SIZE: NQ

SAMPLE CONDITION
INTACT | REMOULDED | LOST | CORE

FIELD TEST
N : STD PENETRATION TEST ■
Cu : UNDRAINED SHEAR STRENGTH UNDISTRUBED △
Cur : UNDRAINED SHEAR STRENGTH REMOULED ▲
K : PERMEABILITY
PI : LIMIT PRESSURE
E : PRESSUREMETER MODULUS
WL : WATER LEVEL ▽
: WATER LEVEL WITH IRIDESCENCE ▽IR
: HYDROCARBON LEVEL ▼

LABORATORY TEST
GS : GRAIN SIZE ANALYSIS
W_L : LIQUID LIMIT (%) —|
W_P : PLASTIC LIMIT (%) |—
W : NATURAL WATER CONTENT (%) ⊙
UW : UNIT WEIGHT
U : UNIAXIAL COMPRESSIVE STRENGHT
T : TRIAXIAL
St : SENSITIVITY
C : CONSOLIDATION
S : HYDROMETER ANALYSIS

CHEMICAL ANALYSIS
a : PHCs (Petroleum Hydrocarbon)
b : MAHs
c : PAHs
d : METALS
z : OTHER (S)

ORGANOLEPTIC SOIL EXAMINATION
N : NON-EXISTENT
D : DISSEMINATED
S : SOAKED
} VISUAL

HYDROCARBON FUMES
☐ GASTECHTOR ☐ PHOTOVAC

ELEV.(m)	DEPTH(m)	DESCRIPTION	COND.	SAMPLES TYPE-NO.	SAMPLES REC. (%)	TEST AND ANALYSIS	ORGANO. EXAM VISUAL N	VISUAL D	VISUAL S	HYDROC. FUMES	WELL CONSTRUCTION	UNDRAINED SHEAR STRENGH Cu Cur (kPa) 25 50
	0,00	START OF BOREHOLE										
	0,02	Asphalt.										
	0,08	Concrete without adherance (aggregate max. ø = 10 mm).		RC-1	100							
	0,21	Concrete without adherance (aggregate max. ø = 20 mm).										
	0,35	Highly altered concrete.										
	0,50	Probable backfill or weathered rock : grey, sand and gravel (shale) with traces of silt.		RC-2	10							
	1,00											
	1,10	Bedrock : grey, calcareous shale, fractured.		RC-3	63	R.Q.D.:15%						
	1,40											
	1,50	End of borehole at a depth of 1,40 m. WL > 1,40 m, 2007-04-11, unstabilized level.										
	2,00											
	2,50											
	3,00											
	3,50											
	4,00											
	4,50											

94-240MULTI (01-07)

Prepared by : S. Malenfant, Eng. Jr
Approved by: S. Malenfant, Eng. Jr

TECHNISOL

BOREHOLE REPORT

FILE: EM071072-1001 AND EM071072-1002
PROJECT: CONCRETE SLAB REPAIR
LOCATION: QUEBEC ARMOURY, WILFRID-LAURIER AVENUE

BOREHOLE NO.: F-3
DATE: 11 AVRIL 2007
PAGE: 1 OF: 1

SAMPLE TYPE
SS : SPLIT SPOON — SIZE B
TM : THIN WALL TUBE
PS : PISTON TUBE
WS : WASH SAMPLE
AS : AUGER
RC : ROCK CORE — SIZE NQ

SAMPLE CONDITION
INTACT, REMOULDED, LOST, CORE

FIELD TEST
N : STD PENETRATION TEST ■
Cu : UNDRAINED SHEAR STRENGTH UNDISTRUBED △
Cur : UNDRAINED SHEAR STRENGTH REMOULED ▲
K : PERMEABILITY
PI : LIMIT PRESSURE
E : PRESSUREMETER MODULUS
WL : WATER LEVEL ▽
: WATER LEVEL WITH IRIDESCENCE ▽IR
: HYDROCARBON LEVEL ▼

LABORATORY TEST
GS : GRAIN SIZE ANALYSIS
W_L : LIQUID LIMIT (%)
W_P : PLASTIC LIMIT (%)
W : NATURAL WATER CONTENT (%) ⊙
UW : UNIT WEIGHT
U : UNIAXIAL COMPRESSIVE STRENGHT
T : TRIAXIAL
St : SENSITIVITY
C : CONSOLIDATION
S : HYDROMETER ANALYSIS

CHEMICAL ANALYSIS
a : PHCs (Petroleum Hydrocarbon)
b : MAHs
c : PAHs
d : METALS
z : OTHER (S)

ORGANOLEPTIC SOIL EXAMINATION
N : NON-EXISTENT
D : DISSEMINATED
S : SOAKED
} VISUAL

HYDROCARBON FUMES
☐ GASTECHTOR ☐ PHOTOVAC

ELEV.(m)	DEPTH(m)	DESCRIPTION	SAMPLES COND.	TYPE-NO.	REC. (%)	TEST AND ANALYSIS	ORGANO. EXAM VISUAL N	D	S	HYDROC. FUMES	WELL CONSTRUCTION	UNDRAINED SHEAR STRENGH Cu Cur (kPa) 25 50
	0,00	START OF BOREHOLE										
	0,02	Asphalt.										
	0,05	Concrete without adherance (aggregate max. ø = 10 mm).		RC-1								
	0,205											
	0,34	Concrete without adherance (aggregate max. ø = 20 mm).										
	0,50	Delaminated concrete.										
		Probable backfill or weathered rock : dark grey, compact, sand and gravel (shale) with traces of silt.		SS-2	73	N: 33						
	1,00			RC-2								
	1,15	Bedrock : grey, calcareous shale, fractured.		RC-3	51	R.Q.D.: 20%						
	1,50	End of borehole at a depth of 1,50 m. WL. > 1,50 m, 2007-04-11, unstabilized level.										
	2,00											
	2,50											
	3,00											
	3,50											
	4,00											
	4,50											

94-240MULTI (01-07)

Prepared by : S. Malenfant, Eng. Jr
Approved by: S. Malenfant, Eng. Jr

APPENDIX D

Analysis Results

LVM
325, rue de l'Espinay,
Québec (Québec) G1L 2J2
Tel : 418.647.1402 Fax : 418.648.9288

Swelling Potential Petrographic Index (SPPI)
(Quebec Standard - NQ 2560-500)

Client : EMS Ingénierie
Project no. : EM071072-1002
Project : Concrete Slab Repair
From / Location: Quebec Armoury, Wilfrid-Laurier Ave.
Project Manager : Simon Malenfant, jr. Eng

Date: 2007-04-19
Sample no. : 07-0190
Sampling location : F1, CR-2 from 1.2 to 1.5 m.
Sampled by : Simon Malenfant, jr. Eng., 2007-04-11
Type of sample : Crushed aggregate

Rock, Soils and Aggregates

The sample consists of a partly argillaceous limestone.

Petrographic facies	Index	%	SPPI
Limestone (black)	0.25	100	25
			25

SPPI Results : 25

Chemical analysis (%):

Sulfur (total) : 1.71	CO_2 : 27.7	Pyrite (initial) : 3.21	Oxidation rate : 2.34
Hydrosoluble Sulfate (SO_4) : 0.12	Al_2O_3 : 4.79	Pyrite (residual) : 3.13	Calcite equivalent : 62.879
			Clay Minerals : 14.37

Remarks :

The sample shows a Swelling Potential Petrographic Index (SPPI) of 25 (low to moderate). Also, chemical analysis performed on the sample indicates an extremely high content of residual pyrite (3.13 %). Consequently and according to Quebec Standard NQ 2560-510, the rock in place cannot serve as foundation for a backfill under the concrete slab if no mitigation measures are taken to reduce the risk of swelling.

Swelling Potential Petrographic Index (SPPI) interpretation:

0-10 : Negligible	21-40 : Low to moderate	61-80 : High
11-20 : Low	41-60 : Moderate to high	81-100 : Extremely high

Residual pyrite results interpretation :

0-0.5% : Negligible	0.75-1.0% : Low to moderate	1.25-1.5% : High
0.5-0.75% : Low	1.0-1.25% : Moderate to high	1.5% or more : Extremely high

Jean-Léo Guimond, Eng.
Prepared by

Date : 2007-04-19

LVM
325, rue de l'Espinay,
Québec (Québec) G1L 2J2
Tel : 418.647.1402 Fax : 418.648.9288

Swelling Potential Petrographic Index (SPPI)
(Quebec Standard - NQ 2560-500)

Client : EMS Ingénierie
Project no. : EM071072-1002
Project : Concrete Slab Repair
From / Location: Quebec Armoury, Wilfrid-Laurier Ave.
Project Manager : Simon Malenfant, jr. Eng

Date: 2007-04-19
Sample no. : 07-0191
Sampling location : F3, CR-2 from 1.0 to 1.2 m.
Sampled by : Simon Malenfant, jr. Eng, 2007-04-11
Type of sample : Crushed aggregate

Rock, Soils and Aggregates

The sample consists of a partly argillaceous limestone.

Petrographic facies	Index	%	SPPI
Limestone (black)	0.25	100	25
			25

SPPI Results : 25

Chemical analysis (%):

Sulfur (total) : 2.55	CO_2 : 22.0	Pyrite (initial) : 4.78	Oxidation rate : 3.53
Hydrosoluble Sulfate (SO_4) : 0.27	Al_2O_3 : 6.87	Pyrite (residual) : 4.61	Calcite equivalent : 49.94
			Clay Minerals : 20.61

Recommandations :

The sample shows a Swelling Potential Petrographic Index (SPPI) of 25 (low to moderate). Also, chemical analysis performed on the sample shows an extremely high content of residual pyrite (4.61 %). Consequently and according to Quebec Standard NQ 2560-510, the rock in place cannot serve as foundation for a backfill under a concrete slab if no mitigation measures are taken to reduce the risk of swelling.

Swelling Potential Petrographic Index (SPPI) interpretation:

0-10 : Negligible	21-40 : Low to moderate	61-80 : High
11-20 : Low	41-60 : Moderate to high	81-100 : Extremely high

Residual pyrite results interpretation :

0-0.5% : Negligible	0.75-1.0% : Low to moderate	1.25-1.5% : High
0.5-0.75% : Low	1.0-1.25% : Moderate to high	1.5% or more : Extremely high

Jean-Léo Guimond, Eng.
Prepared by

Date : 2007-04-19

LVM
325, rue de l'Espinay,
Québec (Québec) G1L 2J2
Tel : 418.647.1402 Fax : 418.648.9288

Swelling Potential Petrographic Index (SPPI)
(Quebec Standard - NQ 2560-500)

Client : EMS Ingénierie
Project no. : EM071072-1002
Project : Concrete Slab Repair
From / Location: Quebec Armoury, Wilfrid-Laurier Ave.
Project Manager : Simon Malenfant, jr. Eng

Date: 2007-04-19
Sample no. : 07-0192
Sampling location : F3, CR-3 from 1.2 to 1.5 m.
Sampled by : Simon Malenfant, jr. Eng, 2007-04-11
Type of sample : Crushed aggregate

Rock, Soils and Aggregates

The sample consists of a partly argillaceous limestone.

Petrographic facies	Index	%	SPPI
Limestone (black)	0.25	100	25
			25

SPPI Results : 25

Chemical analysis (%):

Sulfur (total) : 0.75	CO_2 : 26.3	Pyrite (initial) : 1.41	Oxidation rate : 2.98
Hydrosoluble Sulfate (SO_4) : 0.067	Al_2O_3 : 4.93	Pyrite (residual) : 1.36	Calcite equivalent : 59.70
			Clay Minerals : 14.79

Recommandations :

The sample shows a Swelling Potential Petrographic Index (SPPI) of 25 (low to moderate). Also, chemical analysis performed on the sample shows a high content of residual pyrite (1.36 %). Consequently and according to Quebec Standard NQ 2560-510, the rock in place cannot serve as foundation for a backfill under a concrete slab if no mitigation measures are taken to reduce the risk of swelling.

Swelling Potential Petrographic Index (SPPI) interpretation:

0-10 : Negligible	21-40 : Low to moderate	61-80 : High
11-20 : Low	41-60 : Moderate to high	81-100 : Extremely high

Residual pyrite results interpretation :

0-0.5% : Negligible	0.75-1.0% : Low to moderate	1.25-1.5% : High
0.5-0.75% : Low	1.0-1.25% : Moderate to high	1.5% or more : Extremely high

Jean-Léo Guimond, Eng.
Prepared by

Date : 2007-04-19