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LOCATION Hwy 17 & Champlain St
 H.M.L & Overhead Signs

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OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT.

REMARKS:

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PETO MacCALLUM LTD.
CONSULTING ENGINEERS

CONT 93-62
GEOTECHNICAL INVESTIGATION
PROPOSED HIGH MAST LIGHTING
AND OVERHEAD SIGNS
HIGHWAY 17 AND CHAMPLAIN STREET
DISTRICT 9-OTTAWA
FOR
MINISTRY OF TRANSPORTATION
W.P. 11-81-02

GEOCRES # 31G5-169

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Job No. 89 F 451

October, 1989

Job No. 89 F 451

89-10-31

Mr. M. S. Devata, P.Eng.
Chief Foundations Engineer
Ministry of Transportation, Ontario
Room 315, Central Building
1201 Wilson Avenue
Downsview, Ontario
M3M 1J8

Dear Mr. Devata

Re: Geotechnical Investigation
High Mast Lighting and
Overhead Signs
Highway 17 and Champlain St.
District 9-Ottawa, W.P.11-81-02

We are pleased to present our report for the geotechnical investigation carried out for the above noted project as authorized in Agreement Number 4238-9089-236.

The stratigraphy encountered at the site generally comprises surficial sand and silt fills overlying a thin discontinuous silt till veneer underlain by limestone bedrock. On the eastern part a buried bedrock valley infilled with clay was encountered which was not fully penetrated to the maximum explored depth of 12.8 m. Groundwater is generally controlled by the topography and is anticipated at shallow depths.

We consider that drilled foundations in bedrock and overburden for the proposed high mast lighting and overhead signs can be designed and installed with minimal problems. We consider that use of liners and conventional pumping techniques will be adequate to keep the holes open.

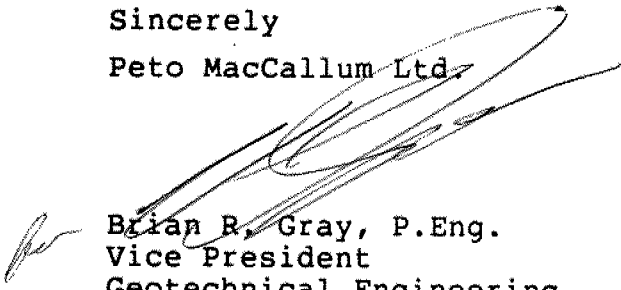
The report presents shear strength parameters locationwise for the subsurface soils and rock for the design and construction of the foundations for the proposed structures.

We believe this report has been completed within our terms of reference and trust the information presented herein is sufficient for your requirements.

Should you have any questions, or when we may be of further assistance to you during the construction phase of the project, please do not hesitate to contact our office. We appreciate this opportunity to be of service to the Ministry of Transportation

Sincerely

Peto MacCallum Ltd.



Brian R. Gray, P.Eng.
Vice President
Geotechnical Engineering

BRG:myb

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Record of Borehole Sheets

Drawing 118102-A

1. INTRODUCTION

Peto MacCallum Ltd. was authorized by The Ministry of Transportation Ontario, Agreement Number 4238-9089-236 to carry out a geotechnical investigation at the sites of the proposed High Mast Lighting Structures and Sign Boards on Highway 17 in the vicinity of Champlain Street in the City of Ottawa, Ontario.

A total of fourteen (14) locations have been identified for the High Mast Lighting Posts and six (6) locations for the cantilever and overhead signs. Two of these locations, A and B, for the sign posts are located on the ring road.

The purpose of the investigation was to determine the subsurface soil/rock and groundwater conditions at every designated location and based on this information to provide geotechnical parameters pertaining to the design and construction of the proposed structures.

2. FIELDWORK

The fieldwork for the investigation was carried out during the period 89-08-31 and 89-09-21 and comprised twenty (20) boreholes, put down to depths ranging from 1.25 to 12.80 m below existing grade. Generally the boreholes were taken down to refusal depth on probable bedrock. In the easterly part; where a buried bedrock valley is recognized; the boreholes terminated at depths ranging between 10.05 and 12.80 m without attaining refusal, considered to be adequate for the purpose of this investigation. Borehole locations are shown on the appended drawing 118102-A.

Boreholes C-4-6, C-10-6 and CSE were moved from the original locations due to operational reasons and the Record of Borehole sheets indicate the new locations at which drilling was carried out. The new locations together with original locations are given below.

<u>Borehole</u>	<u>Original Location and Elevation</u>	<u>New Location and Elevation</u>
C-4-6	N 5 037 838 E 381 285 Elev. 61.85	N 5 037 837 E 381 285 Elev. 61.65
C-10-6	N 5 038 165 E 381 864 Elev. 59.50	N 5 038 162 E 381 864 Elev. 59.80
CSE	N 5 038 081 E 381 544 Sta 9 + 925, 0/S 17.5 m LT C Champlain St. Elev. 64.60	N 5 038 085 E 381 542 STA 9 + 921, 0/S 17.5 m LT C Champlain St. Elev. 64.60

The boreholes were advanced using CME-55 truck and track mounted drillrigs equipped with continuous flight hollow stem and solid stem augers supplied and operated by a specialist drilling contractor.

Samples of the overburden were secured at regular 1.5 m intervals and where changes in the soil type occurred throughout the depth explored. Standard penetration resistance tests were carried out during sampling operations using conventional split spoon equipment. In the boreholes where clayey soils were encountered undisturbed thin wall Shelby tube samples were recovered by advancing the sampling tube hydraulically. A total of fourteen (14) thin wall undisturbed samples were recovered for laboratory testing. Forty-one (41) field vane tests were carried out approximately at 3 m intervals to determine the insitu strength of the clayey soil in boreholes. Bedrock was proven in three of the boreholes by

obtaining up to 2.55 m of BX core. In other boreholes where refusal was encountered to augering additional probing was done by moving the location and augering without sampling to confirm probable bedrock.

The general water conditions in the open boreholes were monitored during and on completion of drilling. Piezometers were installed in boreholes C-10-6 and C-13-5 located in the buried bedrock valley for monitoring the long term groundwater conditions.

The fieldwork was supervised throughout, by a member of our engineering staff who directed the drilling and sampling operations, documented the stratigraphy encountered, monitored groundwater conditions and processed the recovered samples.

The location and ground surface elevation of the boreholes at the time of drilling were established in the field by a survey crew from The Ministry of Transportation Ontario. Clearance of utilities was also arranged by the Ministry. It is understood that all elevations referred to the geodetic datum.

3. LABORATORY TESTING PROGRAM

All recovered samples were brought to our laboratory for detailed visual examination and testing to confirm field classification. The following tests were carried out:

- (i) Natural moisture content determinations on all recovered samples, with results shown on the appended Record of Borehole sheets;
- (ii) Eleven (11) grain size analyses with results illustrated on Figures 1 to 4 and the appended Record of Borehole sheets;
- (iii) Fourteen (14) Atterberg Limits with results presented on Table I, Figures 5 and 6 and the appended Record of Borehole sheets;
- (iv) Fourteen (14) "Quick" triaxial compression tests on undisturbed thin wall Shelby tube samples with results summarized on Table II and shown on the appended Record of Borehole sheets.
- (v) One (1) organic content test on the peat sample recovered from borehole C-4-6. The result is noted on the Record of Borehole sheet.
- (vi) Eighteen (18) unit weight determinations which comprising one on the fill, three on the rock cores and fourteen on the clay samples. The results are presented on the appended Record of Borehole sheets.
- (vii) Three (3) compression tests on the rock core samples. The results are summarized on Table III.

4. SITE DESCRIPTION

The site is located along the existing intersection of Champlain Street and Highway 17 and about 4 km east of the intersection, on the Township Line of Gloucester and Cumberland in the Regional Municipality of Ottawa-Carleton.

Land use in the area is predominantly residential with some commercial uses in the southwest and southeast corners. Topography across the site is generally flat with occasional shallow undulations caused by bedrock outcrops.

The site falls within the physiographic region generally known as the "Ottawa Valley Clay Plains". In this area ridges of rock or sand interrupt the clay plains. Bedrock in the area investigated is generally close to the ground surface, the exceptions being areas where ancient rivers have scoured channels in the bedrock surface.

5. SUMMARIZED SUBSURFACE CONDITIONS

5.1 General

Reference is made to the appended Record of Borehole sheets for details of the fieldwork, including soil classifications, inferred stratigraphy, standard penetration 'N' values, field vane test results, the results of laboratory undrained shear strength testing, moisture content determinations and Atterberg Limit test results, together with groundwater observations in the open boreholes and installed piezometers. Ground surface elevations and locations are also marked on the Record of Borehole sheets.

The stratigraphy at the site generally comprises surficial topsoil and pavement at some locations both underlain by very loose to very dense fill. The fill comprised sand with silt, some clay, trace of gravel and clayey fill with sand and gravel.

Deposits underlying the fill vary from very loose sandy silt to compact to very dense sandy silt till across the greater part of the site. The bedrock surface undulates significantly and was encountered at depths ranging from 1.25 to 4.55 m. In the eastern portion of the site, an infilled abandoned river channel filled with a clay deposit was encountered. The clay was not fully penetrated at a depth of 12.8 m. In several cases the fills were resting directly on rock. The various soil types encountered are as follows:

5.2 Overburden

5.2.1 Topsoil

Surficial topsoil consisting of variable proportions of silt, silty clay, sandy silt, clay and silt was noted in boreholes C-1-5, C-2-5, C-9-5, C-13-5, and C-14-4 outside the paved areas. The colour varied from light brown to dark brown with the organic content from low to high. The thickness varied from 100 to 750 mm.

5.2.2 Pavement Structure

A 50 mm thick asphalt surfacing was noted in boreholes C-6-6 and CSW and was underlain by sand and gravel fill. Elsewhere surficial asphalt surfacing was not present. The composition of the granular materials was brown sand and gravel with trace of silt in a moist state. The total depth was 150 mm in Borehole C-6-6 and 650 mm in borehole CSW.

5.2.3

Sandy Silt, Clayey Silt, Fine Sand,
Some gravel (Fill)

This surficial fill was encountered in all the boreholes located within the roadway embankment. Fill was not encountered in boreholes C-1-5, C-2-5, C-13-5 and C-14-4. The composition varied from sand and gravel to clay, with varying silt fractions, the predominant fraction being silty fine sand. Minor amounts of organics and topsoil inclusions were noted at some locations. Limestone gravel, cobbles and boulders with traces of silt and sand were noted in borehole C-12-5. The total thickness varied from 0.85 to 2.30 m. At several locations a distinct zoning of the fill with depth was noticed and is indicated on the Record of Borehole Sheets. Grain size distribution curves for typical fill samples are shown on Figures 1 and 2. The relative density of this deposit generally varies from very loose to compact. However, standard penetration 'N' values range from 1 to more than 50 blows per 0.3 m. The higher values reflect gravel and boulder content rather than the insitu density of the fill.

5.2.4

Peat

Very loose, dark brown, highly organic fibrous peat was noted in borehole C-4-6 underlying the surficial fill. The thickness of this deposit was 0.95 m. The organic content was measured in the laboratory to be 65%. Standard penetration 'N' values were 2 blows for 0.3 m

penetration of the sampler. A moisture content of 251% was measured.

5.2.5

Clay

Grey inorganic clay of high plasticity was encountered in boreholes C-8-6, C-9-5, C-10-6, C-11-5, C-12-5, C-13-5 and C-14-4 located within the buried bedrock valley in the easterly part of the site, under the surficial fills and topsoil at depths ranging from 0.15 to 1.75 m. The first borehole C-8-6 executed in this area was sampled to a maximum depth of 12.80 m. Other boreholes were terminated at 10.05 m depth without fully penetrating the deposit as this depth was considered adequate for the purpose of the investigation. However, in the boreholes located at the fringes of the buried bedrock valley the clay unit was underlain by sandy silt at a depth of 2.65 m in borehole C-2-5 and sandy silt till in boreholes C-7-5 and CSE at depths of 2.15 and 2.30 m. These boreholes were taken down to refusal on probable bedrock at depths of 4.55, 2.50 and 2.50 m respectively.

The clay is highly plastic and contained many clayey silt and silty clay seams. Atterberg limits for this material are plotted on Figures 5 and 6 and presented on Table I. The Atterberg Limits are between 47 and 57 for the Liquid Limit and between 20 and 31 for the

Plasticity Index. The water contents ranged from 48.3 to 7.2% and are at and above the liquid limit. The grain size distribution envelope is given in Figure 3.

Standard penetration 'N' values ranged from less than 1 (weight of hammer) to 11 blows per 0.3 m. The total of forty-one (41) field vane tests gave shear strength values ranging from 50 to 100 kPa and the sensitivity ranged from 2 to 26. As the clay is sensitive standard penetration 'N' values are not considered to be reliable and based on the field vane tests the consistency of the clay is rated as firm to stiff.

Quick undrained triaxial compression tests conducted on fourteen (14) thinwall tube samples gave C_u values in the range of 25 to 67 kPa confirming the clay deposit to be generally firm to stiff.

5.2.6

Sandy Silt

Underlying the clay deposit, loose grey sandy silt with some clay and a trace of gravel was noted in borehole C-2-5. The thickness of this deposit was 1.90 m. The standard penetration 'N' values were 4 and 5. The water contents for the two samples were 16.5% and 17.2% respectively.

5.2.7 Sandy Silt (Glacial Till)

Sandy silt till was noted overlying bedrock in boreholes C-1-5, C-4-6, C-5-5, C-6-6, C-7-5, CSW, CSE, and OSS where refusal to augering and sampling occurred at shallow depths. This deposit had traces of clay and variable gravel content and was noted to be non-cohesive. In several of the boreholes cobble and boulder sizes were present with depth. Grain size distribution curves for two representative samples are given in Figure 4. The water contents are in the range of 8 to 30%.

Standard penetration 'N' values ranged from 3 to more than 50 blows per 0.3 m penetration of the sampler. The low values of 3 and 8 noted in boreholes C-5-5 and OSS are probably caused by disturbance while placing the fills above the till. The relative density of this deposit is classified as dense to very dense based on standard penetration 'N' values greater than 30 in all other cases.

5.3 Bedrock

Bedrock was proven in boreholes C-6-6, C-4-6 and C-2-5 at depths of 2.90, 3.05 and 4.55 m below the surface by recovering BX size rock core, in lengths of 2.55, 1.55 and 1.90 m respectively. The bedrock is grey limestone of the Ottawa formation. Occasional thin bands of shale 1 to 5 mm thick were noted in the rock cores.

Rock cores indicated moderate weathering in the upper 1 m with unweathered rock below. Rock core recovery varied from 90 to 100%. Bedrock quality is assessed as fair to good based on rock quality designation (RQD) values ranging from 54 to 90%. Unconfined compression tests carried out on three (3) selected rock cores gave compressive strength values in the range of 13.6 to 20.8 MPa indicating weak rock as per Table 3.4 of Canadian Foundation Engineering Manual, 2nd Edition. However, harder zones are noted in rock cores.

Where boreholes met refusal it is presumed that refusal is on bedrock. Confirmation was obtained by moving the drillrig and augering in the vicinity without sampling.

It appears that in the easterly part of the project site the bedrock surface is depressed due to an abandoned river channel infilled by clay deposits. Boreholes in these areas were terminated at a maximum depth of 12.8 m without attaining refusal to augering.

5.4 Groundwater Conditions

The groundwater table tends to reflect surface topography. The water table was not intersected in many of the boreholes where rock was at shallow depth on the high ground. The observations made in the open boreholes are presented on the Record of Borehole sheets.

Piezometers were installed in boreholes C-13-5 and C-10-6 within the buried bedrock valley to establish the groundwater table. Readings taken 24 hours after installation recorded groundwater elevations of 55.40 and 58.22 m at depths of 1.28 and 4.40 m respectively below ground level.

6. DISCUSSION AND RECOMMENDATIONS

6.1 General

It is proposed to construct foundations for fourteen (14) high mast lighting structures and six (6) cantilever and overhead signs along Highway 17 in the vicinity of Champlain Street and on the ring road in the City of Ottawa, Ontario.

The subsoil was investigated to a maximum depth of 12.8 m. Underlying surficial sandy silt and fine sand fills limestone bedrock was interpreted in the majority of the boreholes. A thin discontinuous veneer of sandy silt till was noted immediately overlying bedrock. On the eastern part of the site a buried channel infilled with clay was found. The groundwater level is variable and generally follows the topography and where encountered was between 1.28 and 4.40 m depth at the time of the investigation.

6.2 Design Parameters

The following recommendations are made pertaining to the design and construction of the proposed foundations.

Surficial fills due to their heterogeneous nature and low relative density are considered to be unreliable to provide strength for the foundations. We recommend that the contribution from these fills to the overall foundation capacity be neglected. Topsoil being a loose surficial deposit of small thickness is also to be neglected.

The upper 1.8 m of the clay deposit is subject to frost action and wetting and drying and hence should not be considered in evaluating the foundation capacity.

Peat was recognized in one borehole C-4-6 only and the thickness was 950 mm. This deposit was very loose and saturated. We recommend that contribution from this material to the foundation capacity be neglected.

No shear strength parameters are given for the above materials.

Shear strength parameters for the design of the high mast and overhead signs are given locationwise in Appendix I, enclosed. These parameters are based on overall interpretation of both the field and laboratory investigation results, and the general geology of the area. A factor of safety is not included in the design parameters recommended.

6.3 Construction Recommendations

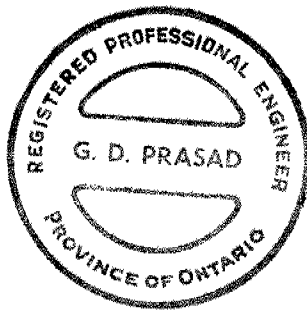
We consider that construction of drilled pier foundations for the proposed structures will be relatively straightforward.

Boulders and cobbles are to be anticipated in the surficial fills and in the till overlying bedrock. Some amount of caving of the fill, loose silts and sands is to be expected, together with seepage water perched on top of bedrock. These factors will require the use of temporary liners sealed into the bedrock.

The boreholes did not reveal any conditions requiring special measures in installing foundations in the clay stratum. However, we recommend the use of liners to prevent 'squeezing' of clay into the open hole. Due to the low permeability of the clay, we do not anticipate significant groundwater problems requiring special measures. Any ingress of water into the drilled holes can be handled by conventional pumping techniques, both in the clay and in bedrock.

We recommend leaving the liners in the clay deposit as withdrawing them will result in loss of shear strength due to the highly sensitive nature of the clay and may cause 'necking' during placement of concrete.

All construction operations are to be carried out in accordance with The Ontario Occupational Health and Safety Act, 1981.



Your very truly
Peto MacCallum Ltd.

G. Prasad
G. D. Prasad, P.Eng.
Senior Engineer

[Signature]
Alastair E. Gorman, P.Eng.
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APPENDIX A

**Recommended Shear Strength Parameters
for Foundation Soils and Rock**

**Highmast Lighting and Overhead Signs
Highway 17 and Champlain Street
District 9 - Ottawa
WP 11-81-02**

Job No. 89 F 451

October, 1989

ABBREVIATIONS USED IN THIS SUMMARY

γ	=	unit weight of soil or rock
γ'	=	unit weight of submerged soil or rock
ϕ	=	apparent angle of internal friction
c	=	apparent cohesion
DTPL		Drier Than Plastic Limit
APL		About Plastic Limit
WTPL		Wetter Than Plastic Limit

WP 11-81-02 DIST 9 HWY 17

BOREHOLE C-1-5

Elev. 59.75 Loc: N 5 037 696 E 380 912

<u>Depth</u> (m)	<u>Elevation</u> (m)	<u>Description</u>	<u>Recommended Shear Strength Parameters</u>	<u>Remarks</u>
0.00-0.15	59.75-59.60	Silt topsoil	insignificant	Moist
0.15-1.25	59.60-58.50	Very dense sandy silt (Glacial till)	$\gamma = 20.4 \text{ kN/m}^3$ $\phi = 32^\circ$ $c = 0 \text{ kPa}$	Moist
1.25 End of Hole	58.50	Probable Limestone Bedrock	$\gamma' = 15.8 \text{ kN/m}^3$ $\gamma = 25.6 \text{ kN/m}^3$ $\phi = 0^\circ$ $c = 500 \text{ kPa}$	Water table not en- countered

BOREHOLE C-2-5

Elev. 59.30 Loc: N 5 037 767 E 381 036

<u>Depth</u> (m)	<u>Elevation</u> (m)	<u>Description</u>	<u>Recommended Shear Strength Parameters</u>	<u>Remarks</u>
0.00-0.60	59.30-58.70	Silty clay topsoil, organic	insignificant	WTPL
0.60-2.65	58.70-56.65	Stiff clay	$\gamma = 15.6 \text{ kN/m}^3$ $\phi = 0^\circ$ $c = 40 \text{ kPa}$	WTPL
2.65-4.55	56.65-54.75	Loose sandy silt	$\gamma' = 7.3 \text{ kN/m}^3$ $\gamma = 17.1 \text{ kN/m}^3$ $\phi = 26^\circ$ $c = 0 \text{ kPa}$	saturated
4.55-6.45 End of Hole	54.75-52.85	Limestone bedrock Moderately weather- ed to unweathered	$\gamma' = 15.8 \text{ kN/m}^3$ $\gamma = 25.6 \text{ kN/m}^3$ $\phi = 0^\circ$ $c = 500 \text{ kPa}$	Water level at 56.55

BOREHOLE C-3-5

Elev. 60.85 Loc: N 5 037 836 E 381 152

<u>Depth</u> (m)	<u>Elevation</u> (m)	<u>Description</u>	<u>Recommended Shear Strength Parameters</u>	<u>Remarks</u>
0.00-1.40	60.85-59.45	Sandy silt (fill) organic	insignificant	moist
1.40 End of Hole	59.45	Probable Limestone Bedrock	$\gamma' = 15.8 \text{ kN/m}^3$ $\gamma = 25.6 \text{ kN/m}^3$ $\phi = 0^\circ$ $c = 500 \text{ kPa}$	Water table not en- countered

BOREHOLE C-4-6

Elev. 61.65 Loc: N 5 037 837 E 381 285

<u>Depth</u> (m)	<u>Elevation</u> (m)	<u>Description</u>	<u>Recommended Shear Strength Parameters</u>	<u>Remarks</u>
0.00-1.35	61.65-60.30	Clayey silt (fill), trace organic	insignificant	APL
1.35-2.30	60.30-59.35	Peat	insignificant	moist
2.30-3.05	59.35-58.60	Compact to dense sandy silt (Glacial till)	$\gamma' = 9.4 \text{ kN/m}^3$ $\gamma = 19.2 \text{ kN/m}^3$ $\phi = 30^\circ$ $c = 0 \text{ kPa}$	saturated
3.05-4.60 End of Hole	58.60-57.05	Limestone bedrock Moderately weather- ed to unweathered	$\gamma' = 15.8 \text{ kN/m}^3$ $\gamma = 25.6 \text{ kN/m}^3$ $\phi = 0^\circ$ $c = 500 \text{ kPa}$	Water level at 59.25

BOREHOLE C-5-5

Elev. 64.45 Loc: N 5 037 973 E 381 367

<u>Depth</u> (m)	<u>Elevation</u> (m)	<u>Description</u>	<u>Recommended Shear Strength Parameters</u>	<u>Remarks</u>
0.00-2.30	64.45-62.15	Fine sand (fill)	insignificant	moist
2.30-2.75	62.15-61.70	Very loose sandy silt (Glacial Till)	$\gamma = 17.1 \text{ kN/m}^3$ $\phi = 27^\circ$ $c = 0 \text{ kPa}$	wet

BOREHOLE C-5-5 con't

Elev. 64.45 Loc: N 5 037 973 E 381 367

<u>Depth</u> (m)	<u>Elevation</u> (m)	<u>Description</u>	<u>Recommended Shear Strength Parameters</u>	<u>Remarks</u>
2.75 End of Hole	61.70	Probable Limestone Bedrock	$\gamma' = 15.8 \text{ kN/m}^3$ $\gamma = 25.6 \text{ kN/m}^3$ $\phi = 0^\circ$ $c = 500 \text{ kPa}$	Water table not en- countered

BOREHOLE C-6-6

Elev. 65.90 Loc: N 5 038 018 E 381 484

<u>Depth</u> (m)	<u>Elevation</u> (m)	<u>Description</u>	<u>Recommended Shear Strength Parameters</u>	<u>Remarks</u>
0.00-0.15	65.90-65.75	Pavement structure	insignificant	
0.15-1.50	65.75-64.40	Fine sand (fill)	insignificant	Moist
1.50-2.90	64.40-63.00	Dense sandy silt (Glacial Till) scattered boulders	$\gamma = 20.4 \text{ kN/m}^3$ $\phi = 32^\circ$ $c = 0 \text{ kPa}$	moist to wet
2.90-5.45 End of Hole	63.00-60.45	Limestone Bedrock Moderately weather- ed to unweathered	$\gamma' = 15.8 \text{ kN/m}^3$ $\gamma = 25.6 \text{ kN/m}^3$ $\phi = 0^\circ$ $c = 500 \text{ kPa}$	Water table not en- countered

BOREHOLE C-7-5

Elev. 64.10 Loc: N 5 038 086 E 381 588

<u>Depth</u> (m)	<u>Elevation</u> (m)	<u>Description</u>	<u>Recommended Shear Strength Parameters</u>	<u>Remarks</u>
0.00-0.55	64.10-63.55	Sand and gravel (fill)	insignificant	moist
0.55-1.50	63.55-62.60	Sandy silt (fill)	insignificant	moist
1.50-2.15	62.60-61.95	Stiff clay	$\gamma = 15.6 \text{ kN/m}^3$ $\phi = 0^\circ$ $c = 60 \text{ kPa}$	DTPL
2.15-2.50	61.95-61.60	Compact sandy silt (Glacial Till) scattered boulders	$\gamma = 19.2 \text{ kN/m}^3$ $\phi = 30^\circ$ $c = 0 \text{ kPa}$ $c = 500 \text{ kPa}$	wet

BOREHOLE C-7-5 con't

Elev. 64.10 Loc: N 5 038 086 E 381 588

<u>Depth</u> (m)	<u>Elevation</u> (m)	<u>Description</u>	<u>Recommended Shear Strength Parameters</u>	<u>Remarks</u>
2.50 End of Hole	61.60	Probable Limestone Bedrock	$\gamma' = 15.8 \text{ kN/m}^3$ $\gamma = 25.6 \text{ kN/m}^3$ $\phi = 0^\circ$ $c = 500 \text{ kPa}$	Water table not en- countered

BOREHOLE C-8-6

Elev. 63.50 Loc: N 5 038 138 E 381 592

<u>Depth</u> (m)	<u>Elevation</u> (m)	<u>Description</u>	<u>Recommended Shear Strength Parameters</u>	<u>Remarks</u>
0.00-0.60	63.50-62.90	Sand and gravel (fill)	insignificant	moist
0.60-1.50	62.90-62.00	Fine sand (fill)	insignificant	moist to
1.50-12.80 End of Hole	62.00-50.70	Stiff clay	$\gamma' = 5.8 \text{ kN/m}^3$ $\gamma = 15.6 \text{ kN/m}^3$ $\phi = 0^\circ$ $c = 40 \text{ kPa}$	WTPL Water level not estab- lished

BOREHOLE C-9-5

Elev. 63.10 Loc: N 5 038 181 E 381 696

<u>Depth</u> (m)	<u>Elevation</u> (m)	<u>Description</u>	<u>Recommended Shear Strength Parameters</u>	<u>Remarks</u>
0.00-1.75	63.10-61.35	Silty sand (fill)	insignificant	moist to
1.75-10.05 End of Hole	61.35-53.05	Stiff clay	$\gamma' = 5.8 \text{ kN/m}^3$ $\gamma = 15.6 \text{ kN/m}^3$ $\phi = 0^\circ$ $c = 40 \text{ kPa}$	WTPL Water level not estab- lished

BOREHOLE C-10-6

Elev. 59.80 Loc: N 5 038 162 E 381 864

<u>Depth</u> (m)	<u>Elevation</u> (m)	<u>Description</u>	<u>Recommended Shear Strength Parameters</u>	<u>Remarks</u>
0.00-1.35	59.80-58.45	Clayey silt (fill), insignificant organic		APL
1.35-10.05 End of Hole	58.45-49.75	Stiff clay	$\gamma' = 5.8 \text{ kN/m}^3$ $\gamma = 15.6 \text{ kN/m}^3$ $\phi = 0^\circ$ $c = 40 \text{ kPa}$	WTPL Water level at 55.40, unstable (Piezo)

BOREHOLE C-11-5

Elev. 61.45 Loc: N 5 038 263 E 381 920

<u>Depth</u> (m)	<u>Elevation</u> (m)	<u>Description</u>	<u>Recommended Shear Strength Parameters</u>	<u>Remarks</u>
0.00-1.35	61.45-60.10	Sandy silt (fill)	insignificant	moist to wet
1.35-10.05 End of Hole	60.10-51.40	Stiff clay	$\gamma' = 5.8 \text{ kN/m}^3$ $\gamma = 15.6 \text{ kN/m}^3$ $\phi = 0^\circ$ $c = 40 \text{ kPa}$	WTPL Water level not estab- lished

BOREHOLE C-12-5

Elev. 60.55 Loc: N 5 038 323 E 382 028

<u>Depth</u> (m)	<u>Elevation</u> (m)	<u>Description</u>	<u>Recommended Shear Strength Parameters</u>	<u>Remarks</u>
0.00-1.10	60.55-59.45	Limestone gravel, cobbles and boulders (fill)	insignificant	moist
1.10-10.05 End of Hole	59.45-50.50	Stiff clay	$\gamma' = 5.8 \text{ kN/m}^3$ $\gamma = 15.6 \text{ kN/m}^3$ $\phi = 0^\circ$ $c = 40 \text{ kPa}$	WTPL Water level not estab- lished

BOREHOLE C-13-5

Elev. 59.50 Loc: N 5 038 386.5 E 382 146.5

<u>Depth</u> (m)	<u>Elevation</u> (m)	<u>Description</u>	<u>Recommended Shear Strength Parameters</u>	<u>Remarks</u>
0.00-0.75	59.50-58.75	Silt and clay topsoil, organic	insignificant	WTPL to APL
0.75-10.05 End of Hole	58.75-49.45	Stiff clay	$\gamma' = 5.8 \text{ kN/m}^3$ $\gamma = 15.6 \text{ kN/m}^3$ $\phi = 0^\circ$ $c = 60 \text{ kPa}$	WTPL Water level at 58.22 (Piezo)

BOREHOLE C-14-4

Elev. 53.65 Loc: N 5 040 159 E 384 639.5

<u>Depth</u> (m)	<u>Elevation</u> (m)	<u>Description</u>	<u>Recommended Shear Strength Parameters</u>	<u>Remarks</u>
0.00-0.15	53.65-53.50	Silt and clay topsoil, organic	insignificant	DTPL
0.15-10.05 End of Hole	53.50-43.60	Stiff clay	$\gamma' = 5.8 \text{ kN/m}^3$ $\gamma = 15.6 \text{ kN/m}^3$ $\phi = 0^\circ$ $c = 60 \text{ kPa}$	APL to WTPL Water level not estab- lished

BOREHOLE CSW

Elev. 65.20 Loc: N 5 038 074 E 381 505
Sta 9 + 916 O/S 20.0 m RT E of Champlain St.

<u>Depth</u> (m)	<u>Elevation</u> (m)	<u>Description</u>	<u>Recommended Shear Strength Parameters</u>	<u>Remarks</u>
0.00-0.65	65.20-64.55	Sand and gravel (fill)	insignificant	moist
0.65-1.50	64.55-63.70	Sandy silt (fill), scattered cobbles	insignificant	wet
1.50-2.00	63.70-63.20	Dense sandy silt (Glacial Till)	$\gamma = 20.4 \text{ kN/m}^3$ $\phi = 32^\circ$ $c = 0 \text{ kPa}$	moist to wet
2.00 End of Hole	63.20	Probable Limestone Bedrock	$\gamma' = 15.8 \text{ kN/m}^3$ $\gamma = 25.6 \text{ kN/m}^3$ $\phi = 0^\circ$ $c = 500 \text{ kPa}$	Water table not en- countered

BOREHOLE CSE

Elev. 64.60 Loc: N 5 038 085 E 381 542
 Sta 9 + 921 O/S 17.5 m LT b of Champlain St.

<u>Depth</u> (m)	<u>Elevation</u> (m)	<u>Description</u>	<u>Recommended Shear Strength Parameters</u>	<u>Remarks</u>
0.00-1.50	64.60-63.10	Sandy silt (fill)	insignificant	moist
1.50-2.30	63.10-62.30	Stiff clay	$\gamma = 15.5 \text{ kN/m}^3$ $\phi = 0^\circ$ $c = 60 \text{ kPa}$	DTPL
2.30-2.50	62.30-62.10	Compact sandy silt (Glacial Till)	$\gamma = 19.2 \text{ kN/m}^3$ $\phi = 30^\circ$ $c = 0 \text{ kPa}$	moist to wet
2.50 End of Hole	62.10	Probable Limestone Bedrock	$\gamma' = 15.8 \text{ kN/m}^3$ $\gamma = 25.6 \text{ kN/m}^3$ $\phi = 0^\circ$ $c = 500 \text{ kPa}$	Water table not en- countered

BOREHOLE OSN

Elev. 61.30 Loc: N 5 037 699 E 380 998
 Sta 9 + 365 O/S 7.5 m LT b HWY 17 E.B.L.

<u>Depth</u> (m)	<u>Elevation</u> (m)	<u>Description</u>	<u>Recommended Shear Strength Parameters</u>	<u>Remarks</u>
0.00-0.75	61.30-60.55	Sand and gravel (fill)	insignificant	moist
0.75-2.40	60.55-58.90	Silty clay (fill)	insignificant	APL
2.40-2.80	58.90-58.50	Boulders	insignificant	
2.80 End of Hole	58.50	Probable Limestone Bedrock	$\gamma' = 15.8 \text{ kN/m}^3$ $\gamma = 25.6 \text{ kN/m}^3$ $\phi = 0^\circ$ $c = 500 \text{ kPa}$	Water table not en- countered

BOREHOLE OSS

Elev. 59.75 Loc: N 5 037 677 E 381 110
 Sta 9 + 365 O/S 17 m RT b HWY 17 E.B.L.

<u>Depth</u> (m)	<u>Elevation</u> (m)	<u>Description</u>	<u>Recommended Shear Strength Parameters</u>	<u>Remarks</u>
0.00-0.30	59.75-59.45	Sand and gravel (fill)	insignificant	moist
0.30-2.30	59.45-57.45	Clay (fill)	insignificant	APL
2.30-3.30	57.45-56.45	Loose to compact sandy silt (Glacial Till)	$\gamma' = 8.0 \text{ kN/m}^3$ $\gamma = 17.8 \text{ kN/m}^3$ $\phi = 27^\circ$ $c = 0 \text{ kPa}$	wet
3.30 End of Hole	56.45	Probable Limestone Bedrock	$\gamma' = 15.8 \text{ kN/m}^3$ $\gamma = 25.6 \text{ kN/m}^3$ $\phi = 0^\circ$ $c = 500 \text{ kPa}$	Water level at 57.10

BOREHOLE A

Elev. 63.60 Loc: N 5 037 902 E 381 473
 Sta 9 + 868 O/S 1.25 m RT b Ring Road

<u>Depth</u> (m)	<u>Elevation</u> (m)	<u>Description</u>	<u>Recommended Shear Strength Parameters</u>	<u>Remarks</u>
0.00-0.75	63.60-62.85	Sandy gravel (fill)	insignificant	moist
0.75-1.75	62.85-61.85	Clay, silt and sand (fill)	insignificant	moist
1.75 End of Hole	61.85	Probable Limestone Bedrock	$\gamma' = 15.8 \text{ kN/m}^3$ $\gamma = 25.6 \text{ kN/m}^3$ $\phi = 0^\circ$ $c = 500 \text{ kPa}$	Water table not en- countered

BOREHOLE B

Elev. 63.90 Loc: N 5 037 930 E 381 519
 Sta 9 + 932 b Ring Road

<u>Depth</u> (m)	<u>Elevation</u> (m)	<u>Description</u>	<u>Recommended Shear Strength Parameters</u>	<u>Remarks</u>
0.00-0.75	63.90-63.15	Sandy gravel (fill)	insignificant	moist
0.75-2.30	63.15-61.60	Clay, silt and sand (fill)	insignificant	moist
2.30 End of Hole	61.60	Probable Limestone Bedrock	$\gamma' = 15.8 \text{ kN/m}^3$ $\gamma = 25.6 \text{ kN/m}^3$ $\phi = 0^\circ$ $c = 500 \text{ kPa}$	Water table not en- countered

Job No. 89 F 451

Date: October, 1989

TABLE I
ATTERBERG LIMIT TEST RESULTS
HIGH MAST LIGHTING AND OVERHEAD SIGNS
HIGHWAY 17 AND CHAMPLAIN STREET
DISTRICT 9 - OTTAWA

BOREHOLE NO.	SAMPLE NO.	DEPTH	NATURAL WATER CONTENT	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	REMARKS
		(m)	(w) %	(^w L)	(^w p)	(^I p)	
C-8-6	6	6.10 to 6.70	66.5	49	25	24	Clay
C-8-6	9	10.65 to 11.30	48.3	47	25	22	Clay
C-9-5	3	2.30 to 2.85	51.1	57	31	26	Clay
C-9-5	7	7.60 to 8.25	53.6	49	22	27	Clay
C-10-6	4	4.25 to 5.05	59.7	48	24	24	Clay
C-10-6	6	7.60 to 8.25	65.0	49	24	25	Clay
C-11-5	3	3.05 to 3.50	68.7	55	24	31	Clay
C-11-5	5	6.10 to 6.70	60.4	50	26	24	Clay
C-12-5	3	3.05 to 3.50	67.1	51	26	25	Clay
C-12-5	6	7.60 to 8.05	70.2	52	32	20	Clay

con't

BOREHOLE NO.	SAMPLE NO.	DEPTH	NATURAL WATER CONTENT	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	REMARKS
		(m)	(w) %	(^w L)	(^w p)	(^I p)	
C-13-5	4	4.55 to 5.05	67.2	50	28	22	Clay
C-13-5	6	7.60 to 8.05	70.0	54	27	27	Clay
C-14-4	4	4.55 to 5.05	60.7	48	22	26	Clay
C-14-4	6	7.60 to 8.05	68.9	48	26	22	Clay

Job No. 89 F 451

Date: October, 1989

TABLE II
"QUICK" TRIAXIAL COMPRESSION TEST RESULTS

HIGH MAST LIGHTING AND OVERHEAD SIGNS
 HIGHWAY 17 AND CHAMPLAIN STREET
 DISTRICT 9 - OTTAWA

<u>BOREHOLE</u>	<u>SAMPLE</u>	<u>DEPTH</u> (m)	NATURAL WATER CONTENT (w) %	UNIT WEIGHT		VOID RATIO (e)	DEGREE OF SATUR- ATION (%)	CELL PRES- SURE (σ_3) (kPa)	FAIL- URE STRAIN (ϵ_f) (%)	SHEAR STRENGTH (τ_f) (kPa)
				WET (γ_w) (kN/m ³)	DRY (γ_d) (kN/m ³)					
C-8-6	6	6.10 to 6.70	66.5	15.8	9.5	1.78	100	101	4.5	45
C-8-6	9	10.65 to 11.30	48.3	15.5	10.5	1.52	86	171	3.7	44
C-9-5	3	2.30 to 2.85	51.1	15.5	10.2	1.59	87	40	9.5	26
C-9-5	7	7.60 to 8.25	53.6	15.6	10.2	1.60	90	124	5.2	43
C-10-6	4	4.25 to 5.05	59.7	16.2	10.2	1.60	100	75	3.7	29
C-10-6	6	7.60 to 8.25	65.0	15.7	9.6	1.77	99	124	4.5	52
C-11-5	3	3.05 to 3.50	68.7	15.9	9.4	1.81	100	52	4.1	25
C-11-5	5	6.10 to 6.70	60.4	15.5	9.7	1.73	94	99	3.3	52
C-12-5	3	3.05 to 3.50	67.1	16.0	9.6	1.76	100	52	3.8	60
C-12-5	6	7.60 to 8.05	70.2	15.1	8.9	1.98	96	119	8.9	54

Job No. 89 F 451

Date: October, 1989

TABLE II (contd)

BOREHOLE	SAMPLE	DEPTH (m)	NATURAL WATER CONTENT (w) %	UNIT WEIGHT		VOID RATIO (e)	DEGREE OF SATUR- ATION (%)	CELL PRES- SURE (σ_3) (kPa)	FAIL- URE STRAIN (ϵ_f) (%)	SHEAR STRENGTH (τ_f) (kPa)
				WET (γ) (kN/m ³)	DRY (γ_d) (kN/m ³)					
C-13-5	4	4.55 to 5.05	67.2	15.6	9.3	1.83	99	75	4.5	46
C-13-5	6	7.60 to 8.05	70.0	15.7	9.2	1.86	100	124	4.4	67
C-14-4	4	4.55 to 5.05	60.7	16.5	10.3	1.56	100	79	4.5	54
C-14-4	6	7.60 to 8.05	68.9	13.6	8.2	2.23	83	107	3.4	61

Job No. 89 F 451

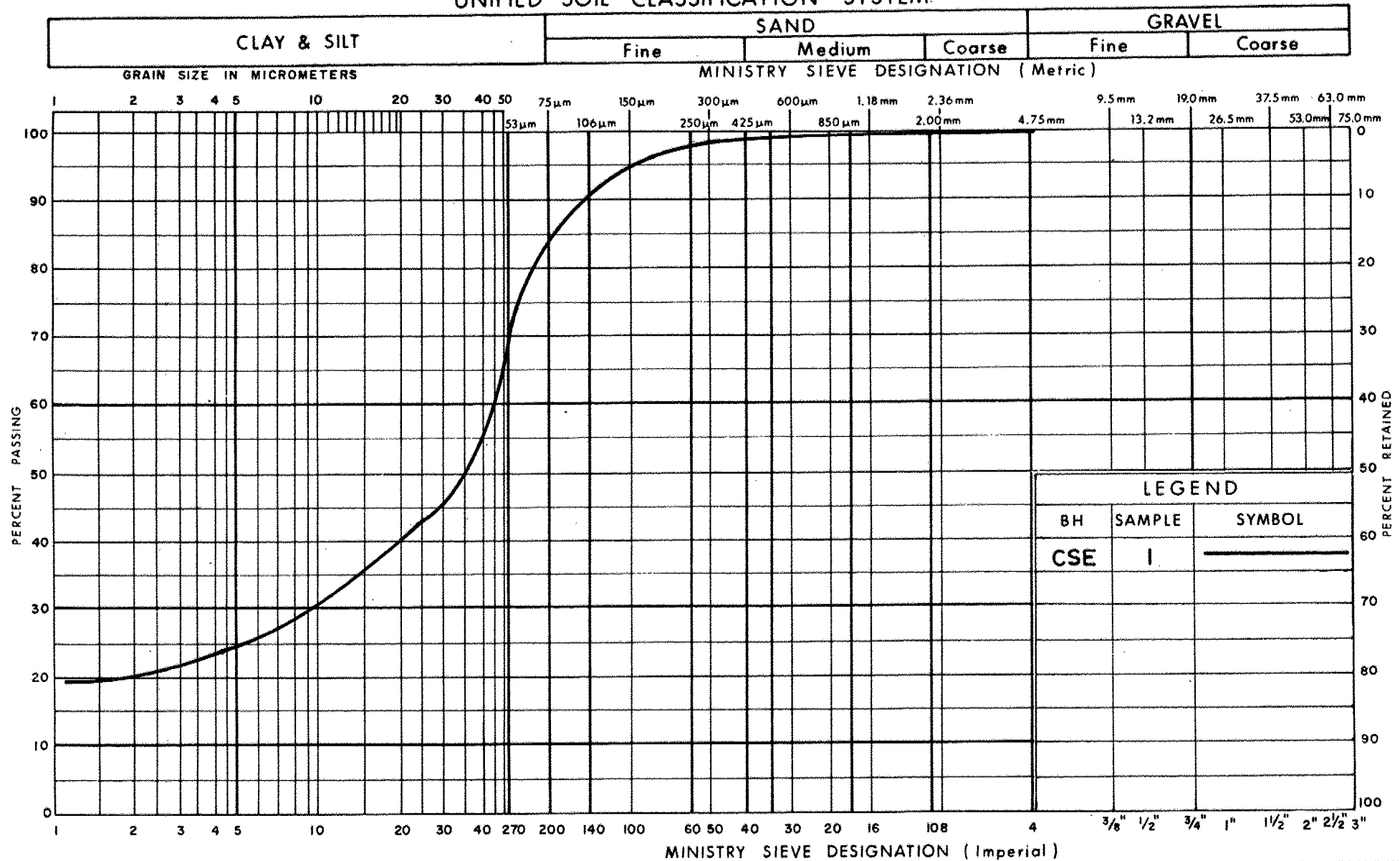
Date: October, 1989

TABLE III
COMPRESSION TEST RESULTS ON ROCK CORES

HIGH MAST LIGHTING AND OVERHEAD SIGNS
HIGHWAY 17 AND CHAMPLAIN STREET
DISTRICT 9 - OTTAWA

<u>BOREHOLE NO.</u>	<u>DEPTH</u> (m)	<u>UNIT WEIGHT</u> (kN/m ³)	<u>COMPRESSIVE STRENGTH</u> (MPa)	<u>REMARKS</u>
C-6-6	4.95 to 5.05	26.05	20.8	Limestone with Shale Seams
C-4-6	3.80 to 3.90	25.21	14.4	Limestone with Shale Seams
C-2-5	6.20 to 6.35	25.63	13.6	Limestone with Shale Seams

UNIFIED SOIL CLASSIFICATION SYSTEM



GRAIN SIZE DISTRIBUTION
SANDY SILT (FILL)
 WITH SOME CLAY, TRACE OF GRAVEL

FIG No 1

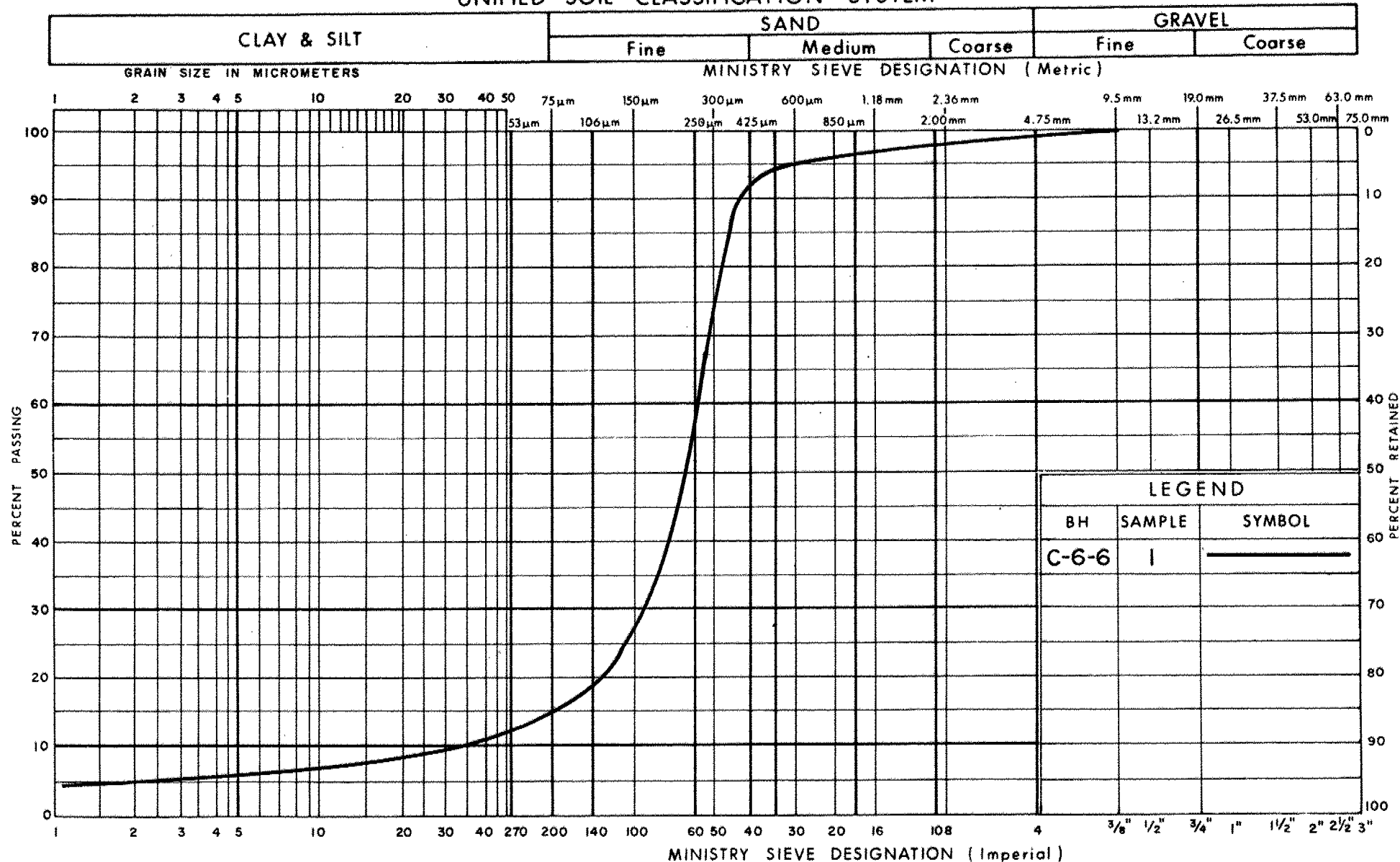
W P 11-81-02



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UNIFIED SOIL CLASSIFICATION SYSTEM



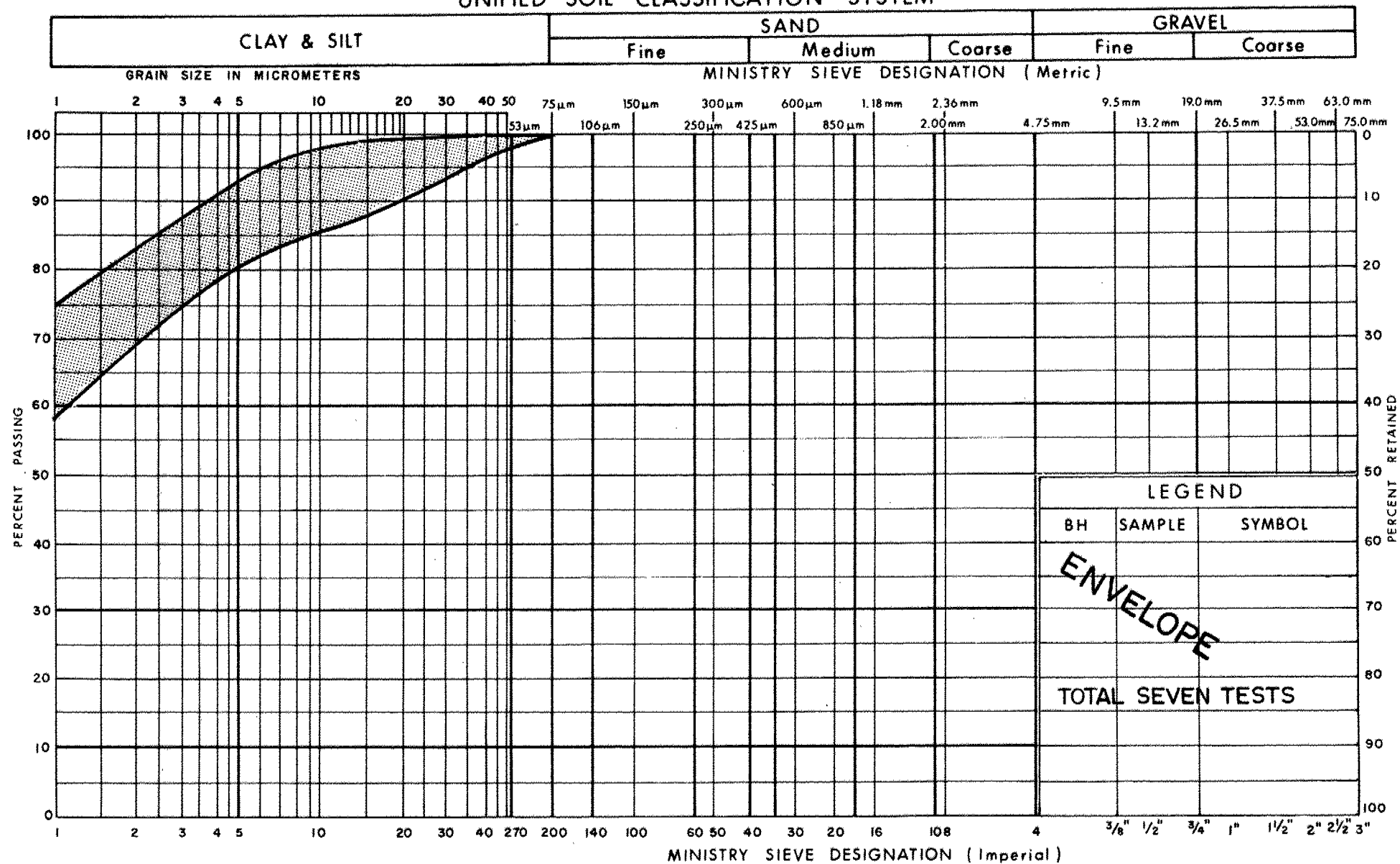
Ministry of
Transportation

GRAIN SIZE DISTRIBUTION
SAND (FILL)
WITH SILT, SOME CLAY, TRACE OF GRAVEL

FIG No 2

W P II - 81 - 02

UNIFIED SOIL CLASSIFICATION SYSTEM



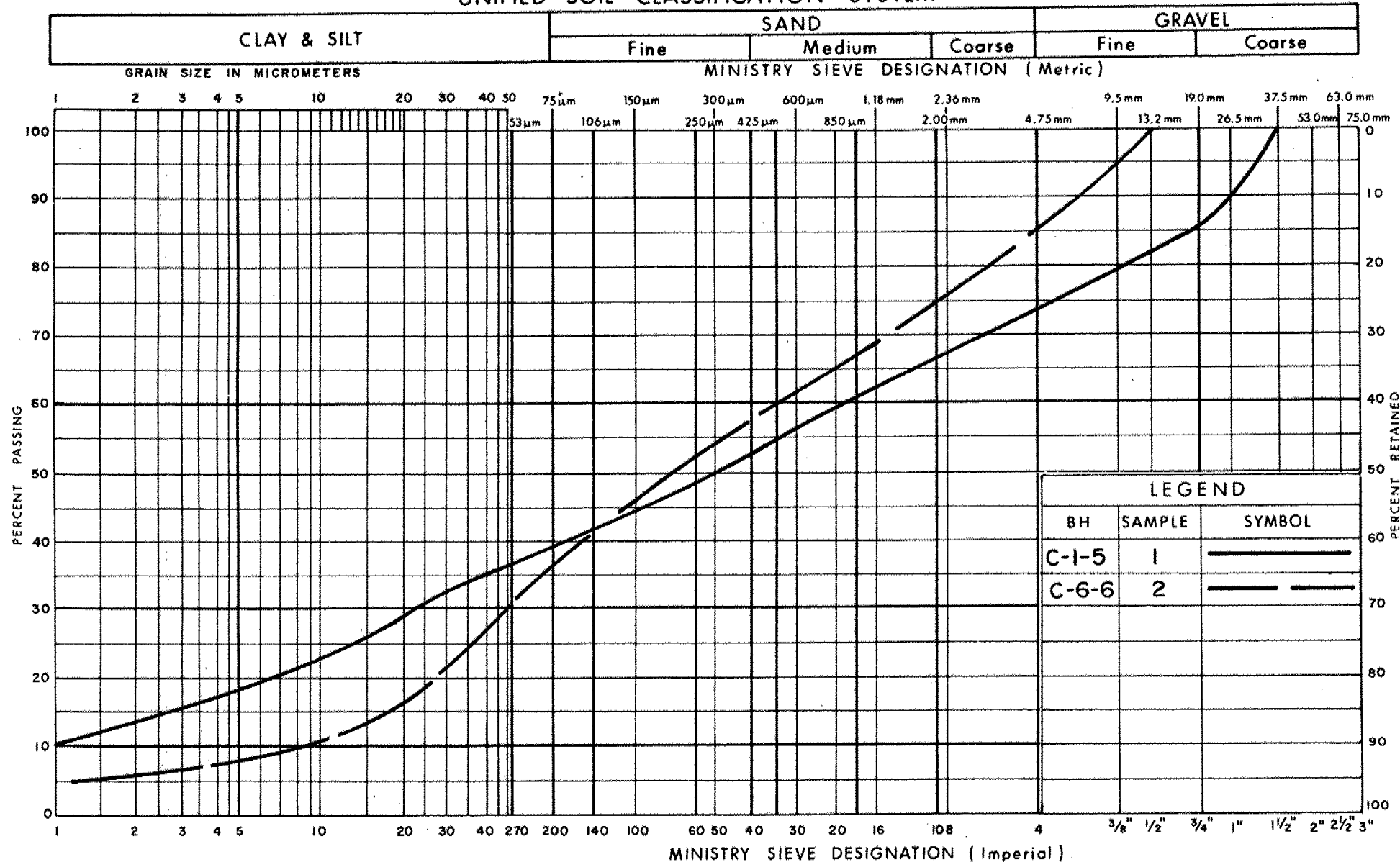
Ministry of
Transportation

**GRAIN SIZE DISTRIBUTION
CLAY**
WITH LAYERS OF CLAYEY SILT

FIG No 3

W P 11-81-02

UNIFIED SOIL CLASSIFICATION SYSTEM



GRAIN SIZE DISTRIBUTION
SANDY SILT (GLACIAL TILL)
 SOME CLAY, SOME GRAVEL

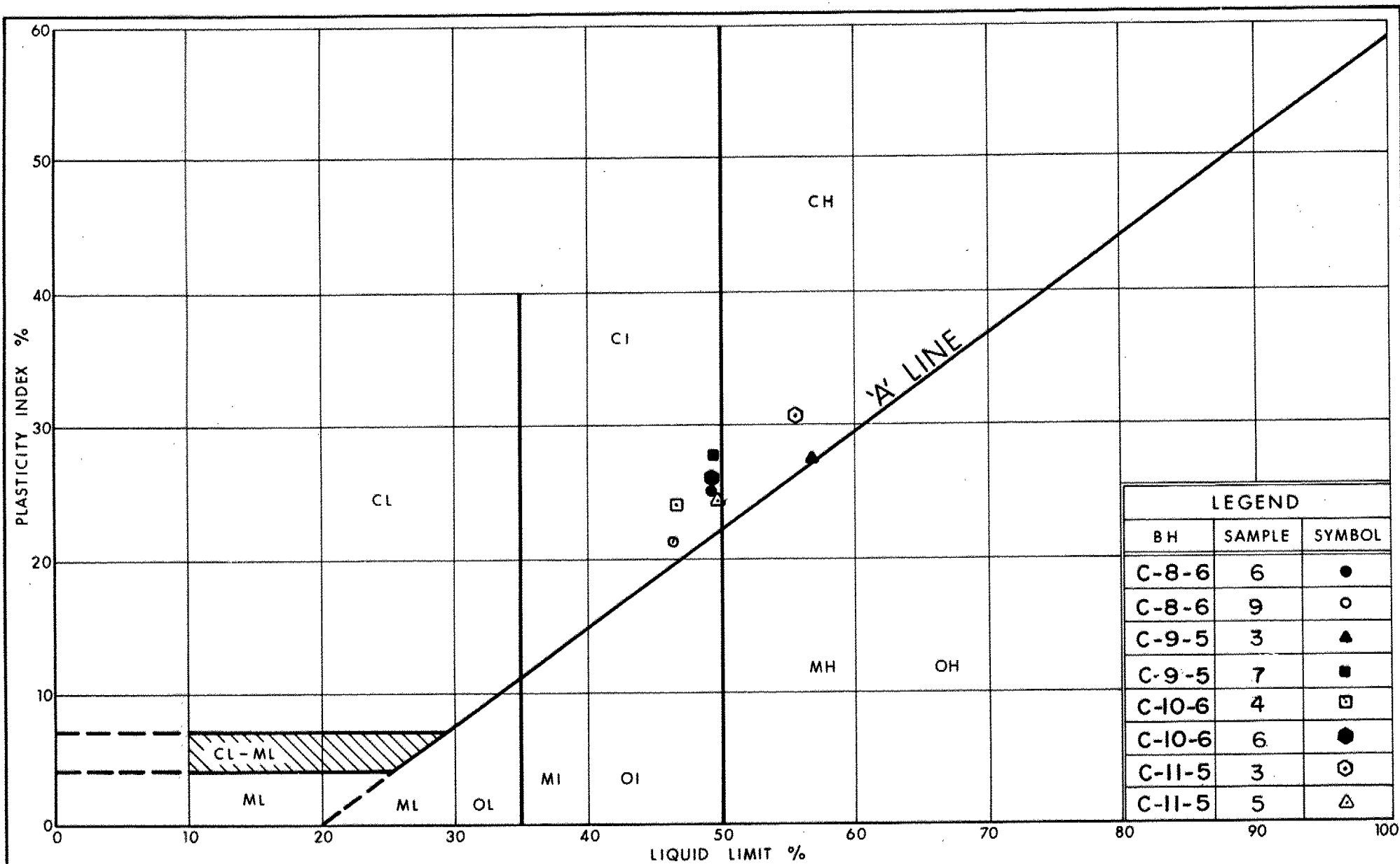
FIG No 4

W P II 81-02



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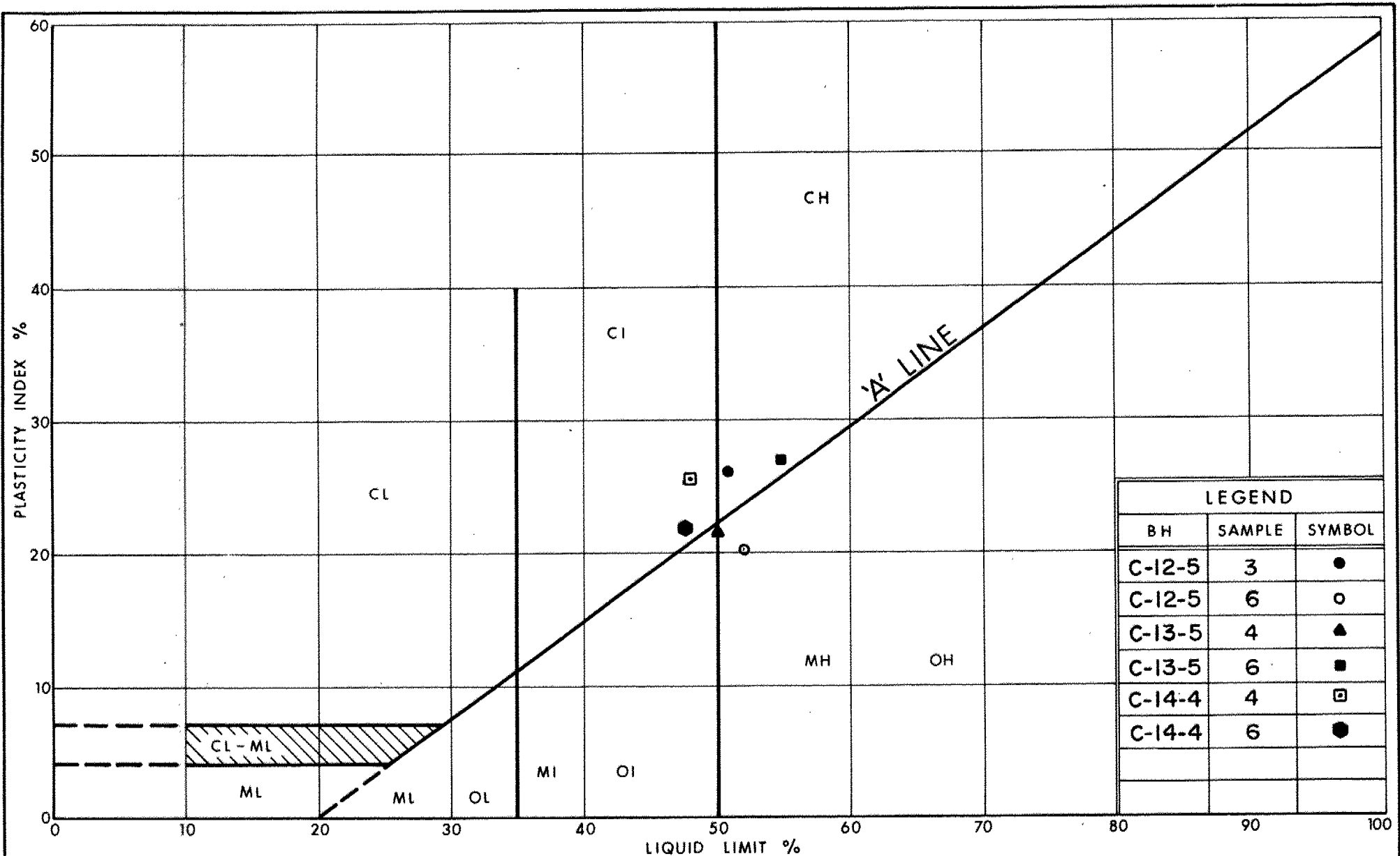
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PLASTICITY CHART CLAY WITH LAYERS OF CLAYEY SILT

FIG No 5

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PLASTICITY CHART CLAY WITH LAYERS OF CLAYEY SILT

FIG No 6

W P 11-81-02

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 'A' 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 (R Q D), 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

MECHANICAL PROPERTIES OF SOIL

m_v	kPa^{-1}	COEFFICIENT OF VOLUME CHANGE
C_c	1	COMPRESSION INDEX
C_s	1	SWELLING INDEX
C_α	1	RATE OF SECONDARY CONSOLIDATION
c_v	m^2/s	COEFFICIENT OF CONSOLIDATION
H	m	DRAINAGE PATH
T_v	1	TIME FACTOR
U	%	DEGREE OF CONSOLIDATION
σ'_{vo}	kPa	EFFECTIVE OVERBURDEN PRESSURE
σ'_p	kPa	PRECONSOLIDATION PRESSURE
τ_f	kPa	SHEAR STRENGTH
c'	kPa	EFFECTIVE COHESION INTERCEPT
ϕ'	-°	EFFECTIVE ANGLE OF INTERNAL FRICTION
c_u	kPa	APPARENT COHESION INTERCEPT
ϕ_u	-°	APPARENT ANGLE OF INTERNAL FRICTION
τ_R	kPa	RESIDUAL SHEAR STRENGTH
τ_r	kPa	REMOULDED SHEAR STRENGTH
S_t	1	SENSITIVITY = $\frac{c_u}{\tau_r}$

STRESS AND STRAIN

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

PHYSICAL PROPERTIES OF SOIL

ρ_s	kg/m^3	DENSITY OF SOLID PARTICLES	e	1, %	VOID RATIO	e_{\min}	1, %	VOID RATIO IN DENSEST STATE
γ_s	KN/m^3	UNIT WEIGHT OF SOLID PARTICLES	n	1, %	POROSITY	I_D	1	DENSITY INDEX = $\frac{e_{\max} - e}{e_{\max} - e_{\min}}$
ρ_w	kg/m^3	DENSITY OF WATER	w	1, %	WATER CONTENT	D	mm	GRAIN DIAMETER
γ_w	KN/m^3	UNIT WEIGHT OF WATER	S_r	%	DEGREE OF SATURATION	D_n	mm	n PERCENT - DIAMETER
ρ	kg/m^3	DENSITY OF SOIL	w_L	%	LIQUID LIMIT	C_u	1	UNIFORMITY COEFFICIENT
γ	KN/m^3	UNIT WEIGHT OF SOIL	w_p	%	PLASTIC LIMIT	h	m	HYDRAULIC HEAD OR POTENTIAL
ρ_d	kg/m^3	DENSITY OF DRY SOIL	w_s	%	SHRINKAGE LIMIT	q	m^3/s	RATE OF DISCHARGE
γ_d	KN/m^3	UNIT WEIGHT OF DRY SOIL	I_p	%	PLASTICITY INDEX = $w_L - w_p$	v	m/s	DISCHARGE VELOCITY
ρ_{sat}	kg/m^3	DENSITY OF SATURATED SOIL	I_L	1	LIQUIDITY INDEX = $\frac{w - w_p}{I_p}$	i	1	HYDRAULIC GRADIENT
γ_{sat}	KN/m^3	UNIT WEIGHT OF SATURATED SOIL	I_C	1	CONSISTENCY INDEX = $\frac{w_L - w}{I_p}$	k	m/s	HYDRAULIC CONDUCTIVITY
ρ'	kg/m^3	DENSITY OF SUBMERGED SOIL	e_{\max}	1, %	VOID RATIO IN LOOSEST STATE	j	KN/m^2	SEEPAGE FORCE
γ'	KN/m^3	UNIT WEIGHT OF SUBMERGED SOIL						

RECORD OF BOREHOLE No C-1-5

METRIC

W P 11 - 81 - 02 LOCATION N 5 037 696 E 380 912 ORIGINATED BY J.H.
 DIST 9 HWY 17 BOREHOLE TYPE Hollow Stem Auger COMPILED BY J.H.
 DATUM Geodetic DATE 89 - 09 - 18 CHECKED BY GDP

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	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					
59.75	Ground Level																
59.60	Topsoil, silt, low																
0.15	organic, dark brown Sandy Silt with gravel, some clay (Glacial Till)						59										
58.50	Brown Very Dense		1	SS	74	*							0				25 37 25 13
1.25	End of Borehole Refusal to Augering Probable Bedrock *Note: Water table not encountered																

OFFICE REPORT ON SOIL EXPLORATION

+³, x⁵: Numbers refer to
Sensitivity

20
15 5 (%) STRAIN AT FAILURE
10

RECORD OF BOREHOLE No C-2-5

METRIC

W P 11 - 81 - 02 LOCATION N 5 037 767 E 381 036 ORIGINATED BY J.H.
 DIST 9 HWY 17 BOREHOLE TYPE Hollow Stem Auger COMPILED BY J.H.
 DATUM Geodetic DATE 89 - 09 - 18 CHECKED BY GDP

OFFICE REPORT ON SOIL EXPLORATION

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	N' VALUES			20	40	60	80	100					
59.30	Ground Level																
0.00	Topsoil, silty clay, high organic, dark						59										
58.70	brown																
0.60	Clay, trace silt with wet silt seams Brown Grey	Stiff	1	SS	7		58										
			2	SS	2												
56.65							57										
2.65	Sandy Silt, some clay, trace gravel, seams of silty sand		3	SS	5		56										
			4	SS	4												
54.75	Grey	Loose					55										
4.55	Grey Limestone with randomly interbedded shale seams 1 to 5mm thick		5	RC RX													
			6	RC BX			54										
52.85							53										
6.45	End of Borehole																
Note: Upon completion of augering water at elevation 56.55 inside augers																	

Water level in open borehole

+3, x5: Numbers refer to
Sensitivity

20
15 5 (%) STRAIN AT FAILURE
10

RECORD OF BOREHOLE No C-3-5

METRIC

W P 11 - 81 - 02 LOCATION N 5 037 836 E 381 152 ORIGINATED BY J.H.
 DIST 9 HWY 17 BOREHOLE TYPE Hollow Stem Auger COMPILED BY J.H.
 DATUM Geodetic DATE 89 - 09 - 18 CHECKED BY GDP

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
60.85	Ground Level																
0.00	Sandy Silt (Fill) with clay, trace gravel, trace organic Dark Brown Loose																
59.45	Boulders		1	SS	63*	**	60						o			20.1	
1.40	End of Borehole Refusal to Augering Probable Bedrock *Note: High 'N' value due to driving on boulder **Note: Water table not encountered																

OFFICE REPORT ON SOIL EXPLORATION

*3, x5: Numbers refer to
Sensitivity

20
15 ϕ 5 (%) STRAIN AT FAILURE
10

RECORD OF BOREHOLE No C-4-6

METRIC

W P 11 - 81 - 02 LOCATION N 5 037 837 E 381 285 ORIGINATED BY J.H.
 DIST 9 HWY 17 BOREHOLE TYPE Hollow Stem Auger COMPILED BY J.H.
 DATUM Geodetic DATE 89 - 09 - 19 CHECKED BY esp

OFFICE REPORT ON SOIL EXPLORATION

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100				
61.65	Ground Level															
0.00	Clayey Silt (Fill) trace sand															
60.30	Brown Firm		1	SS	7		61									
1.35	Peat highly organic, fibrous		2	SS	2		60								25.1	organic content 65%
59.35	Dark Brown Very Loose															
2.30	Sandy silt, trace clay, trace gravel, (Glacial Till)		3	SS	32		59									
58.60	Grey Compact to Dense															
3.05	Grey Limestone with randomly interbedded shale seams 1 to 10mm thick		4	RC BX			58	100%	79%	Moderate to Unweathered					25.21	
57.05																
4.60	End of Borehole															
	Note: Upon completion of augering, water at elevation 58.65 inside hollow stem augers															

▽ Water level in open borehole

+³, x⁵: Numbers refer to
Sensitivity

20
15
10
5 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No C-5-5

METRIC

W P 11 - 81 - 02 LOCATION N 5 037 973 E 381 367 ORIGINATED BY J.H.
 DIST 9 HWY 17 BOREHOLE TYPE Hollow Stem Auger COMPILED BY J.H.
 DATUM Geodetic DATE 89 - 08 - 31 CHECKED BY Gdp

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	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					
64.45	Ground Level													
0.00	Fine Sand (Fill), some silt, trace gravel		1	SS	1	*	64							
2.30	Sandy Silt, trace clay		2	SS	2		63							
62.15	Brown													
2.30	Sandy Silt, trace clay													
61.70	trace gravel, boulders, (Glacial Till)		3	SS	3		62							
2.75	Brown Very Loose End of Borehole Refusal to Augering Probable Bedrock *Note: Water table not encountered													

OFFICE REPORT ON SOIL EXPLORATION

+³, x⁵: Numbers refer to
Sensitivity

20
15 5 (%) STRAIN AT FAILURE
10

RECORD OF BOREHOLE No C-6-6

METRIC

W P 11 - 81 - 02 LOCATION N 5 038 018 E 381 484 ORIGINATED BY J.H.
 DIST 9 HWY 17 BOREHOLE TYPE Hollow Stem Auger and BX Rock Core COMPILED BY J.H.
 DATUM Geodetic DATE 89 - 08 - 31 CHECKED BY G.D.P.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC NATURAL LIQUID LIMIT MOISTURE CONTENT LIMIT			UNIT WEIGHT Y	REMARKS & GRAIN SIZE DISTRIBUTION (%)
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	Wp	W	Wl		
65.90	Ground Level															
65.75	Pavement Structure															
0.15	50mm asphalt over 100mm sand and gravel Fine Sand (Fill) some silt, trace clay		1	SS	11	*	65									1 83 12 4
64.40	Brown															
1.50	Sandy Silt, trace gravel, trace clay, silt sand seams, boulders, (Glacial Till)		2	SS	35		64									14 52 29 5
63.00	Brown Dense		3	SS	69	200mm										
2.90	Grey Limestone with randomly interbedded shale seams, 1 to 5mm thick		4	RC BX			63									
			5	RC BX			62									
60.45	End of Borehole						61								26.05	
5.45	*Note: Water table not encountered															

OFFICE REPORT ON SOIL EXPLORATION

+3, x5: Numbers refer to
Sensitivity

20
15-5 (%) STRAIN AT FAILURE
10

RECORD OF BOREHOLE No C-7-5

METRIC

W P 11 - 81 - 02 LOCATION N 5 038 086 E 381 588 ORIGINATED BY J.H.
 DIST 9 HWY 17 BOREHOLE TYPE Hollow Stem Auger COMPILED BY J.H.
 DATUM Geodetic DATE 89 - 09 - 01 CHECKED BY GDP

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			SHEAR STRENGTH kPa								
64.10	Ground Level															
0.00	Sand and Gravel (Fill) trace silt						64									
63.55	Grey Brown															
0.55	Sandy Silt (Fill) some clay		1	SS	10 *		63									
62.60	Brown															
1.50	Clay, some silt		2	SS	11											
61.95	Brown Stiff															
2.15	Sandy Silt, trace clay						62									
61.60	trace gravel, boulders		3	SS	37/	180mm										
2.50	(Glacial Till)															
	Brown Compact															
	End of Borehole															
	Refusal to Augering															
	Probable Bedrock															
	* Note: Water table not encountered															

OFFICE REPORT ON SOIL EXPLORATION

+3, x5: Numbers refer to
Sensitivity

20
15 - 5 (%) STRAIN AT FAILURE
10

RECORD OF BOREHOLE No C-8-6

METRIC

W P 11 - 81 - 02 LOCATION N 5 038 138 E 381 592 ORIGINATED BY J.H.
 DIST 9 HWY 17 BOREHOLE TYPE Hollow Stem Auger COMPILED BY J.H.
 DATUM Geodetic DATE 89 - 09 - 01 CHECKED BY G.P.

OFFICE REPORT ON SOIL EXPLORATION

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40					
63.50	Ground Level													
0.00	Sand and Gravel (Fill) trace silt													
62.90	Brownish Grey													
0.60	Fine Sand (Fill), some silt		1	SS	12									
62.00	Brown													
1.50	Clay, some silt		2	SS	7									
	Brown Grey		3	SS	2									
	Stiff		4	SS	2									
			5	SS	1									
			6	TW	PH									
			7	SS	WoH									
			8	SS	WoH									
			9	TW	PM									
50.70														
12.80	End of Borehole													

▽ Water level in open borehole
 WoH Weight of Hammer

+3, x5: Numbers refer to Sensitivity

20
 15 5 (%) STRAIN AT FAILURE
 10

On Gas line

RECORD OF BOREHOLE No C-9-5

METRIC

W P 11 - 81 - 02 LOCATION N 5 038 181 E 381 696 ORIGINATED BY J.H.
 DIST 9 HWY 17 BOREHOLE TYPE Hollow Stem Auger COMPILED BY J.H.
 DATUM Geodetic DATE 89 - 08 - 31 CHECKED BY GGP

OFFICE REPORT ON SOIL EXPLORATION

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40					
63.10	Ground Level													
0.10	Topsoil, sandy silt, organic													
	Dark brown Silty fine sand (Fill), trace clay		1	SS	10									
61.35	Brown		2	SS	4									
1.75	Clay, some silt													
	Brown Grey Stiff		3	TW	PH								15.5	0 0 23 77
			4	SS	WoH									
			5	SS	WoH									
			6	SS	WoH									
			7	TW	PH								15.6	0 0 20 80
			8	SS	WoH									
53.05														
10.05	End of Borehole													

Water level in open borehole
 WoH Weight of Hammer

+3, +5: Numbers refer to Sensitivity

20
 15 5 (%) STRAIN AT FAILURE
 10



METRIC

W P 11 - 81 - 02 LOCATION N 5 038 162 E 381 864 ORIGINATED BY J.H.
DIST 9 HWY 17 BOREHOLE TYPE Hollow Stem Auger COMPILED BY J.H.
DATUM Geodetic DATE 89 - 09 - 19 CHECKED BY Gpp

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC NATURAL LIQUID LIMIT			UNIT WEIGHT γ KN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL			
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	'N' VALUES			20 40 60 80 100							W _p	W	W _L
								SHEAR STRENGTH kPa							WATER CONTENT (%)		
						○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE											
						50 100 150 200 250					20 40 60						
59.80	Ground Level																
0.00	Clayey Silt (Fill) trace sand, trace gravel, organic																
58.45	Dark Brown Soft		1	SS	2		59										
1.35	Clay, some silt Grey Stiff		2	SS	1		58										
								+11									
			3	SS	1		57										
							56	+10									
			4	TW	PH		55						16.2	0 0 31 69			
								+11									
							54										
			5	SS	1												
							53	+12									
	trace organic		6	TW	PH		52						15.7				
								+12									
							51										
			7	SS	1												
49.75							50	+11									
10.05	End of Borehole																
Note: Piezometer installed at elevation 50.35, with seal at elevation 58.30																	
Date Water Elevation																	
Sept.20/89 53.40 Water level was not stabilized at conclusion of field work ,																	
Sept.21/89 55.40																	

▽ Water level in open borehole
 ▼ Piezometric level

+3, x5 : Numbers refer to Sensitivity

20
15 ϕ 5 (%) STRAIN AT FAILURE
10

RECORD OF BOREHOLE No C-11-5

METRIC

W P 11 - 81 - 02 LOCATION N 5 038 263 E 381 920 ORIGINATED BY J.H.
 DIST 9 HWY 17 BOREHOLE TYPE Hollow Stem Auger COMPILED BY J.H.
 DATUM Geodetic DATE 89 - 09 - 21 CHECKED BY SDP

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	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										
							○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE											
61.45	Ground Level																	
0.00	Sandy Silt (Fill) trace clay, trace gravel, trace organics		1	SS	2		61											
60.10	Brown						60											
1.35	Clay, some silt		2	SS	3		59	2										
	Grey	Stiff					58						15.9	0 0 26 74				
			3	TW	PH		57											
			4	SS	1		56											
							55						15.5					
			5	TW	PH		54											
							53											
			6	SS	1		52											
			7	SS	2													
51.40																		
10.05	End of Borehole																	

▽ Water level in open borehole

+3, x5: Numbers refer to
Sensitivity

20
15 5 (%) STRAIN AT FAILURE
10

OFFICE REPORT ON SOIL EXPLORATION

RECORD OF BOREHOLE No C-12-5

METRIC

W P 11 - 81 - 02 LOCATION N 5 038 323 E 382 028 ORIGINATED BY J.H.
 DIST 9 HWY 17 BOREHOLE TYPE Hollow Stem Auger COMPILED BY J.H.
 DATUM Geodetic DATE 89 - 09 - 19 CHECKED BY gdp

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC NATURAL LIQUID LIMIT MOISTURE CONTENT LIMIT			UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20 40 60 80 100	W _p W W _L	WATER CONTENT (%)				
60.55	Ground Level													
0.00	Limestone gravel, cobbles and boulders (fill), trace silt. trace sand													
59.45	Grey		1	SS	30/0mm*									
1.10	Clay, some silt													
	Grey	Stiff	2	SS	2									
			3	TW	PH									
			4	SS	WoH									
	trace organics		5	SS	WoH									
			6	TW	PH									
			7	SS	WoH									
50.50														
10.05	End of borehole													
	*Note High 'N' value due to driving on cobble													

OFFICE REPORT ON SOIL EXPLORATION

▽ Water level in open borehole

+3, x5: Numbers refer to Sensitivity

20
15
10
5 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No C-13-5

METRIC

W P 11 - 81 - 02 LOCATION N 5 038 386.5 E 382 146.5 ORIGINATED BY J.H.
 DIST 9 HWY 17 BOREHOLE TYPE Hollow Stem Auger COMPILED BY J.H.
 DATUM Geodetic DATE 89 -09 - 18 CHECKED BY GDP

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
59.50	Ground Level																
0.00	Topsoil, clay and silt medium organic																
58.75	Dark brown																
0.75	Clay, some silt Grey	Stiff	1	SS	2												
			2	SS	1												
			3	SS	1												
			4	TW	PH												
			5	SS	1												
	trace organics		6	TW	PH												
			7	SS	WoH												
49.45																	
10.05	End of Borehole																
Note: Piezometer installed at elevation 50.50 with seal at elevation 58.50 Date <u>Water</u> Sept.20/89 <u>58.02</u> Water level was not stabilized at conclusion of field work Sept.21/89 <u>58.22</u>																	

OFFICE REPORT ON SOIL EXPLORATION

▽ Water level in open borehole
 ▽ Piezometric level
 ▴ WoH Weight of Hammer

+3, x5: Numbers refer to
Sensitivity

20
15 5 (%) STRAIN AT FAILURE
10

RECORD OF BOREHOLE No C-14-4

METRIC

W P 11 - 81 - 02 LOCATION N 5 040 159 E 384 639.5 ORIGINATED BY J.H.
 DIST 9 HWY 17 BOREHOLE TYPE Hollow Stem Auger COMPILED BY J.H.
 DATUM Geodetic DATE 89 - 09 - 18 CHECKED BY GdP

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ kN/m ³	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										
							○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE											
53.65	Ground Level																	
53.50	Topsoil, silty clay, low organic, dark brown																	
0.15	Clay, some silt																	
	Brown Very Stiff		1	SS	9		53											
	Gray Stiff		2	SS	6		52											
							51		+2									
			3	SS	2		50		+10									
			4	TW	PH		49						16.5					
							48		+8									
			5	SS	1		47		+26									
			6	TW	PH		46						13.6					
							45		+30									
			7	SS	WoH		44											
43.60									+15									
10.05	End of Borehole																	

OFFICE REPORT ON SOIL EXPLORATION

▽ Water level in open borehole
 WoH Weight of Hammer

+3, x5: Numbers refer to
 Sensitivity

20
 15 5 (%) STRAIN AT FAILURE
 10

RECORD OF BOREHOLE No CSW

METRIC

W P 11 - 81 - 02 LOCATION N 5 038 074; E 381 505
DIST 9 HWY 17 BOREHOLE TYPE Hollow Stem Auger
DATUM Geodetic DATE 89 - 09 - 21
ORIGINATED BY J.H.
COMPILED BY J.H.
CHECKED BY GGP

OFFICE REPORT ON SOIL EXPLORATION

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100		
65.20	Ground Level													
0.00	Pavement Structure													
64.55	50mm asphalt over sand and gravel (Fill)													
0.65	Brown													
63.70	Sandy Silt (Fill) trace clay, trace gravel, scattered cobbles		1	SS	11	*								
1.50	Brown													
63.20	Sandy Silt, trace clay trace gravel, boulders (Glacial Till)		2	SS	62									
2.00	Brown Very Dense													
	End of Borehole													
	Refusal to Augering													
	Probable Bedrock													
	*Note: Water table not encountered													

+3, x5: Numbers refer to Sensitivity

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

RECORD OF BOREHOLE No CSE

METRIC

W P 11 - 81 - 02 LOCATION Sta. 9 + 921 o/s 17.5m LT @ Champlain St. ORIGINATED BY J.H.
 DIST 9 HWY 17 BOREHOLE TYPE Hollow Stem Auger COMPILED BY J.H.
 DATUM Geodetic DATE 89 - 09 - 01 CHECKED BY GDP

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	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					
64.60	Ground Level																
0.00	Sandy Silt (Fill) some clay		1	SS	13	*	64										0 15 65 20
63.10	Brown																
1.50	Clay, some silt		2	SS	8		63										
62.30	Brown Stiff																
62.10	Sandy silt, trace clay		3	SS	50/	150mm											
2.50	trace gravel, (Gracial Till) Brown Compact																
	End of Borehole																
	Refusal to Augering Probable Bedrock																
	*Note: Water table not encountered																

OFFICE REPORT ON SOIL EXPLORATION

+³, x⁵: Numbers refer to
Sensitivity

20
15 5 (%) STRAIN AT FAILURE
10

RECORD OF BOREHOLE No OSN

METRIC

W P 11 - 81 - 02 LOCATION N 5 037 699; E 380 998 ORIGINATED BY J.H.
 DIST 9 HWY 17 BOREHOLE TYPE Hollow Stem Auger COMPILED BY J.H.
 DATUM Geodetic DATE 89 - 09 - 21 CHECKED BY GDP

OFFICE REPORT ON SOIL EXPLORATION

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40					
61.30	Ground Level													
0.00	Sand and Gravel (Fill) trace silt, scattered cobbles						61							
60.55	Greyish Brown													
0.75	Silty Clay (Fill) trace sand, trace gravel, scattered topsoil inclusions		1	SS	3		60							
	Brown		2	SS	6									
			3	SS	46	150mm	59							
58.50	Boulders													
2.80	End of Borehole Refusal to Augering Probable Bedrock													
	*Note: Water table not encountered													

+³, x⁵: Numbers refer to
Sensitivity

20
15
10
5 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No OSS

METRIC

W P 11 - 81 - 02 LOCATION Sta. 9 + 365 o/s 17.0m RT of Hwy 17 E.B.L. ORIGINATED BY J.H.
 DIST 9 HWY 17 BOREHOLE TYPE Hollow Stem Auger COMPILED BY J.H.
 DATUM Geodetic DATE 89 - 09 - 20 CHECKED BY G.D.P.

OFFICE REPORT ON SOIL EXPLORATION

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	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					
59.75	Ground Level																
0.00 59.45 0.30	Sand and Gravel (Fill) trace silt Brownish Grey																
	Clay (Fill), some silt trace sand, trace gravel, scattered topsoil inclusions		1	SS	6		59										
			2	SS	14		58										
57.45	Brown																
2.30	Sandy Silt some clay, trace gravel (Glacial Till)		3	SS	8		57										
56.45	Grey Loose		4	SS	42	75mm											
3.30	End of Borehole																
	Refusal to Augering Probable Bedrock																

▽ Water level in open borehole

+³, x⁵: Numbers refer to
Sensitivity

20
15 5 (%) STRAIN AT FAILURE
10

RECORD OF BOREHOLE No A

METRIC

W P 11 - 81 - 02 LOCATION N 5 037 902; E 381 473
 DIST 9 HWY 17 BOREHOLE TYPE Hollow Stem Auger ORIGINATED BY J.H.
 DATUM Geodetic DATE 89 -09 - 20 COMPILED BY J.H.
 CHECKED BY GDP

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	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					
63.60	Ground Level																
0.00	Sandy Gravel (Fill) scattered cobbles																
62.85	Grey						63										
0.75	Clay and Silt (Fill) trace sand, trace gravel		1	SS	22	*							o				
61.85	Brown Sand and Gravel		2	SS	50/	150mm	62						o				
1.75	End of Borehole Refusal to Augering Probable Bedrock *Note: Water table not encountered																

OFFICE REPORT ON SOIL EXPLORATION

+³, x⁵: Numbers refer to
Sensitivity

20
15 5 (%) STRAIN AT FAILURE
10



RECORD OF BOREHOLE No B

METRIC

W P 11 - 81 - 02

LOCATION Sta. 9 + 932 on G Ring Road

ORIGINATED BY J.H.

DIST 9 HWY 17

BOREHOLE TYPE Hollow Stem Auger

COMPILED BY J.H.

DATUM Geodetic

DATE 89 - 09 - 20

CHECKED BY JDP

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	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					
63.90	Ground Level																
0.00	Sandy Gravel (Fill) scattered cobbles																
63.15	Grey																
0.75	Clay and Silt (Fill), Trace gravel scattered fine sand layers		1	SS	22	*											
			2	SS	34												
61.60	Brown																
2.30	End of Borehole Refusal to Augering Probable Bedrock *Note: Water table not encountered																

+3, x5: Numbers refer to
Sensitivity

20
15 ϕ 5 (%) STRAIN AT FAILURE
10

MINISTRY OF TRANSPORTATION, ONTARIO PH-D-207 88 10

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

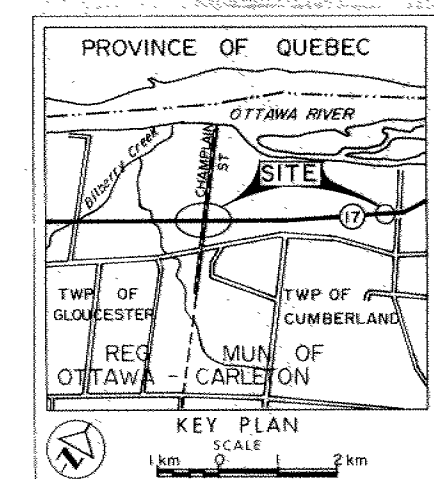
CONT No
WP No 11-81-02



HWY 17 & CHAMPLAIN ST
HIGH MAST LIGHTING & OVERHEAD SIGNS
BORE HOLE LOCATIONS & SOIL STRATA

SHEET

PETO MacCALLUM LTD.



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)
- W.L. at time of investigation

No	ELEVATION	CO-ORDINATES	
		NORTH	EAST
C-1-5	59.75	5 037 696	380 912
C-2-5	59.30	5 037 767	381 036
C-3-5	60.85	5 037 836	381 152
C-4-6	61.65	5 037 837	381 285
C-5-5	64.45	5 037 973	381 367
C-6-6	65.90	5 038 018	381 484
C-7-5	64.10	5 038 086	381 588
C-8-6	63.50	5 038 138	381 592
C-9-5	63.10	5 038 181	381 696
C-10-6	59.80	5 038 162	381 864
C-11-5	61.45	5 038 263	381 920
C-12-5	60.55	5 038 323	382 028
C-13-5	59.50	5 038 386.5	382 146.5
C-14-4	53.65	5 040 159	384 639.5
CSW	65.20	5 038 074	381 505
CSE	64.60	5 038 085	381 542
OSN	61.30	5 037 699	380 998
OSS	59.75	5 037 677	381 010
A	63.60	5 037 902	381 473
B	63.90	5 037 930	381 519

NOTE:
For Subsurface details refer to
Record of Borehole Sheets.

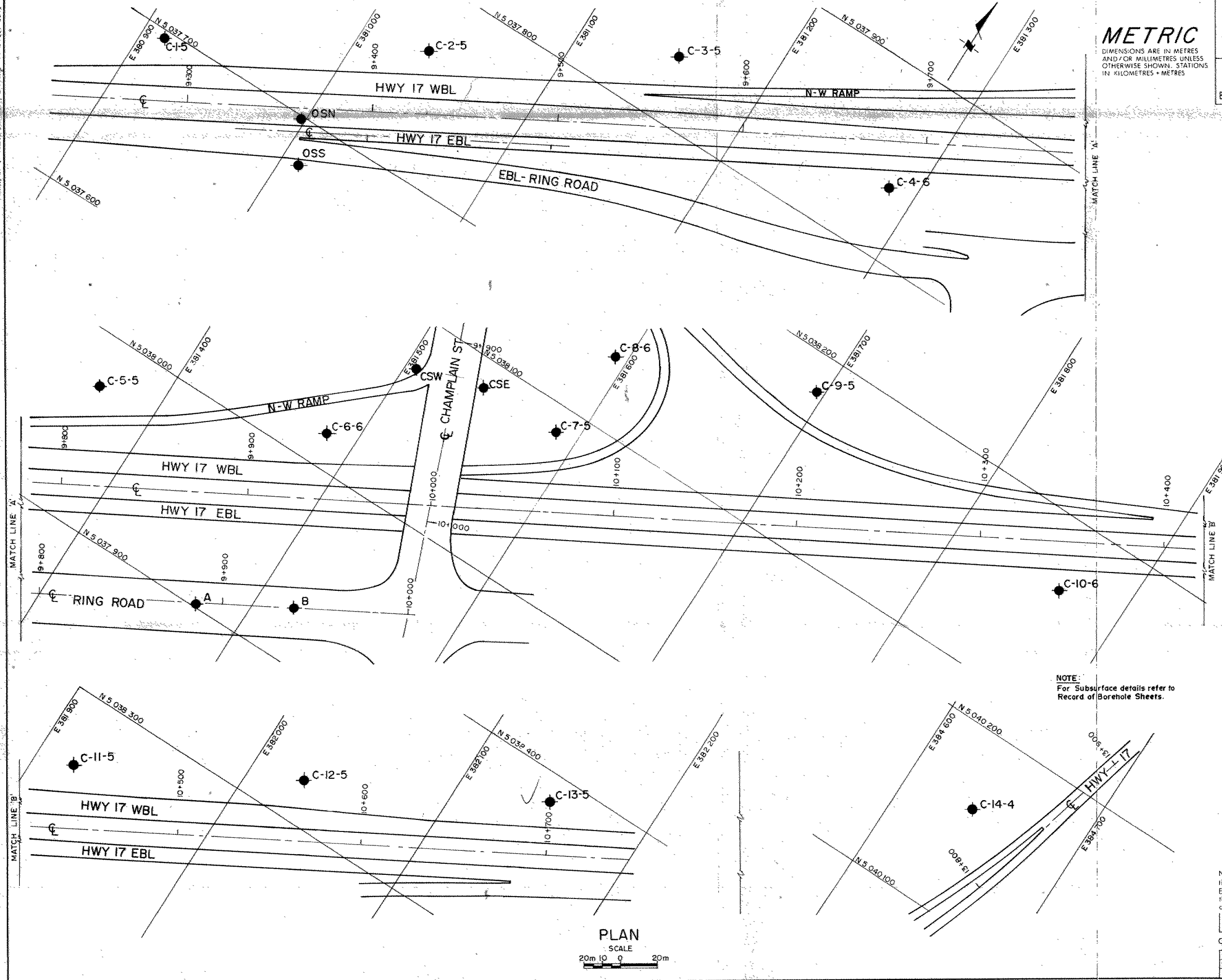
NOTE:
The boundaries between soil strata have been established
only at Bore Hole locations. Between Bore Holes the
boundaries are assumed from geological evidence.

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 3165-169

HWY No 17	CHECKED	DATE 1989 10	SITE 9
SUBMD GDP	CHECKED	APPROVED	OWG 118102-A
DRAWN KK	CHECKED		



PLAN
SCALE
20m 10 0 20m