# SOIL-MAT ENGINEERS & CONSULTANTS LTD.

www.soil-mat.com info@soil-mat.on.ca TF: 800.243.1922

**Hamilton**: 130 Lancing Drive L8W 3A1 T: 905.318.7440 F: 905.318.7455
**Milton**: 20 – 348 Bronte Street South L9T 5B6 T: 905.875.3228 F: 905.875.4426


**PROJECT NO.: SM 145975-G** January 12, 2015

PCL CONSTRUCTORS CANADA INC.
2085 Hurontario Street, Suite 400
Mississauga, Ontario
L5A 4G1

Attention: Mr. Mike Uronick, Project Manager

**TEST PIT STUDY – PAVEMENT CONSIDERATIONS**
**PROPOSED NEW PARKING LOT**
**NIAGARA HEALTH CENTRE**
**ST. CATHARINES, ONTARIO**

Dear Mr. Uronick,

We have completed the fieldwork and report preparation in connection with the above noted project. The investigation and reporting were undertaken in general accordance with our proposal P5385, dated April 24, 2014, modified per our discussions with Mr. David Funk. Our comments and recommendations, based on our findings at the four test pit locations are presented in the following paragraphs.

## INTRODUCTION

We understand that it is proposed to construct an additional on grade asphalt paved parking lot near the existing heli-pad, to the west of the main hospital facility. It is noted that the proposed parking lot was part of the overall development plan for the facility during the planning process in 2009, and general comments and recommendations regarding pavement design and construction were provided in geotechnical reports by this office at that time. The purpose of this geotechnical investigation work was to determine subsurface soils information at a number of test pit locations and to provide comments and recommendations with respect to the design and construction of the pavement structure and related earthworks, from a geotechnical point of view.

## SITE CONDITIONS

The area of the proposed parking lot is located within the vacant parcel north of the heli-pad to the west of the Francis Creek channel. At the time of our site visit a temporary gravel parking area was being prepared to the north of the proposed permanent lot. The area is relatively flat with minor scrub vegetation. Four shallow test pits were advanced by the contractor within the area of the proposed building, with our observations

summarized in the follow table. The native silty clay soils in the base of the test pits were probed with a 15-millimetre diameter steel rod, yielding limited penetration and demonstrating a relatively stiff to very stiff consistency.

**Summary of Test Pit Observations**

| Test Pit No. | Depth | Material Encountered |
|---|---|---|
| Test Pit No. 1 | 0 m – 0.4 m | Approximately 400 mm of Topsoil. |
| | 0.4 m – 1.4 m | Native Silty Clay – Brown, trace gravel and shale fragments, with occasional organic staining in the upper metre, stiff to hard. |
| Test Pit No. 2 | 0 m – 0.3 m | Approximately 300 mm of Topsoil. |
| | 0.3 m – 1.2 m | Native Silty Clay – Brown, trace gravel and shale fragments, with occasional organic staining in the upper metre, stiff to hard. |
| Test Pit No. 3 | 0 m – 0.35 m | Approximately 350 mm of Topsoil. |
| | 0.35 m – 1.3 m | Native Silty Clay – Brown, trace gravel and shale fragments, with occasional organic staining in the upper metre, stiff to hard. |
| Test Pit No. 4 | 0 m – 0.3 m | Approximately 300 mm of Topsoil. |
| | 0.3 m – 1.0 m | Native Silty Clay – Brown, trace gravel and shale fragments, with occasional organic staining in the upper metre, stiff to hard. |

A review of available published information [Ministry of Natural Resources – Quaternary Geology of Ontario, Southern Sheet Map 2556 and Quaternary Geology of Niagara-Welland Map 2496] indicates the site to be in an area of silty and clayey till. The conditions encountered in the test pits are consistent with this information and our past experience on the project site.

No free groundwater was observed in the test pits. Based on our previous experience in the area the static groundwater level is anticipated to be at a depth on the order of perhaps 3 to 5 metres, or more, certainly well below the depths of construction.

PAVEMENT CONSIDERATIONS

All areas to be paved must be cleared of all topsoil and unsuitable materials and the exposed subgrade proofrolled with 3 to 4 passes of a loaded tandem-axle truck in the presence of a representative of Soil-Mat Engineers & Consultants Ltd., immediately prior to the placement of the sub-base material. Based on our past experience and the conditions encountered in the test pits it is anticipated that the native silty clay soils will provide a competent and stable subgrade. Nevertheless, any areas of distress revealed by this or other means should be sub-excavated and replaced with suitable backfill material. Where the subgrade condition is poorer it may be necessary to implement more aggressive stabilisation methods, such as the use of coarse aggregate [50mm clear stone, 'rip rap' stone, black rock, etc.] 'punched' into the soft areas. It may also be prudent to consider the provision of a heavy geofabric over the subgrade to act as a separator between the subgrade and granular base materials. In such case it is recommended that a non-woven product be specified.

The need for subexcavations of softened subgrade materials will be reduced if construction is undertaken during dry periods of the year and careful attention is paid to the compaction operations. The on-site soils are sensitive to disturbance and moisture and may present difficulty for roadway construction during 'wet' periods of the year. Should pavement construction be undertaken during 'wet' periods of the year it should be anticipated that greater stabilisation efforts will be required and/or additional depth of OPSS Granular B, Type II sub-base course material may be required.

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

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

The suggested pavement structures outlined in Table B are based on the subgrade parameters estimated on the basis of visual and tactile examinations of the on-site soils and past experience. The outlined pavement structure may be expected to have an approximate fifteen-year life, assuming that regular maintenance is performed, or greater depending on the tolerance of the owner to damage and distress of the pavement.

Where garbage trucks, delivery trucks, etc. are routinely required the recommended heavy duty pavement structure should be provided. Where only light vehicle traffic is to be supported then the recommended light duty pavement structure would be appropriate. Should a move detailed pavement structure design be required, site specific traffic information would be needed, together with detailed laboratory testing of the subgrade soils.

**TABLE A**
**RECOMMENDED PAVEMENT STRUCTURE**

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

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

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

To minimise segregation of the finished asphalt mat, the asphalt temperature must be maintained uniform throughout the mat during placement and compaction. All too often, significant temperature gradients exist in the delivered and placed asphalt with the cooler portions of the mat resisting compaction and presenting a honeycomb surface. As the spreader moves forward, a responsible member of the paving crew should monitor the pavement surface, to ensure a smooth uniform surface. The contractor can

mitigate the surface segregation by 'back-casting' or scattering shovels of the full mix material over the segregated areas and raking out the coarse particles during compaction operations. Of course, the above assumes that the asphalt mix is sufficiently hot to allow the 'back-casting' to be performed.

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

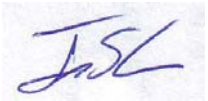
GENERAL COMMENTS

The comments provided in this document are intended only for the guidance of the design team. The subsoil descriptions and test pit information are only intended to describe conditions at the test pit locations. Contractors placing bids or undertaking this project should carry out due diligence in order to verify the results of this investigation and to determine how the subsurface conditions will affect their operations.

We trust that this information is satisfactory for you purposes. Should you have any questions please do not hesitate to contact the undersigned.

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

Matt LiVecchi, B. Eng., EIT



Ian Shaw, P.Eng.
Project Engineer

Distribution: PCL Constructors Canada Inc.. [2, plus pdf]