

**FOUNDATION INVESTIGATION AND DESIGN REPORT
PROPOSED PYLON SIGN AT HIGHWAY 407 EAST/BALDWIN STREET
COMMUTER CARPOOL LOT (CCL)
TOWN OF WHITBY, ONTARIO
G.W.P. 2081-12-00
W.P. 2083-12-01**

Prepared For:
Ainley Group
280 Pretty River Parkway
Collingwood, Ontario, L9Y 4J5

SPL Project No.: 10001315
December 30, 2015

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FOUNDATION INVESTIGATION REPORT
PROPOSED PYLON SIGN AT HIGHWAY 407 EAST/BALDWIN STREET
TOWN OF WHITBY, ONTARIO
G.W.P. 2081-12-00
W.P. 2081-12-01

1. INTRODUCTION

SPL Consultants Limited (SPL) was retained by Ainley Group to undertake a foundation investigation for the proposed pylon signs for Commuter Carpool Lot (CCL) at Highway 407 East and Baldwin Street in the Town of Whitby, Ontario.

It is understood that a GO Transit pylon sign will be installed on the proposed Commuter Carpool Lot (CCL) located in the southwest quadrant of the intersection of Baldwin Street and the future Highway 407 East Phase 1 Interchange. At the time of investigation, the location of the pylon sign has not been finalized and therefore two locations (Pylon Sign 1 and an alternative Pylon Sign 2) were investigated.

The purpose of the geotechnical investigation was to obtain subsurface information at the location of the overhead signs by means of exploratory boreholes and to assess the engineering characteristics of the subsurface soils by means of field and laboratory tests.

This report presents the findings of the foundation investigation carried out at the site and provides factual information concerning subsurface conditions, in-situ and laboratory test results carried out as part of the investigation.

This report is provided on the basis of the terms of reference presented above and on the assumption that the design will be in accordance with the applicable codes and standards. If there are any changes in the design features relevant to the geotechnical analyses, or if any questions arise concerning the geotechnical aspects of the codes and standards, this office should be contacted to review the design. It may then be necessary to carry out additional borings and reporting before the recommendations of this office can be relied upon.

The foundation investigation follows generally accepted practice for geotechnical consultants in Ontario and in compliance with Canadian Highway Bridge Design Code (2004). The format and contents are guided by client specific needs and economics. Field and laboratory testing for most part follows ASTM, LS or CSA Standards or modifications of these standards that have become standard practice.

The limitations conditions presented in this report form an integral part of the report and they must be considered in conjunction with this report.

2. SITE DESCRIPTION AND PHYSIOGRAPHY

The site is located on the west side of Baldwin Street and to the south of the Highway 407 East Phase 1 Extension in the Town of Whitby, Ontario.

The study area is located within the physiographic region known as South Slope¹. The quaternary geology in the area indicates the overburden consists of sandy silt to silty sand textured till on Paleozoic terrain (Halton Till).

¹ L.J. Chapman and D.F. Putnam, The Physiography of Southern Ontario, Third Edition, ON Geology Survey Special Volume 2, 1984.

3. FIELD AND LABORATORY WORK

Two boreholes (PS2-1 and PS2-2, see Drawing 1 for borehole locations) were drilled at the locations of the proposed pylon signs (with ground surface elevations of 157.5 m and 155.3 m respectively), to depths varying from 5.5 to 5.8m. Borehole locations for this investigation were established by SPL personnel in accordance with the drawing and coordinates provided by the Ainley Group. Prior to drilling operations, all underground utilities were cleared at the borehole locations by representatives of the public utilities locate companies.

Boreholes were drilled with solid stem continuous flight auger equipment by a drilling sub-contractor under the direction and supervision of SPL Consultants Limited personnel. Samples were retrieved at regular intervals with a 50 mm O.D. split-barrel sampler driven with a hammer weighing 624 N and dropping 760mm in accordance with the Standard Penetration Test (SPT) method. The number of blows of the hammer required to drive the sampler into relatively undisturbed ground by a vertical distance of 0.30m is recorded as the Standard Penetration Resistance (SPT) or the N-value of the soil. The N-value is indicative of the compactness condition of granular (or cohesionless, i.e. gravels, sands and silts) soils or the consistency of cohesive soils (clay and clayey soils). The samples were logged in the field and returned to the SPL Consultants Limited laboratory for detailed examination by the project engineer and for laboratory testing.

As well as visual examination in the laboratory, all soil samples were tested for moisture contents. Grain size analyses of three selected soil samples were conducted and the results are presented on Fig. 1 in Appendix B of this report.

Groundwater level observations were made during drilling and upon completion. Upon their completion, the boreholes were grouted using a cement/bentonite mixture as per MTO procedures.

The elevation surveying of the borehole locations was undertaken by SPL Consultants Limited personnel.

4. SUBSURFACE CONDITIONS

The subsurface conditions at the site are discussed in the following sections. Detailed descriptions of the soil and groundwater conditions encountered at each of the borehole locations are included in the individual borehole logs in Appendix A and are also shown on Drawing 1. General notes on sample description are presented on Drawing 1A.

4.1 Topsoil

One borehole (PS2-2) was drilled in the grass area and encountered 380mm of topsoil at the surface. The thickness of topsoil can vary and the above noted thickness should not be relied upon for topsoil quantity estimation purposes.

4.2 Fill

Underlying the topsoil, fill materials were encountered in both boreholes (PS2-1 and PS2-2) extending to a depth of 1.5m. The upper fill material at borehole location PS2-1 consisted of cohesionless sand and gravel, extending to a depth of 0.8m. The upper cohesionless fill was found in a compact state, with measured SPT 'N' value of 10 blows/0.3m. Underlying the sand and gravel layer in Borehole PS2-1, cohesive fill material consisting of clayey silt and topsoil, were encountered extending to a depth of 1.5m. The cohesive fill was in a soft consistency, with measured SPT 'N' value of 3 blows/0.3m. Fill material at borehole location PS2-2 consisted of cohesive soil of silty clay. The cohesive soil was generally present in a soft to stiff consistency, with measured SPT 'N' value ranged from 2 to 13 blows/0.3m. Moisture contents in the tested samples from the fill material ranged from 15 to 73 percent.

4.3 Silty Clay Till

The silty clay till deposit was encountered at borehole location PS2-1 below the fill material, extending to a depth of 2.3m. This deposit was present in a stiff consistency, with a measured SPT 'N' value of 9 blows/0.3m. Moisture content in the tested sample from the silty clay till was 12 percent. Due to the mode of deposition, cobbles and boulders should always be expected in the till deposits.

4.4 Silty Sand (Till)/Sand

The silty sand till deposit was encountered in both the boreholes below fill or silt clay (till), extending to the maximum explored depth of PS2-1 and to a depth of 3.8m in PS2-2. The silty sand till deposit was present in a dense to very dense state, with typical measured SPT 'N' values ranging from 40 to over 50 blows/0.3m of penetration. Moisture contents in the tested samples from the till deposit ranged from 7 to 11 percent.

Grain size analyses of two samples from silty sand till (PS2-1/SS5, and PS2-2/SS3) were conducted and the gradation curves are presented in Appendix B, with the following fractions:

Clay: 10%
Silt: 25 to 31%
Sand: 47 to 55%
Gravel: 10 to 12%

Due to the mode of deposition, the presence of cobbles and boulders should always be anticipated in the glacial till deposits.

Underlying silty sand till, a cohesionless sand deposit was encountered at the location of Borehole PS2-2 extending to the maximum explored depth of the borehole. This deposit was present in a dense to very dense state, with measured SPT 'N' values of 41 to over 50 blows/0.3m of penetration. Moisture contents in the tested samples from the sand deposit ranged from 12 to 19 percent.

Grain size analysis of one sample from sand (PS2-2/SS6) was conducted and the gradation curve is presented in Appendix B, with the following fractions:

Clay: 5%
Silt: 14%
Sand: 81%
Gravel: 0%

4.5 Groundwater Conditions

The observed groundwater level in both boreholes (PS2-1 and PS2-2) upon completion of drilling was at a depth of 1.8m below the ground surface. It should however be pointed out that this may not represent the stabilized groundwater level as it is a short-term observation (i.e. immediately after completion of the borehole). Wet spoon samples in the boreholes were noted at about 1.5m and 4.5m depth below ground surface. The boreholes (PS2-1 and PS2-2) caved-in at depths of 3.7m and 4.6m, respectively. No piezometers were installed for long-term groundwater level monitoring.

It should be noted that the groundwater levels can vary and are subject to seasonal fluctuations in response to major weather events.

SPL CONSULTANTS LIMITED


Alka Sangar, M.Eng., P.Eng.



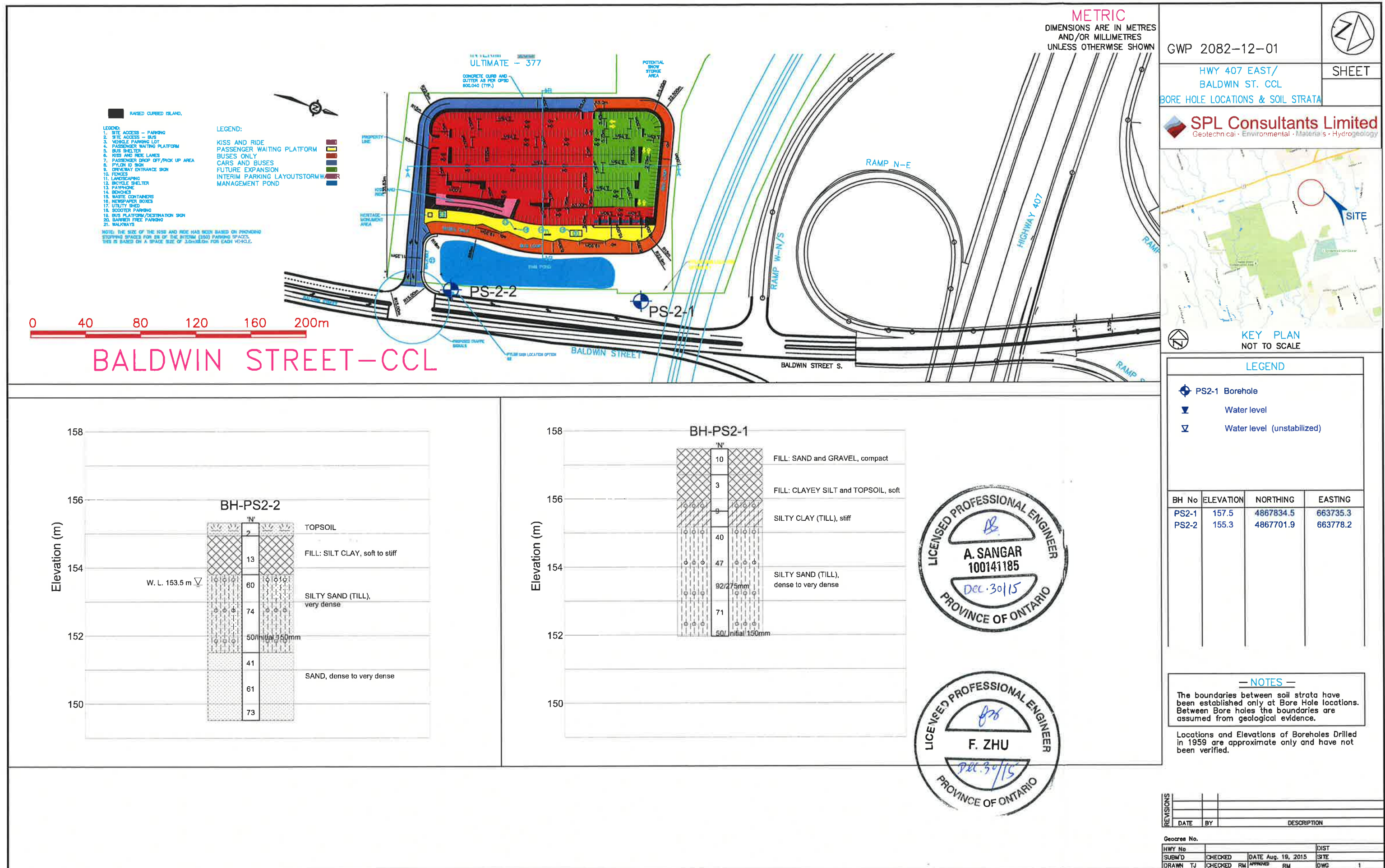

Vasantha Wijeyakulasuriya, M.Eng., P. Eng.
Senior Foundation Engineer, Principal



Fanyu Zhu, Ph.D., P.Eng. (MTO Designated Foundation Engineer)

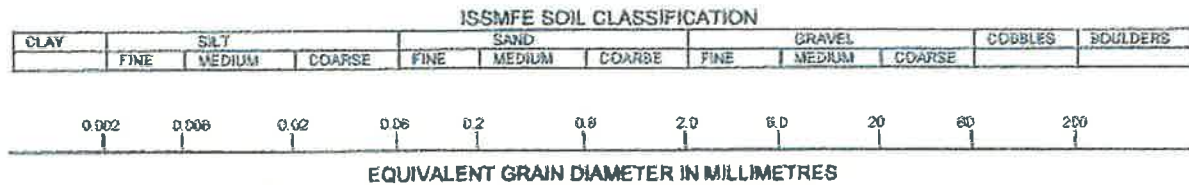


Drawings



Drawing 1A: Notes On Sample Descriptions

1. All sample descriptions included in this report generally follow the Unified Soil Classification. Laboratory grain size analyses provided by SPL also follow the same system. Different classification systems may be used by others, such as the system by the International Society for Soil Mechanics and Foundation Engineering (ISSMFE). Please note that, with the exception of those samples where a grain size analysis and/or Atterberg Limits testing have been made, all samples are classified visually. Visual classification is not sufficiently accurate to provide exact grain sizing or precise differentiation between size classification systems.



| | | | | | |
|-------------------|------|--------|------|--------|--------|
| CLAY (PLASTIC) TO | FINE | MEDIUM | CRS. | FINE | COARSE |
| SILT (NONPLASTIC) | SAND | | | GRAVEL | |

UNIFIED SOIL CLASSIFICATION

2. **Fill:** Where fill is designated on the borehole log it is defined as indicated by the sample recovered during the boring process. The reader is cautioned that fills are heterogeneous in nature and variable in density or degree of compaction. The borehole description may therefore not be applicable as a general description of site fill materials. All fills should be expected to contain obstruction such as wood, large concrete pieces or subsurface basements, floors, tanks, etc., none of these may have been encountered in the boreholes. Since boreholes cannot accurately define the contents of the fill, test pits are recommended to provide supplementary information. Despite the use of test pits, the heterogeneous nature of fill will leave some ambiguity as to the exact composition of the fill. Most fills contain pockets, seams, or layers of organically contaminated soil. This organic material can result in the generation of methane gas and/or significant ongoing and future settlements. Fill at this site may have been monitored for the presence of methane gas and, if so, the results are given on the borehole logs. The monitoring process does not indicate the volume of gas that can be potentially generated nor does it pinpoint the source of the gas. These readings are to advise of the presence of gas only, and a detailed study is recommended for sites where any explosive gas/methane is detected. Some fill material may be contaminated by toxic/hazardous waste that renders it unacceptable for deposition in any but designated land fill sites; unless specifically stated the fill on this site has not been tested for contaminants that may be considered toxic or hazardous. This testing and a potential hazard study can be undertaken if requested. In most residential/commercial areas undergoing reconstruction, buried oil tanks are common and are generally not detected in a conventional preliminary geotechnical site investigation.
3. **Till:** The term till on the borehole logs indicates that the material originates from a geological process associated with glaciation. Because of this geological process the till must be considered heterogeneous in composition and as such may contain pockets and/or seams of material such as sand, gravel, silt or clay. Till often contains cobbles (60 to 200 mm) or boulders (over 200 mm). Contractors may therefore encounter cobbles and boulders during excavation, even if they are not indicated by the borings. It should be appreciated that normal sampling equipment cannot differentiate the size or type of any obstruction. Because of the horizontal and vertical variability of till, the sample description may be applicable to a very limited zone; caution is therefore essential when dealing with sensitive excavations or dewatering programs in till materials.

Appendix A: Borehole Logs

PROJECT: Geotechnical Investigation of Highway 407 CCL
 CLIENT: Ainley GROUP
 PROJECT LOCATION: Baldwin Street, Whitby
 DATUM: Geodetic
 BH LOCATION: Baldwin CCL N 4867834.5 E 663735.3

DRILLING DATA

Method: Solid Stem Auger

Diameter: 115mm

Date: Mar/17/2015 to Mar/17/2015

REF. NO.: 10001315

ENCL. NO.: 3

| SOIL PROFILE | | | SAMPLES | | | GROUND WATER CONDITIONS | ELEVATION | DYNAMIC CONE PENETRATION RESISTANCE PLOT | | PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT | | | POCKET PEN (C _u) (kPa) | NATURAL UNIT WT (kN/m ³) | REMARKS AND GRAIN SIZE DISTRIBUTION (%) |
|--------------|-------------|-------------|---------|----------------------|-----------------|-------------------------|-----------|--|-----------------|---|-------------------|----------|------------------------------------|--------------------------------------|---|
| (m) | DESCRIPTION | STRATA PLOT | NUMBER | TYPE | "N" BLOWS 0.3 m | | | 20 40 60 80 100 | 20 40 60 80 100 | W _p W W _L | WATER CONTENT (%) | 10 20 30 | | | |
| 157.5 | 0.0 | | 1 | SS | 10 | | 157 | | | | | | | | wet spoon |
| 156.7 | 0.8 | | 2 | SS | 3 | | 156 | | | | | | | | |
| 155.9 | 1.5 | 3 | SS | 9 | 155 | | | | | | | | | | |
| 155.2 | 2.3 | 4 | SS | 40 | 154 | | | | | | | | | | |
| | | 5 | SS | 47 | 153 | | | | | | | | | | |
| | | 6 | SS | 92/ 275mm | | | | | | | | | | | |
| | | 7 | SS | 71 | | | | | | | | | | | |
| 152.0 | 5.5 | 8 | SS | 50/ Initial 150mm | | | | | | | | | | | |
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GROUNDWATER ELEVATIONS

Measurement 1st 2nd 3rd 4th

GRAPH NOTES

+ 3, X 3: Numbers refer to Sensitivity






○ ε=3% Strain at Failure

PROJECT: Geotechnical Investigation of Highway 407 CCL
 CLIENT: Ainley GROUP
 PROJECT LOCATION: Baldwin Street, Whitby
 DATUM: Geodetic
 BH LOCATION: Baldwin CCL N 4867701.9 E 663778.2

DRILLING DATA

Method: Solid Stem Auger
 Diameter: 115mm
 Date: Mar/17/2015 to Mar/17/2015

REF. NO.: 10001315
 ENCL. NO.: 4

| SOIL PROFILE | | | SAMPLES | | | GROUND WATER CONDITIONS | ELEVATION | DYNAMIC CONE PENETRATION RESISTANCE PLOT | | | PLASTIC LIMIT W _p | NATURAL MOISTURE CONTENT W | LIQUID LIMIT W _L | POCKET PEN (C _u) (kPa) | NATURAL UNIT WT (kN/m ³) | REMARKS AND GRAIN SIZE DISTRIBUTION (%) | | | |
|---------------|--|---|---------|------|------------------------|---|-----------|---|----|----|------------------------------------|-------------------------------------|-----------------------------------|---------------------------------------|---|---|-------------------|----|-----|
| (m) | DESCRIPTION | STRATA PLOT | NUMBER | TYPE | "N" BLOWS 0.3 m | | | SHEAR STRENGTH (kPa) | | | | | | | | | WATER CONTENT (%) | | |
| ELEV DEPTH | | | | | | | | 20 | 40 | 60 | | | | | | | | 80 | 100 |
| 155.3 | | | | | | | | | | | | | | | | | | | |
| 0.0 | TOPSOIL: 380mm |  | 1 | SS | 2 |  | 155 | | | | | | | | 73 | | | | |
| 154.9 | | | | | | | | | | | | | | | | | | | |
| 0.4 | FILL: silty clay, trace topsoil, some sand to sandy, trace gravel, brown, moist, soft to stiff. |  | 2 | SS | 13 | | | | | | | | | | | | | | |
| 1 | | | | | | | | | | | | | | | | | | | |
| 153.8 | | | | | | | | 154 | | | | | | | | | | | |
| 1.5 | SILTY SAND (TILL): trace to some clay, some gravel, brown, moist, very dense. |  | 3 | SS | 60 | | | | | | | | | | | | | | |
| 2 | | | | | | | | | | | | | | | | | | | |
| 3 | | | 4 | SS | 74 | | | | | | | | | | | | | | |
| 4 | | | | | | | | | | | | | | | | | | | |
| 151.5 | | | 5 | SS | 50/ Initial 50mm | | 152 | | | | | | | | | | | | |
| 3.8 | SAND: some silt, trace clay, grey, wet, dense to very dense. |  | 6 | SS | 41 | | | | | | | | | | | | | | |
| 5 | | | | | | | | | | | | | | | | | | | |
| 149.5 | | | 7 | SS | 61 | | | | | | | | | | | | | | |
| 5.8 | END OF THE BOREHOLE | | | | | | | | | | | | | | | | | | |
| | Note: 1) Borehole caved at 3.7m and water at 1.8m below ground surface upon completion. | | | | | | | | | | | | | | | | | | |

SPL SOIL LOG BALDWIN STREET AUGUST 18, 2015 CPJ SPL GDT 26/8/15

GROUNDWATER ELEVATIONS

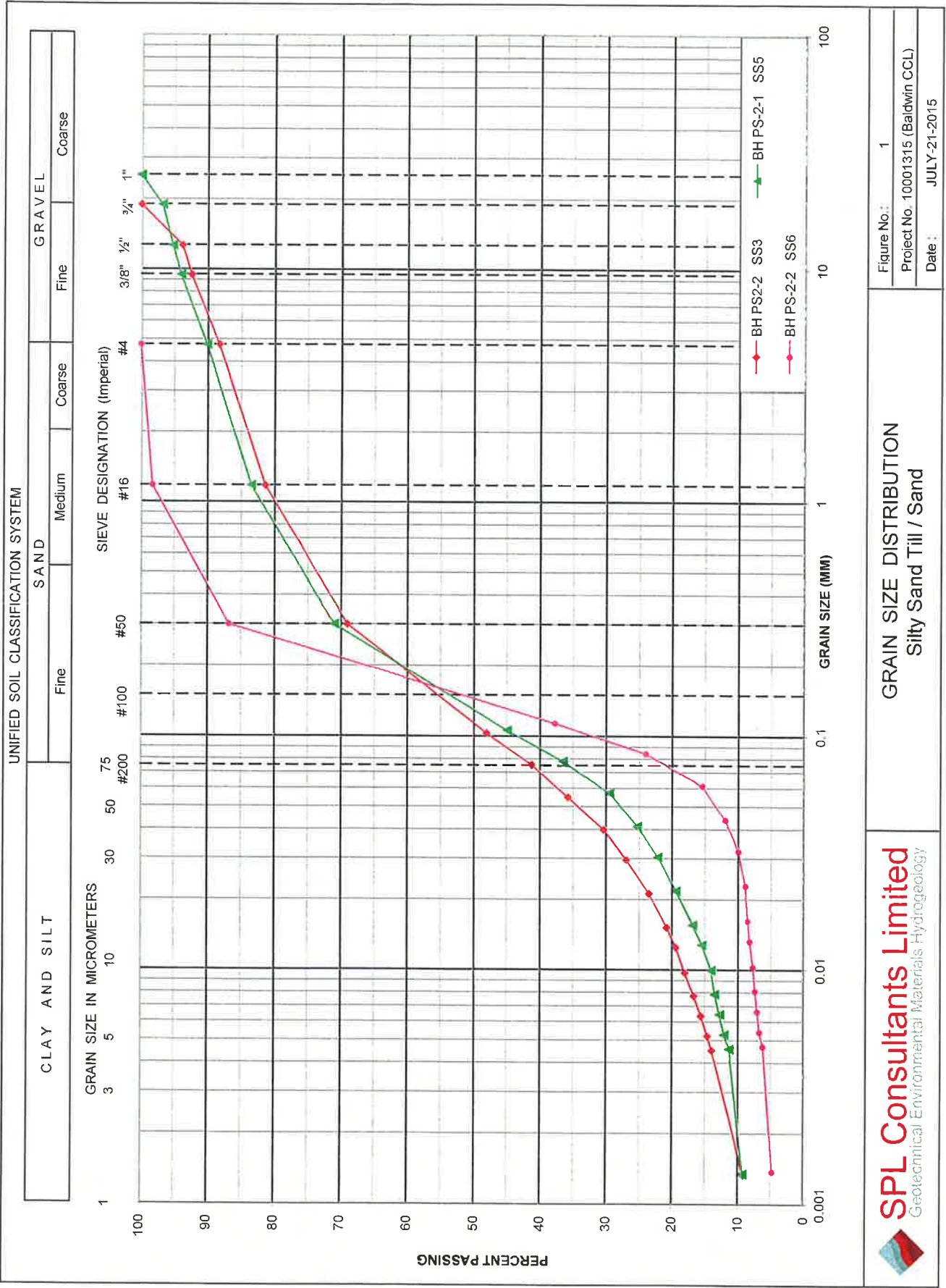
Measurement 1st 2nd 3rd 4th

GRAPH NOTES

+ 3, X 3: Numbers refer to Sensitivity

○ ε=3% Strain at Failure

Appendix B: Gradation Curves



Appendix C: SITE PHOTOGRAPHS

Photo 1: Near Borehole PS2-1 Looking South-East



Photo 2: Near Borehole PS2-2 Looking South-East



Appendix D: Limitations of Report

LIMITATIONS OF REPORT

This report is intended solely for the Client named. The material in it reflects our best judgment in light of the information available to SPL Consultants Limited at the time of preparation. Unless otherwise agreed in writing by SPL Consultants Limited, it shall not be used to express or imply warranty as to the fitness of the property for a particular purpose. No portion of this report may be used as a separate entity, it is written to be read in its entirety.

The conclusions and recommendations given in this report are based on information determined at the test hole locations. The information contained herein in no way reflects on the environment aspects of the project, unless otherwise stated. Subsurface and groundwater conditions between and beyond the test holes may differ from those encountered at the test hole locations, and conditions may become apparent during construction, which could not be detected or anticipated at the time of the site investigation. The benchmark and elevations used in this report are primarily to establish relative elevation differences between the test hole locations and should not be used for other purposes, such as grading, excavating, planning, development, etc.

The design recommendations given in this report are applicable only to the project described in the text and then only if constructed substantially in accordance with the details stated in this report.

The comments made in this report on potential construction problems and possible methods are intended only for the guidance of the designer. The number of test holes may not be sufficient to determine all the factors that may affect construction methods and costs. For example, the thickness of surficial topsoil or fill layers may vary markedly and unpredictably. The contractors bidding on this project or undertaking the construction should, therefore, make their own interpretation of the factual information presented and draw their own conclusions as to how the subsurface conditions may affect their work. This work has been undertaken in accordance with normally accepted geotechnical engineering practices.

Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. SPL Consultants Limited accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

We accept no responsibility for any decisions made or actions taken as a result of this report unless we are specifically advised of and participate in such action, in which case our responsibility will be as agreed to at that time.

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**SPL Project No.: 10001315
December 30, 2015**

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| 6. CLOSURE | 10 |

APPENDIX D: LIMITATIONS OF REPORT

**FOUNDATION DESIGN REPORT
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W.P. 2081-12-01**

5. DISCUSSION AND RECOMMENDATIONS

5.1 GENERAL

SPL Consultants Limited (SPL) was retained by Ainley Group to undertake a foundation investigation for the proposed pylon signs for Commuter Carpool Lot (CCL) at Highway 407 East and Baldwin Street in the Town of Whitby, Ontario.

It is understood that a GO Transit pylon sign will be installed on the proposed Commuter Carpool Lot (CCL) located in the southwest quadrant of the intersection of Baldwin Street and the future Highway 407 East Phase 1 Interchange. At the time of investigation, the location of the pylon sign has not been finalized and therefore two locations (Pylon Sign 1 and an alternative Pylon Sign 2) were investigated.

Two boreholes (PS2-1 and PS2-2) were drilled at the site (see Drawing 1 for locations), indicating that the site at the borehole locations is underlain by a veneer of topsoil and fill to a depth of 1.5m. A silty sand till/sand deposit was observed, extending to the explored depths 5.5m and 5.8m respectively. The silty sand till/sand was found to be dense to very dense based on SPT N values recorded.

Groundwater was observed in both boreholes (PS2-1 and PS2-2) on completion at a depth of 1.8m below ground surface. Wet spoon conditions were also observed in both boreholes, and the details are given on the Record of Borehole Sheet (borehole logs).

The frost depth applicable to the subject site is 1.3m.

Based on the boreholes information, foundation comments and recommendations for the proposed pylon signs at the site are presented as follows.

5.2 FOUNDATION DESIGN CONSIDERATIONS

5.2.1 PYLON STRUCTURES

The subsurface conditions encountered at the site are considered suitable for the construction of the overhead sign structures using the conventional deep foundation techniques.

Generally, each post will be supported on a single caisson (i.e. drilled and cast-in-place concrete pile) foundation. The required depth of the caissons will vary depending on the design loads, especially horizontal loads, and the subsurface conditions encountered at each location.

5.2.2 LATERAL CAPACITY OF PILES

Lateral resistance (capacity) of the ground is conventionally calculated using Brom's theory. Input to these calculations are undrained shear strength for cohesive (clayey) soils and unit weight and passive earth pressure coefficient for cohesionless (sandy) soils. A geotechnical resistance factor of 0.5 should be applied to the calculated capacities in accordance with CFEM (2006). Passive resistance within the frost depth should be neglected except for the weight of the soil. These input parameters are given for each borehole on a soil type basis in Table 1.

The lateral capacity design can be carried out in accordance with the method described by Broms, as detailed in the following papers.

- BROMS, B.B.: Lateral Resistance of Piles in Cohesive Soils, Journal of the Soil Mechanics and Foundation Division, ASCE, Vol. 90, No. SM2, Paper No. 3825, 1964.
- BROMS, B.B.: Lateral Resistance of Piles in Cohesionless Soils, Journal of the Soil Mechanics and Foundation Division, ASCE, Vol. 90, No. SM3, Paper No. 3909, 1964.

5.2.3 LATERAL PILE DISPLACEMENTS

Lateral pile/caisson displacements are generally calculated using subgrade modulus concept (CHBDC S6-06 C6 8.7.1, Terzaghi (1955), Davisson (1970)). Where the pile is primarily cohesive, the coefficient of horizontal subgrade reaction can be estimated from: $K_s = 67S_u/d$; K_s = coefficient of horizontal subgrade reaction, S_u = undrained shear strength as given in Table 1, and d = pile dia. or pile width. In cohesionless soils, the coefficient of horizontal subgrade reaction can be estimated from: $K_s = n_h z/d$ where n_h is a coefficient related to soil density as given in Table 1 and d as defined before.

The lateral pile deflection estimates can be carried out in accordance with the method described by Broms, as detailed in the following paper.

- BROMS, B.B.: Design of Laterally Loaded Piles, Journal of the Soil Mechanics and Foundation Division, ASCE, Vol. 91, No. SM3, 1965.

5.2.4 AXIAL CAPACITY

Axial capacity: As these structures are not subjected to impose vertical loads as in bridges or buildings, the axial capacity does not govern their designs. Subject to minimum fixity requirements, the factored ULS within the silty clay till or end bearing/within the silty sand till can be taken as 225kPa and the SLS of 150kPa can be considered. Higher capacities are available but are not considered to be required.

Based on the boreholes information, the soil parameters at each borehole location are given in Table 1. The following notation has been adopted:

ϕ = friction angle of cohesionless soils in degrees.

S_u = undrained shear strength of cohesive soils, in kPa

γ = bulk unit weight in kN/m³.

Table 1: Soil Parameters

| BH No. | Elevation (m) | Type of Material | Consistency or Compactness Condition | S_u (kPa) | ϕ (deg.) | γ (kN/m ³) | η_h (MN/m ³) | Anticipated water Level Depth/Elev. |
|--------|----------------|------------------|--------------------------------------|-------------|---------------|-------------------------------|-------------------------------|-------------------------------------|
| PS2-1 | 157.5 to 156.7 | Fill | Loose | 0 | 25 | 18.0 | - | 1.8/155.7* |
| | 156.7 to 155.9 | Fill | Very soft | 20 | 0 | 16.0 | - | |
| | 155.9 to 155.2 | Silty clay till | Stiff | 60 | 0 | 18.0 | - | |
| | 155.2 to 153.7 | Silty sand till | Dense | 0 | 34 | 21.0 | 7.5 | |
| | 153.7 to 152.0 | Silty sand till | Very dense | 0 | 36 | 22.0 | 11.0 | |
| PS2-2 | 154.9 to 153.8 | Fill | Stiff ¹ | 50 | 0 | 18.0 | - | 1.8/153.5* |
| | 153.8 to 151.5 | Silty sand till | Very dense | 0 | 36 | 21.0 | 11.0 | |
| | 151.5 to 149.5 | Sand | Dense to v. dense | 0 | 35 | 22.0 | 9.0 | |

*short-term (unstabilized) water levels

¹Irrespective of nature of fill, it is considered to be of soft/compact consistency/state due to high moisture/frozen ground at time of drilling and potential for variability.

The contribution to lateral resistance of the soil within the frost depth (i.e. 1.3 m below the final grade) should not be included in the calculations, except of course, for the weight of the soil.

5.3 COMMENTS ON CONSTRUCTION

All excavations should be carried out in accordance with the Occupational Health and Safety Act (OHSA), Regulation 213/91, as well as the following specifications:

OPSS 539 – Protection Systems

OPSS 902 – Excavation and Backfilling to Structures

The following soil classifications can be expected for temporary excavations in accordance with OHSA.

| | | |
|-----------------------|---|--|
| Fill | : | Type 3 Soil above groundwater level and Type 4 Soil below groundwater level. |
| Stiff Silty Clay till | : | Type 3 Soil below ground water table |
| Silty Sand Till | : | Type 2 Soil above water table and Type 4 Soil below the water table |

The borehole indicated the presence of fill above the native deposits. This fill material is considered unsuitable as a bearing material.

Large obstructions such as buried concrete pieces, can be anticipated in the fill material. Provisions must be made in the excavation contract for the removal of potential obstructions in the fill material. In addition, being of glacial origin, the tills can be expected to contain random cobbles and boulders, as occasionally encountered in boreholes during drilling. The contractor should be made aware that the presence of cobbles and boulders in the tills can always be expected which can cause problems during the installation of the caissons.

The fill and the till deposits should not yield significant amounts of water in the short term in caisson holes. It is expected the water seepage entering the caisson holes can be removed by conventional pumping. However, the concrete should be poured expeditiously on completion of the caisson hole, without undue delay.

Temporary liners should be anticipated to prevent caving of fill material and sandy soils during the shaft excavation. If lateral capacities can be met for pile lengths above the caving depths, then special construction techniques may not be warranted within the till. If deeper caisson depths extending into the caving zones are compelled to be used, then techniques such as use of temporary liners are likely to be required for hole stability.

Field inspection and confirmation of bearing stratum will be required during the construction.

6. CLOSURE

We recommend that once the details of the project are finalized, our recommendations be reviewed for their specific applicability.

The Limitations of Report, as quoted in Appendix D, are an integral part of this report.


We trust that the information contained in this report is satisfactory. Should you have any questions, please do not hesitate to contact this office.

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Appendix D: Limitations of Report

LIMITATIONS OF REPORT

This report is intended solely for the Client named. The material in it reflects our best judgment in light of the information available to SPL Consultants Limited at the time of preparation. Unless otherwise agreed in writing by SPL Consultants Limited, it shall not be used to express or imply warranty as to the fitness of the property for a particular purpose. No portion of this report may be used as a separate entity, it is written to be read in its entirety.

The conclusions and recommendations given in this report are based on information determined at the test hole locations. The information contained herein in no way reflects on the environment aspects of the project, unless otherwise stated. Subsurface and groundwater conditions between and beyond the test holes may differ from those encountered at the test hole locations, and conditions may become apparent during construction, which could not be detected or anticipated at the time of the site investigation. The benchmark and elevations used in this report are primarily to establish relative elevation differences between the test hole locations and should not be used for other purposes, such as grading, excavating, planning, development, etc.

The design recommendations given in this report are applicable only to the project described in the text and then only if constructed substantially in accordance with the details stated in this report.

The comments made in this report on potential construction problems and possible methods are intended only for the guidance of the designer. The number of test holes may not be sufficient to determine all the factors that may affect construction methods and costs. For example, the thickness of surficial topsoil or fill layers may vary markedly and unpredictably. The contractors bidding on this project or undertaking the construction should, therefore, make their own interpretation of the factual information presented and draw their own conclusions as to how the subsurface conditions may affect their work. This work has been undertaken in accordance with normally accepted geotechnical engineering practices.

Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. SPL Consultants Limited accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

We accept no responsibility for any decisions made or actions taken as a result of this report unless we are specifically advised of and participate in such action, in which case our responsibility will be as agreed to at that time.