

DOCUMENT MICROFILMING IDENTIFICATION

GEOCRES No. 30M13-108A

DIST. 6 REGION                     

W.P. No. 141-87-00 (P)

CONT. No. 92-40

W. O. No.                     

STR. SITE No.                     

HWY. No. 407

LOCATION Hwy 407; Humber River to  
Pine Valley Dr. (H.M.L)

No of PAGES -                     

=====

OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT.                     

REMARKS:



Ministry  
of  
Transportation

---

## **FOUNDATION DESIGN SECTION**

**foundation  
investigation and  
design report**

ENGINEERING MATERIALS OFFICE  
FOUNDATION DESIGN SECTION

*CONT. 92-40*

WP 141-87-00P DIST 6

HWY 407 STR SITE N/A

High Mast Lighting Footings  
Highway 407, Humber River to Pine Valley Drive

DISTRIBUTION

V.F. Boehnke (3)  
G. Cautillo  
J. Cullen (2)  
A. Wittenberg  
K.G. Bassi  
S.J. Dunham  
E.A. Joseph  
B. Steeves (Cover Only)  
I. Bullen (Cover Only)  
File (2)

FOUNDATION INVESTIGATION REPORT  
For  
High Mast Lighting Footings  
Highway 407, Humber River to Pine Valley Drive  
W.P. 141-87-00P  
District 6, Toronto

INTRODUCTION

This report summarizes the results of a foundation investigation conducted at the aforementioned site. A total of six (6) high mast lighting pole footings are proposed within the boundary limits. Four (4) footings are proposed in excavation cut sections whilst two (2) footings are proposed in fill sections. Factual data to facilitate the design and construction of the high mast lighting foundations are included in this report.

SITE DESCRIPTION AND GEOLOGY

The site spans the area bounded by the Humber River to the west and the existing Pine Valley Drive to the east along the proposed Hwy. 407 alignment. Two railroads are located within the general site area. The CPR railroad tracks intersect the proposed highway between the Humber River and Islington Avenue and the existing CNR railroad tracks parallel the proposed highway approximately 0.5 km south of the highway right-of-way. A residential subdivision bounds the site location at Islington Avenue and eastwardly to Pine Valley Drive. In addition, hydro transmission towers intersect the site approximately at mid-distance between Islington Avenue and Pine Valley Drive. The existing hydro corridor continues parallel to the proposed Hwy. 407 right-of-way beyond the line of intersection, located north and south of the proposed highway, west and east of the line of intersection respectively.

Land use at the site is primarily agricultural and residential. Agricultural farmland comprises the sector of land between Islington Avenue and Pine Valley Drive. The land west of Islington Avenue is composed of a river valley approximately 20 m in depth with a crest width of approximately 200 m. The valley houses the Jersey Creek, a meandering creek that is approximately 2 m wide and a tributary of the Humber River. Aside from the embankment supported CPR railroad, this area is not developed and consists of trees, brush, tall grasses and shrubs.

Physiographically, the site is located in the geological domain known as the Bolton Area. At the site, deltaic and glaciolacustrine sands and silts, the products of Lake Peel (Karrow 1963), a body of water confined between a lobe of glacial ice projecting up the Humber Valley and the surrounding higher elevation grounds, overly a glaciolacustrine Wildfield Till complex consisting of stratified silty clays, clayey silts and silt nodules which are also depositions of Lake Peel. These deposits levelled out the former gently undulating surface of ground moraine, known as the "Peel Plain" (Putnam and Chapman, 1936).

The Bolton area features overburden deposited during the Wisconsin glacialiation of the Pleistocene era. The overburden is underlain by shale bedrock of the Dundas-Meaford formation. Water well records indicate that the bedrock is found at depths ranging from 40 to 60 m.

#### INVESTIGATION PROCEDURE

Soil data and inherent properties were obtained by in situ and laboratory testing derived from investigations executed for the Hwy. 407-Humber River crossing (W.P. 88-78-15), the Hwy. 407/CPR subway (W.P. 88-78-16), the Hwy. 407-Islington Avenue Underpass (W.P. 88-78-18) and the Hwy. 407 excavation cuts between Islington Avenue and Pine Valley Drive (W.P. 141-87-00A). Details of the investigation methods and procedures can be obtained by referring to these reports. Due to property procurement difficulty in the area bounded by Islington Avenue and the CPR railroad embankment, subsurface investigation has not been conducted within this location at the time of this report. Consequently, high mast foundation soil parameters for poles in this section (P6) were obtained by extrapolation of existing information from adjacent sites, namely W.P. 88-78-16.

#### SUBSURFACE CONDITIONS

Due to the variable nature of the soil stratigraphy and surface topography across the site of the proposed high mast lighting poles, the description of the subsurface conditions, including the groundwater conditions, have been hereby divided into three subsections.

- 1) Pine Valley Drive to Islington Avenue (P6, P9, P10)
- 2) CPR/Hwy. 407 Subway (P5)
- 3) Floodplain Area West of CPR (P3 and P4)

A plan of the overall site illustrating the locations of the boreholes advanced within each subsection and the locations of the proposed high mast poles is attached on Dwg. 1418700P-1 in the Appendix. The boundaries between the various soil types, in situ and laboratory test results as well as groundwater levels established at the time of investigation have been summarized on the individual Record of Borehole sheets also attached in the Appendix.

A detailed description of the subsurface conditions for each subsection is given below.

#### AREA 1 - Pine Valley Drive to Islington Avenue

The soil stratigraphy within this area consists of a surficial veneer of topsoil, brown in colour and of thickness equivalent to approximately 0.7 m. The topsoil is underlain by a cohesionless brown sand that contains traces/some silt and traces/some gravel. This deposit has a thickness ranging from 0.7 m to 2.9 m and generally has a compact denseness. A cohesionless deposit of non plastic, brown silt underlies the sand deposit and extends for a relatively shallow thickness ranging from 0.3 m to 1.6 m. Thicknesses of the sands and silts generally decline in an easterly direction across the site. The non-plastic silt is underlain by a glacio-lacustrine deposit consisting of a cohesive, grey clayey silt to silty clay containing interbedded layers and random nodules of silt within the soil matrix. The stratum can be categorized as having a stiff consistency and ranges in thickness from 2.6 m to 4.8 m.

The glaciolacustrine stratum is underlain by a cohesive unstratified glacial till deposit consisting of a clayey silt host material with traces/some sand and traces of gravel. The extent of this deposit was not fully explored across the entire site. For the area bounded by BH's 8 and BH's 7 (Sta. 15+975 to 15+500), the deposit was penetrated up to a maximum thickness of 11.1 m. At BH's 9 and BH 10, the thickness of the deposit is in the order of 5 to 6 m and is underlain

by a cohesionless deposit of sand to silty sand. The extent of the underlying cohesionless deposit was not determined during the investigation.

#### Topsoil

A thin veneer of topsoil that is brown in colour, moist, and contains a rich, earthy odour is spread across the site. The thickness of this veneer is approximately 0.8 m.

#### Sand, trace Silt, trace/some Gravel

The surficial topsoil is underlain by a brown, cohesionless sand that contains traces of silt and traces/some gravel. A grain size distribution envelope for this deposit as determined by mechanical sieve analysis is provided in Figure 1 in the Appendix. The thickness of this native deposit varies from 0.7 m to 2.9 m extending to elevations ranging from El. 159.4 m to 156.4 m. The thickness decreases in an easterly direction and is typically in the 0.7 to 0.9 m range east of BH 8.

This cohesionless deposit was partially submerged below the groundwater table at the time of investigation and soil cave was witnessed in the open borehole. Natural moisture contents determined in the laboratory range from 6.5 to 15.5%.

Standard Penetration Tests carried out in this deposit revealed 'N' values ranging from 6 blows/0.3 m to 28 blows/0.3 m indicating that the deposit ranges in denseness from loose to compact. In general, the deposit can be categorized as compact.

#### Silt

The cohesionless sand deposit is underlain by a thin stratum of plastic silt ranging in thickness from 0.3 m to 1.6 m and found to extend to elevations ranging from 154.7 m to 158.4 m. The stratum is generally brown in colour although the stratum has been oxidized to grey at some locations.

The plasticity of the silt was confirmed by performing Atterberg Limit tests and the results are tabulated in Table 1 below and illustrated in Figure 2 in the Appendix. Natural moisture contents determined in the laboratory are also summarized in Table 1 and reveal values ranging from 21 to 22%.

Table 1 - Silt

	<u>Range</u>	<u># of Tests</u>
Natural Moisture Content(w%)	21-22	5
Liquid Limit (w <sub>L</sub> %)	19-21	3
Plasticity Index (IP)	3-4.5	3

The silt stratum was submerged beneath the groundwater table at the time of the investigation and soil sloughing in the open borehole is expected to have developed concurrent with the overlying sand deposit.

Standard Penetration tests carried out in this deposit revealed 'N' values ranging from 9 blows/0.3 m to 47 blows/0.3 m indicating a range of denseness of loose to dense. In general, 'N' values were in the 15 blows/0.3 m to 25 blows/0.3 m which is equivalent to a compact denseness.

Clayey Silt to Silty Clay with random nodules/seams of Silt

Underlying the cohesionless silt deposit, a layer of clayey silt to silty clay with random nodules or zones and interbedded seams of silt exists. The surface of this stratum is at an elevation ranging from 158.4 m to 154.7 m and extends to an elevation ranging from 154.1 to 151.7 m. The thickness of the stratum varies from 2.6 m to 4.8 m. The stratum is grey in colour with the silt nodules and seams present at a lighter grey hue.

Atterberg Limit tests were carried out to define the behaviour and plasticity of the soil and the results are plotted in Figure 3. A summary of the indices is provided in Table 2. Unit Weights are also included.



Table 2 - Clayey Silt to Silty Clay

	<u>Range</u>	<u># of Tests</u>
Natural Moisture Content(w%)	20-34	14
Liquid Limit (w <sub>L</sub> %)	23-46.5	12
Plasticity Index (I <sub>p</sub> )	9.5-28.5	12
Unit Weight (kN/m <sup>3</sup> )	17.5-22.6	7
Undrained Shear Strength (c <sub>u</sub> ) (kPa)		
- Field Vane	30->120	10
Sensitivity	2-4	10
SPT 'N' values (blows/0.3 m)	5-24	24

The test results reveal that the deposit varies randomly in plasticity ranging from low (clayey silt) to intermediate (silty clay). Natural moisture contents range from 20-34% but are generally in the 20-25% range.

Undrained shear strength measurements (c<sub>u</sub>) of the soil were obtained by conducting in situ vane tests. Results are plotted on the Record of Borehole sheets in the Appendix and summarized in Table 2 above. The results reveal undrained shear strength values ranging from 30->120 and hence the soil can be classified as having a consistency ranging from firm to very stiff. In general, the soil can be categorized as stiff.

The sensitivity of the soil as defined by the ratio of the undrained strength in the undisturbed state to the undrained strength, at the same water content, in the remoulded state was also determined by the field vane tests and the results are tabulated in Table 2 and identified on the Record of Borehole sheets. Sensitivity values range from 2 to 4 indicating that the soil has a low sensitivity.

Standard Penetration tests carried out in this stratum revealed 'N' values ranging from 5 blows/0.3 m to 24 blows/0.3 m as tabulated in Table 2. The range of values confirms the firm to very stiff categorization determined from the in situ vane test.

Clayey Silt, trace/some Sand, trace Gravel (Glacial Till)

The clayey silt to silty clay stratum is underlain by a glacial till deposit consisting of a clayey silt host material combined with varying percentages (trace to some) of sand and traces of gravel. The extent of the deposit was not determined throughout the site area. For the area bounded by BH's 8 and 7, the deposit was explored to a maximum thickness of 11.1 m. At BH's 9 and 10, the thickness of the deposit is in the order of 5 to 6 m.

A grain size distribution envelope for this deposit as determined by mechanical sieve and hydrometer analysis is given in Figure 4 in the Appendix. The envelope illustrates that clay and silt percentages in the deposit range from 26-41% and 58-65% respectively. The envelope also depicts percentages of sand up to 32% also comprise the deposit.

Atterberg Limit tests were carried out to define the behaviour and plasticity of the fine grained portion of the soil and the results are plotted in Figure 5 in the Appendix. A summary of the indices is provided in Table 3 below. Unit weights are also included.

Table 3 - Clayey Silt Till

	<u>Range</u>	<u># of Tests</u>
Natural Moisture Content(w%)	15-25	8
Liquid Limit ( $w_L$ %)	19-34	8
Plasticity Index (IP)	7-15	8
Unit Weight ( $kN/m^3$ )	18.3-20.8	6
Undrained Shear Strength (cu) (kPa)		
- Field Vane	30->120	32
Sensitivity	2-4	32
SPT 'N' values (blows/0.3 m)	3-29	(see BH logs)

The test results reveal that the fine grained portion of the deposit is predominantly of low plasticity and hence can be classified as clayey silt.

Undrained shear strength measurements ( $c_u$ ) of the soil were obtained by conducting in situ vane tests. Results are plotted on the Record of Borehole sheets in the Appendix and summarized in Table 3 above. A shear strength ( $c_u$ ) vs. Elevation (m) profile is also provided in Figure 6 in the Appendix. Based on shear strength values ranging from 30-120 kPa, the consistency of the soil ranges from firm to very stiff. In consideration that the higher shear strength values determined may not be representative because of the presence of the sand and gravel components of the till, the deposit can be generally categorized as having a stiff consistency. As Figure 6 illustrates, however, the consistency does become stiffer with depth.

The sensitivity of the soil as defined by the ratio of the undrained strength in the undisturbed state to the undrained strength, at the same water content, in the remoulded state was also determined by the field vane test and the results are tabulated in Table 3 and identified in the Record of Borehole sheets. Sensitivity values range from 2 to 4 indicating that the soil has a low sensitivity.

Standard Penetration tests carried out in the stratum revealed 'N' values ranging from 3 blows/0.3 m to 29 blows/0.3 m. 'N' values generally increase with depth in the deposit indicating that the consistency of the soil becomes stiffer with depth.

#### Sand to Silty Sand

At BH's A-9 and A-10, the till deposit is underlain by a cohesionless sand to silty sand deposit. The deposit exists at an elevation ranging from 149.5 m to 148.7 m or depths of 10.7 to 11.4 m below the natural ground surface. The extent of this deposit was not determined during the investigation.

The fact that sloughing of the borehole occurred upon penetration into this deposit indicates that the deposit is under subartesian head. "Blow back" in the order of 2 to 3 m was observed when sampling through this material. A head of water was required to balance the unbalanced hydrostatic head so that penetration through this soil could be achieved.

Standard Penetration tests carried out in this deposit revealed 'N' values in the order of 5-6 blows/0.3 m indicating a loose material denseness.

#### Groundwater Conditions

Observation of the groundwater level was carried out by measuring the water level in the open boreholes and monitoring water levels in piezometers installed in the surficial sand and silt deposits. The piezometers were installed with the tips at an approximate elevation of 156 m with a bentonite seal of 0.3 m thickness below the piezometer tip and a bentonite seal at the surface of equal thickness. Pea gravel (10 mm) was used to fill the annular space between the piezometer and the borehole.

Measurements obtained from the aforementioned sources at the time of the investigation revealed water levels ranging from 2 to 2.5 m below the natural ground surface (Elevation 157.8 m to 158.8 m). At BH's A-7 and A-4, water levels could not be obtained because of the sloughing of the boreholes at depths of 1.5 m to 2.1 m respectively.

Groundwater levels, in general, are subject to seasonal fluctuations and hence can vary from the values given in this report.

#### AREA 2 - CPR/Hwy. 407 Subway

At the location of the proposed high mast lighting pole (P6), the stratigraphy consists of a surficial native deposit composed of a clayey silt to silty clay with occasional sand seams and traces of gravel. This stratum is a till deposit of glacial origin and extends to a thickness in the order of 12.5 m. The thickness of this deposit decreases down the existing natural valley slope and is not present at the valley floor.

Underlying the surficial deposit, exists a deposit of clayey silt that extends for a thickness in the order of 23 m.

The clayey silt deposit is in turn underlain by a cohesionless deposit of sand with a trace to some silt. Random zones of silt also exist in this deposit. Gravel, boulders and cobbles are also components of the lower depths of the deposit. The thickness of this deposit is in the order of 10 m. This cohesionless deposit overlies shale bedrock of the Georgian Bay shale formation.

#### Silty Clay to Clayey Silt (Glacial Till)

The native surficial deposit present at the site consists of a cohesive silty clay to clayey silt with traces of sand and gravel and occasional random interbedded sand seams. The thickness of the deposit explored in the investigation is in the order of 12.5 m and the interbedded sand seams are generally 50 to 100 mm in thickness. The deposit is generally oxidized (brown) for the upper 1.5 to 3.5 m and unoxidized (grey) for its lower thickness. The deposit is a till of glacial origin.

Atterberg Limit tests were carried out to define the behaviour and plasticity of the soil and the results are plotted in Figure 7. A summary of the indices is provided in Table 4.

Table 4 - Silty Clay to Clayey Silt

	<u>Range</u>	<u># of Tests</u>
Natural Moisture Content(w%)	15-29	14
Liquid Limit ( $w_L$ %)	22-47	14
Plasticity Index ( $I_p$ )	12-20	14
Unit Weight ( $kN/m^3$ )	18.8-20.3	9
Undrained Shear Strength (cu) (kPa)		
- Field Vane	35->120	28
- Laboratory*	41-82	4
Sensitivity	2-3	28
SPT 'N' values (blows/0.3 m)	2-15	(see BH logs)

\*Unconfined Compression Tests

\*Unconsolidated Undrained Tests

The test results reveal that the deposit varies randomly in plasticity ranging from low (clayey silt) to intermediate (silty clay).

Undrained shear strength measurements ( $c_u$ ) of the soil were obtained both by in situ vane tests and by laboratory tests, namely unconfined compression tests and unconsolidated undrained tests (quick triaxial). Results are plotted on the Record of Borehole sheets in the Appendix and summarized in Table 4. A Shear Strength vs. Elevation profile is also provided in Figure 8. Based on shear strength values ranging from 35-120 kPa, it is considered that the soil has a firm to very stiff consistency.

The sensitivity of the soil as defined by the ratio of the undrained strength in the undisturbed state to the undrained strength, at the same water content, in the remoulded state was also determined by the field vane test and the results are tabulated in Table 2 and identified on the Record of Borehole sheets. Sensitivity values range from 2 to 3 indicating that the soil has a low sensitivity.

Standard Penetration tests carried out in this deposit revealed 'N' values ranging from 2 blows/0.3 m to 15 blows/0.3 m.

#### Clayey Silt

Underlying the surficial native clayey silt to silty clay deposit at a depth approximately 13.5 m below the ground surface (Elevation 138 to 139 m) and extending for a thickness in the order of 12.5 m, exists a cohesive, grey deposit of clayey silt. This stratum also contains traces of sand and random zones of silt.

Atterberg Limit tests were carried out to evaluate the behaviour and plasticity of the soil and the results are plotted in Figure 9 and summarized in Table 5 below. Unit weights are also included.

Table 5

	<u>Range</u>	<u># of Tests</u>
Natural Moisture Content(w%)	14-35	13
Liquid Limit (w <sub>L</sub> %)	22-30	13
Plasticity Index (I <sub>p</sub> )	14-18	13
Unit Weight (kN/m <sup>3</sup> )	20-22	6

The test results reveal that the deposit is predominantly of low plasticity.

Standard Penetration tests carried out in this stratum revealed 'N' values ranging from 5 blows/0.3 m to 76 blows/0.3 m indicating that the deposit ranges in consistency from firm to hard. In general, in the upper 10 m or so, 'N' values ranged from 20 blows/0.3 m to 25 blows/0.3 m, indicating a very stiff consistency, but in the lower depths of the deposit, 'N' values ranged from 10 blows/0.3 m to 20 blows/0.3 m and the soil can be categorized as having a stiff consistency.

#### Sand, some Silt

Underlying the clayey silt deposit and extending to bedrock a cohesionless deposit of sand with some silt exists. The thickness of the deposit is approximately 10 m. Random zones of silt are also present within this deposit. In addition, gravel, boulders and cobbles exist as a heterogeneous mixture in the main deposit at the lower depths immediately above the bedrock. A grain size distribution envelope for this deposit is provided in Figure 10 in the Appendix.

This cohesionless deposit is water bearing and consequently, when the deposit was penetrated in the open borehole, soil cave-in resulted due to unbalanced hydrostatic head.

Standard Penetration tests carried out in this deposit revealed 'N' values ranging from 15 blows/0.3 m to 120 blows/0.2 m indicating that the deposit ranging in denseness from compact to very dense. In view of the fact that the lower 'N' values may be attributable to sampling disturbance induced by unbalanced hydrostatic head as mentioned above and the higher 'N' values not necessarily representing the state of denseness because of the large boulders and cobbles, the deposit can be generally categorized as dense.

### Bedrock

The cohesionless sand with some silt deposit is directly underlain by shale bedrock of the Georgian Bay shale formation. The bedrock surface is generally flat with surface elevations ranging from 105.9 m to 107.7 m. The bedrock was cored by NQ size up to 2.8 m in thickness.

The shale bedrock is grey in colour and is very fine grained and thinly laminated. The rock is generally slightly to moderately weathered and contains occasional clay seams, approximately 50 to 100 mm in thickness. Minor beds of argillaceous limestone are also present in the rock formation.

Core recoveries and Rock Quality Designations (RQD) were determined in situ and also in the laboratory to evaluate the competence and integrity of the rock. Rock recoveries varied between 60 and 100% while RQD's varied between 0 and 15%. The shale bedrock is weak to very weak rock.

### Groundwater Conditions

Observation of the groundwater level in the boreholes in the area of the proposed high mast lighting pole P6 was carried out by measuring the water level in the open boreholes. Measurements obtained at the time of the investigation revealed levels approximately 17 m below the existing ground surface. Hence, the groundwater table was at an elevation of 135 m. Groundwater levels, in general, are subject to seasonal fluctuations and hence can vary from the values given in this report.



### AREA 3 - Floodplain West of CPR

The subsoils encountered in the floodplain area consist of a surficial layer of topsoil and sandy silt to silty sand underlain at depths ranging from 1.2 m to 2.9 m by about 0.8 to 2 m of a waterbearing sand and gravel deposit.

The granular materials are underlain by about 3.3 to 10 m of a deposit consisting of interlayered to stratified clayey silt and silt. The frequency of the silt interlayers is extremely variable across the site. The undrained shear strength of the cohesive clayey silt was determined by conducting in situ vane tests and results ranged from about 42 kPa to greater than 90 kPa.

The layered clayey silt and silts are underlain at depths of about 8.5 m to 12 m by a cohesionless deposit varying in composition from silt to sand and silt. The thickness of this deposit ranges from 4.5 m to 6.5 m. Blow back of these fine granular materials occurred in the open borehole during the drilling and sampling process.

The sand and silt deposit is underlain at depths of about 11.4 m to 14.6 m by a hard/very dense till deposit which ranges in composition from clayey silt to sandy silt and contains a variable proportion of gravel. The silt content of this stratum increases with depth and the deposit grades to a silt containing trace sand and clay. 'N' values measured in this deposit were generally greater than 100 blows per 0.3 m of penetration.

The till deposit is underlain by a sand and gravel deposit present approximately 19.5 m to 20.5 m below ground surface (Elevation 115 m to 116 m). This deposit exists under an artesian water pressure equivalent to approximately 4.5 m above the ground surface.

### Surficial Sandy Silt to Silty Sand

Underlying approximately 0.3 m to 1.6 m of topsoil, a surficial deposit of sandy silt to silty sand exists. The deposit extends for a thickness ranging from 0.7 m to 1.8 m and based on 'N' values derived from the Standard Penetration Test ranging from 2 to 11 blows per 0.3 m of penetration, the deposit can be categorized as having a very loose to loose state of denseness.

### Upper Sand to Sand and Gravel

The surficial silts and sands are underlain by about 0.8 m to 2 m of a deposit which varies in composition from sand containing some gravel to sand and gravel. The deposit is generally in a very loose to compact state of denseness with 'N' values ranging from 3 to 22 blows per 0.3 m of penetration.

### Interlayered Clayey Silt and Silt

The granular deposits are underlain by about 3.3 m to 9.7 m of a deposit which consists primarily of a clayey silt. The upper 3.3 m to 6.5 m of the deposit exhibits little stratification and contains a variable proportion of coarse sand sizes with occasional fine gravel, giving this portion of the deposit a till-like texture. The lower 1.6 m to 5.6 m of the deposit contains silty clay and silt interlayers.

Laboratory testing was carried out to evaluate the behaviour of the fine-grained portion of the material and the results are tabulated in Table 6 below and illustrated in Figure 11 in the Appendix.

Table 6

	<u>Range</u>	<u># of Tests</u>
Natural Moisture Content (w%)	16-31	46
Liquid Limit (w <sub>L</sub> %)	24-37	8
Plasticity Index (I <sub>p</sub> %)	5-14	8

The results reveal that the deposit ranges from a low plasticity clayey silt to an intermediate plasticity silt clay with interbeds of plastic silt.

The measured consistency of the layered deposit is also variable across the site. Undrained shear strength values, determined by in situ vane tests range from 42 kPa to 103 kPa. 'N' values range from 4 to 24 blows per 0.3 m of penetration. Generally, the deposit can be categorized as stiff to very stiff.

Sensitivity values, also determined by the in situ vane test, range from 2 to 4 indicating that the soil is of low sensitivity.

#### Silt to Sand and Silt

The clayey silt stratum is underlain by 4.5 m to 6.5 m of a cohesionless deposit consisting of silt to sand and silt. Grain size distribution curves representative of this deposit is illustrated in Figure 12 in the Appendix. "Blow-Back" of this material occurred in the open borehole during the sampling process as a result of unbalanced hydrostatic head.

Measured 'N' values ranged from 1 to 20 blows per 0.3 m of penetration indicating that the deposit is in a very loose to compact state of denseness.

#### Clayey Silt/Silt, some Sand, trace of Gravel (Glacial Till)

The clayey silt and silt deposits are underlain at depths of about 11.4 m to 14.6 m by a complex sequence of hard clayey silt to very dense silt containing a variable proportion of sand and gravel. These till deposits are also interlayered with silt and clayey silt strata.

The surface of the hard/very dense deposit was generally encountered at about El. 120.6 m to 124.7 m. 'N' values measured in this deposit were generally greater than 100 blows per 0.3 m of penetration.

#### Lower Sand and Gravel

The till deposit was penetrated in the area east of the Humber River and was found to be underlain by a sand and gravel deposit. The extent of this deposit was not determined during the investigation because of artesian conditions present within this deposit. The sand and gravel deposit is in a very dense state of condition with 'N' values greater than 79 blows/0.3 m.

### GROUNDWATER CONDITIONS

Artesian pressure conditions were encountered once the till deposit was penetrated to the underlying sand and gravel. The head of water measured within the hollow stem augers was estimated to be about 4.6 m above ground surface. Mechanical packers and cement grout had to be pumped into the hole to retard the artesian water flow because of the associated high water pressure.

Artesian conditions were also noted within the till deposit at which the water level rose to ground surface within a few hours of the borehole completion. Grout plugs were successfully installed to arrest the artesian flow within this deposit without the requirement of mechanical packers.

Piezometers were installed in the various boreholes across the site. The water level observed varied depending on the depth at which the piezometer was installed. The water level in the upper sand and gravel layer was about 1.2 m below ground surface, coincident with the adjacent river water level. Within the till deposit, a piezometer level equivalent to El. 136.4 m to El. 140.7 m (about 1.4 m to 5.2 m above ground surface) was recorded. Piezometers sealed into the overlying loose silts and stiff clayey silts indicate the piezometric level to be about El. 135.8 m to 138.6 m (about 0.5 m to 2.5 m above ground surface). These results reflect an overall upward gradient through the strata present between the lower sand and gravel deposit and the surficial sands.

## DISCUSSION AND RECOMMENDATIONS

In conjunction with the proposed Hwy. 407 in the area bounded by the Humber River and extending eastwardly to Pine Valley, a total of six (6) high mast lighting poles have been proposed. Four (4) of the poles have been proposed at the toe or within excavation cut slopes. The other two (2) poles are proposed at the location of the proposed embankment fills within the floodplain area adjacent to the Hwy. 407/Humber River overpass structure. These two (2) poles are to be located along the centreline of the embankment with alternate locations proposed at the crest of the embankment slopes.

Heights equivalent to 35 m are contemplated for all the proposed superstructure high mast lighting poles except for the alternate locations proposed at the crest of the embankment fills which are 45 m in height.

Recommendations pertaining to the design and construction of the high mast pole foundations are contained in the scope of this report.

### I/Design Consideration/Parameters

#### General

The foundation design of HML structures must satisfy the conditions of limit states design as specified in the O.H.B.D.C. Consequently, the size and embedment length of the foundation must be of appropriate dimension to provide the lateral resistance required to support the induced loadings. In view of the fact that HML structures are free-headed and hence do not support significant vertical loadings, the lateral soil capacity governs the HML foundation design.

The design of HML foundations is a function of the coefficient of horizontal subgrade reaction, pile length and size and pile stiffness. The coefficient of horizontal subgrade reaction is a function of the soil/rock properties as discussed below. Typically, HML foundations consist of a single cast-in-place concrete bored pile or caisson, provided compatibility with the subsurface conditions are met.

The design of HML foundations must compensate for any utilities that may be located adjacent to the foundation. To minimize the influence of the HML foundation loading, it is recommended that the HML be placed a minimum of 3D metres (D=pile diameter) from the utility. In addition, it is recommended that the details of the utility excavation trench be reviewed by this office so that the implication on the lateral resistance of the HML foundation can be assessed.

### Soil Design Parameters

To facilitate the design of the HML foundation pertinent soil parameters are required to determine the horizontal subgrade soil reaction necessary in the foundation computations. These parameters are summarized in Table 1 in the Appendix corresponding to the soil data obtained at the proposed HML location. These parameters include.

- 1) the angle of internal friction ( $\phi$ ) for cohesionless soils.
- 2) the undrained shear strength ( $c_u$ ) for cohesive soils (the unconfined compressive strength ( $q_u$ ) of the soil can be obtained by the relation  $q_u = 2c_u$ ).
- 3) saturated unit weight of soil ( $\gamma$ ). The buoyant unit weight of soil ( $\gamma'$ ) shall be applied for soils submerged beneath the groundwater table.

The shear strength parameters ( $\phi$ ,  $c_u$ ) tabulated are unfactored and hence should be factored in accordance with Section 6-5.2 of the O.H.B.D.C.

The denseness of cohesionless soils, described as very loose, loose, compact (medium), dense or very dense is also included in Table 1 in the Appendix. Similarly, the consistency of cohesive soils have also been described.

### HML Foundations on Cut/Fill Slopes

As previously mentioned, the proposed HML foundations are to be located in either an excavation cut or embankment fill scenarios. The following comments should be examined and evaluated prior to finalizing the precise location of the HML foundation.

#### 1. Cut Slopes

HML foundations located on a bench a minimum of 3 m from the toe of the excavation cut slope will not attract any implications caused by the presence of that slope. However, for HML foundations located within 3 m of the toe of the slope or within the gradient of the slope itself, consideration has to be given to the additional lateral active earth thrust attributable to the upper slope. In addition, for HML foundations on the gradient of the slope, a reduction of the lateral resistance must also be included in the design. The magnitudes of the additional earth forces and reduction of the lateral soil capacity are dependent on the soil properties and the geometry of the slope. Once the geometries have been finalized, this office can be contacted to ascertain these specific design parameters.

Groundwater elevations in the cut slopes can be assumed to coincide with the surface of the slope at the site location.

#### 2. Fill Slopes

HML foundations located at the median location of the embankment can be designed without any implications caused by the embankment slopes at the site location.

However, for HML foundations as contemplated adjacent to the crest of the embankment slope (P4 and P5 alternate), the following recommendations are provided.

- (a) The foundation should be a minimum 3 m from the crest of the slope.
- (b) The upper 60% of the embedment length within the fill (taken from frost penetration depth) should be disregarded for lateral resistance.

In addition, the following recommendations pertain to the design of HML foundations in embankment fills in general, regardless of the location within the embankment.

- (a) The properties of the fill material can vary within the limitations of OPSS 212 series. To account for uncertainties in material selection and method of placement, it is recommended that the shear strength parameters be reduced by 10%.
- (b) At the site, up to about 90 mm of settlement due to the consolidation of the native layered clayey silts and silts is anticipated. In addition, approximately 50 mm of settlement within the embankment fill can also be anticipated. These settlements are expected to be realized immediately or shortly following construction. Consequently, to avoid the effects of these settlements, it is recommended that the embankment fills be preloaded for 3 months prior to the construction of the HML foundation.

#### FROST EFFECTS

The design of HML foundations shall be calculated neglecting lateral resistance in the frost penetration zone but including lateral loads within the frost penetration zone. At the site, the frost penetration depth is equivalent to 1.2 m.



## Construction Considerations

Construction of conventional bored caissons through cohesionless soils submerged beneath the groundwater table will require methods that will prevent the drilled shaft from cave-in. One method of achieving this is by installing a temporary steel liner and constructing the caisson within the steel liner. After the liner has been cleaned out and the required reinforcing installed, the concrete should be placed in the dry or via tremie methods. A rapid withdrawal of the temporary casing should be avoided subsequent to concrete placement to prevent the intrusion of soil in the concrete (necking). Conversely, the temporary liner should not be allowed to get stuck in partial set concrete. Alternatively, mud drilling and tremie techniques may be employed. The application of this method should be associated with a quality assurance program that will verify the quality of the bentonite slurry (density, viscosity, etc.).

In the construction of the HML foundations in the floodplain area (poles P4 and P5), the impact of the artesian conditions produced by the lower sand and gravel deposit must be accounted for. As previously described an overall upward excess head gradient exists between the lower sand and gravel deposit and the surficial cohesionless materials. To prevent soil cave-in and sloughing that can result, the Contractor must control this unbalanced head inherent of these soils and maintain the stability of the bored hole throughout the caisson installation process. One method of achieving this is by slurry and tremie methods as previously mentioned.

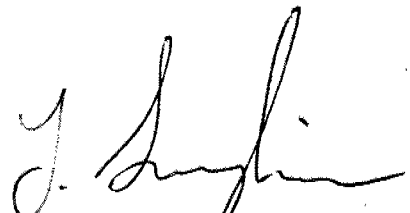
In conjunction with the caisson installation within the artesian-influenced soil, special provisions will be required to control the loss of soil and any water seepage flow that can develop subsequent to construction. It is recommended that a drainage/filter system be designed below the frost level as illustrated in Figure 13 in the Appendix.

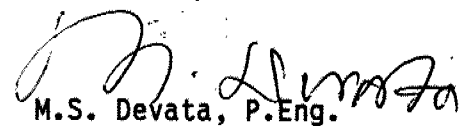
MISCELLANEOUS

The factual information pertaining to the subsurface conditions for this project was derived from investigations carried out previously within the site area in conjunction with various other Hwy. 407 projects.

The report for this project was written by T. Sangiuliano, reviewed by Dr. B. Iyer and approved by Mr. M.S. Devata, Chief Foundation Engineer.



  
T. Sangiuliano, P.Eng.  
Foundation Engineer

  
M.S. Devata, P.Eng.  
Chief Foundation Engineer

## APPENDIX

## EXPLANATION OF TERMS USED IN REPORT

**N VALUE:** THE STANDARD PENETRATION TEST (SPT) N-VALUE IS THE NUMBER OF BLOWS REQUIRED TO CAUSE A STANDARD 51mm O.D. SPLIT BARREL SAMPLER TO PENETRATE 0.3m INTO UNDISTURBED GROUND IN A BOREHOLE WHEN DRIVEN BY A HAMMER WITH A MASS OF 63.5kg, FALLING FREELY A DISTANCE OF 0.76m. FOR PENETRATIONS OF LESS THAN 0.3m N-VALUES ARE INDICATED AS THE NUMBER OF BLOWS FOR THE PENETRATION ACHIEVED. AVERAGE N-VALUE IS DENOTED THUS  $\bar{N}$ .

**DYNAMIC CONE PENETRATION TEST:** CONTINUOUS PENETRATION OF A CONICAL STEEL POINT (51mm O.D. 60° CONE ANGLE) DRIVEN BY 475 J IMPACT ENERGY ON 1" SIZE DRILL RODS. THE RESISTANCE TO CONE PENETRATION IS MEASURED AS THE NUMBER OF BLOWS FOR EACH 0.3m ADVANCE OF THE CONICAL POINT INTO THE UNDISTURBED GROUND.

SOILS ARE DESCRIBED BY THEIR COMPOSITION AND CONSISTENCY OR DENSENESS.

**CONSISTENCY:** COHESIVE SOILS ARE DESCRIBED ON THE BASIS OF THEIR UNDRAINED SHEAR STRENGTH ( $c_u$ ) AS FOLLOWS:

$c_u$ (kPa)	0 - 12	12 - 25	25 - 50	50 - 100	100 - 200	> 200
	VERY SOFT	SOFT	FIRM	STIFF	VERY STIFF	HARD

**DENSENESS:** COHESIONLESS SOILS ARE DESCRIBED ON THE BASIS OF DENSENESS AS INDICATED BY SPT N-VALUES AS FOLLOWS:

N (BLOWS/0.3m)	0 - 5	5 - 10	10 - 30	30 - 50	> 50
	VERY LOOSE	LOOSE	COMPACT	DENSE	VERY DENSE

ROCKS ARE DESCRIBED BY THEIR COMPOSITION AND STRUCTURAL FEATURES AND/OR STRENGTH.

**RECOVERY:** SUM OF ALL RECOVERED ROCK CORE PIECES FROM A CORING RUN EXPRESSED AS A PERCENT OF THE TOTAL LENGTH OF THE CORING RUN.

**MODIFIED RECOVERY:** SUM OF THOSE INTACT CORE PIECES, 100mm+ IN LENGTH EXPRESSED AS A PERCENT OF THE LENGTH OF THE CORING RUN. THE ROCK QUALITY DESIGNATION (RQD), FOR MODIFIED RECOVERY, IS:

RQD (%)	0 - 25	25 - 50	50 - 75	75 - 90	90 - 100
	VERY POOR	POOR	FAIR	GOOD	EXCELLENT

**JOINTING AND BEDDING:**

SPACING	50mm	50 - 300mm	0.3m - 1m	1m - 3m	> 3m
JOINTING	VERY CLOSE	CLOSE	MOD. CLOSE	WIDE	VERY WIDE
BEDDING	VERY THIN	THIN	MEDIUM	THICK	VERY THICK

## ABBREVIATIONS AND SYMBOLS

### FIELD SAMPLING

S S	SPLIT SPOON	T P	THINWALL PISTON
W S	WASH SAMPLE	O S	OSTERBERG SAMPLE
S T	SLOTTED TUBE SAMPLE	R C	ROCK CORE
B S	BLOCK SAMPLE	P H	T W ADVANCED HYDRAULICALLY
C S	CHUNK SAMPLE	P M	T W ADVANCED MANUALLY
T W	THINWALL OPEN	F S	FOIL SAMPLE

### STRESS AND STRAIN

$u_w$	kPa	PORE WATER PRESSURE
$r_u$	1	PORE PRESSURE RATIO
$\sigma$	kPa	TOTAL NORMAL STRESS
$\sigma'$	kPa	EFFECTIVE NORMAL STRESS
$\tau$	kPa	SHEAR STRESS
$\sigma_1, \sigma_2, \sigma_3$	kPa	PRINCIPAL STRESSES
$\epsilon$	%	LINEAR STRAIN
$\epsilon_1, \epsilon_2, \epsilon_3$	%	PRINCIPAL STRAINS
E	kPa	MODULUS OF LINEAR DEFORMATION
G	kPa	MODULUS OF SHEAR DEFORMATION
$\mu$	1	COEFFICIENT OF FRICTION

### MECHANICAL PROPERTIES OF SOIL

$m_v$	kPa <sup>-1</sup>	COEFFICIENT OF VOLUME CHANGE
$C_c$	1	COMPRESSION INDEX
$C_s$	1	SWELLING INDEX
$C_\alpha$	1	RATE OF SECONDARY CONSOLIDATION
$c_v$	m <sup>2</sup> /s	COEFFICIENT OF CONSOLIDATION
H	m	DRAINAGE PATH
$T_v$	1	TIME FACTOR
U	%	DEGREE OF CONSOLIDATION
$\sigma'_{v0}$	kPa	EFFECTIVE OVERBURDEN PRESSURE
$\sigma'_p$	kPa	PRECONSOLIDATION PRESSURE
$\tau_f$	kPa	SHEAR STRENGTH
$c'$	kPa	EFFECTIVE COHESION INTERCEPT
$\phi'$	-°	EFFECTIVE ANGLE OF INTERNAL FRICTION
$c_u$	kPa	APPARENT COHESION INTERCEPT
$\phi_u$	-°	APPARENT ANGLE OF INTERNAL FRICTION
$\tau_R$	kPa	RESIDUAL SHEAR STRENGTH
$\tau_r$	kPa	REMOULDED SHEAR STRENGTH
$S_f$	1	SENSITIVITY = $\frac{c_u}{\tau_r}$

### PHYSICAL PROPERTIES OF SOIL

$\rho_s$	kg/m <sup>3</sup>	DENSITY OF SOLID PARTICLES	e	1, %	VOID RATIO	$e_{min}$	1, %	VOID RATIO IN DENSEST STATE
$\gamma_s$	kn/m <sup>3</sup>	UNIT WEIGHT OF SOLID PARTICLES	n	1, %	POROSITY	$i_D$	1	DENSITY INDEX = $\frac{e_{max} - e}{e_{max} - e_{min}}$
$\rho_w$	kg/m <sup>3</sup>	DENSITY OF WATER	w	1, %	WATER CONTENT	D	mm	GRAIN DIAMETER
$\gamma_w$	kn/m <sup>3</sup>	UNIT WEIGHT OF WATER	$S_r$	%	DEGREE OF SATURATION	$D_n$	mm	n PERCENT - DIAMETER
$\rho$	kg/m <sup>3</sup>	DENSITY OF SOIL	$w_L$	%	LIQUID LIMIT	$C_u$	1	UNIFORMITY COEFFICIENT
$\gamma$	kn/m <sup>3</sup>	UNIT WEIGHT OF SOIL	$w_p$	%	PLASTIC LIMIT	h	m	HYDRAULIC HEAD OR POTENTIAL
$\rho_d$	kg/m <sup>3</sup>	DENSITY OF DRY SOIL	$w_s$	%	SHRINKAGE LIMIT	q	m <sup>3</sup> /s	RATE OF DISCHARGE
$\gamma_d$	kn/m <sup>3</sup>	UNIT WEIGHT OF DRY SOIL	$I_p$	%	PLASTICITY INDEX = $w_L - w_p$	v	m/s	DISCHARGE VELOCITY
$\rho_{sat}$	kg/m <sup>3</sup>	DENSITY OF SATURATED SOIL	$I_L$	1	LIQUIDITY INDEX = $\frac{w - w_p}{I_p}$	i	1	HYDRAULIC GRADIENT
$\gamma_{sat}$	kn/m <sup>3</sup>	UNIT WEIGHT OF SATURATED SOIL	$I_C$	1	CONSISTENCY INDEX = $\frac{w_L - w}{I_p}$	k	m/s	HYDRAULIC CONDUCTIVITY
$\rho'$	kg/m <sup>3</sup>	DENSITY OF SUBMERGED SOIL	$e_{max}$	1, %	VOID RATIO IN LOOSEST STATE	j	kn/m <sup>3</sup>	SEEPAGE FORCE
$\gamma'$	kn/m <sup>3</sup>	UNIT WEIGHT OF SUBMERGED SOIL						

Table 1 - HML Foundation Design Parameters

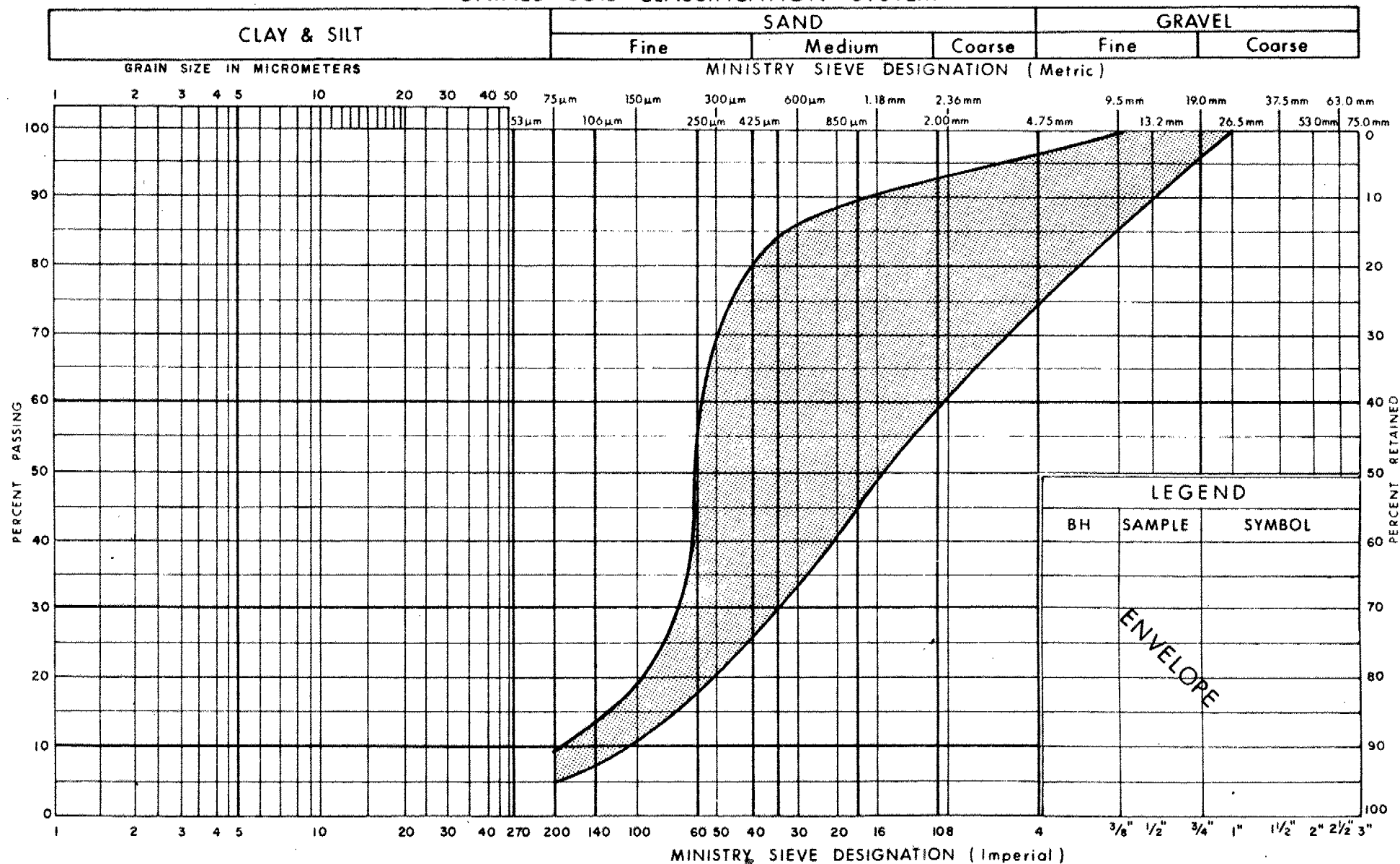
HML	Nearest Borehole	Geodetic El. (m)	GWL EL. (m)	Description	Consistency/ Denseness	Shear Strength Parameters ( $\phi$ ) ( $c_u$ )		Saturated Unit Weight ( $kN/m^3$ )	Cut/Fill	Remarks
P4	5	Grade-135	Artesian	Fill	Compact	30°	-	20	Fill (Granular)	- located at embankment median - Artesian condition construc- tion
		135-133.5		Sandy Silt	Loose	28°	-	20		
		133.5-133		Sand & Gravel	Compact	30°	-	20		
		133-124		Clayey Silt/Silt	Stiff/Compact	-	80	20		
		124-115		Clayey Silt/ Silt Till	Hard/V.Dense	35°	-	20		
P4 (Alt.)	6	Grade-135	Artesian	Fill	Compact	30°	-	20	Fill (Granular)	- located at embankment crest - Artesian condition construc- tion
		135-133.5		Sandy Silt	Loose	28°	-	20		
		133.5-133		Sand & Gravel	Compact	30°	-	20		
		133-124		Clayey Silt/Silt	Stiff/Compact	-	80	20		
		124-115		Clayey Silt/ Silt Till	Hard/V.Dense	35°	-	20		
P5	11	Grade-135	Artesian	Fill	Compact	30°	-	20	Fill (Granular)	- located at embankment median - Artesian condition construc- tion
		135-133		Sandy Silt	Loose	28°	-	20		
		133-132		Sand & Gravel	Compact	30°	-	20		
		132-127		Clayey Silt/Silt	Stiff	-	80	20		
		127-125		Clayey Silt Till	Stiff	-	80	20		
		125-122		Silt and Sand	Loose	28°	-	20		
		122-117		Clayey Silt	Hard	-	250	20		
		<117		Sand & Gravel	V.Dense	35°	-	20		
P5 (Alt.)	12	Grade-135	Artesian	Fill	Compact	30°	-	20	Fill (Granular)	- located at embankment crest - Artesian condition construc- tion
		135-134		Sandy Silt	Loose	28°	-	20		
		134-132.5		Sand & Gravel	Compact	30°	-	20		
		132.5-124		Clayey Silt/Silt	V.Stiff	-	100	20		
		124-122		Silt & Sand	Loose	28°	-	20		
		122-117		Clayey Silt Till		-	250	20		
		<117		Sand & Gravel	V.Dense	35°	-	20		

Table 1 - HML Foundation Design Parameters .../cont'd

HML	Nearest Borehole	Geodetic El. (m)	GWL EL. (m)	Description	Consistency/Denseness	Shear Strength Parameters (0) (Cu)		Saturated Unit Weight (kN/m <sup>3</sup> )	Cut/Fill	Remarks
P6	C4, D1	150.5-136.3	136	Clayey Silt Till	Firm to V.Stiff	-	60	20	Cut	Soil cave-in encountered in sand deposit q=25MPa
		136.3-125.0		Clayey Silt	Stiff	-	100	21		
		125.0-115		Clayey Silt	Stiff	-	80	21		
		115-105.9		Sand	Dense	32	-	20		
		below 105.9		Bedrock	-	-	-	25		
P7	A7.4	158.5-156.3	157	Sand	Compact	30	-	20	Cut	Soil cave-in encountered in surficial sands/silts
		156.3-154.7		Silt	Compact	30	-	20		
		154.7-151.7		Clayey Silt	Firm to V.Stiff	-	50	20		
		151.7-146.0		Clayey Silt Till	Firm to Stiff	-	50	19		
		146.0-133.5		Clayey Silt Till	Firm to Stiff	-	80	20		
		133.5-125.9		Clayey Silt	Hard	-	100	20		
P8	A4	160.1-158.9	158	Sand	Compact	30	-	20	Cut	clayey silt till extent inferred from cone test at BH A5
		158.9-157.4		Silt	Compact	30	-	20		
		157.4-153.3		Clayey Silt	Stiff	-	80	20		
		153.3-137.3		Clayey Silt Till	Stiff	-	60	19		
P9	A1	159.4-157.2	158	Sand	Compact	30	-	20	Cut	clayey silt till extent inferred from cone test at BH A5
		157.2-156.7		Silt	Compact	30	-	20		
		156.7-154.1		Clayey Silt	Firm	-	40	20		
		154.1-149		Clayey Silt Till	Stiff	-	60	19		
		149-137		Clayey Silt Till	Stiff	-	80	19		
P10	A9	159.3-158.6	158	Sand	Compact	30	-	20		Soil Cave-in encountered in surficial and lower sands
		158.6-157.8		Silt	Compact	30	-	20		
		157.8-154.0		Clayey Silt	Stiff	-	50	20		
		154-150		Clayey Silt Till	Firm	-	40	19		
		150-148.5		Clayey Silt Till	Stiff	-	75	19		
		>148		Sand		30	-	20		

## FIGURES

## UNIFIED SOIL CLASSIFICATION SYSTEM



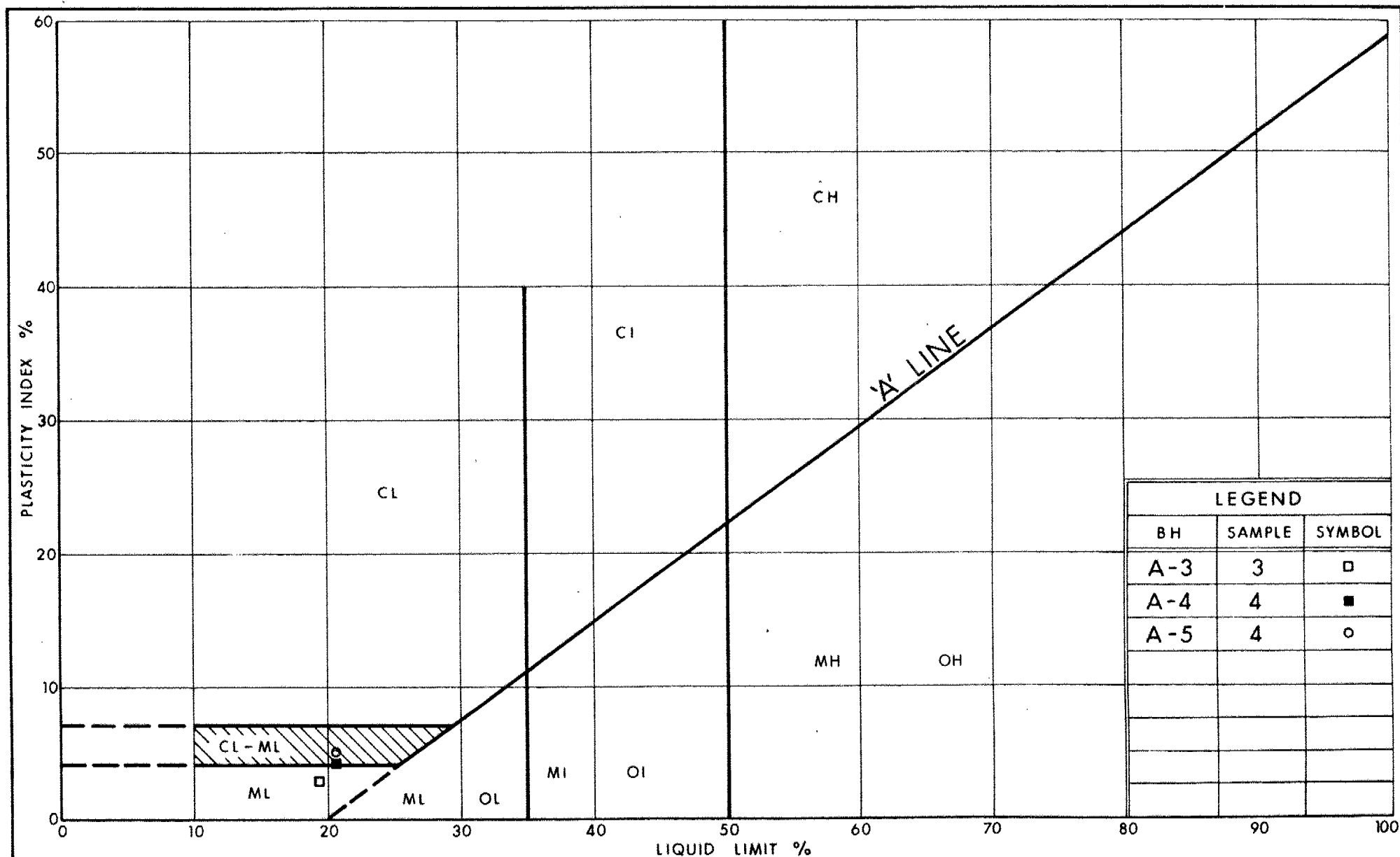
Ministry of  
Transportation

**GRAIN SIZE DISTRIBUTION**  
SAND, TRACE SILT, TRACE /SOME GRAVEL

FIG No 1

W P 141-87-00 (P)



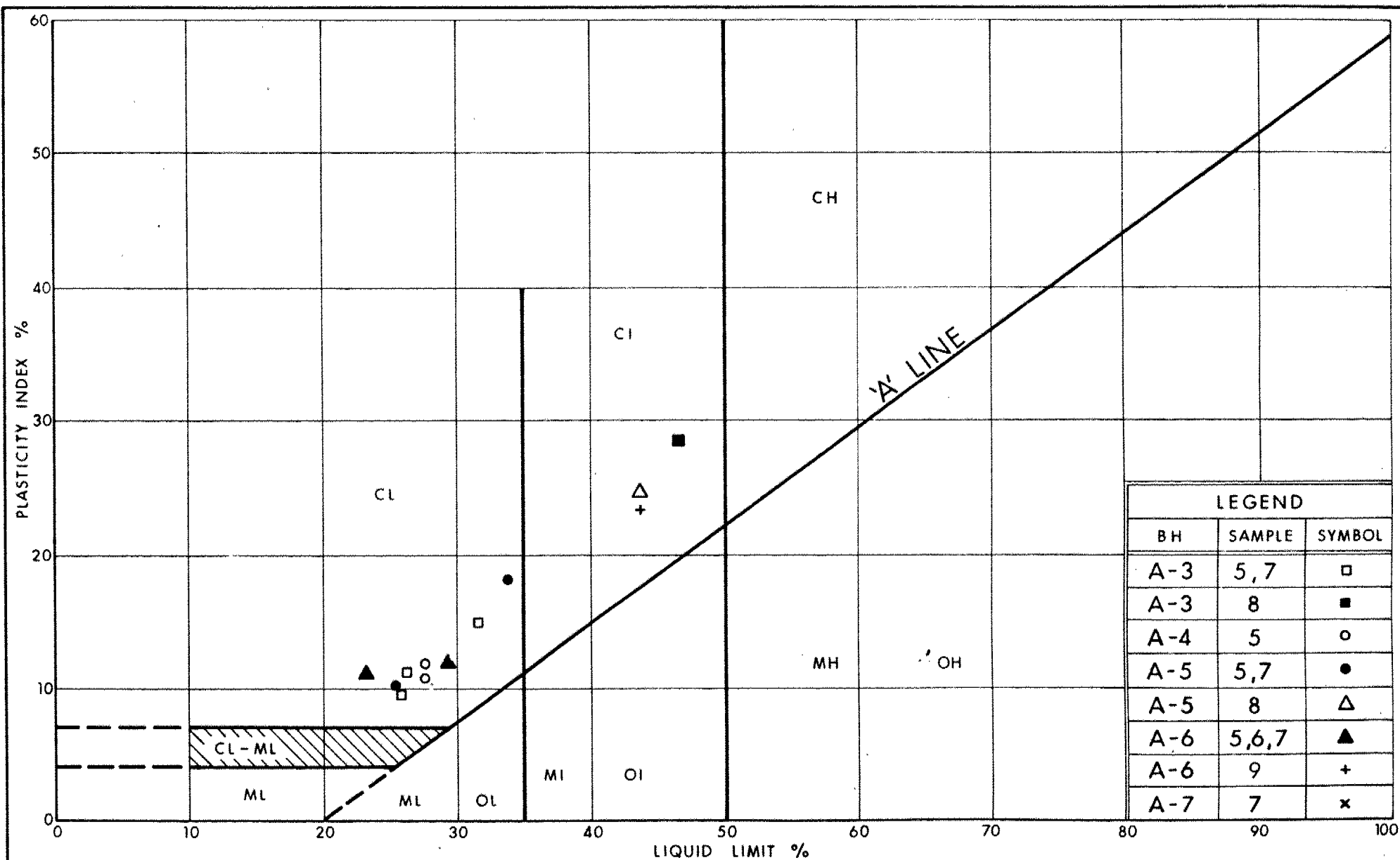


Ministry of  
Transportation  
Ontario

## PLASTICITY CHART SILT

FIG No 2

W P 141-87-00 (P)



Ontario

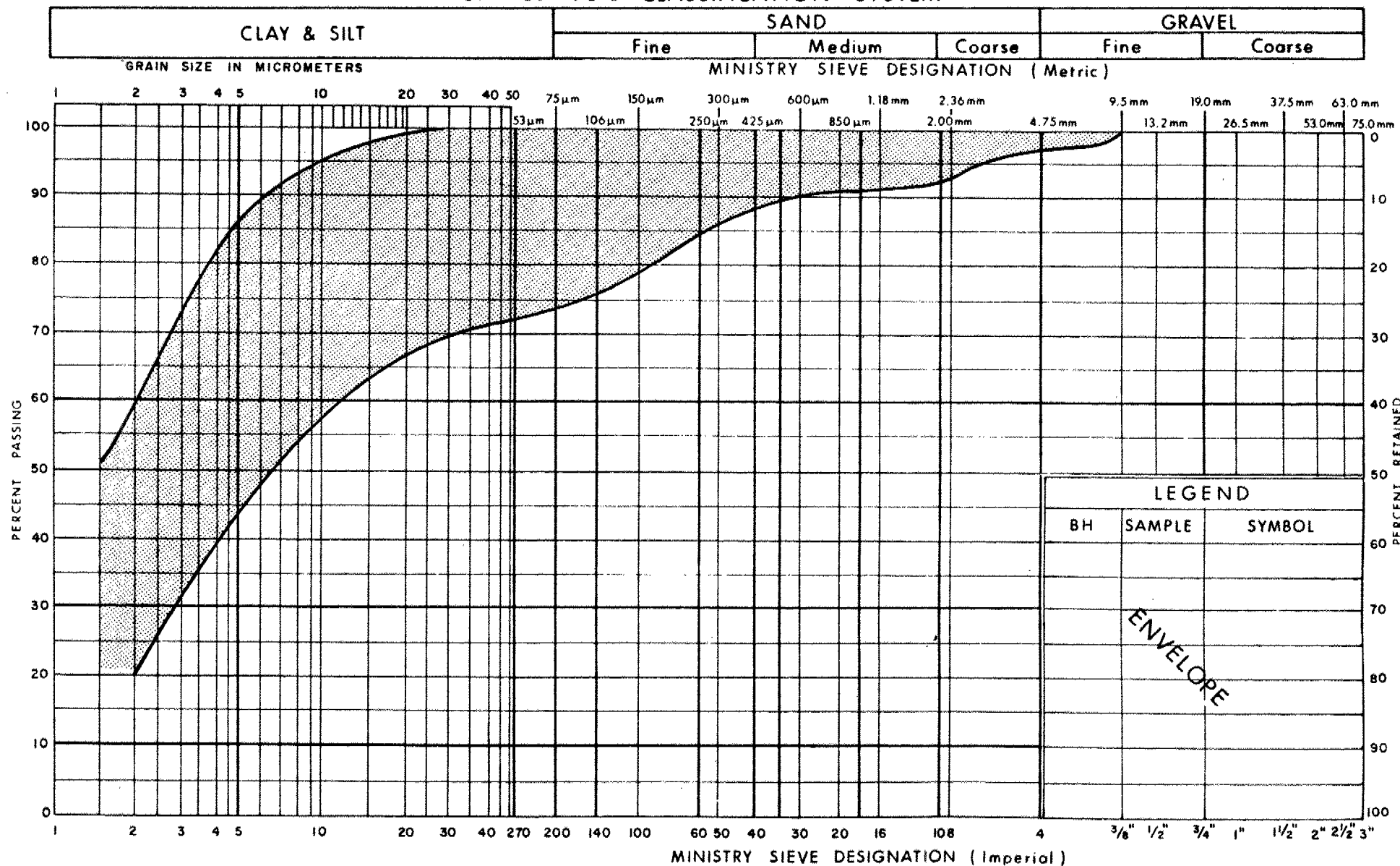
Ministry of  
Transportation

**PLASTICITY CHART**  
**CLAYEY SILT TO SILTY CLAY**  
 WITH RANDOM NODULES / SEAMS OF SILT

FIG No 3

W P 141-87-00(P)

## UNIFIED SOIL CLASSIFICATION SYSTEM

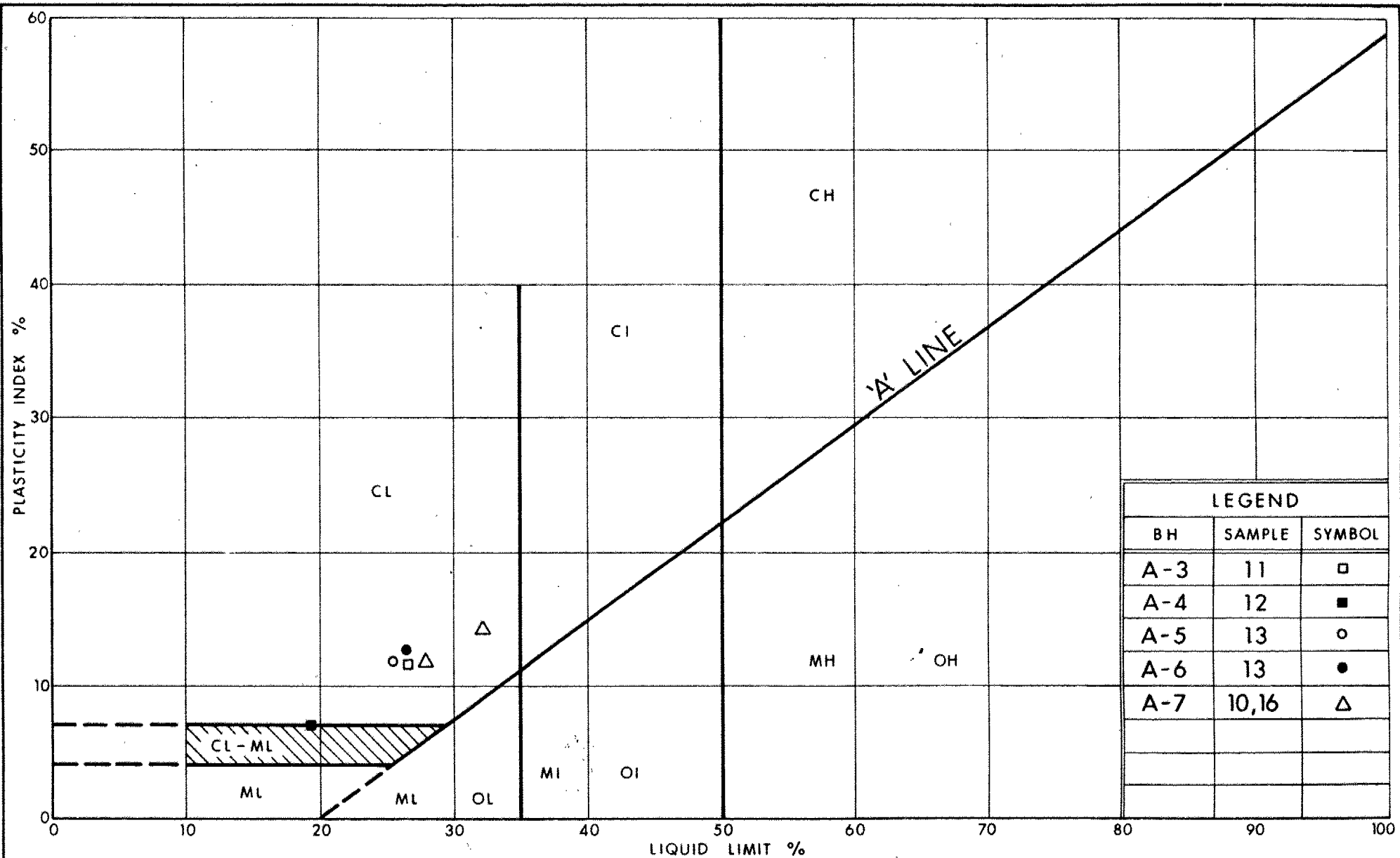


Ministry of  
Transportation

**GRAIN SIZE DISTRIBUTION**  
**CLAYEY SILT, SOME / TRACE SAND, TRACE GRAVEL**  
 (GLACIAL TILL)

FIG No 4

W P 141-87-00 (P)

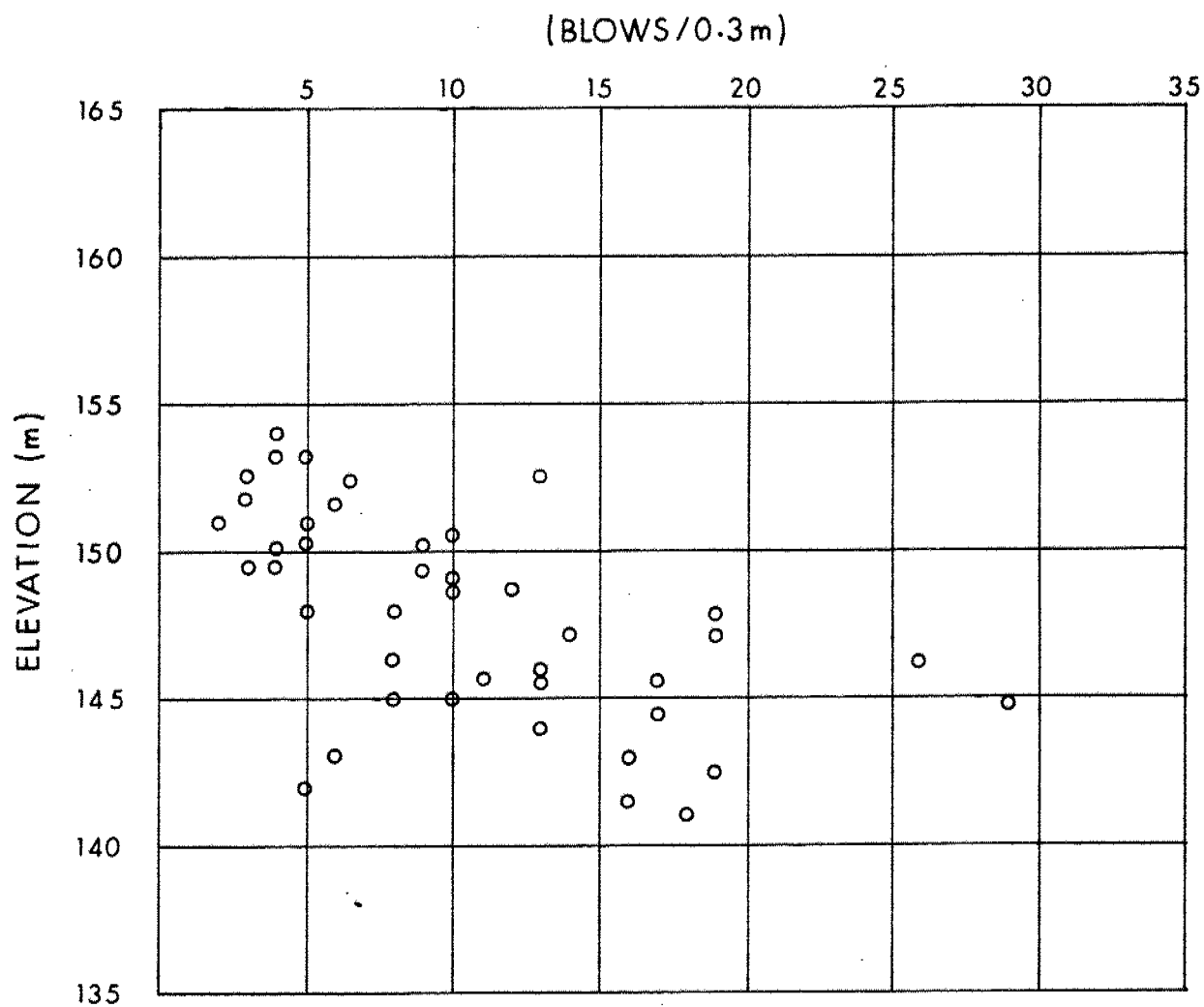


Ministry of  
Transportation  
Ontario

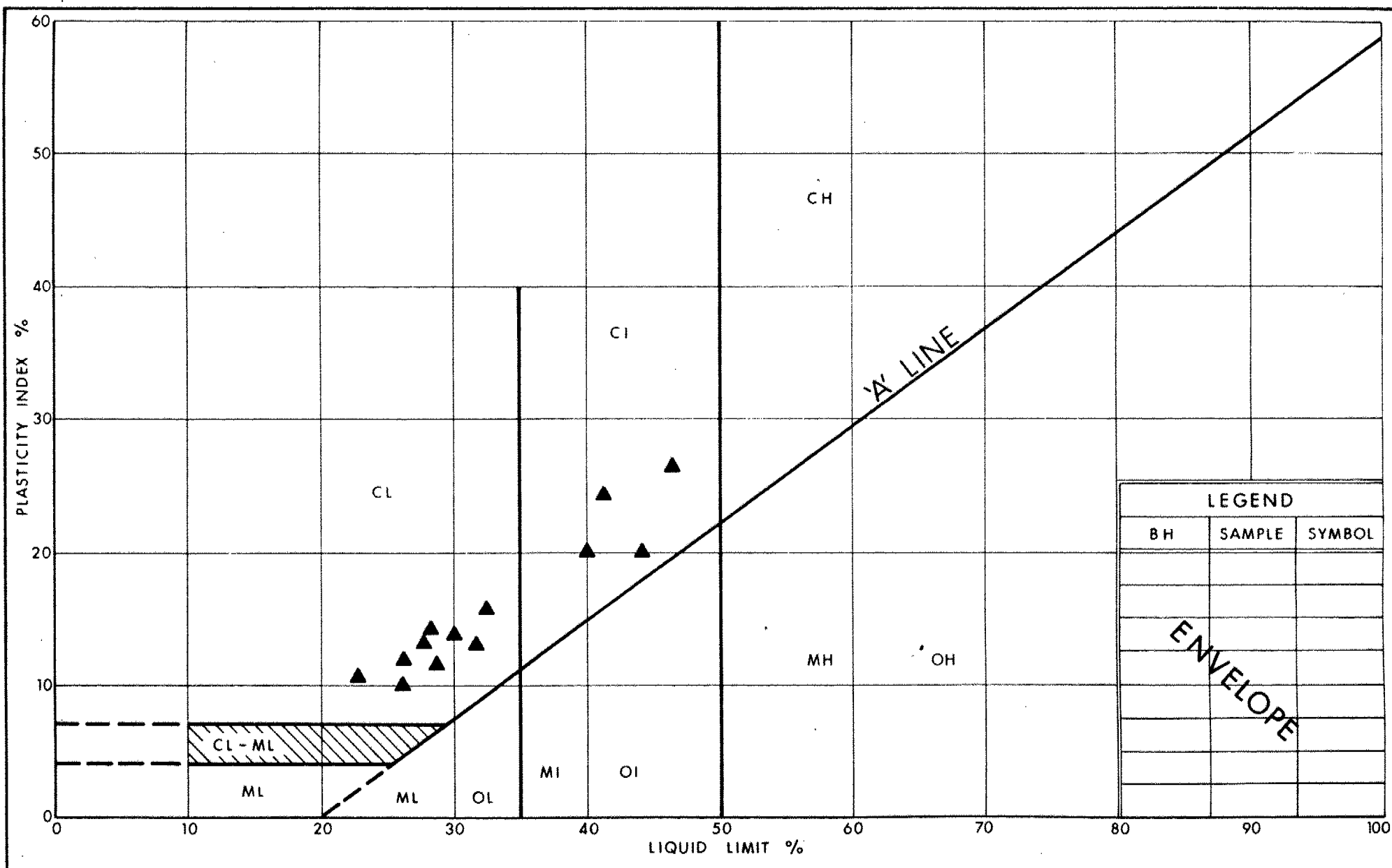
# PLASTICITY CHART CLAYEY SILT, SOME/TRACE SAND, TRACE GRAVEL (GLACIAL TILL)

FIG No 5

W P 141-87-00(P)



SPT 'N' VALUES (BLOWS/0.3m) VS ELEVATION (m)  
CLAYEY SILT, SOME / TRACE SAND, TRACE GRAVEL  
(GLACIAL TILL)



Ministry of  
Transportation

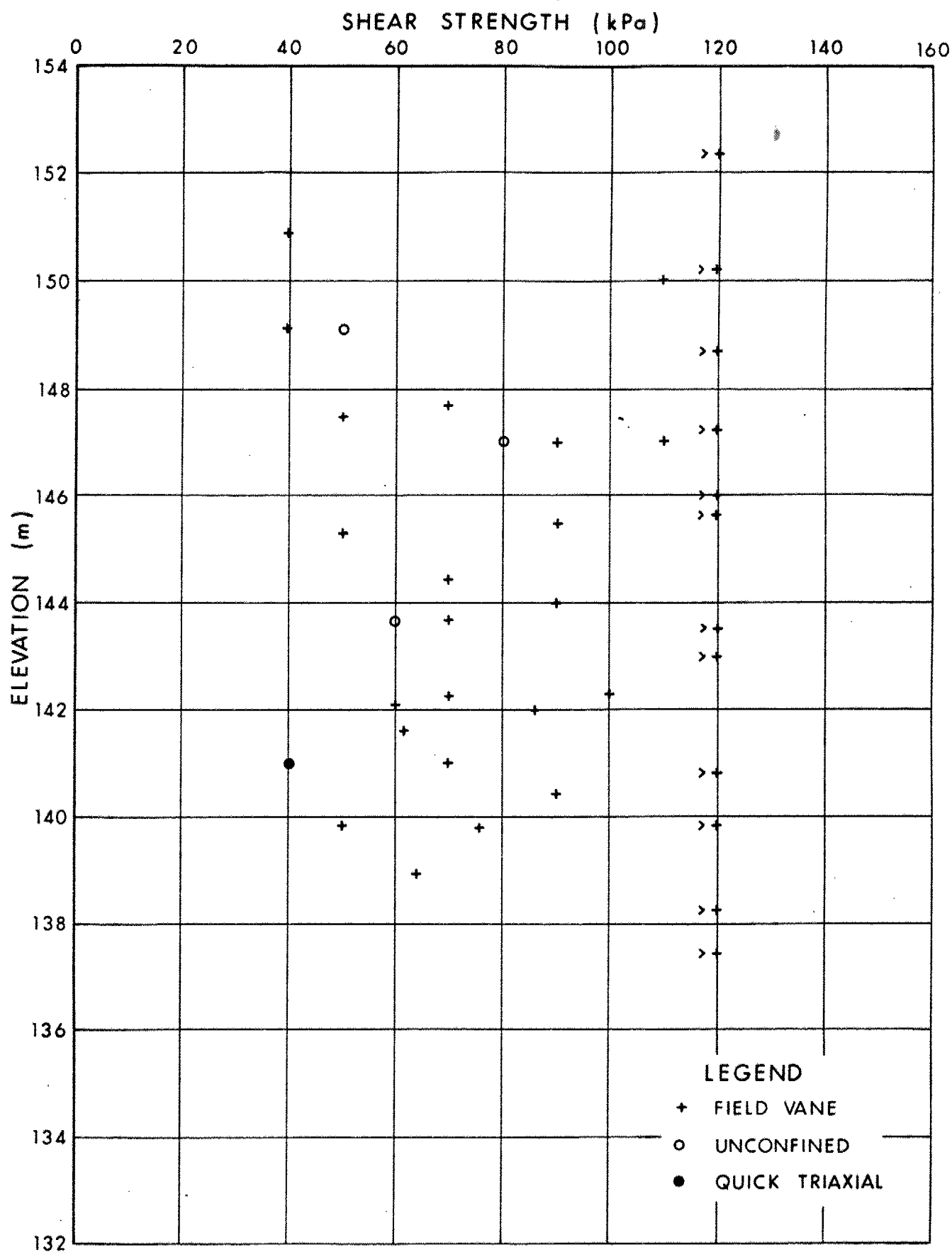
Ontario

**PLASTICITY CHART**  
**SILTY CLAY TO CLAYEY SILT**  
(Glacial Till)

FIG No 7

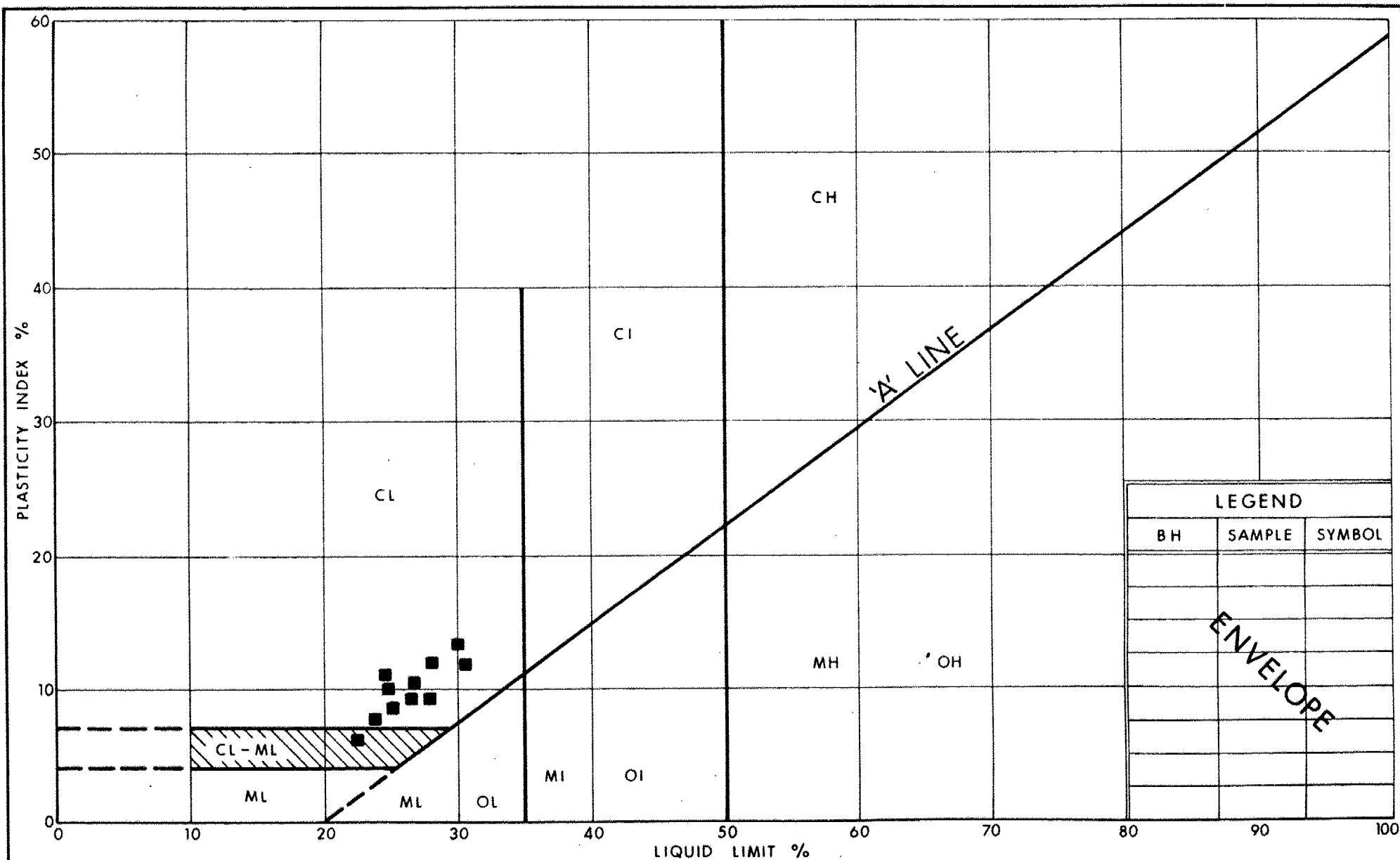
W P 141-87-00 (P)

# UNDRAINED SHEAR STRENGTH $V_s$ ELEVATION



W P 141-87-00(P)

Fig 8



LEGEND		
BH	SAMPLE	SYMBOL



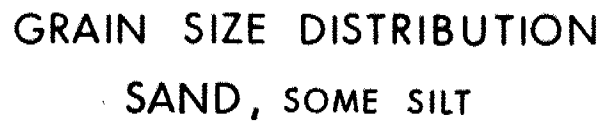
Ministry of  
Transportation

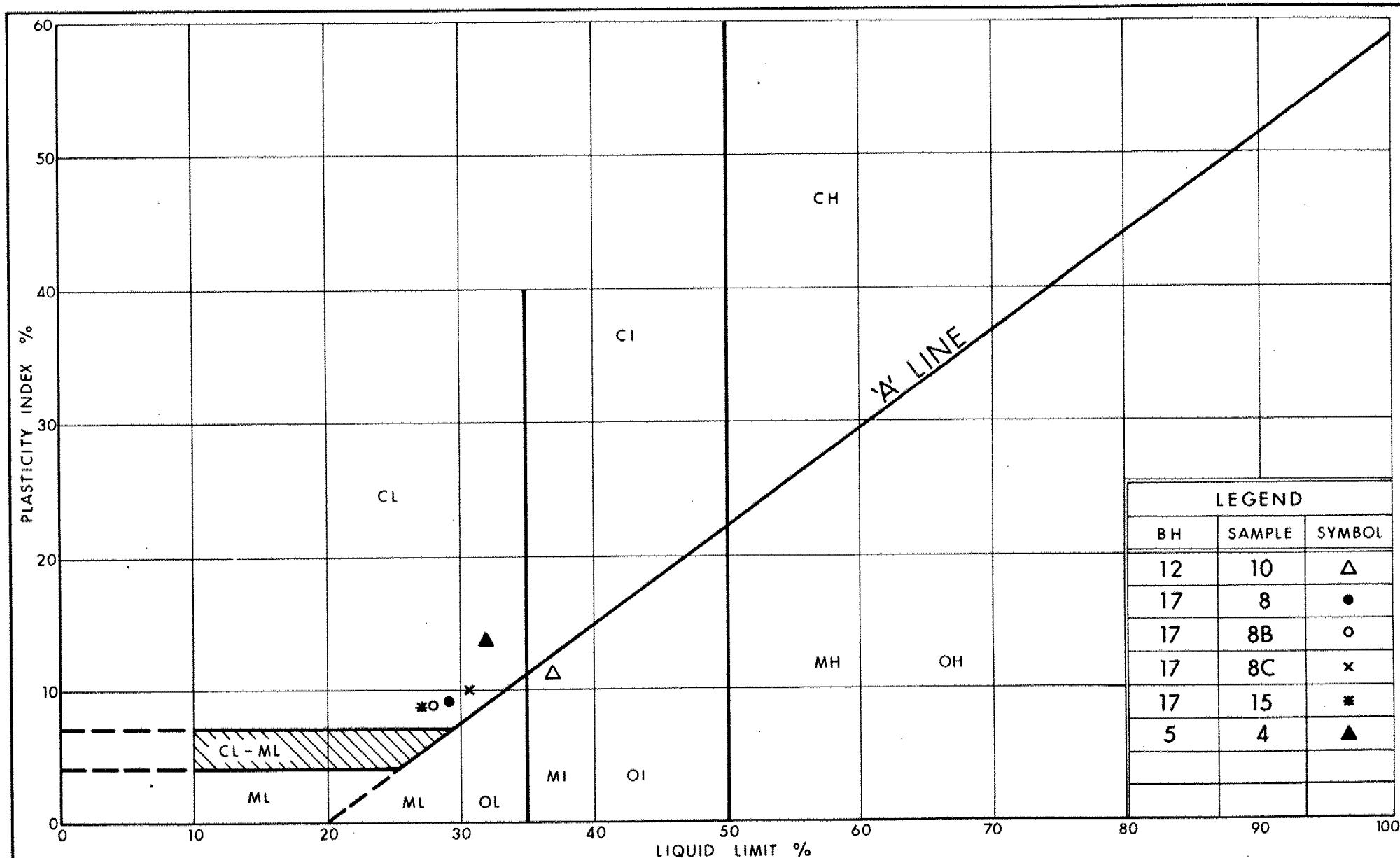
Ontario

# PLASTICITY CHART CLAYEY SILT

FIG No 9  
W P 141-87-00(P)







Ontario

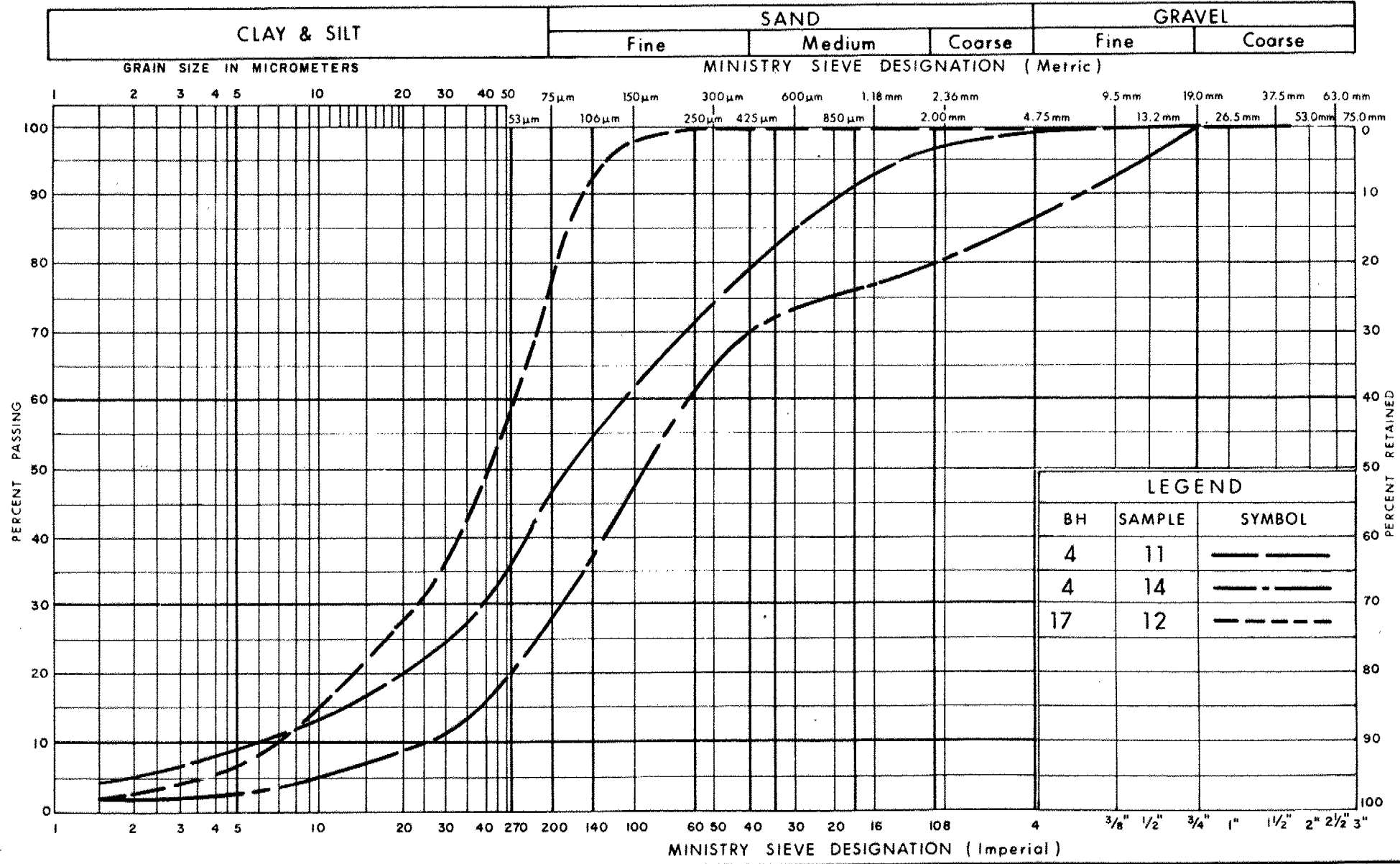
Ministry of  
Transportation

# PLASTICITY CHART INTERLAYERED CLAYEY SILT & SILT

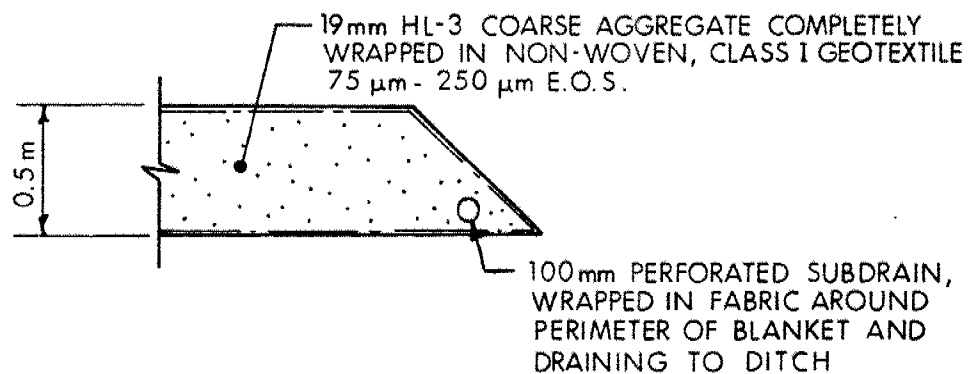
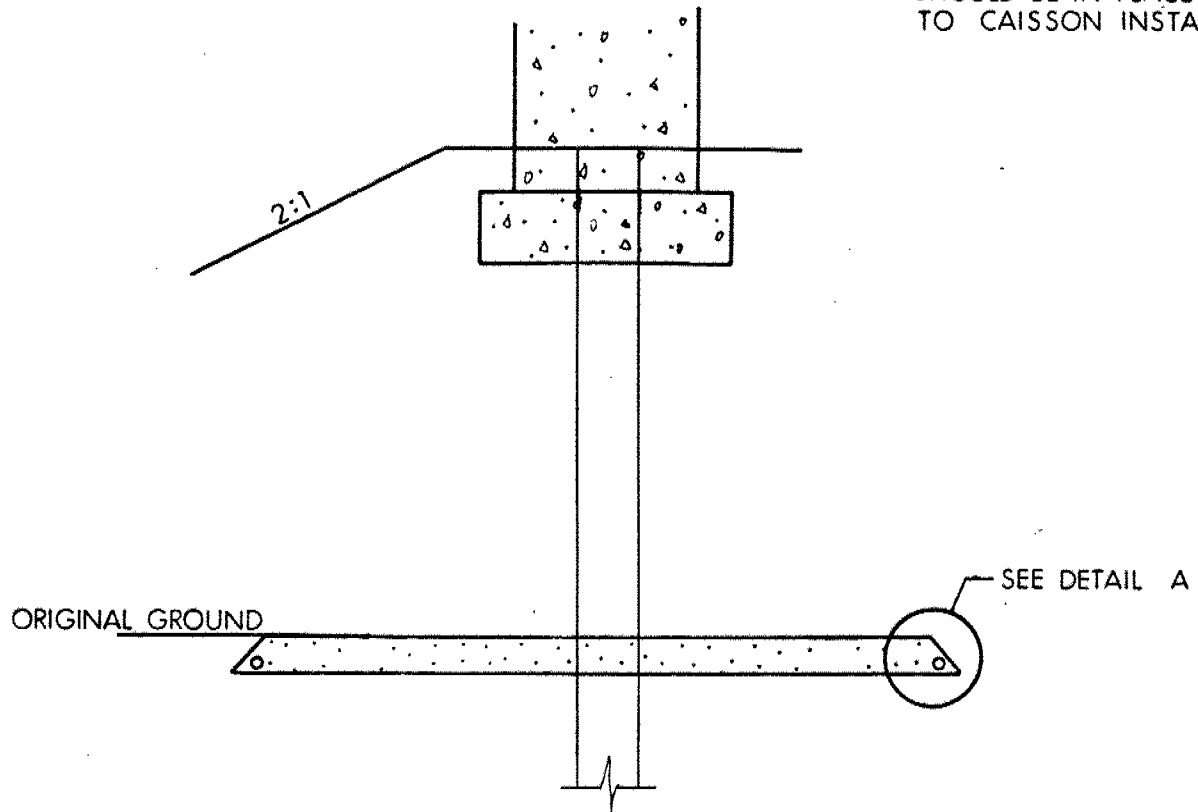
FIG No 11

W P 141-87-01 (P)

# UNIFIED SOIL CLASSIFICATION SYSTEM



NOTE : THE DRAINAGE BLANKETS  
SHOULD BE IN PLACE PRIOR  
TO CAISSON INSTALLATION



DETAIL A

FIG -13 - DRAINAGE / FILTRATION SYSTEM

## **BOREHOLE LOGS**

**AREA 1**

**WP 141-87-00A**

**(HWY 407 DEEP CUTS BETWEEN  
ISLINGTON AND PINE VALLEY)**

# RECORD OF BOREHOLE No A-1

1 OF 1

METRIC

W.P. 141-87-00A LOCATION Co-ords: N 4 847 751.6 : E 298 751.3 ORIGINATED BY TS  
DIST 6 HWY 407 BOREHOLE TYPE HS Auger COMPILED BY TS  
DATUM Geodetic DATE 90 01 16-17 CHECKED BY BC

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT 7 KN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20 40 60 80 100	20 40 60 80 100	20 40 60 80 100	20 40 60 80 100	20 40 60 80 100		
160.2	Ground Surface													
159.4	Topsoil													
0.8	Sand, Tr. Gravel		1	AS	-									
	Brown, Compact		2	SS	14									
157.2			3	SS	9									
156.7	Silt, Brown, Compact		4	SS	9									
3.5	Clayey Silt with Random Nodules/ Seams of Silt		5	SS	7									
	Grey, Stiff to Very Stiff		6	SS	6									
154.1			7	SS	5									
6.1			8	SS	4									
			9	SS	3									
	Clayey Silt, Tr. Sand, Tr. Gravel (Glacial Till)		10	SS	5									
	Grey, Firm to Very Stiff		11	SS	3									
			12	SS	8									
			13	SS	8									
144.5			14	SS	8									
15.7	End of Borehole													
* GROUND WATER CONDITIONS														
PIEZO. NO.			GROUND WATER ELEVATION (Metres)											
1			158.2											

# RECORD OF BOREHOLE No A-2

1 OF 1

METRIC

W.P. 141-87-00A LOCATION Co-ords: N 4 847 790.6 ; E 298 676.7 ORIGINATED BY TS  
DIST 6 HWY 407 BOREHOLE TYPE HS Auger COMPILED BY TS  
DATUM Geodetic DATE 90 01 16-17 CHECKED BY BC

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT 7 kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20 40 60 80 100	20 40 60 80 100	20 40 60 80 100	20 40 60 80 100	20 40 60 80 100		
160.1	Ground Surface													
159.3	Topsail													
0.8	Sand, Tr. Gravel		1	SS	18									
	Brown, Compact		2	SS	21									
			3	SS	15									
156.4			4	SS	25									
155.8	Silt, Brown, Very Dense		5	SS	47									
4.3			6	SS	24									
	Clayey Silt with Random Nodules/ Seams of Silt		7	SS	19									
	Grey, Stiff to Very Stiff		8	SS	7									
152.5														
7.6			9	SS	6									
			10	SS	5									
	Clayey Silt, Tr. Sand, Tr. Gravel (Glacial Till)		11	SS	9									
	Grey, Firm to Very Stiff		12	SS	19									
			13	SS	26									
144.4			14	SS	29									
15.7	End of Borehole													

+3, x5: Numbers refer to  
Sensitivity

20  
15-5 (%) STRAIN AT FAILURE  
10



# RECORD OF BOREHOLE No A-3

1 OF 1

METRIC

W.P. 141-87-00A LOCATION Co-ords: N 4 847 713 : E 298 662.2 ORIGINATED BY TS  
DIST 6 HWY 407 BOREHOLE TYPE HS Auger COMPILED BY TS  
DATUM Geodetic DATE 90 01 16 CHECKED BY BC

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT w <sub>p</sub>	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w <sub>L</sub>	UNIT WEIGHT γ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20 40 60 80 100	20 40 60 80 100					
160.9	Ground Surface													
160.2	Topsoil													
0.7	Sand, Tr. Gravel Brown, Loose	0.6-1.1	1	SS	7									
158.9			2	SS	6									
2.0	Silt	1.1-2.0	3	SS	13									
157.4	Compact		4	SS	12									
3.5	Clayey Silt to Silty Clay with Random Nodules/Interbeds of Silt  Grey, Stiff to Very Stiff	2.0-3.5	5	SS	12									
			6	SS	5									
			7	SS	12									
			8	TW	PH									
153.3														
7.6	Clayey Silt, Tr. Sand, Tr. Gravel (Glacial Till) Grey, Stiff to Very Stiff	3.5-7.6	9	SS	5									
			10	SS	3									
			11	SS	9									
			12	SS	10									
			13	SS	19									
			14	SS	13									
145.2														
15.7	End of Borehole													

# RECORD OF BOREHOLE No A-4

1 OF 1

METRIC

W.P. 141-87-00A LOCATION Co-ords: N 4 847 740.9 ; E 298 588.6 ORIGINATED BY TS  
DIST 5 HWY 407 BOREHOLE TYPE HS Auger COMPILED BY TS  
DATUM Geodetic DATE 90 01 16 CHECKED BY BC

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>P</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
160.9	Ground Surface																
160.1	Topsoil																
0.8	Sand, Tr. Gravel, Tr. Silt		1	SS	24												
158.9	Brown, Compact		2	SS	28												
2.0	Silt		3	SS	27												
157.4	Compact		4	SS	17												
3.5			5	SS	15												
	Clayey Silt with Random Nodules/ Seams of Silt		6	SS	13												
	Stiff to Very Stiff		7	SS	14												
			8	SS	11												
153.3																	
7.6			9	SS	4												
			10	TW	PH												
	Clayey Silt, Some Sand, Tr. Gravel (Glacial Till)		11	SS	5												
	Grey, Firm to Stiff		12	SS	12												
			13	SS	14												
145.2			14	SS	17												
15.7	End of Borehole																
	* Hole caved-in at 2.1m																

# RECORD OF BOREHOLE No A-5

1 OF 1

METRIC

W.P. 141-87-00A LOCATION Co-ords: N 4 847 660.1 : E 298 576.7 ORIGINATED BY TS  
DIST 6 HWY 407 BOREHOLE TYPE HS Auger COMPILED BY TS  
DATUM Geodetic DATE 90 01 15 CHECKED BY BC

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT w <sub>p</sub>	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w <sub>L</sub>	UNIT WEIGHT 7 kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20 40 60 80 100	20 40 60 80 100					
160.2	Ground Surface													
159.4	Topsoil													
0.8	Sand, Some Gravel Brown, Compact		1	SS	11									11 82 (7)
			2	SS	10									
157.2			3	SS	17									25 68 (7)
156.4	Silt, Brown, Compact		4	SS	14								18.8	0 0 (100)
3.8	Clayey Silt to Silty Clay with Random Nodules/Interbeds of Silt Grey, Stiff		5	SS	10									
			6	SS	11								22.6	
			7	SS	5									
			8	TW	PH									0 0 32 68 c'=0 φ'=28°
152.6	Clayey Silt, Some Sand, Tr. Gravel (Glacial Till) Grey, Firm to Stiff		9	SS	13									
7.6			10	SS	2									
			11	SS	4									
			12	SS	5									
			13	SS	8								18.4	1 15 (84)
			14	SS	10									
			15	SS	6									
141.5			16	SS	5									
18.7	End of Borehole													
137.3														
22.9	End of Cone Test													

# RECORD OF BOREHOLE No A-6

1 OF 1

METRIC

W.P. 141-B7-00A LOCATION Co-ords: N 4 847 691.2 ; E 298 501.7 ORIGINATED BY TS  
 DIST 6 HWY 407 BOREHOLE TYPE HS Auger COMPILED BY TS  
 DATUM Geodetic DATE 90 01 12-15 CHECKED BY BC

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
159.8	Ground Surface																
159.0	Topsoil		1	AS	-	XXXX											
0.8	Sand, Tr. Silt, Some Gravel		2	SS	26												14 79 (7)
157.5	Brown, Compact		3	SS	18		158										0 19 76 5
2.3	Silt		4	SS	21												0 0 60 40
156.8	Brown, Compact		5	SS	18												0 0 77 23
3.0	Clayey Silt to Silty Clay with Random Nodules/Interbeds of Silt Firm to Stiff		6	SS	16	XXXX	156									20.0	
			7	SS	12											22.2	
			8	SS	8		154									19.8	
			9	SS	5												
			10	TW	PH		152										
152.0	Clayey Silt, Tr. Sand, Tr. Gravel (Glacial Till) Grey, Stiff to Very Stiff		11	SS	10		150										
7.8			12	SS	10												
			13	TW	PH		148									20.3	1 11 62 26 * c' = 10 kPa φ' = 29°
			14	SS	13		146										
			15	SS	17		144									20.8	1 20 49 30
			16	SS	16												
			17	SS	16		142										
141.1	End of Borehole																
137.5																	
22.3	End of Cone Test																
* GROUND WATER CONDITIONS																	
	PIEZO. NO.	GROUND WATER ELEVATION (Metres)															
	1	157.5															

# RECORD OF BOREHOLE No A-7

1 OF 1

METRIC

W.P. 141-87-00A LOCATION Co-ords: N 4 847 615.4 ; E 298 488.6 ORIGINATED BY TS  
DIST 6 HWY 407 BOREHOLE TYPE HS Auger COMPILED BY TS  
DATUM Geodetic DATE 90 01 11-12 CHECKED BY BC

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT w <sub>p</sub>	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w <sub>L</sub>	UNIT WEIGHT 7 kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			20 40 60 80 100	20 40 60 80 100					
159.3	Ground Surface												
158.5	Topsoil		1	AS	-								
0.8	Sand, Tr. Silt, Tr. Gravel Brown, Compact		2	SS	16								5 89 (5)
156.3			3	SS	22								
			4	SS	16								
3.0	Silt Compact		5	SS	26								0 3 86 11
154.7			6	SS	16								
4.6	Clayey Silt with Random Nodules/ Seams of Silt Grey, Stiff		7	TW	PH								0 0 75 25
151.7			8	SS	8								
			9	SS	9								
7.6			10	SS	6								0 0 65 35
			11	SS	4								
			12	TW	PH								0 0 58 42
	Clayey Silt, Tr. Sand, Tr. Gravel (Glacial Till) Grey, Firm to Stiff		13	TW	PM								
			14	SS	11								
			15	SS	13								
			16	SS	19								
140.6			17	SS	17								0 10 56 34
18.7	End of Borehole  * Hole Cave-in at 1.5m												

# RECORD OF BOREHOLE No A-8

1 OF 1

METRIC

W.P. 141-87-00A LOCATION Co-ords: N 4 847 881 ; E 298 813  
 DIST 5 HWY 407 BOREHOLE TYPE HS Auger  
 DATUM Geodetic DATE 90 02 23

ORIGINATED BY TS

COMPILED BY TS

CHECKED BY BC

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT 7 kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
160.2	Ground Surface																
159.4	Topsoil																
0.8	Sand, Tr. Gravel																
158.7	Silt, Brown, Compact		1	SS	12												
1.8	Clayey Silt with Random Nodules/ Seams of Silt		2	SS	10												
	Grey, Stiff		3	SS	7												
154.1			4	SS	3												
6.1	Clayey Silt, Tr. Sand, Tr. Gravel (Glacial Till)		5	SS	3												
	Grey, Stiff to Very Stiff		6	SS	7												
			7	SS	12												
147.6			8	SS	16												
12.6	End of Borehole																

# RECORD OF BOREHOLE No A-9

1 OF 1

METRIC

W.P. 141-87-00A LOCATION Co-ords: N 4 847 921 ; E 298 877 ORIGINATED BY TS  
DIST 6 HWY 407 BOREHOLE TYPE HS Auger COMPILED BY TS  
DATUM Geodetic DATE 90 02 23 CHECKED BY BC

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT w <sub>p</sub>	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w <sub>L</sub>	WATER CONTENT (%) w	UNIT WEIGHT γ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100						
160.1	Ground Surface																	
159.3	Topsoil																	
0.8	Sand, Tr. Gravel																	
158.6	Brown																	
1.5	Silt		1	SS	16													
157.8	Brown, Compact																	
2.3	Clayey Silt with Random Nodules/ Seams of Silt		2	SS	14													
	Grey, Stiff to Very Stiff		3	SS	7													
154.0			4	SS	3													
6.1	Clayey Silt, Tr. Sand, Tr. Gravel (Glacial Till)		5	SS	3													
	Grey, Firm to Very Stiff		6	SS	5													
148.7			7	SS	8													
11.4	Sand, Tr. Silt																	
147.5	Loose		8	SS	6													
12.6	End of Borehole																	

# RECORD OF BOREHOLE No A-10

1 OF 1

METRIC

W.P. 141-87-00A LOCATION Co-ords: N 4 847 953 : E 298 923 ORIGINATED BY TS  
DIST 6 HWY 407 BOREHOLE TYPE HS Auger COMPILED BY TS  
DATUM Geodetic DATE 90 02 23 CHECKED BY BC

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT γ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20 40 60 80 100	20 40 60 80 100	20 40 60 80 100	20 40 60 80 100	20 40 60 80 100		
160.0	Ground Surface													
159.4	Topsoil													
0.6 158.5	Sand, Tr. Gravel Brown, Compact													
1.5 157.7	Silt Brown, Compact		1	SS	14									
2.3	Clayey Silt with Random Nodules/ Seams of Silt		2	SS	6									
	Grey, Very Stiff		3	SS	11									
153.9			4	SS	6									
6.1	Clayey Silt, Tr. Sand, Tr. Gravel (Glacial Till)		5	SS	5									
	Grey, Firm to Stiff		6	TW	PH									
149.3			7	SS	5									
10.7	Silty Sand													
147.4	Grey, Loose		8	SS	5									
12.6	End of Borehole													



**AREA 1**

**WP 88-78-18**

**(HWY 407 / ISLINGTON STRUCTURE)**

# RECORD OF BOREHOLE No 1

1 OF 2 METRIC

W.P. 88-78-18 LOCATION Co-ords: N 4 847 645 E 288 404 ORIGINATED BY HCO  
 DIST 5 HWY 407 BOREHOLE TYPE Wash Boring, Hollow Stem Augers, Solid Stem Augers COMPILED BY RWR  
 DATUM Geodetic DATE June 20 to 23, 1983 CHECKED BY HCO

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT γ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20 40 60 80 100	20 40 60 80 100	20 40 60 80 100	20 40 60 80 100	20 40 60 80 100		
159.5														
159.1	Topsoil - Brown, Sandy													
0.4			1	SS	15		158							
			2	SS	18									
			3	SS	18									
			4	SS	15		156							
			5	SS	11									
			6	SS	14									
			7	SS	15		154							
152.2			8	SS	4		152							
7.3			9	SS	WR		150							
			10	SS	PH		148							
			11	TW	PM		146							
			12	SS	1		144							
			13	SS	WR		142							
143.2			14	TW	PH		140							
16.3			15	SS	13		138							
			16	SS	21		136							
			17	SS	14		134							
			18	TW	PH		132							
			19	SS	10		130							
133.9			20	SS	22									
25.6			21	SS	27									
			22	SS	11									
129.3														
30.2														

Continued

+3, x5: Numbers refer to  
Sensitivity

20  
15-5 (%) STRAIN AT FAILURE  
10

Continued

# RECORD OF BOREHOLE No 1

2 OF 2

METRIC

W.P. 88-78-18 LOCATION Co-ords: N 4 847 645 E 298 404 ORIGINATED BY HCO  
 DIST 6 HWY 407 BOREHOLE TYPE Wash Boring, Hollow Stem Augers, Solid Stem Augers COMPILED BY RWR  
 DATUM Geodetic DATE June 20 to 23, 1983 CHECKED BY HCO

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT w <sub>p</sub>	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w <sub>L</sub>	UNIT WEIGHT γ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20 40 60 80 100										WATER CONTENT (%)		
								SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 20 40 60 80 100										10 20 30		
30.5	<div>Continued</div> <div>Compact ----- Very Dense</div> <div>Sandy Silt to Silty Sand, Trace Clay, Trace Gravel Occasional Sand Seams</div>	<div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div>&lt;</div>																		

# RECORD OF BOREHOLE No 2

1 OF 2

METRIC

W.P. 88-78-18 LOCATION Co-ords: N 4 847 575 E 298 428 ORIGINATED BY HCO  
DIST 6 HWY 407 BOREHOLE TYPE Wash Boring COMPILED BY EFO  
DATUM Geodetic DATE July 7-11, 1983 CHECKED BY HCO

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT w <sub>p</sub>	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w <sub>L</sub>	UNIT WEIGHT γ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			SHEAR STRENGTH kPa						
158.5	Ground Surface							20 40 60 80 100	20 40 60 80 100	10 20 30				
0.0	Sand, Some Gravel Compact		1	SS	15			○ UNCONFINED + FIELD VANE						
			2	SS	20			● QUICK TRIAXIAL × LAB VANE						
	Silt - Sandy Silt Compact		3	SS	12		156							
	Brown		4	SS	21									
	Grey		5	SS	10									
153.0			6	SS	15		154							
5.5	Clayey Silt, [CL-ML], with interbedded zones of Silt. Stiff, Grey		7	SS	13		152	+3 + >96						
150.0			8	SS	13		150	+ >96						
8.5			9	SS	PH		148	+2				18.7		
	Silty Clay [CI] with random zones, Traces of Gravel, layered Firm to Stiff Grey		10	TW	PH		146	+3 +5						
			11	SS	6		144	+2 +2						
143.3			12	TW	PH		142	+3 +3						
15.2			13	SS	11		140	+1 +1						
			14	SS	17		138	>100+ >100+						
			15	SS	26		136							
	Clayey Silt with / some Sand and Trace Gravel (Glacial Till) Stiff to Hard, Grey		16	SS	20		134							
			17	SS	18		132							
			18	SS	20		130							
			19	SS	16									
			20	SS	54									
131.0			21	SS	10									
27.5	Clayey Silt, Trace / Some Fine Sand Very Stiff to Hard Grey		22	SS	31									
128.0														

Continued

+3, x5: Numbers refer to  
Sensitivity

20  
15-5 (%) STRAIN AT FAILURE  
10

Continued

# RECORD OF BOREHOLE No 2

2 OF 2

METRIC

W.P. 88-78-18 LOCATION Co-ords: N 4 847 575 E 298 428 ORIGINATED BY HCO  
DIST 6 HWY 407 BOREHOLE TYPE Wash Boring COMPILED BY EFO  
DATUM Geodetic DATE July 7-11, 1983 CHECKED BY HCO

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT      NATURAL MOISTURE CONTENT      LIQUID LIMIT			UNIT WEIGHT 7 kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			SHEAR STRENGTH kPa							WATER CONTENT (%)		
								20 40 60 80 100							10 20 30		
							o UNCONFINED      + FIELD VANE • QUICK TRIAXIAL      x LAB VANE										
30.3	Continued  Limestone Cobbles with Silty Sand  Dense, Grey		23	SS	33	/15cm	126							19.8			
			24	SS	100		126										
125.3			25	WS	-		126										
33.2	Silt Some Sand and Gravel, Trace Clay, Occasional Sand layers  Very Dense, Grey		26	SS	48	/23cm	124							19.8	0 46 50 4		
			27	SS	97		124										
			28	SS	63		122										
			29	SS	60		120										
118.7			30	SS	33		118										
39.8	Clayey Silt layered  Hard, Grey  Some Sand		31	SS	117		116							19.8	0 1 59 40		
			32	SS	91		116										
114.1			33	SS	100		116										
44.4	End of Borehole																
** Water Level Elev. 140.7 m Aug 24 /83.																	
* GROUND WATER CONDITIONS																	
PIEZO. NO.		GROUND WATER ELEVATION (Metres)															
1		140.7															

# RECORD OF BOREHOLE No 3

1 OF 2

METRIC

W.P. 88-78-18 LOCATION Co-ords: N 4 847 617 E 298 429 ORIGINATED BY HCO  
DIST 5 HWY 407 BOREHOLE TYPE Hollow Stem Auger, Wash Boring COMPILED BY EFO  
DATUM Geodetic DATE July 12-13, 1983 CHECKED BY HCO

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT w <sub>p</sub>	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20 40 60 80 100	20 40 60 80 100					
159.6														
0.0 158.8	Fill - Sand and Gravel													
0.8	Sandy Silt Very Loose to Compact		1	SS	5		158							
			2	SS	7									
			3	SS	15									
			4	SS	5		156							
			5	SS	4									
154.7			6	SS	3									
4.9	Clayey Silt [CL], Trace Sand Random Silt Zones Stiff, Grey		7	SS	6		154							
151.7			8	TW	PH		152							
7.9			9	TW	PH		150							
			10	SS	6		148							
			11	SS	6		146							
			12	SS	9		144							
			13	SS	16		142							
			14	SS	12		140							
			15	SS	10		138							
			16	SS	12		136							
			17	SS	11		134							
137.1			18	SS	34		132							
22.5			19	SS	58		130							
			20	SS	36									
			21	SS	30									
			22	SS	19									
129.8														
28.9 129.1														
30.5	As below													

Continued

+3, x5; Numbers refer to  
Sensitivity

20  
15-5 (%) STRAIN AT FAILURE  
10

Continued

# RECORD OF BOREHOLE No 3

2 OF 2

METRIC

W.P. 88-78-18 LOCATION Co-ords: N 4 847 617 E 298 429 ORIGINATED BY HCO  
 DIST 6 HWY 407 BOREHOLE TYPE Hollow Stem Auger, Wash Boring COMPILED BY EFO  
 DATUM Geodetic DATE July 12-13, 1983 CHECKED BY HCO

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT $\gamma$ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100	W <sub>p</sub>	W	W <sub>L</sub>		
30.5	Continued  Sandy Silt to Silty Sand Compact to Dense		23	SS	19												
			24	SS	48												
			25	SS	20												
			26	SS	69												
123.0	Clayey Silt Hard		27	SS	67												
36.5			28	SS	49												
121.0	Sandy Silt, Some Gravel Very Dense																
38.5			29	SS	76												
119.5	End of Borehole  * Water Level Elev. 154.9 m Aug. 24 /83																
40.1																	
* GROUND WATER CONDITIONS																	
PIEZO. NO.			GROUND WATER ELEVATION (Metres)														
1			154.9														

# RECORD OF BOREHOLE No 4

1 OF 2

METRIC

W.P. 88-78-18 LOCATION Co-ords: N 4 847 569.3 E 298 444.7 ORIGINATED BY IR  
 DIST 5 HWY 407 BOREHOLE TYPE HS Auger and Washboring COMPILED BY HS  
 DATUM Geodetic DATE 84 07 23 CHECKED BY JP

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT 7 kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20 40 60 80 100	20 40 60 80 100					
159.4	Ground Surface													
0.0	Clayey Silt with random zones of silt firm to stiff compact Sand trace silt		1	SS	5		158							
			2	SS	16		156							23 66 9 2
			3	SS	16		154							
			4	SS	8		152							0 0 82 18
149.6			5	SS	9		150							
9.8							148							
	Silty Clay trace gravel firm		6	SS	5		146							
143.2			7	SS	5		144							
16.2							142							
	Clayey Silt some sand, trace gravel (Glacial Till)		8	SS	8		140							
							138							
	stiff very stiff		9	SS	13		136							
			10	SS	15		134							
133.5							132							
25.9	Clayey Silt trace sand, occasional cobbles very stiff to hard		11	SS	78		130							
128.8														
30.5														

Continued

+3, x5: Numbers refer to  
Sensitivity

20  
15-5 (%) STRAIN AT FAILURE  
10

Continued



# RECORD OF BOREHOLE No 4

2 OF 2

METRIC

W.P. 88-78-18 LOCATION Co-ords: N 4 847 569.3 E 298 444.7 ORIGINATED BY JR  
DIST 6 HWY 407 BOREHOLE TYPE HS Auger and Washboring COMPILED BY HS  
DATUM Geodetic DATE 84 07 23 CHECKED BY JP

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT w <sub>p</sub>	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w <sub>L</sub>	UNIT WEIGHT γ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
30.5	<del>Ground Surface</del> <b>Continued</b>		12	SS	67		128										
			13	SS	17		126										
	Sand(cemented) some silt, occasional cobbles very dense  hard		14	SS	100	/28cm	124										
			15	SS	163	/25cm	122										
117.3			16	SS	54		120										
42.1	Sandy Gravel some silt  to  Silty Sand  very dense		17	SS	32	/5cm	118										
			18	SS	150		116										
			19	SS	61		114										
			20	SS	150	/23cm	112										
110.9			21	SS	200	/23cm											
48.5	End of Borehole		22	SS	150	/5cm											

**AREA 2**

**WP 88-78-16**

**(HWY 407 / CPR STRUCTURE)**

# RECORD OF BOREHOLE No C-1

METRIC

W P 141-87-00C LOCATION Co-ords: N 4 847 519.6; E 298 137.8 ORIGINATED BY TS  
 DIST 6 HWY 407 BOREHOLE TYPE H.S. Auger COMPILED BY TS  
 DATUM Geodetic DATE 1989 11 24 CHECKED BY

SOIL PROFILE			SAMPLES			GROUND WATER CONDITION	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT Y	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
136.5	Ground Surface																
0.0																	
	Trace Organics		1	SS	7		136										
			2	SS	9												
	Firm to Stiff		3	SS	11		134										
	Stiff to Hard	Brown Grey	4	SS	22												0 2 73 25
			5	SS	30		132									21.6	
			6	SS	32												
	Clayey Silt		7	SS	28		130										
	Trace of Sand		8	SS	30		128									21.3	0 5 65 30
			9	SS	12												
125.8			10	SS	12		126										0 1 84 15
10.7	Sandy Silt		11	SS	18		124										0 36 60 4
			12	SS	120		122										28 32 34 6
	Compact V. Dense		13	SS	120/	15cm	120										
	Occ. Gravel Seams		14	SS	90		118										
			15	SS	94		116										
			16	AS	-		114										
111.8	Gravel, Boulders and Cobbles						112										
24.7	End of Borehole																
	*Artesian Head 3.0m Above Ground Surface																

OFFICE REPORT ON SOIL EXPLORATION

\*3, \*5: Numbers refer to  
Sensitivity

20  
15  $\pm$  5 (%) STRAIN AT FAILURE  
10

# RECORD OF BOREHOLE No C-2

METRIC

W P 141-87-00C LOCATION Co-ords: N 4 847 540.1; E 298 173.9 ORIGINATED BY BC  
 DIST 6 HWY 407 BOREHOLE TYPE H.S. Auger COMPILED BY BC  
 DATUM Geodetic DATE 1989 11 28 CHECKED BY

OFFICE REPORT ON SOIL EXPLORATION

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT Y	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES		20	40	60	80	100		
147.4	Ground Surface						SHEAR STRENGTH $kPa$						
							○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE						
							20	40	60	80	100		
							WATER CONTENT (%)						
							W <sub>p</sub> — W — W <sub>L</sub> 10 20 30						
0.0													
	Sand, Trace Silt					146							
	Trace Gravel		1	SS	5								
	(Fill)												
	Brown, V. Loose		2	SS	4	144							10 81 (9)
	to Loose												
142.4			3	SS	7								
5.0						142							
	Silty Clay		4	SS	5								
	to												
	Clayey Silt					140							
	Trace Gravel		5	SS	10								
	Occ. Sand Seams												
	Firm to V. Stiff		6	TW	PH	138							
	(Glacial Till)												
			7	TW	PH	136							
135.2													
12.2			8	SS	9								
						134							0 4 66 30
	Clayey Silt		9	SS	15								
	Trace Sand		10	SS	14								
	Grey		11	SS	15								
			12	SS	13	132							
			13	SS	11								
			14	SS	12	130							
			15	SS	13	128							
			16	SS	10	126							
			17	SS	7								
124.5													
22.9			18	SS	5	124							
	Sand												
	Some Silt												
122.6													
	Grey, Loose		19	SS	8								
24.8	End of Borehole												

\* 3, x 5: Numbers refer to  
 Sensitivity  
 20  
 15 — 5 (%) STRAIN AT FAILURE  
 10

# RECORD OF BOREHOLE No C-3

METRIC

W P 141-87-00C LOCATION Co-ords: N 4 847 561.0; E 298 190.8 ORIGINATED BY TS  
 DIST 6 HWY 407 BOREHOLE TYPE H.S. Auger, NW Casing, Washbore, NQ Core COMPILED BY TS  
 DATUM Geodetic DATE 89 11 22 - 25 CHECKED BY

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT Y	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			20	40	60	80	100					
152.2	Ground Surface					152										
0.0																
	Clayey Silt, Trace Sand, Trace Gravel		1	SS	8											
			2	SS	9											
	Brown Grey		3	SS	2											
			4	TW	PH											
	Firm to V. Stiff Occ. Sand Seams (Glacial Till)		5	SS	12											0 4 61 35
			6	SS	5											20.2
	Silt, Tr. Sand		7	SS	12											0 10 85 5
140.0			8	SS	16											
12.2			9	SS	23											
	Clayey Silt Trace Sand Grey, Stiff to V. Stiff		10	SS	24											
			11	SS	26											
			12	SS	26											
			13	SS	27											0 8 69 23
			14	SS	29											
			15	SS	24											
			16	SS	21											
			17	SS	15											
			18	SS	36											
			19	SS	14											
			20	SS	14											
			21	SS	11											
			22	SS	14											
122.0						124										
30.2																

OFFICE REPORT ON SOIL EXPLORATION

Continued

\*3, \*5: Numbers refer to Sensitivity

20  
15  
10  
5 (%) STRAIN AT FAILURE

Continued

# RECORD OF BOREHOLE No C-3 Cont'd

METRIC

W P 141-87-00C LOCATION Co-ords: N 4 847 561.0; E 298 190.8 ORIGINATED BY TS  
 DIST 6 HWY 407 BOREHOLE TYPE H.S. Auger, NW Casing, Washbore, NO Core COMPILED BY TS  
 DATUM Geodetic DATE 89 11 22 - 25 CHECKED BY \_\_\_\_\_

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20 40 60 80 100							SHEAR STRENGTH kPa
											○ UNCONFINED ● QUICK TRIAXIAL	+ FIELD VANE × LAB VANE			
122.0	Continued														
121.7	Clayey Silt		23	SS	10										
30.5															
	Sand						120								
	Some Silt														
	Grey, Compact to Dense		24	SS	39		118								
			25	SS	28		116								
			26	SS	46		114							0 62 30 8	
							112								
							110								
	Occ. Cobbles Boulders and Gravel						108								
105.9															
46.3	Bedrock Shale		27	RC	REC 60%		106							RQD = 10%	
105.0															
47.2	End of Borehole														

OFFICE REPORT ON SOIL EXPLORATION

# RECORD OF BOREHOLE No C-4

METRIC

W P 141-87-00C LOCATION Co-ords: N 4 847 580.0; E 298 204.5 ORIGINATED BY BC  
 DIST 6 HWY 407 BOREHOLE TYPE H.S. Auger COMPILED BY BC  
 DATUM Geodetic DATE 1989 11 27 CHECKED BY           

OFFICE REPORT ON SOIL EXPLORATION

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20 40 60 80 100	20 40 60 80 100					
147.0	Ground Surface													
0.0							146							
							144							
	Brown Grey		1	SS	12									
	Clayey Silt		2	SS	6									
	Some Sand, Tr. Gravel		3	SS	7									
	Stiff to V. Stiff		4	SS	5									
	Occ. Sand Seams (Glacial Till)		5	SS	5									
136.3			6	SS	13									
10.7			7	SS	22									
	Clayey Silt		8	SS	13									
	Grey, Stiff to Hard		9	SS	34									
	Random Zones of Silt		10	SS	39									
			11	SS	25									
			12	SS	23									
			13	SS	19									
			14	SS	18									
			15	SS	15									
			16	SS	14									
			17	SS	10									
122.2			18	SS	11									
24.8	End of Borehole													

+3, x5: Numbers refer to  
 Sensitivity

20  
 15  
 10  
 5  
 (%) STRAIN AT FAILURE

# RECORD OF BOREHOLE No D-1

METRIC

W P 88-78-16 LOCATION Co-ords: N 4 847 491.9; E 298 279.3 ORIGINATED BY TS  
 DIST 6 HWY 407 BOREHOLE TYPE H.S. Auger, BW Casing, Washbore, BXL Rock Core & Cone Test COMPILED BY TS  
 DATUM Geodetic DATE 89 10 21-30 CHECKED BY \_\_\_\_\_

OFFICE REPORT ON SOIL EXPLORATION

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			20 40 60 80 100	20 40 60 80 100					
152.0	Ground Surface												
0.0	Sand (Fill) Brown, Compact		1	AS									
150.5			2	SS	10								
1.5			3	SS	10								
	Brown Grey		4	SS	6								
			5	TW	PH								
	Silty Clay to Clayey Silt		6	SS	9								
			7	SS	9								
	Some Sand		8	SS	9								
	Stiff		9	SS	7								
	Occ. Sand Seams		10	TW	PH								
	(Glacial Till)		11	SS	4								
138.3			12	SS	21								
13.7			13	SS	21								
	Clayey Silt		14	SS	32								
	V. Stiff to Hard		15	SS	30								
			16	SS	26								
			17	SS	32								
			18	SS	19								
			19	SS	18								
			20	SS	20								
			21	SS	16								
			22	SS	18								
121.8													
30.2													

Continued

+3, x5: Numbers refer to  
 Sensitivity

20  
 15  
 10  
 5 (%) STRAIN AT FAILURE





Continued



# RECORD OF BOREHOLE No D-1 Cont'd METRIC

W P 88-78-16 LOCATION Co-ords: N 4 847 491.9; E 298 279.3 ORIGINATED BY TS  
 DIST 6 HWY 407 BOREHOLE TYPE R.S. Auger, BW Casing, Washbore, BXL Rock Core & Cone Test COMPILED BY TS  
 DATUM Geodetic DATE 89 10 21-30 CHECKED BY \_\_\_\_\_

OFFICE REPORT ON SOIL EXPLORATION

SOIL PROFILE		STRAT PLOT	SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT Y	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION		NUMBER	TYPE	'N' VALUES			20	40	60	80	100		
121.8	Continued		23	SS	16		120							
30.2			24	SS	16									
			25	SS	76		118							
			26	SS	45		116							
			27	SS	15		114							
115.4	Sand Tr. Silt Compact to V. Dense		28	SS	59		112							
36.6			29	SS	58		110							
			30	SS	65		108							
			31	SS	33		106							
			32	SS	44		104							
			33	SS	129/23cm									
105.9	Bedrock Shale Weak to Very Weak		34	BXL RC	REC 73%									RQD = 34%
46.1			35	BXL RC	REC 100%									RQD = 0%
103.1	End of Borehole													
48.9														

# RECORD OF BOREHOLE No D-2

METRIC

W P 88-78-16 LOCATION Co-ords: N 4 847 472.6; E 298 274.6 ORIGINATED BY TS  
 DIST 6 HWY 407 BOREHOLE TYPE R.S. Auger, BW Casing, Washbore, NQ Core COMPILED BY TS  
 DATUM Geodetic DATE 1989 11 08-11 CHECKED BY

OFFICE REPORT ON SOIL EXPLORATION

SOIL PROFILE		STRAT PLOT	SAMPLES		GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV. DEPTH	DESCRIPTION		NUMBER	TYPE			20 40 60 80 100	20 40 60 80 100					
153.0	Ground Surface												
0.0	Irregular Mixture of Silt, Sand, Slag Ballast (Fill)		1	SS	11								
150.6	Brown-Black, Compact												
2.4			2	SS	7								
			3	SS	7								
	Brown Grey		4	SS	8								
	Silty Clay to Clayey Silt		5	TW	PH							21.0	1 13 58 28
	Some Sand, Trace Gravel Firm to V. Stiff		6	TW	PH								
	Occ. Sand Seams		7	SS	4								4 13 35 48
	(Glacial Till)		8	SS	4								
139.3													
13.7			9	SS	22								0 4 79 17
	Clayey Silt Firm to V. Stiff		10	SS	20								
			11	SS	23								
			12	SS	12								
			13	SS	20								
			14	SS	18								
			15	SS	13								
122.8													
30.2													

Continued

\*3, \*5: Numbers refer to Sensitivity

20  
15  
10  
5  
[%] STRAIN AT FAILURE

Continued

# RECORD OF BOREHOLE No D-2 Cont'd METRIC

W P 88-78-16 LOCATION Co-ords: N 4 847 472.6; E 298 274.6 ORIGINATED BY TS  
 DIST 6 HWY 407 BOREHOLE TYPE H.S. Auger, SW Casing, Washbore, NO Core COMPILED BY TS  
 DATUM Geodetic DATE 1989 11 08-11 CHECKED BY \_\_\_\_\_

OFFICE REPORT ON SOIL EXPLORATION

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT Y	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20 40 60 80 100					W <sub>p</sub>	W			W <sub>L</sub>
								SHEAR STRENGTH kPa									



# RECORD OF BOREHOLE No D-3

METRIC

W P 141-87-00D LOCATION Co-ords: N 4 847 504.0; E 298 204.0 ORIGINATED BY TS  
DIST 6 HWY 407 BOREHOLE TYPE H.S. Auger COMPILED BY TS  
DATUM Geodetic DATE 1989 11 27 CHECKED BY

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT Y	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
136.0	Ground Surface																
0.0																	
	Interbedded Layers of Sand and Gravel Tr. Organics		1	SS	4												
			2	SS	2												
			3	SS	14												
			4	SS	12												
			5	SS	22												
			6	SS	19												
			7	SS	27												
	Clayey Silt																
	Tr. Sand, Tr. Gravel		8	SS	20												
			9	SS	20												
	Stiff to Hard																
124.9			10	SS	15												
11.1																	
	Silt																
	Tr. Clay, Tr. Sand		11	SS	7												
	Loose		12	SS	85												
	V. Dense																
			13	SS	100/	15cm											
119.1			14	SS	120/	10cm											
16.9	End of Borehole																

+3, x5 : Numbers refer to  
Sensitivity

20  
15 5 (%) STRAIN AT FAILURE  
10

OFFICE REPORT ON SOIL EXPLORATION

# RECORD OF BOREHOLE No D-4

METRIC

W P 88-78-16 LOCATION Co-ords: N 4 847 539.4; E 298 210.1 ORIGINATED BY TS  
 DIST 6 HWY 407 BOREHOLE TYPE H.S. Auger, NW Casing, Washbore, NO Rock Core COMPILED BY TS  
 DATUM Geodetic DATE 89 11 13-21 CHECKED BY \_\_\_\_\_

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
152.1	Ground Surface						152										
0.0																	
	Clayey Silt With Interbedded Layers of Sand (Fill)		1	SS	2		150										
			2	SS	3		148										0 32 64 4
	Brown to Grey		3	SS	3		146										
	V. Soft to Stiff		4	SS	6		144									20.0	0 2 78 20
			5	SS	6		142										
			6	SS	8		140										
			7	SS	15		138									20.2	4 22 49 25
139.9			8	SS	20		136										
12.2	Clayey Silt Grey, Stiff to Hard		9	SS	25		134										
			10	SS	30		132										
	Sandy Silt		11	SS	53		130										
			12	SS	32		128										
			13	SS	17		126										
			14	SS	11		124										
			15	SS	13		122										0 0 88 12
121.9																	
30.2																	

OFFICE REPORT ON SOIL EXPLORATION

Continued

3, 5: Numbers refer to Sensitivity

20  
15  
10  
5 (%) STRAIN AT FAILURE

Continued

# RECORD OF BOREHOLE No D-4 Cont'd METRIC

W P 88-78-16 LOCATION Co-ords: N 4 847 539.4; E 298 210.1 ORIGINATED BY TS  
 DIST 6 HWY 407 BOREHOLE TYPE H.S. Auger, NW Casing, Washbore, NQ Rock Core COMPILED BY TS  
 DATUM Geodetic DATE 89 11 13 CHECKED BY \_\_\_\_\_







SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC NATURAL LIQUID LIMIT MOISTURE CONTENT LIMIT			UNIT WEIGHT  γ  kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)  GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20 40 60 80 100		W <sub>p</sub> W W <sub>L</sub>				
								SHEAR STRENGTH kPa		WATER CONTENT (%)				
121.9 30.2	Continued		16	SS	10									
	Clayey Silt Grey Stiff to Hard						120							
118.6 33.5			17	SS	45									
	Sand  Some Silt  Grey, Compact  to V. Dense						118							
			18	SS	20									
							116							
			19	SS	72									
							114							
							112							
							110							
			20	SS	120/8 cm									
							108							
			21	SS	65									
107.1 45.0	Bedrock Shale		22	NQ RC	REC 60%		106							
105.8 46.3	End of Borehole													

OFFICE REPORT ON SOIL EXPLORATION

# RECORD OF BOREHOLE No D-4A

METRIC

W P 88-78-16 LOCATION Co-ords: N 4 847 520.0; E 298 212.0 ORIGINATED BY TS  
 DIST 6 HWY 407 BOREHOLE TYPE R-Casing, Washbore COMPILED BY TS  
 DATUM Geodetic DATE 1989 11 30 CHECKED BY \_\_\_\_\_

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 					UNIT WEIGHT Y	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL		
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			SHEAR STRENGTH kPa								
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE								
143.5	Ground Surface						20	40	60	80	100	PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>		
0.0	Sand, Tr. Gravel (Fill)  Brown,  Loose to Compact		1	SS	6	*	142									
			2	SS	21		140									
138.9			3	SS	37		138									
4.6	Clayey Silt With Interbedded Layers of Sand (Fill)		4	SS	22											
136.9	Brown, Stiff to Hard															
6.6	End of Borehole  *Borehole Dry															

OFFICE REPORT ON SOIL EXPLORATION

\*3, x<sup>5</sup>: Numbers refer to  
 Sensitivity

20  
 15 5 (%) STRAIN AT FAILURE  
 10

# RECORD OF BOREHOLE No D-5

METRIC

W P 141-87-00D LOCATION Co-ords: N 4 847 605.0; E 298 115.0 ORIGINATED BY TS  
 DIST 6 HWY 407 BOREHOLE TYPE H.S. Auger COMPILED BY TS  
 DATUM Geodetic DATE 1989 11 16-17 CHECKED BY

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT Y kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL				
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			SHEAR STRENGTH kPa							WATER CONTENT (%)			
								20 40 60 80 100										
							20 40 60 80 100					10 20 30						
							○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE											
154.3	Ground Surface																	
0.0						*	154											
	Silty Clay		1	SS	7		152											
	to		2	SS	3		150						19.5	0 4 61 35				
	Clayey Silt						148											
	Trace Gravel		3	TW	PH		146											
	Grey, Firm		4	TW	PH		144						20.1	6 7 60 27				
	to V. Stiff						142											
	Occ. Sand Seams		5	SS	11		140											
	(Glacial Till)		6	SS	8		138						20.0	0 2 74 24				
			7	SS	10		136											
			8	SS	5													
			9	SS	10													
139.1			10	SS	12													
15.2	Clayey Silt		11	SS	22													
	Grey, Stiff to		12	SS	32													
	V. Stiff		13	SS	22													
134.0	End of Borehole																	
20.3	*Borehole Dry																	

OFFICE REPORT ON SOIL EXPLORATION

+<sup>3</sup>, x<sup>5</sup>: Numbers refer to Sensitivity  
 20  
 15  
 10  
 5 (%) STRAIN AT FAILURE



# RECORD OF BOREHOLE No D-6

METRIC

W P 88-78-16 LOCATION Co-ords: N 4 847 511.1; E 298 240.4 ORIGINATED BY TS  
 DIST 6 HWY 407 BOREHOLE TYPE H.S. Auger COMPILED BY TS  
 DATUM Geodetic DATE 89 11 20 CHECKED BY \_\_\_\_\_

OFFICE REPORT ON SOIL EXPLORATION

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					NATURAL MOISTURE CONTENT			UNIT WEIGHT Y kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100	W <sub>p</sub>	W	W <sub>L</sub>		
152.5	Ground Surface																
0.0	Sand, Tr. Silt (Fill)					*	152										
150.5	Brown, V. Loose		1	SS	4												
2.0			2	SS	6		150										
	Clayey Silt With Interbedded Layers of Sand (Fill)		3	SS	6		148										0 5 73 22
	Brown, Firm		4	SS	5		146										19.4 0 2 84 14
			5	SS	7		144										19.2 0 14 64 22
			6	SS	6												
141.8			7	SS	4		142										1 79 15 5
10.7	Sand, Some Silt (Fill)		8	SS	6		140										
	Brown, Very Loose to Loose																
138.6			9	SS	7												6 72 18 4
13.9	Clayey Silt, Tr. Gravel						138										
	Tr. Organics																
136.8	Grey, Firm to Stiff		10	SS	14												
15.7	End of Borehole																
	*Borehole Dry																

# RECORD OF BOREHOLE No D-6A

METRIC

W P 88-78-16 LOCATION Co-ords: N 4 847 504.0; E 298 229.0 ORIGINATED BY TS  
 DIST 6 HWY 407 BOREHOLE TYPE B-Casing, Washbore COMPILED BY TS  
 DATUM Geodetic DATE 1989 11 29 CHECKED BY

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT Y	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
143.5	Ground Surface																
0.0			1	SS	2	*											
	Sand, Some Gravel, Trace Silt		2	SS	6		142										20 77 (3)
	(Fill)		3	SS	8												
			4	SS	9												
	Brown, V. Loose to Compact		5	SS	12		140										26 59 (15)
138.9																	
4.6	Clayey Silt (Fill) Brown, V. Stiff		6	SS	19		138										
137.3	Clayey Silt																
136.9	Grey, Tr. Organics		7	SS	29												4 6 65 25
6.6	End of Borehole * Borehole Dry																

OFFICE REPORT ON SOIL EXPLORATION

# RECORD OF BOREHOLE No D-7

METRIC

W P 88-78-16 LOCATION Co-ords: N 4 847 530.8; E 298 232.1 ORIGINATED BY TS  
 DIST 6 HWY 407 BOREHOLE TYPE H.S. Auger COMPILED BY TS  
 DATUM Geodetic DATE 89 11 20 CHECKED BY \_\_\_\_\_

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			20	40	60	80	100					
152.5	Ground Surface															GR SA SI CL
0.0					*	152										
			1	SS	2											11 62 23 4
			2	SS	3											
	Clayey Silt Brown, Firm		3	SS	8	148										0 12 66 22
			4	SS	4											
	Silty Sand		5	SS	5	146										2 41 54 3
	to		6	SS	5											
	Sandy Silt		7	SS	8	144										
	(Fill)		8	SS	9											
	V. Loose to Loose		9	SS	9	142										
			10	SS	8	140										0 30 66 4
136.3						138										1 63 31 5
16.2	End of Borehole Auger Refusal Probable Culvert Roof															4 73 19 4
	*Borehole Dry															

OFFICE REPORT ON SOIL EXPLORATION

+3, x5: Numbers refer to Sensitivity

20  
15  
10  
5 (%) STRAIN AT FAILURE

# RECORD OF BOREHOLE No D-8

METRIC

W P 88-78-16 LOCATION Co-ords: N 4 847 516.1; E 298 252.3 ORIGINATED BY TS  
 DIST 6 HWY 407 BOREHOLE TYPE H.S. Auger, BN Casing, Washbore, NQ Rock Core COMPILED BY TS  
 DATUM Geodetic DATE 89 11 02-08 CHECKED BY

OFFICE REPORT ON SOIL EXPLORATION

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			20 40 60 80 100	20 40 60 80 100					
150.6	Ground Surface												
0.0													
	Sand, Some Silt With Interbedded Layers of Clayey Silt Brown, Loose		1	SS	9			2					14 56 29 1
	(Fill)		2	SS	6								
			3	SS	4								0 13 75 12
144.5			4	SS	4								0 7 52 41
6.1	Clayey Silt Grey, Firm to Stiff Occ. Sand Seams		5	SS	8							20.2	
	(Glacial Till)		6	SS	12								
			7	SS	4								
139.9			8	SS	17								
10.7	Clayey Silt Grey, Firm to Hard		9	SS	22							20.3	2 1 72 25
			10	SS	19								
			11	SS	22								
			12	SS	28							21.6	
			13	SS	25								
			14	SS	23								
			15	SS	19								
			16	SS	16								0 5 60 35
			17	SS	14								
			18	SS	18								
			19	SS	10								
120.4													
30.2													

Continued

\*3, \*5: Numbers refer to Sensitivity

20  
15 5 (%) STRAIN AT FAILURE  
10

Continued

# RECORD OF BOREHOLE No D-8 Cont'd METRIC

W P 88-78-16 LOCATION Co-ords: N 4 847 516.1; E 298 252.3 ORIGINATED BY TS  
 DIST 6 HWY 407 BOREHOLE TYPE H.S. Auger, BW Casing, Washbore, NO Rock Core COMPILED BY TS  
 DATUM Geodetic DATE 89 11 02-08 CHECKED BY

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT Y KN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES		20	40	60	80	100					
120.4	Continued															
30.2			20	SS	9											
	Silt, Tr Sand V. Dense		21	SS	107											0 7 79 14
	Clayey Silt															
	Grey		22	SS	36											
	Firm to Hard															
111.9																
38.7	Sand With Silt Grey, Compact		23	SS	12											
107.7	Some Gravel		24	SS	120	15 cm										17 38 31 14
42.9	Bedrock Shale Weak to Very Weak		25	NQ RC	REC 100%											RQD = 15%
105.9																
44.7	End of Borehole															

OFFICE REPORT ON SOIL EXPLORATION

**AREA 3**

**WP 88-78-15 & 32.**

**(HWY 407 / HUMBER RIVER STRUCTURE)**

# RECORD OF BOREHOLE No 4

METRIC

W P 88-78-32; 88-78-15

LOCATION

ORIGINATED BY RF

DIST 6 HWY 407

BOREHOLE TYPE Hollow Stem Augers

COMPILED BY ASP

DATUM Geodetic

DATE March 21, 1990

CHECKED BY

OFFICE REPORT ON SOIL EXPLORATION

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH (m)	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100				
135.17	Ground Surface															
134.52	Topsoil						135									
0.63	Sand, fine, some silt to sandy silt, trace clay & organics		1	SS	3											
133.17	Very loose Brown		2	SS	2											
132.00	Sand and Gravel.															
132.87			3	SS	3											
2.50	Clayey Silt, trace sand, occasional gravel (Till-like texture)															
	Stiff to very stiff Grey		4	SS	5											
			5	SS	14											
129.67							130									
5.50	Silt, trace sand, some silty sand interlayers.		6	SS	7											
	Loose Grey															
			7	SS	4											
126.67																
8.50	Clayey Silt, trace sand, occasional gravel (Till-like texture). Occasional silt seams.		8	SS	4											
	Stiff to hard Grey															
			9	SS	11		125									
			10	SS	74											
122.07																
13.10	Silt and Sand, trace clay.		11	SS	25											1 51 42.6
	Compact Grey															
120.27																
14.90	Silt, trace sand and clay.		12	SS	159		120									0 3 90 7
	Very dense Grey															
			13	SS	188											
117.57																
17.60	Silty Sand, some gravel trace clay (Till)															
116.42	Very dense Grey		14	SS	130											15 56 27 2
18.75	End of Borehole						115									

+3, x5: Numbers refer to Sensitivity

20  
15 5 (%) STRAIN AT FAILURE  
10

# RECORD OF BOREHOLE No 5

METRIC

W P 88-78-32;88-78-15

LOCATION

ORIGINATED BY RF

DIST 6 HWY 407

BOREHOLE TYPE Hollow Stem Augers

COMPILED BY ASP

DATUM Geodetic

DATE March 19 and March 20, 1990

CHECKED BY

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV. (m)	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
135.85	Ground Surface																
0.00	Topsoil																
135.25	0.60 Sandy Silt, trace clay, some organics, occasional shell fragments.		1	SS	4		135										
133.85	Loose Brown		2	SS	7												
2.00	Sand and Gravel. Compact																
133.25	2.60 Clayey Silt, trace sand occ. gravel (Till-like texture)		3	SS	22												
	Stiff Grey		4	TW	PH												
			5	SS	6												
			6	SS	4												
130.05	5.80 Silt, some sand, occ. clayey silt seam.																
129.15	Compact Grey		7	SS	11												
6.70	Stratified Clayey silt and silty clay, trace sand, frequent silt seams.																
	Stiff to very stiff Grey		8	SS	5												
			9	SS	5												
			10	SS	13												
123.55	12.30 Clayey Silt, some sand & gravel (Till).		11	SS	93												
122.45	Hard Grey																
13.40	Clayey Silt, trace sand & interlayered with silt and silty sand.		12	SS	53												
121.25	Hard Grey																
14.60	Silt, trace clay and sand.																
	Very dense Grey		13	SS	134												
119.65	16.20 Heterogeneous mixture of silt and gravel, some sand and clay (Till).																
	Very dense Grey		14	SS	100/100 mm												
			15	SS	182												
116.65	19.20 Silty Sand, some gravel, trace clay (Till)																
115.73	Very dense Grey		16	SS	142												
20.12	End of Borehole																

OFFICE REPORT ON SOIL EXPLORATION

+<sup>3</sup>, x<sup>5</sup>: Numbers refer to Sensitivity

20  
15  
10

5 (%) STRAIN AT FAILURE



# RECORD OF BOREHOLE No 6

METRIC

W P 88-78-32; 88-78-15

LOCATION

ORIGINATED BY SB

DIST 6 HWY 407

BOREHOLE TYPE

Hollow Stem Augers

COMPILED BY ASP

DATUM Geodetic

DATE

March 9, March 15 and March 16, 1990.

CHECKED BY

OFFICE REPORT ON SOIL EXPLORATION

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV. DEPTH (m)	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE			20	40	60	80	100					
135.16	Ground Surface															
134.36	Topsoil															
0.80	Sandy Silt, trace clay.		1	SS	6											
133.35	Loose Brown		2	SS	11											
1.80	Sand and Gravel, some silt.															
132.26	Compact Brown/Grey		3	SS	14											
2.90	Clayey Silt, trace to some sand, occasional gravel (Till-like texture).		4	SS	6											
	Very Stiff Grey		5	SS	12											
			6	SS	12											
			7	SS	5											
127.96	Silt, trace clay, interlayers of sandy silt and clayey silt.		8	SS	3											
	Very loose to loose Grey		9	SS	8											
125.16	Clayey silt, some silt partings		10	SS	19											
123.56	Very Stiff Grey		11	SS	70											
11.60	Clayey Silt, trace to some sand, trace gravel		12	SS	117											
122.06	Hard Grey		13	SS	43											
13.10	Silt to sandy silt, trace clay.		14	SS	176/225 mm											
118.96	Dense to very dense Grey		15	SS	92											
16.20	Clayey Silt, and gravel, some sand (Till).		16	SS	75											
117.66	Hard Grey		17	SS	34											
17.50	Sandy Silt, some gravel (Till).															
115.96	Very Dense Grey															
19.20	Silty sand, trace gravel.															
114.89	Dense Grey															
20.27	End of Borehole															

+3, x5: Numbers refer to Sensitivity

20  
15  
10

(%) STRAIN AT FAILURE

# RECORD OF BOREHOLE No 11

METRIC

W P 88-78-32; 88-78-15

LOCATION

ORIGINATED BY JR

DIST 6 HWY 407

BOREHOLE TYPE Hollow Stem Auger; BW Casing - Wash Boring

COMPILED BY ASP

DATUM Geodetic

DATE February 14 to February 20, 1990

CHECKED BY

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV. DEPTH (m)	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
135.44	Ground Surface.																GR SA SI CL
0.00	Topsoil						135										
134.95	0.50 Sandy Silt, trace clay and organics. Loose		1	SS	8												
134.04	1.40 Silty Sand, silt inter layers. Very Loose		2	SS	3												
133.34	2.10 Silty clay, gravel seams. Stiff		3	SS	10												
132.54	2.90 Clayey Silt, trace to some sand, occasional to trace gravel (Till-like texture). Very Stiff Grey		4	SS	15												
			5	SS	14												
			6	SS	15												
							130										
128.84	6.60 Silty Clay, stratified with silt partings. Very Stiff Grey		7	SS	12												
			8	TW	PH												
			9	SS	13												
126.94	8.50 Clayey Silt, some sand, trace gravel (Till). Very Stiff Grey		10	SS	13												
125.44	10.00 Silt and sand, fine, trace clay. Occasional interlayer of clayey silt. Loose Grey		11	SS	9												
			12	SS	WR												
122.04	13.40 Silty Clay and clayey silt, stratified with silt partings. Hard Grey		13	SS	110												
			14	SS	115												
118.98	16.48 End of Borehole.		15	SS	184												
							120										
							115										

OFFICE REPORT ON SOIL EXPLORATION

## METRIC

W P 88-78-32; 88-78-15 LOCATION \_\_\_\_\_ ORIGINATED BY JR  
DIST 6 HWY 407 BOREHOLE TYPE Hollow Stem Auger; Wash Boring COMPILED BY ASP  
DATUM Geodatic DATE February 23 to February 27, 1990. CHECKED BY \_\_\_\_\_

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT	NATURAL MOISTURE CONTENT	LIQUID LIMIT	UNIT WEIGHT  Y	REMARKS & GRAIN SIZE DISTRIBUTION (%)  GR SA SI CL
ELEV DEPTH (m)	DESCRIPTION	STRAT. PLT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100	W <sub>p</sub>	W	W <sub>L</sub>		
								SHEAR STRENGTH kPa									
135.55	Ground Surface																
0.00	Topsoil																
135.09	0.50 Sandy Silt, trace clay and gravel. Loose		1	SS	7												
134.15	1.40 Sand and Gravel, trace silt.		2	SS	6												
132.65	Loose to Compact Grey		3	SS	14												
2.90	Clayey Silt, trace to some sand, occasional to trace gravel (Till- like texture).  Very Stiff Grey		4	SS	23												
			5	SS	24												
			6	SS	19												
			7	SS	14												
			8	SS	16												
126.15			9	SS	17												
9.40	Silty Clay, stratified with silt partings.  Very Stiff Grey		10	SS	14												
123.95			11	SS	2												
11.60	Silt and Sand, fine, trace clay.  Very Loose Grey		12	SS	48												
122.15			13	SS	140												
13.40	Clayey Silt to silty clay, trace to some sand (Till-like texture).  Hard Grey		14	SS	142												
			15	SS	146												
118.15			16	SS	134												
17.40	Clayey Silt Hard																
117.72																	
17.83	End of Borehole.																

OFFICE REPORT ON SOIL EXPLORATION

## RECORD OF BOREHOLE No 17

METRIC

W P 88-78-32; 88-78-15

LOCATION

ORIGINATED BY JR

DIST 6 HWY 407

BOREHOLE TYPE Hollow Stem Auger; BW Casing - Wash Boring

COMPILED BY ASP

DATUM Geodetic

DATE February 14 to February 20, 1990

CHECKED BY

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH (m)	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
135.50	Ground Surface																
0.00																	
134.90	Topsoil						135										
0.60	Sandy Silt, trace clay and organics. Compact		1	SS	11	Artesian Head at Elev. 140 m on completion of drilling											
134.10																	
1.40	Silty Sand, trace organics. Loose		2	SS	6												
133.40																	
2.10	Organic Silt with peat seams. Soft		3	SS	2												
133.60																	
2.90	Silty Sand and gravel, occ. organics.		4	SS	15												
131.10	Compact Grey		5	SS	10												
4.40	Silty Clay and clayey silt, trace sand.		6	SS	11												
	Interlayered with frequent silt partings and seams.		7	SS	7		130										
	Occasional interlayer of sandy silt, trace of clay.		8	TW	PH												
			9	SS	7												
	Stiff to very stiff.		10	SS	9												
124.83	Grey		11	TW	PH												
10.67	Silt, some sand, trace clay.		12	SS	9		125										
123.90	Loose Grey																
11.60	Sandy Silt, trace gravel and clay.		13	SS	20												
122.70	Compact Grey																
12.80	Clayey Silt to silty clay, trace to some sand, trace gravel. (Till-like texture)		14	SS	172												
	Hard Grey		15	SS	130		120										
118.70																	
16.80	Silt, trace clay and sand.																
	Very dense Grey		16	SS	115												
114.80							115										
20.70	Sand and Gravel, trace silt.		17	SS	79												
	Very dense Grey																
113.00																	

OFFICE REPORT ON SOIL EXPLORATION

22.00 Borehole Continued

+3, x5: Numbers refer to  
Sensitivity20  
15 5 (%) STRAIN AT FAILURE  
10

## RECORD OF BOREHOLE No 17

METRIC

W P 88-78-32; 88-78-15

LOCATION

ORIGINATED BY RF

DIST 6 HWY 407

BOREHOLE TYPE Hellos Stem Auger; BW Casing - Wash Boring

COMPILED BY ASP

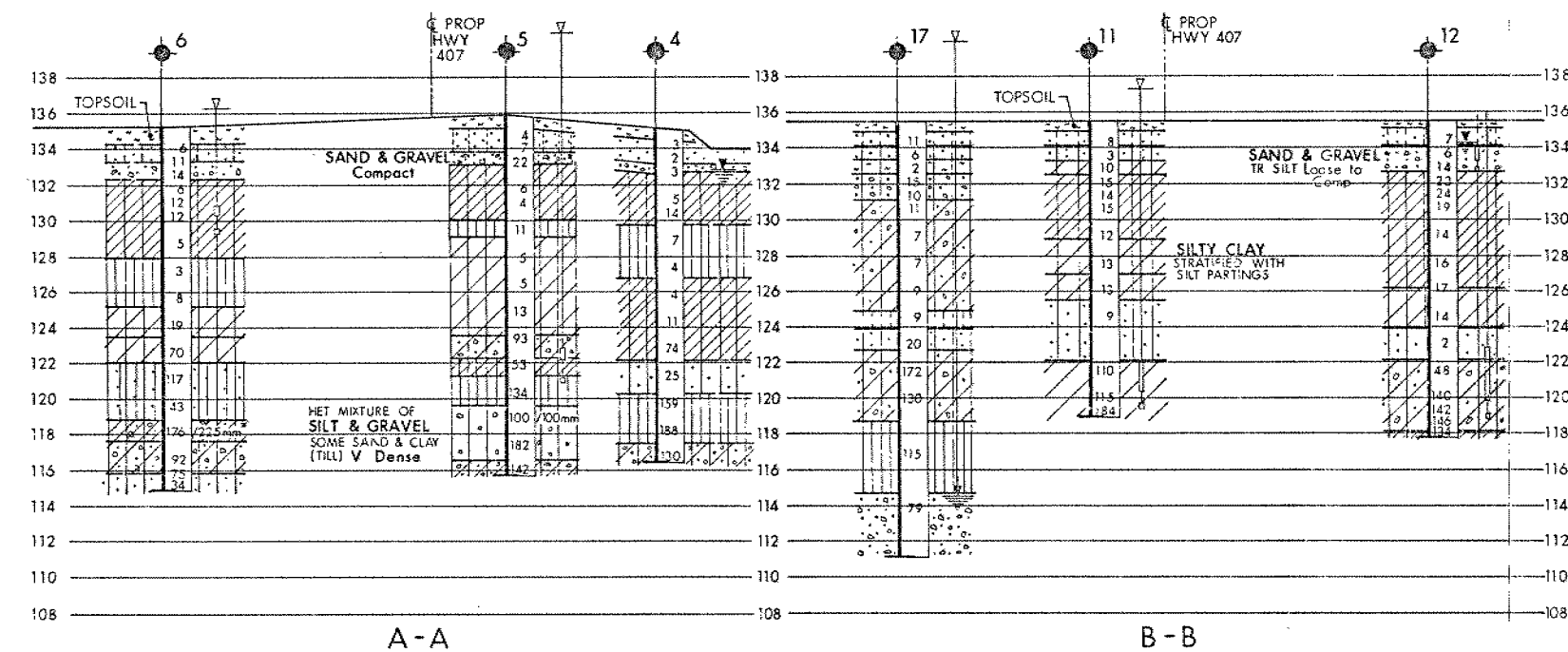
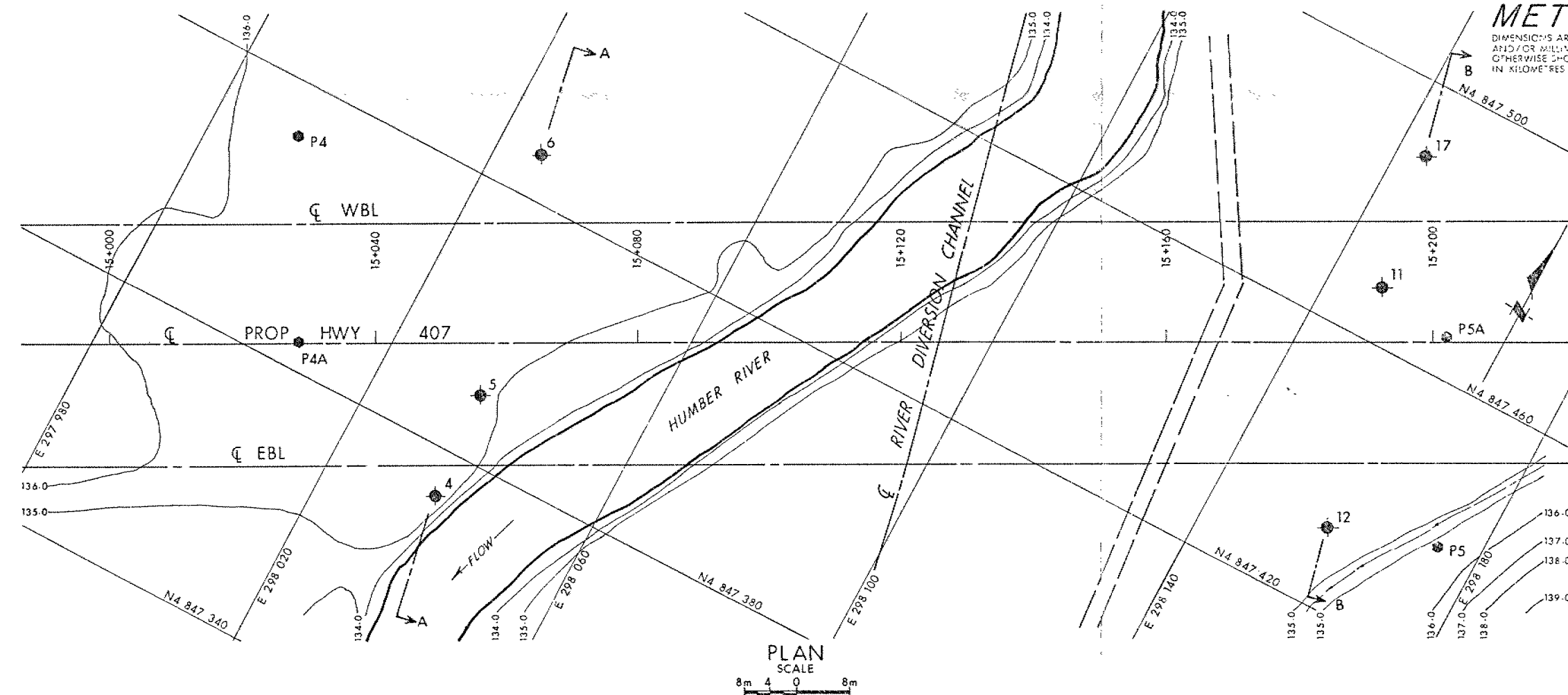
DATUM Geodetic

DATE February 14 to February 20, 1990

CHECKED BY

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			'N' VALUES	20	40	60	80					
113.00	Continued															
22.50	Sand and Gravel, trace silt.															
111.12	Very dense Grey															
24.38	End of Borehole															

OFFICE REPORT ON SOIL EXPLORATION

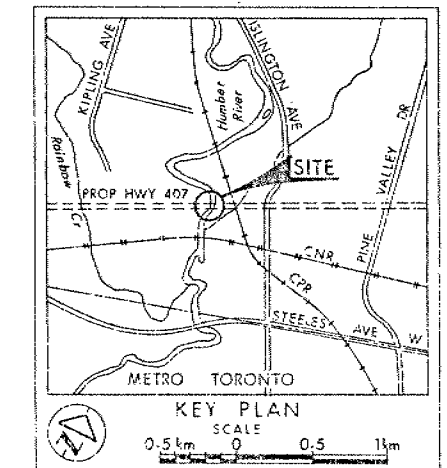


**SECTIONS**  
SCALE  
8m 4 0 8m Hor  
4m 2 0 4m Vert

**SOIL STRATIGRAPHY LEGEND**

- CLAYEY SILT TO SILTY CLAY**  
TRACE/SOME SAND & INTERLAYERED WITH SILT & SILTY SAND  
OCC. GRAVEL (FILL LIKE TEXTURE)  
Stiff to Hard
- SILTY CLAY & CLAYEY SILT**  
TR/SOME SAND, TR. CLAY  
INTERLAYERED WITH FREQUENT SILT PARTINGS & SEAMS, OCC. INTERLAYERS OF SANDY SILT  
Stiff to Very Stiff
- SILTY SAND & GRAVEL**  
OCC. ORG'S  
Compact
- SILTY SAND**  
SOME GRAVEL, TR/OCC ORG'S  
TR. CLAY (FILL)  
Loose to Very Dense
- SANDY SILT**  
TR. CLAY & GRAVEL  
SOME ORG'S, OCC. SHELL FRAGMENTS  
Loose
- STRATIFIED CLAYEY SILT & SILTY CLAY, TR. SAND**  
FREQUENT SILT SEAMS  
Stiff to Very Stiff
- CLAYEY SILT**  
SOME SAND & GRAVEL  
SOME SILT PARTINGS (FILL)  
Very Stiff to Hard
- SILTY CLAY & CLAYEY SILT**  
TR/SOME SAND, TR. CLAY  
INTERLAYERED WITH FREQUENT SILT PARTINGS & SEAMS, OCC. INTERLAYERS OF SANDY SILT  
Stiff to Very Stiff
- SILTY SAND & GRAVEL**  
OCC. ORG'S  
Compact
- SILTY SAND**  
SOME GRAVEL, TR/OCC ORG'S  
TR. CLAY (FILL)  
Loose to Very Dense
- SANDY SILT**  
TR. CLAY & GRAVEL  
SOME ORG'S, OCC. SHELL FRAGMENTS  
Loose
- STRATIFIED CLAYEY SILT & SILTY CLAY, TR. SAND**  
FREQUENT SILT SEAMS  
Stiff to Very Stiff

**CONT No**  
**WP No 141-87-00(P)**  
**HWY 407**  
**(FLOODPLAIN WEST OF CPR)**  
**BORE HOLE LOCATIONS & SOIL STRATA**



- LEGEND**
- Bore Hole
  - Dynamic Cone Penetration Test (Cone)
  - Bore Hole & Cone
  - Blows/0.3m (Std Pen Test, 475 J/blow)
  - Cone Blows/0.3m (60° Cone, 475 J/blow)
  - W.L. at time of investigation 90 02 and 90 03
  - High Mast Lighting Poles

No.	ELEVATION	CO-ORDINATES	
		NORTH	EAST
4	135.2	4 847 374.1	298 036.6
5	135.9	4 847 391.7	298 034.2
6	135.2	4 847 427.6	298 029.1
11	135.4	4 847 469.3	298 147.6
12	135.6	4 847 433.8	298 157.4
17	135.5	4 847 490.3	298 144.9

**NOTE**  
The boundaries between soil strata have been established only at Bore Hole locations. Between Bore Holes the boundaries are assumed from geological evidence.

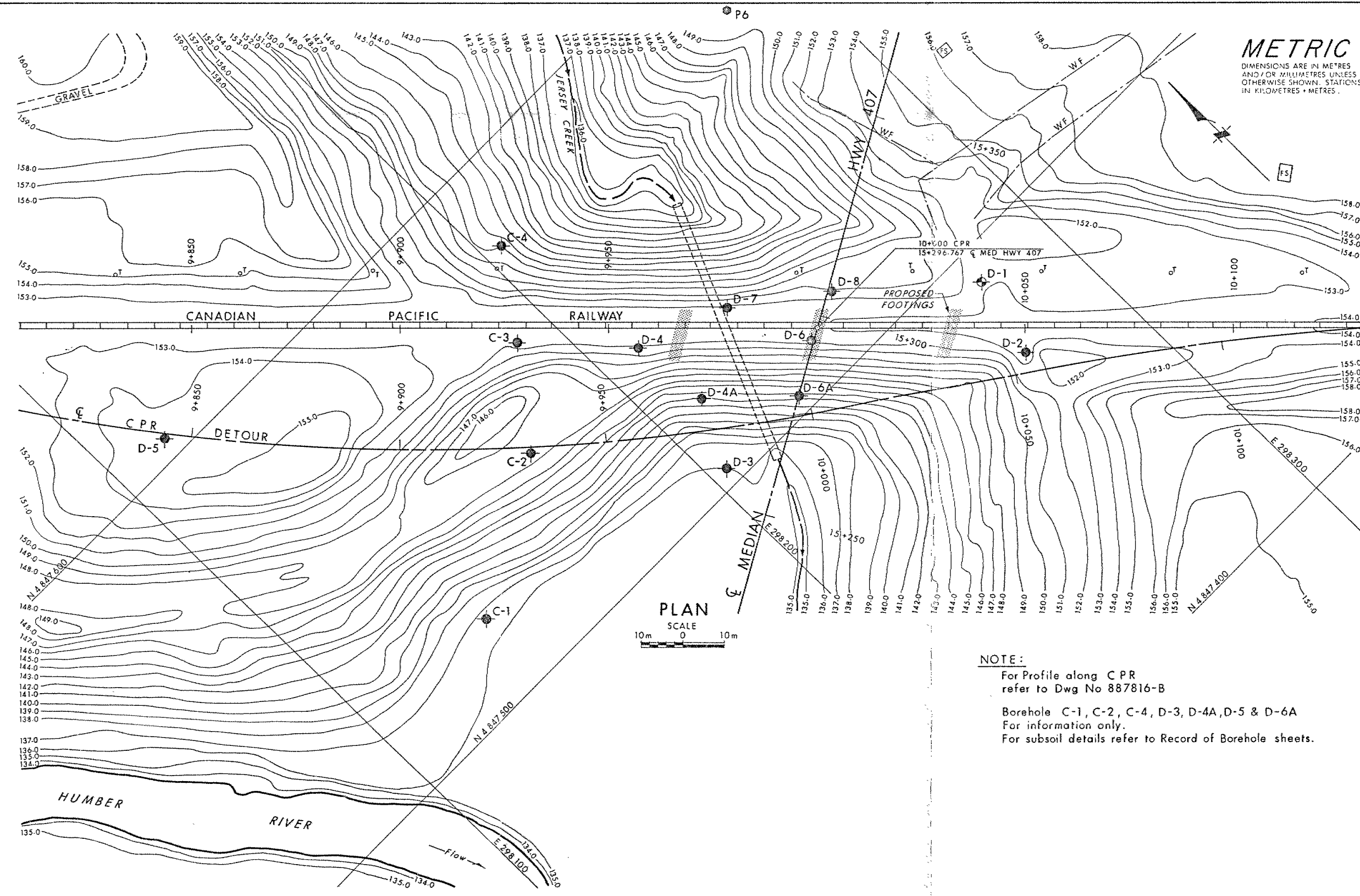
NOTE: The complete foundation investigation and design report for this project and other related documents may be examined at the Engineering Materials Office, Downsview. Information contained in this report and related documents is specifically excluded in accordance with the conditions of Section 102-2 of Farm 100.

REV.	DATE	BY	DESCRIPTION

Geocres No 30M13-108A

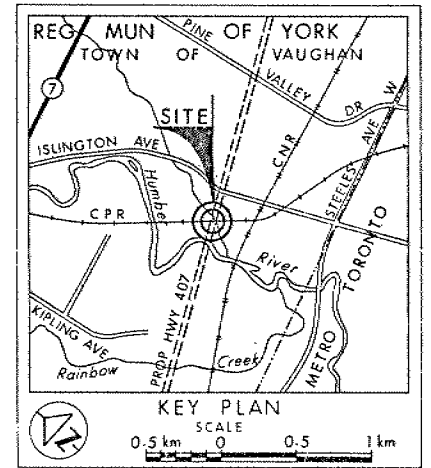
HWY No 407  
SLRMD TS CHECKED DATE 90 08 15  
DRAWN DT CHECKED DATE 90 08 15

LOIST 6  
SITE  
DWG 1418700P-A



**METRIC**  
DIMENSIONS ARE IN METRES  
AND/OR MILLIMETRES UNLESS  
OTHERWISE SHOWN. STATIONS  
IN KILOMETRES + METRES.

CONT No		
WP No 141-87-00(P)		
HWY 407 & CPR SUBWAY		SHEET
BORE HOLE LOCATIONS & SOIL STRATA		



- LEGEND**
- Bore Hole
  - Dynamic Cone Penetration Test (Cone)
  - Bore Hole & Cone
  - N Blows/0.3m (Std Pen Test, 475 J/blow)
  - CONE Blows/0.3m (60° Cone, 475 J/blow)
  - WL at time of investigation
  - High Mast Lighting Poles

No	ELEVATION	CO-ORDINATES NORTH	EAST
C-1	136.5	4 847 519.6	298 137.8
C-2	147.4	4 847 540.1	298 173.9
C-3	152.2	4 847 561.0	298 190.8
C-4	147.0	4 847 580.0	298 204.5
D-1	152.0	4 847 491.9	298 279.3
D-2	153.0	4 847 472.6	298 274.6
D-3	136.0	4 847 504.0	298 204.0
D-4	152.1	4 847 539.4	298 210.1
D-4A	143.5	4 847 520.0	298 212.0
D-5	154.3	4 847 605.0	298 115.0
D-6	152.5	4 847 511.2	298 240.4
D-6A	143.5	4 847 504.0	298 229.0
D-7	152.5	4 847 530.8	298 232.1
D-8	150.6	4 847 516.1	298 252.3

**NOTE:**  
For Profile along C P R  
refer to Dwg No 887816-B  
  
Borehole C-1, C-2, C-4, D-3, D-4A, D-5 & D-6A  
For information only.  
For subsoil details refer to Record of Borehole sheets.

**NOTE**  
The boundaries between soil strata have been established  
only at Bore Hole locations. Between Bore Holes the  
boundaries are assumed from geological evidence.

NOTE: The complete foundation investigation and design report for  
this project and other related documents may be examined at the  
Engineering Materials Office, Downsview. Information contained in  
this report and related documents is specifically excluded in  
accordance with the conditions of Section 102-2 of Form 100.

REV.	DATE	BY	DESCRIPTION

Geocres No 30M13-108A

HWY No 407	DIST 6
SUBMITTAL CHECKED DATE 90 03 14	SITE 37-1327
DRAWN BY CHECKED	DWG 1418700P-B



**METRIC**  
DIMENSIONS ARE IN METRES  
AND/OR MILLIMETRES UNLESS  
OTHERWISE SHOWN. STATIONS  
IN KILOMETRES + METRES

CONT No  
WP No 141-87-00(P)

HWY 407 & CPR SUBWAY

SHEET

BORE HOLE LOCATIONS & SOIL STRATA

SEE DWG No 887816-A

KEY PLAN  
SCALE

# LEGEND

- Bore Hole
- Dynamic Cone Penetration Test (Cone)
- Bore Hole & Cone
- N Blows/0.3m (Std Pen Test, 475 J/blow)
- CCONE Blows/0.3m (60° Cone, 475 J/blow)
- WL at time of investigation  
89 10 and 89 11
- WL in Piezometer
- Piezometer

No	ELEVATION	CO-ORDINATES	
		NORTH	EAST
C-3	152.2	4 847 561.0	298 190.8
D-1	152.0	4 847 491.9	298 279.3
D-2	153.0	4 847 472.6	298 274.6
D-4	152.1	4 847 539.4	298 210.1
D-6	152.5	4 847 511.2	298 240.4
D-7	152.5	4 847 530.8	298 232.1
D-8	150.6	4 847 516.1	298 252.3

# NOTE

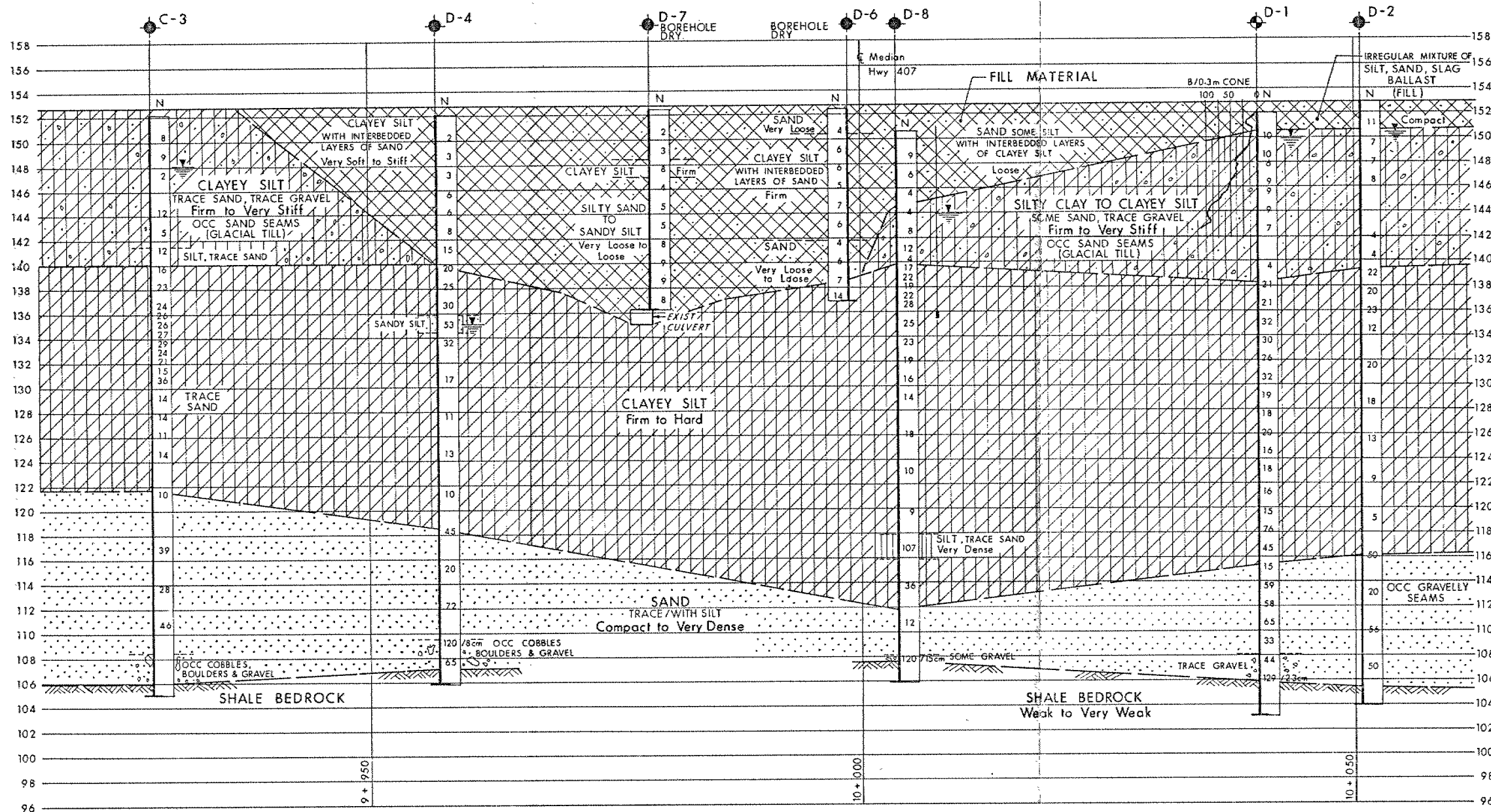
The boundaries between soil strata have been established only at Bore Hole locations. Between Bore Holes the boundaries are assumed from geological evidence.

NOTE: The complete foundation investigation and design report for this project and other related documents may be examined at the Engineering Materials Office, Downsview. Information contained in this report and related documents is specifically excluded in accordance with the conditions of Section 102-2 of Form 100.

REV	DATE	BY	DESCRIPTION
-----	------	----	-------------

Geocres No 30M13-108A

HWY No 407	DATE 90 03 07	DATE 90 03 07	DATE 90 03 07
SUBMITTAL CHECKED	DATE 90 03 07	DATE 90 03 07	DATE 90 03 07
DRAWN BY	CHECKED	DATE 90 03 07	DATE 90 03 07



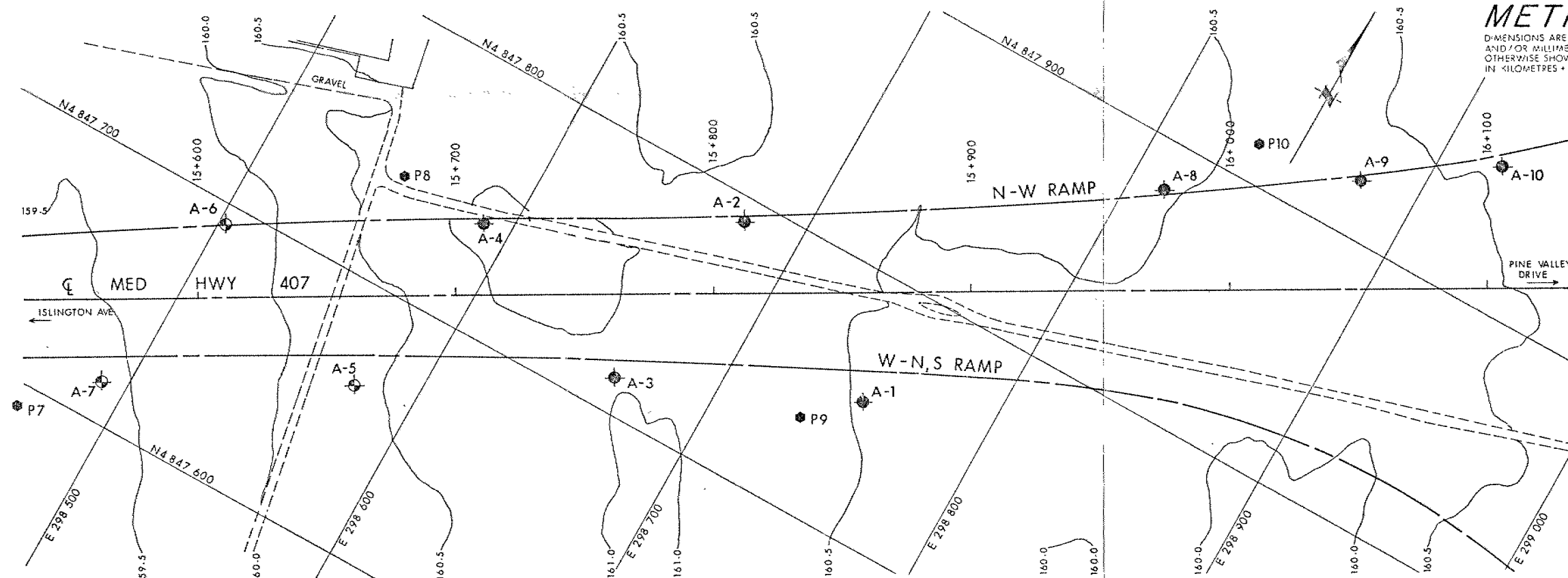
# PROFILE C P R

SCALE  
5m 0 5m Hor  
4m 0 4m Vert

# NOTE:

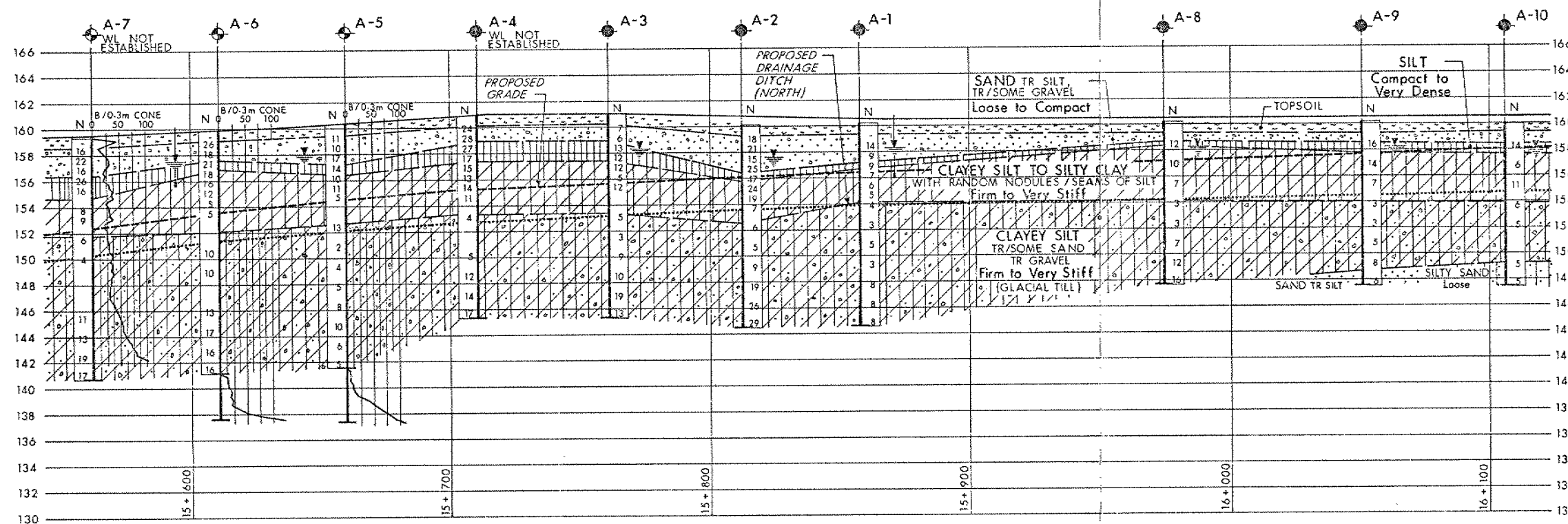
For Plan refer to  
Dwg No 887816-A





## PLAN

SCALE  
20m 0 20m



Q PROFILE HWY 407

\* NOTE

For Subsoil information refer to  
Record of Borehole Sheets

### METRIC

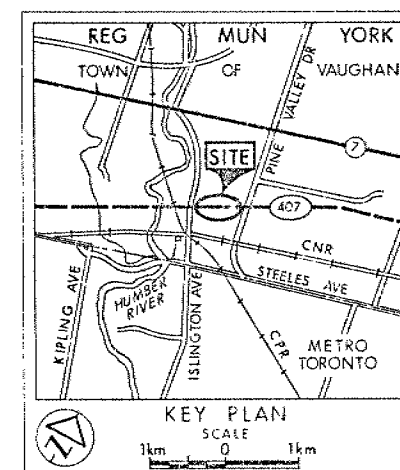
DIMENSIONS ARE IN METRES  
AND/OR MILLIMETRES UNLESS  
OTHERWISE SHOWN. STATIONS  
IN KILOMETRES + METRES.

CONT No  
WP No 141-87-00(P)







HWY 407  
(FROM ISLINGTON AVE TO PINE VALLEY DR)  
BORE HOLE LOCATIONS & SOIL STRATA



SHEET



LEGEND

-  Bore Hole
-  Dynamic Cone Penetration Test (Cone)
-  Bore Hole & Cone
- N Blows/0.3m (Std Pen Test, 475 J/blow)
- CONE Blows/0.3m (60° Cone, 475 J/blow)
-  WL at time of investigation  
90 01 and 90 02
-  WL in Piezometer
-  High Mast Lighting Poles

No	ELEVATION	CO-ORDINATES	
		NORTH	EAST
A-1	160.2	4 847 751.6	298 751.3
A-2	160.1	4 847 790.6	298 676.7
A-3	150.9	4 847 713.0	298 662.2
A-4	160.9	4 847 740.9	298 588.6
A-5	150.2	4 847 660.1	298 576.7
A-6	159.8	4 847 691.2	298 501.7
A-7	159.3	4 847 615.4	298 488.6
A-8	160.2	4 847 681.0	298 813.0
A-9	160.1	4 847 921.0	298 877.0
A-10	160.0	4 847 953.0	298 923.0
1	159.5	4 847 645.0	298 404.0
2	158.5	4 847 575.0	298 423.0
3	159.6	4 847 617.0	298 429.0
4	159.4	4 847 569.3	298 444.7

⇒ NOTE ⇒

The boundaries between soil strata have been established only at Bore hole locations. Between Bore Holes the boundaries are assumed from geological evidence.

NOTE: The complete foundation investigation and design report for this project and other related documents may be examined at the Engineering Materials Office, Downsview. Information contained in this report and related documents is specifically excluded in accordance with the conditions of Section 102-2 of Form 100.

REV				
DATE	BY		DESCRIPTION	

Geocore No 30M13-108A

HWY No 407		DIST 6	
SLUMP	TS	CHECKED	DATE 92 05 29
SLUMP	DT	CHECKED	DATE 92 05 29
		DWS 14187CUP-D	

SEND  
TO

M. DEVATA

CHIEF FND. ENG.  
FOUNDATION DESIGN SECTION  
ATT. DR. B. TYER

RECEIVED

OCT 03 1991

DEPT.

DATE

FROM

BOB JEFFRIES

STATION SECT

91/10/2

SUBJECT

407 - HUMBER R. TO PINE VALLEY W.P. 141-87-00

AS A RESULT OF A RECENT REVIEW OF THIS PROJECT THE  
FOLLOWING ISSUES REQUIRE FOUNDATION OFFICE COMMENTS.

- H.M.L. FOUNDATIONS - FIG. 13 - DRAINAGE/FILTRATION SYSTEM  
WHAT ARE THE DIMENSION LIMITS OF THE BLANK AS  
SHOWN IN YOUR REPORT FOR POLES P4 & P5?  
- PLEASE REVIEW THE N.S.S.P. TO ADDRESS CONCERNS RE: PAGE 22 OF REPORT
- HUMBER R. BRIDGE - IS THERE ANY SPECIAL TREATMENT  
REQUIRED FOR THE FILLING OF THE EXISTING HUMBER RIVER  
WATERWAY IN THE AREA OF THE WEST ABUTMENT -  
E.B. STRUCTURE.
- C.P.R. SUBWAY - DWG'S INDICATE A 200mm SUBDRAIN BEHIND

REPLY

- ABUTMENTS - ALL REMAINING STRUCTURE HAVE 150mm SUBDRAINS
- WE ARE ASKING YOUR OFFICE & C.P. IF 150mm IS ACCEPTABLE
- ISLINGTON AVE O'PASS - PLEASE FIND ATTACHED  
CONSUMERS GAS RELOCATION DWGS. 1, 2 + 3 OF 6 #30-30.83  
SHOWING THE PROPOSED LOCATION. (PLEASE RETURN DWGS.)
- THE PROPOSAL IS TO BORE THE PIPELINE WHICH  
APPEARS ACCEPTABLE, HOWEVER IF ITS UNSUCCESSFUL, A RELOCATION  
AFTER BRIDGE CONSTRUCTION TAKES PLACE. PLEASE COMMENT ON  
THE MINIMUM OFFSETS FROM THE FTGS FOR BOTH BORING & OPEN CUT.

REPLY FROM

REPLY DATE