

APPENDIX C

GEOTECHNICAL INVESTIGATION

COPY



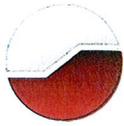
GEMTEC

**Geotechnical Investigation
Supply & Services Canada
Superannuation Building Parking Lot**

Shediac, New Brunswick
19 January 2011

Prepared for Roy Consultants
Project No. 387.07





GEMTEC

CONSULTING ENGINEERS
AND SCIENTISTS

GEMTEC Limited tel: 506.858.7180
77 Rooney Crescent fax: 506.858.0742
Moncton, NB gemtec@gemtec.ca
E1E 4M4 www.gemtec.ca

19 January 2011

File: 387.07 – R01

Roy Consultants
548 King Street
Bathurst, NB
E2A 1P7

Attention: Jean-Claude Arsenault, P.Eng

Re: **Geotechnical Investigation, Supply & Services Canada**
Superannuation Building Parking Lot, Shediac, New Brunswick

Enclosed is our **FINAL** geotechnical report for the above noted project.

Contact the undersigned if you have any questions or require additional information.



Serge Bourque, M.Sc.E, P. Eng
GEMTEC Limited

nyr

(N:\Files\0300\0387.07\2011nyr0119R01.doc)



**Geotechnical Investigation
Supply & Services Canada
Superannuation Building Parking Lot
Shediac, New Brunswick**

Table of Contents

| | |
|--|----|
| Table of Contents | ii |
| 1.0 Introduction | 1 |
| 2.0 Site Conditions | 3 |
| 3.0 Soil, Bedrock and Groundwater Conditions | 3 |
| 3.1 Asphalt Concrete | 4 |
| 3.2 Crushed Rock | 4 |
| 3.3 Sandstone | 4 |
| 3.4 Glacial Till | 5 |
| 3.5 Sand | 5 |
| 3.6 Bedrock | 5 |
| 3.7 Groundwater Seepage | 5 |
| 4.0 Pavement Structure Recommendations | 6 |
| 5.0 General | 6 |

Appendices

- A Descriptive Terms and Detailed Test Pit Logs

List of Figures

| | |
|--------------------------|---|
| Figure 1 Site Plan | 2 |
|--------------------------|---|

List of Tables

| | |
|-----------------------------------|---|
| Table 3.1 Soil Stratigraphy | 3 |
|-----------------------------------|---|

**Geotechnical Investigation
Supply & Services Canada
Superannuation Building Parking Lot
Shediac, New Brunswick**

1.0 Introduction

GEMTEC Limited was retained by Roy Consultants to undertake a geotechnical investigation at the existing parking lot for the Supply and Services Canada Superannuation building parking lot in Shediac, New Brunswick. We understand that the owner wants to upgrade the parking area.

The purpose of this investigation was to assess the composition of the existing pavement structure and underlying subgrade at the site. This report contains a general description of the area under investigation, as well as a summary of the fieldwork carried out. A detailed description of the soil conditions encountered during our fieldwork is presented, along with project specific geotechnical recommendations.

Six boreholes (BH) were put down at the site on 30 November 2010 in the presence of one of our geotechnical technologists (Norm Richard). This work was carried out using truck-mounted auger boring equipment.

The location of each borehole was established in the field by GEMTEC Limited personnel with the assistance of Bertrand Thibodeau of SNC Lavalin. A site plan with borehole locations is shown in Figure 1.

Detailed borehole logs are appended (Appendix A).



LEGEND

 BOREHOLE LOCATION
BH

| | | | |
|-----------------|---|--------------|----------|
| Drawn By | TDS | Checked By | |
| Calculations By | | Checked By | |
| Date | DECEMBER 2010 | | |
| Project | PARKING LOT INVESTIGATION DSS BUILDING SHEDIAC SHEDIAC, NEW BRUNSWICK | | |
| Drawing | BOREHOLE LOCATION PLAN | | |
| Scale | N.T.S. | | |
| File No. | 0387.07 | Drawing | FIGURE 1 |
| | | Revision No. | 0 |



2.0 Site Conditions

As shown in Figure 1, the site is located on Belliveau Street in Shediac, New Brunswick. At the time of our investigation, the site was covered with asphalt concrete.

The original portion of the parking lot was constructed about 35 years ago with additional parking at the southeast corner constructed about 10 years ago. Most of the parking area shows signs of distress with numerous large cracks. We understand that cracks were being filled or injected to minimize water penetration into the pavement structure for a number of years but have not been filled in the last 10 years.

The site grades slope slightly from south to north.

3.0 Soil, Bedrock and Groundwater Conditions

The pavement structure consists of 90 to 130 mm of asphalt concrete surface underlain by 150 mm of crushed rock fill, which in turn is underlain by sandstone fill. Glacial till and/or sand and gravel were encountered below the pavement structure.

Bedrock was encountered at three borehole locations.

Groundwater seepage was encountered in two of the boreholes.

The pavement structure is summarized in Table 3.1.

Table 3.1 Pavement Structure

| Borehole | Asphalt Concrete Thickness (mm) | Crushed Rock Thickness (mm) | Sandstone Fill Thickness (mm) |
|-----------------|--|------------------------------------|--------------------------------------|
| 1 | 100 | 150 | 300 |
| 2 | 130 | 150 | 330 |
| 3 | 130 | 150 | 960 |
| 4 | 100 | 150 | -- |
| 5 | 90 | 150 | 830 |
| 6 | 130 | 250 | 850 |

Laboratory analysis testing was also carried out on selected soil samples. Results are shown in Table 3.2.

Table 3.2 Laboratory Results

| Borehole Number | Sample Number | Soil Description | Moisture Content % | Fines* % | Sample Description based on Laboratory Results |
|------------------------|----------------------|-------------------------|---------------------------|-----------------|---|
| 1 and 4 | 1 | Crushed Rock | 6.0 | 15.5 | Gravelly sand, some silt |
| 2 | 1 | Crushed Rock | 6.0 | 13.4 | Gravelly sand, some silt |
| 1 | 1B | Sandstone | 11.5 | 9.7 | Sand, trace gravel, trace silt |
| 3 | 1 | Sandstone | 8.1 | 11.9 | Sand, trace gravel, trace silt |
| 5 | 2 | Sandstone | 14.2 | 8.8 | Gravelly sand, trace silt |
| 3 | 2 | Sand | 23.6 | 19.8 | Sand, some silt |
| 1 | 2 | Glacial Till | 12.2 | 42.7 | Sand and silt, some gravel |

* Percent passing the #200 sieve or 0.075 mm sieve size.

3.1 Asphalt Concrete

The measure asphalt concrete thickness ranges from 90 to 130 mm, averaging 113 mm. It was difficult to determine the type of asphalt present, whether it was surface asphalt underlain by base asphalt or simply the same type of asphalt throughout the entire thickness.

3.2 Crushed Rock

Crushed rock was encountered at all borehole locations immediately under the asphalt concrete surface. Generally the crushed rock measured 150 mm in thickness except at BH 6 where it measured 250 mm in thickness. Laboratory analysis indicates that the crushed rock contains between 13.4 and 15.5 % fines. Typically a maximum fines content of 8 % is permitted.

3.3 Sandstone

Sandstone was encountered below the crushed rock at all borehole locations. It varied in thickness from 250 to 960 mm. At BH 4, it was difficult to determine if the sandstone was fill or highly weathered bedrock based on the high Standard Penetration Test (SPT) N-values¹ obtained.

¹ The number of blows of a 475 joule hammer required to advance the 50 mm diameter split spoon sampler 300 mm.

Laboratory analysis indicates that the sandstone fill contains between 8.8 and 11.9 % fines. Generally the sandstone fill is medium dense in nature with SPT N values ranging from 12 to 16.

3.4 Glacial Till

Glacial till was encountered below the sandstone fill at BH 1. The thickness of the till was measured at 1.1 metres. Laboratory analysis indicates that the glacial till contains 42.7 % fines. The till is medium dense based on SPT N values of 16 and 20. Because the till is underlain by grey silt, it is possible the till is actually a fill material.

3.5 Sand

Sand was encountered below the sandstone fill at BH 2, 3 and 6. At BH 2 the sand was brown to black and contained gravel. The sand is most likely remnants from an old railway siding which once occupied the site. At BH 3 and 6 the sand is reddish brown in colour. Laboratory analysis indicates that the sand contains 19.8 % fines. A sample obtained from BH 3 at a depth of 1.2 metres indicated a moisture content of 23.6 %. The sand is generally loose in nature with SPT N values ranging from 1 to 10. The sand is underlain at BH 3 by the brown to black sand with gravel.

3.6 Bedrock

Sandstone bedrock was encountered at BH 2 and 5 at depths of 1.1 metres. As previously noted, the sandstone encountered at a depth of 250 mm at BH 4 may also be bedrock based on the high SPT N values obtained. Typically the top metre of sandstone bedrock in the Shediac area is highly weathered.

Test pits put down in our 2000 investigation indicated that the top 500 to 900 mm of the bedrock was weak with horizontal bedding planes ranging from 10 to 100 mm in thickness.

3.7 Groundwater Seepage

Groundwater seepage was noted at BH 3 and 4 at depths ranging from 1.5 to 1.8 metres.

4.0 Pavement Structure Recommendations

We understand that due to the extent of the deterioration of the existing parking lot, it will be completely reconstructed. Due to the high fines content in the crushed rock fill it should not be reused as base for the new pavement structure. In addition, the underlying sandstone fill has weathered down into sand and is not suitable as subbase material.

It is our opinion that the existing pavement structure will need be excavated and replaced with a new pavement structure.

The following pavement structure is recommended for traffic volumes currently experienced at the site:

- | | |
|---|--------|
| • Asphalt concrete surface course (NBDoT Type D) | 75 mm |
| • Granular base (NBDoT 31.5 mm minus crushed rock) | 150 mm |
| • Granular subbase (NBDoT 75 mm minus crushed rock) | 300 mm |
| • Approved subgrade | |

5.0 General

The boreholes put down at this site are widely scattered and soil conditions may vary from those determined at the borehole locations. Although representative samples were taken throughout the site, GEMTEC Limited personnel should be contacted immediately if the soils encountered during excavations are different than those encountered in our geotechnical investigation.

The investigation outlined in this report is strictly geotechnical in nature and should not be viewed as an environmental assessment of the site.

Appendix A

Descriptive Terms and Detailed Borehole Logs



DESCRIPTIVE TERMS- BOREHOLE/TEST PIT LOG

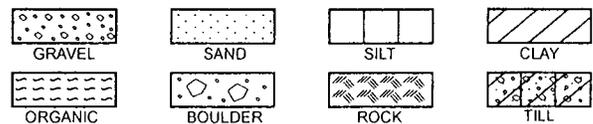
| | | | | | | | |
|-------|--------------------------------------|------------------|-------------------|-------------|--|----------|-----------|
| SOILS | GRAIN SIZE | | | | | | |
| | DESCRIPTIVE TERMINOLOGY | 0-10 | 10-20 | 20-35 | weight. % of material | | |
| | | TRACE | SOME | ADJECTIVE | and > 35% noun > 35% and main fraction | | |
| | | trace clay, etc. | some gravel, etc. | silty, etc. | sand and gravel, etc. | | |
| | COMPACTNESS gravels, sands, tills | N, RANGE | 0 - 4 | 4 - 10 | 10 - 30 | 30 - 50 | > 50 |
| | | DENSITY | V. LOOSE | LOOSE | MEDIUM | DENSE | V. DENSE |
| | CONSISTENCY silt, clay | S, KPa | < 12.5 | 12.5 - 25 | 25 - 50 | 50 - 100 | 100 - 200 |
| | | CONSISTENCY | V. SOFT | SOFT | MEDIUM | STIFF | V. STIFF |

| | | | | | | |
|------|----------------|-----------------|--------|----------|-----------------------|-----------|
| ROCK | RQD | OVERALL QUALITY | | | FRACTURE SPACING | |
| | 0 - 25 | VERY POOR | | | VERY CLOSE 20 - 60 mm | |
| | 25 - 50 | POOR | | | CLOSE 60 - 200 mm | |
| | 50 - 75 | FAIR | | | MODERATE 200 - 600 mm | |
| | 75 - 90 | GOOD | | | WIDE 600 - 2000 mm | |
| | 90 - 100 | EXCELLENT | | | VERY WIDE 2 - 6 m | |
| | COMP. STR. MPa | 1 - 5 | 5 - 25 | 25 - 50 | 50 - 100 | 100 - 250 |
| | DESCRIPTION | V. WEAK | WEAK | MODERATE | STRONG | V. STRONG |

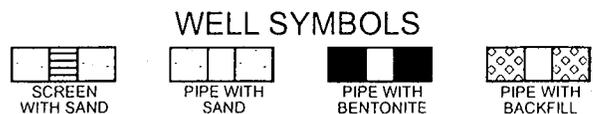
SAMPLE TYPES (location to scale on log)

- | | |
|---------------|----------------|
| S SPLIT TUBE | G SHOVEL |
| T SHELBY TUBE | H CARVED BLOCK |
| P PISTON | K SLOTTED |
| F AUGER | V IN SITU VANE |
| W WASH | NR NO RECOVERY |

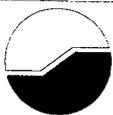
LOG SYMBOLS



ROCK CORES A(30mm); B(41mm); N(54mm)



- N - standard penetration test; blows by 475 J drop hammer to advance Std. 50mm O.D. split tube sampler 0.3m
- RQD - percent of core consisting of hard, sound pieces in excess of 100mm long (excluding machine breaks)
- RECOVERY - sample recovery expressed as percent or length
- S - shear strength, kPa; vane [⊕]; penetrometer [■]; unconfined [○]
- Sr - shear strength, remoulded; vane [⊗]; penetrometer [□]
- Dd - dry density; t/m³
- W - natural moisture content, percent *
- PL - plastic limit, percent —
- LL - liquid limit, percent —
- ND - non detect, total petroleum hydrocarbons (TPH) not detected in soil
- Groundwater Level ∇ ; Seepage ∇



GEMTEC LIMITED
 GROUND ENGINEERING
 & MATERIALS TECHNOLOGY
 Fredericton, Moncton, Bathurst, Grand-Sault, N.B. Canada

BOREHOLE LOGS

| | | | | |
|----------|--|--------------|-------------|-------------|
| Client | Roy Consultants | Proj No. | 387.07 | BOREHOLE |
| Project | Parking Lot Investigation - DSS Building Shediac | Date Drilled | 30.Nov.2010 | BH 1 |
| Location | Shediac, New Brunswick | | | Page 1 of 1 |

Ground Level, m _____ Datum: NA Logged By NYR

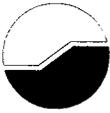
0 25 50 75 100 Undrained Shear Strength - kPa

Unconfined Compression
 Field Vane Test
 Pocket Penetrometer
 Remoulded

Water Content & Atterburg Limits
 Dynamic Penetration Test, blows/0.3m
 Standard Penetration Test, blows/0.3m

W_p W_L
 |-----|-----|
 * ●

| DEPTH m | SAMPLE | | | | LOG | DESCRIPTION |
|------------|--------|------|---------|----------|-------|--|
| | No | TYPE | N (RQD) | REC (mm) | | |
| 0 | | | | | ■ | ASPHALT Pavement |
| | | | | | 0.10 | 0.10 |
| | 1 | S | 12 | 450 | ••••• | Crushed Rock FILL |
| | | | | | 0.25 | 0.25 |
| | | | | | ••••• | Broken Sandstone Fill |
| | | | | | 0.55 | 0.55 |
| | 2 | S | 17 | 600 | ••••• | Reddish brown silt and sand, some gravel (Possible Glacial Till FILL) |
| 1 | | | | | ••••• | |
| | 3 | S | 20 | 500 | ••••• | |
| | | | | | 1.68 | 1.68 |
| | | | | | ••••• | Grey SILT |
| | | | | | 1.83 | 1.83 |
| | | | | | | End of borehole at 1.83 metres Groundwater seepage not encountered |



GEMTEC LIMITED

GROUND ENGINEERING
& MATERIALS TECHNOLOGY
Fredericton, Moncton, Bathurst, Grand-Sault, N.B. Canada

BOREHOLE LOGS

Client Roy Consultants

Proj No. 387.07

BOREHOLE

Project Parking Lot Investigation - DSS Building Shediac

Date Drilled 30.Nov.2010

BH 2

Page 1 of 1

Location Shediac, New Brunswick

Undrained Shear Strength - kPa

Ground Level, m

Datum:

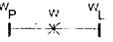
NA

Logged By

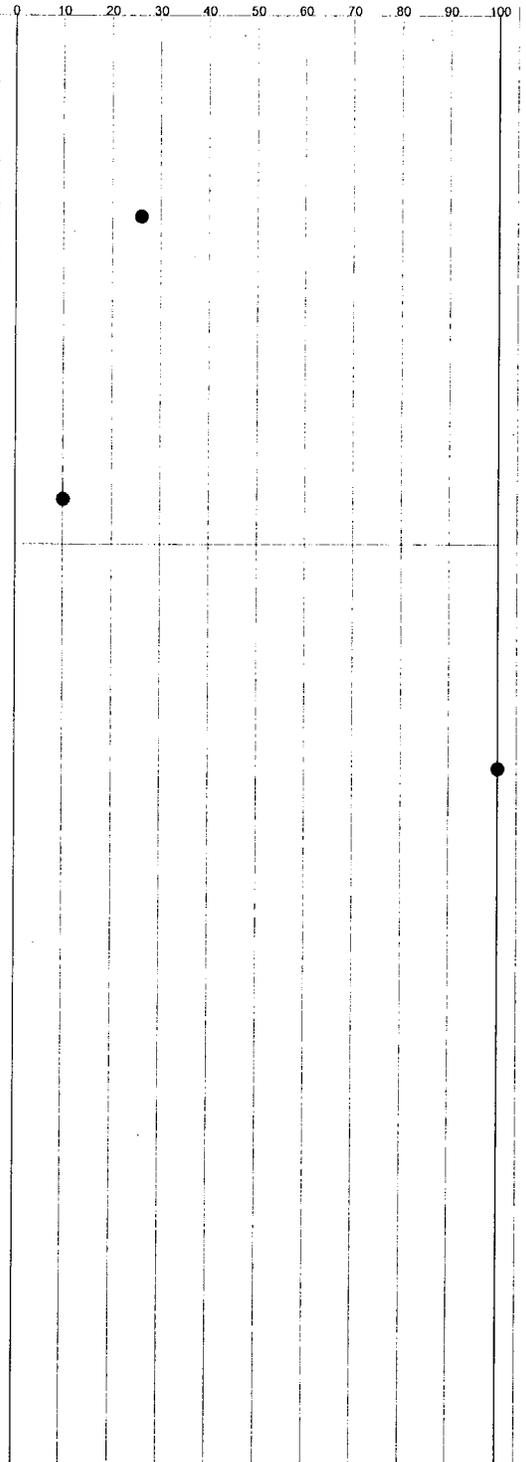
NYR

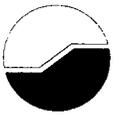
- Unconfined Compression
- Field Vane Test
- Pocket Penetrometer
- Remoulded

Water Content & Atterburg Limits
Dynamic Penetration Test, blows/0.3m
Standard Penetration Test, blows/0.3m



| DEPTH m | SAMPLE | | | | LOG | DESCRIPTION |
|------------|--------|------|---------|----------|---|-------------|
| | No | TYPE | N (RQD) | REC (mm) | | |
| 0 | | | | | ASPHALT pavement | |
| | | | | | 0.13 | 0.13 |
| | 1 | S | 26 | 230 | Crushed Rock FILL | |
| | | | | | 0.28 | 0.28 |
| | | | | | Black sand and gravel FILL | |
| | | | | | 0.36 | 0.36 |
| | | | | | Sandstone FILL | |
| | | | | | 0.61 | 0.61 |
| | 2 | S | 10 | 500 | Black SAND and GRAVEL | |
| 1 | | | | | 1.09 | 1.09 |
| | | | | | SANDSTONE BEDROCK | |
| | 3 | S | 100+ | 150 | | |
| | | | | | 1.63 | 1.63 |
| | | | | | End of Borehole at 1.63 metres Groundwater seepage not encountered | |





GEMTEC LIMITED

GROUND ENGINEERING
& MATERIALS TECHNOLOGY
Fredericton, Moncton, Bathurst, Grand-Sault, N.B. Canada

BOREHOLE LOGS

| | | | | |
|----------|--|--------------|-------------|----------|
| Client | Roy Consultants | Proj No. | 387.07 | BOREHOLE |
| Project | Parking Lot Investigation - DSS Building Shediac | Date Drilled | 30.Nov.2010 | BH 4 |
| Location | Shediac, New Brunswick | Page 1 of 1 | | |

| | | |
|-----------------|--------|-----------|
| Ground Level, m | Datum: | Logged By |
| | NA | NYR |

Undrained Shear Strength - kPa

0 25 50 75 100

Unconfined Compression
 Field Vane Test
 Pocket Penetrometer
 Remoulded

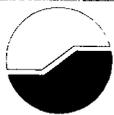
Water Content & Atterburg Limits

Dynamic Penetration Test, blows/0.3m

Standard Penetration Test, blows/0.3m

W_p W_L

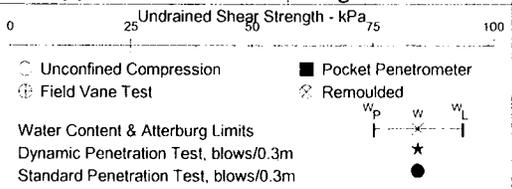
| DEPTH m | SAMPLE | | | | LOG | DESCRIPTION |
|------------|--------|------|---------|----------|------|--|
| | No | TYPE | N (RQD) | REC (mm) | | |
| 0 | | | | | ■ | ASPHALT pavement 0.10 0.10 |
| | 1 | S | 100+ | 450 | •••• | Crushed Rock FILL 0.25 0.25 |
| | | | | | | Light brown SANDSTONE BEDROCK |
| 1 | 2 | S | 100+ | 125 | | |
| | 3 | S | 100+ | 300 | | |
| | | | | | | - Augured to 2.13 metres |
| | | | | | | 2.13 2.13 |
| | | | | | | End of Borehole at 2.13 metres Groundwater seepage encountered at 1.83 metres |



BOREHOLE LOGS

| | | | | |
|----------|--|--------------|-------------|-------------|
| Client | Roy Consultants | Proj No. | 387.07 | BOREHOLE |
| Project | Parking Lot Investigation - DSS Building Shediac | Date Drilled | 30.Nov.2010 | BH 5 |
| Location | Shediac, New Brunswick | | | Page 1 of 1 |

| | | |
|-----------------|--------|-----------|
| Ground Level, m | Datum: | Logged By |
| | NA | NYR |



| DEPTH m | SAMPLE | | | | LOG | DESCRIPTION |
|------------|--------|------|---------|----------|------|---|
| | No | TYPE | N (RQD) | REC (mm) | | |
| 0 | | | | | 0.09 | ASPHALT pavement |
| | | | | | 0.09 | Crushed Rock FILL |
| | 1 | S | 12 | 350 | 0.24 | Sandstone FILL |
| | | | | | 0.24 | |
| | 2 | S | 13 | 600 | | |
| | | | | | | |
| 1 | | | | | 1.07 | Light brown SANDSTONE BEDROCK |
| | | | | | 1.07 | |
| | 3 | S | 100+ | 280 | 1.40 | Grey SANDSTONE BEDROCK |
| | | | | | 1.40 | |
| | | | | | 1.50 | End of Borehole at 1.50 metres Groundwater seepage not encountered |

