

**FOUNDATION INVESTIGATION REPORT
PROPOSED HIGH MAST LIGHT POLES
HIGHWAY 409 REHABILITATION
FROM HIGHWAY 401 WESTERLY TO
HIGHWAY 409/427 INTERCHANGE
TORONTO, ONTARIO
W.P. 321-96-00**

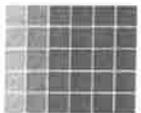
Prepared For:

**MINISTRY OF TRANSPORTATION
CENTRAL REGION**

Prepared by:

SHAHEEN & PEAKER LIMITED

**Project: SPT1076
July 8, 2003**



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DRAWINGS

BOREHOLE LOCATION PLANS

DRAWING No.

1 TO 4

APPENDICES

APPENDIX A: RECORD OF BOREHOLE SHEETS

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1. INTRODUCTION

Highway 409 is an approximately 4.3 km long highway that extends from Highway 401 to Highway 427. This highway was constructed from Highway 401 to Carlingview Drive under Contract 74-020, and from Carlingview Drive to Airport Road under Contract 77-046. The eastern limit of the present project is the bull nose of the E-N/S ramp to Belfield/Kipling Road. The western limit of the project is the center line of the underpass at Highway 427 at Station 10+000.

Shaheen & Peaker Limited (S&P) was retained by the Ministry of Transportation of Ontario, Central Region, to undertake a foundation investigation for proposed high mast light poles along Highway 409. This report presents the foundation investigation results. The work was performed in accordance with Consultant Agreement No. 2005-A-000524.

2. SITE DESCRIPTION AND PHYSIOGRAPHY

The approximately 4.3 km long highway is located on a gently undulating till plain. Within the project limits this till plain is dissected by the Mimico Creek. From the eastern limit, this till plain rises gently to the west reaching a high point in the vicinity of the Highway 27 underpass. The elevation then drops towards Mimico Creek and then rises again towards the west limit at Highway 427 (Station 10+000).

The site is located in the physiographic region known as the Peel Plain. Most of the overburden is composed of Pleistocene deposits, which were mostly laid down under great thicknesses of ice or in the glacial rivers and lakes associated with them during the Wisconsinan Glacial Age.

The geological mapping for this area shows three till sheets of the last Wisconsin glaciation. These till sheets are usually separated from one another by a bed of stratified clay, silt or sand of variable thickness. Sometimes one till sheet lies directly on the older one. Occasionally, a concentration of boulders is present.

The overburden is underlain by grey shale bedrock of the Georgian Bay Formation (also known as the Meaford-Dundas Formation). The Georgian Bay Formation belongs to the Ordovician Period and is approximately 450 million years old. It is known to consist of grey shale with interbeds of relatively more competent siltstone and sandstone and harder limestone. It is also known to contain occasional thin clay seams. The hard layers/seams are usually less than about 100 to 150 mm thick but some layers are much thicker. These are actually lenses and they can vary significantly in thickness over short distances. Stress relief features, such as folds and faults are also found in the formation.

3. INVESTIGATION PROCEDURES

The fieldwork for this project was performed on December 07 and December 16, 2002 and consisted of drilling and sampling a total of 12 boreholes. Ten boreholes (Boreholes 1 to 10 inclusive) were put down on the inner (left) paved shoulder of Highway 409 WBL close to the guardrails along the median centre line of the highway. These boreholes were advanced during timed lane closures effected from 11:00 pm on December 06, 2002 to 10:30 am on December 07, 2002. Two boreholes (Boreholes 11 and 12) were drilled at the Martin Grove Interchange on December 16, 2002. The plan locations of which (the boreholes) are shown on Drawing Nos. 1, 2, 3 and 4.

The boreholes were advanced using truck-mounted drill rigs owned and operated by Groundworks Drilling Inc. and Eastern Soils Limited, under the full time supervision of technical personnel from Shaheen & Peaker Limited.

The depth of the boreholes ranged from 8.7 m to 11.0 m below the ground surface. Sampling in the boreholes was conducted at frequent intervals of depth by the Standard Penetration Test Method (SPT), as specified in ASTM D1586. This consists of freely dropping a 63.5 kg hammer a vertical distance of 0.76 m to drive a 51 mm diameter O.D. split barrel (split-spoon) sampler into the ground. The number of blows of the hammer required to drive the sampler into the relatively undisturbed ground by a vertical distance of 0.30 m is recorded as the Standard Penetration Resistance or the N-value of the soil and this gives an indication of the consistency or the compactness condition of the soil deposit. Continuous sampling was effected in some of the ten boreholes put down along Highway 409, to a depth of 1.2 m through the granular material underlying the asphalt pavement.

Boreholes 1 to 10 were put down through the pavement structure of Highway 409. These holes were backfilled with auger cuttings by reverse augering and the upper portion was sealed with emulsified asphalt. Auger cuttings were used to backfill Boreholes 11 and 12 and the upper portion was then grouted and sealed using a cement/bentonite mixture.

The borehole locations were determined by our technical staff using information contained in the pre-design electrical report (W.P. 321-96-00) of The Greer Galloway Group Inc. and

Moon-Matz Ltd. Using this information and the B-plans supplied by MTO., our technical staff chained the median centreline of Highway 409 and established the locations of Boreholes 1 to 10. Boreholes 11 and 12 were established in the field in relation to the existing features. The coordinates of these boreholes were determined by S&P personnel who used the information provided in the B-plans supplied by MTO. Geodetic elevations were determined by referring the boreholes to catch basins with known elevations located on Highway 409. The geodetic elevations for these catch basins were also extracted from the B-plans supplied by M.T.O.

The results of drilling, in-situ testing and water level measurements are summarized on the Record of Borehole Sheets in Appendix A. The Record of Borehole Sheets (MTO 1971, W.P. 276-65 and MTO 1972, W.P. 218-65-01), of boreholes previously put down by MTO, are shown in Appendix B.

Water level observations in the open boreholes were made during the drilling and at the conclusion of each borehole.

The soil samples were shipped to our laboratory in Toronto for further examination and classification. A laboratory testing programme consisting of natural moisture content, bulk unit weight, Atterberg Limits tests, grain-size analyses and pocket penetrometer tests was performed on selected soil samples. The results of the laboratory tests are presented on the appropriate Record of Borehole Sheets and also in Appendix C.

4. SUBSURFACE CONDITIONS

Details of the subsurface conditions encountered in the borehole are presented on the Record of Borehole Sheets in Appendix A. The conditions are briefly described in the following paragraphs.

4.1 PAVEMENT FILL

Boreholes 1 to 10 inclusive were put down through the left paved shoulder of Highway 409 WBL. They encountered a 100 mm thick layer of asphaltic concrete. This asphaltic concrete is further underlain by granular pavement fill to depths ranging between 0.3 m and 0.7 m below ground surface.

Standard Penetration tests conducted in this light brown granular fill deposit yielded N-values ranging from 4 to more than 50 blows/0.3 m but generally from 10 to 32 blows/0.3 m. From these values the relative density of this deposit is described as very loose to very dense but generally compact. The measured moisture contents of representative samples retrieved from this deposit ranged from 3 to 12%.

4.2 TOPSOIL

Boreholes 11 and 12 were put down at the North East and South West quadrants of the Martin Grove Road interchange. These boreholes encountered a 0.1 m thick layer of topsoil.

4.3 FILL

4.3.1 CLAYEY SILT FILL

Boreholes 1, 2, 3, 7, 8, 9 and 10 encountered a layer of fill that extended to depths ranging from 1.4 m (El. 163.2 m) to 7.5 m (El. 155.7 m) below ground surface. This fill generally consisted of a mixture of clayey silt, with sand and trace to some gravel. In Borehole 10 occasional asphalt inclusions were found in this fill at depths ranging from 1.4 m to 2.4 m and in Borehole 9 a slight hydrocarbon odour was detected in sample SS 2 retrieved from a depth of 0.6 m to 1.2 m below ground surface. In Borehole 8 this clayey silt fill is overlain by a 2.3 m thick layer of sand fill.

The clayey silt fill is a cohesive soil. Standard Penetration tests conducted in this material yielded N-values ranging from 3 blows to more than 60 blows/0.3 m and pocket penetrometer tests on relatively undisturbed samples gave undrained shear strengths ranging from 50 to more than 225 kPa, indicating generally, a soft to hard consistency.

The results of grain-size distribution analyses carried out on six representative samples from this stratum are given in an envelope form in Figure 1 in Appendix C. The results show the following grain-size distribution:

Gravel:	2 – 15%
Sand:	26 – 62 %
Silt:	19 – 49 %
Clay:	4 – 25 %

The measured natural moisture content of samples recovered from this fill material ranged from 4 to 21% and the bulk unit weight of representative samples retrieved from this deposit ranged between 19.8 and 21.7 kN/m³.

A comparison of the grain-size distribution of the soil samples from the clayey silt fill to those of the underlying clayey silt till (Figure 3) indicates that the fill was probably derived from the indigeneous till material.

4.3.2 SAND FILL

In Borehole 8 a layer of brown sand fill with some silt content was contacted at a depth of 0.3 m (El. 162.1 m) below ground surface. This granular fill material extended to a depth of 2.6 m (El. 159.8 m) below ground surface.

Standard Penetration tests conducted in this material gave N-values of 3 and 6 blows/0.3 m indicating a very loose to loose relative density.

A grain-size distribution analysis was carried out on a selected sample from this deposit. The results, illustrated in Figure 2 of Appendix C, indicate the following grain-size distribution:

Gravel:	2 %
Sand:	84 %
Silt:	11 %
Clay:	3 %

The measured natural moisture content of two samples recovered from this fill material ranged from 8 to 12%.

4.4 CLAYEY SILT TILL

Underlying the fill in Boreholes 1 to 10 inclusive and the topsoil in Boreholes 11 and 12, a stratum of clayey silt till was encountered at depths of between 0.1 m (El. 160.5 m) and 7.5 m (El. 155.7 m) below ground surface. This deposit extends to depths ranging from 3.4 m (El. 153.8 m) to borehole termination depths of 10.4 m (El. 152.0 m) and possibly beyond.

In Borehole 3 the clayey silt till deposit is subdivided by a 3.0 m thick layer of silty sand till at 5.6 m (El. 152.5 m). It is also noted that an interbedded 1.6 m thick layer of silty sand, was also encountered in this clayey silt till deposit in Borehole 9 at a depth of 7.0 m (El. 157.0 m) below ground surface.

Standard Penetration tests conducted in the clayey silt till deposit yielded N-values ranging from 9 blows to more than 50 blows/0.3 m and pocket penetrometer tests on relatively undisturbed samples gave undrained shear strengths ranging from 25 to more than 225 kPa. In general however, N-values ranged from 10 blows to 30 blows/0.3 m indicating a stiff to very stiff consistency with occasional firm and hard zones. The clayey silt till has favourable engineering properties, such as relatively high shear strength, low compressibility and low permeability.

The results of grain-size distribution analyses carried out on nineteen representative samples of this till deposit are given in Figure 3, in Appendix C. The results show the following grain-size distribution:

Gravel:	2 – 11 %
Sand:	21 – 41 %
Silt:	37 – 61 %
Clay:	13 – 24 %

Being of glacial origin, the clayey silt till can be expected to contain random cobbles and boulders.

The deposit is described as a cohesive material and Atterberg Limits tests performed on twenty five representative samples gave the following index values:

Liquid Limit:	18 – 32 %
Plastic Limit:	13 – 17 %
Plasticity Index:	5 – 15 %
Natural Moisture Content:	7 – 19%

As shown in Figures 4, 5 and 6 in Appendix C, these values indicate clayey soils of low plasticity.

The measured natural moisture content of samples recovered from this deposit ranged from 5 to 26% and the bulk unit weight of representative samples from this deposit ranged between 19 and 23.1 kN/m³.

4.5 SILTY SAND TILL

The clayey silt till in Boreholes 3, 5, and 6 is underlain by a deposit of silty sand till. This deposit was encountered at depths ranging from 3.4 m (El. 153.8 m) to 5.6 metres (El. 152.5 m) below ground surface and it extends to depths of 8.6 m (El. 149.5 m) to 10.8 m (El. 146.4 m) i.e. the termination depth of Borehole 6.

In Borehole 6 this till deposit is divided by a 1.5 m thick layer of clayey silt till that was encountered at a depth of 5.6 m (El. 151.6 m) and extended to a depth of 7.1 m (El. 150.1 m) below ground surface.

Standard Penetration tests conducted in this till deposit gave N-values ranging from 21 blows to more than 50 blows/0.3 m, indicating a compact to very dense relative density.

The results of grain-size distribution analyses carried out on three representative samples retrieved from this till deposit are given in Figure 7 in Appendix C. The results show the following grain-size distribution:

Gravel:	6 – 16 %
Sand:	53 – 62 %
Silt:	27 – 31 %
Clay:	3 – 6 %

The silty sand till deposit can be expected to contain random cobbles and boulders, owing to its mode of deposition.

The measured natural moisture content of representative samples from this deposit ranged from 6 to 12 % and the bulk unit weight ranged from 20.3 to 22.7 kN/m³.

4.6 SANDY SILT TILL

The clayey silt till in Boreholes 3 and 12 and sand in Boreholes 5 and 11 are underlain by a stratum of sandy silt till. This stratum was encountered at depths between 7.1 m (El. 153.5 m) and 10.1 m (El. 148.0 m). This deposit extends to a maximum termination depth of 11.0 m (El. 149.5 m) in these Boreholes and possibly beyond.

Standard Penetration tests conducted in this deposit gave N-values more than 50 blows/0.3 m, indicating a very dense relative density.

The results of grain-size distribution analyses carried out on four representative samples from this till deposit are given in Figure 8 in Appendix C. The results show the following grain-size distribution:

Gravel:	1 – 14 %
Sand:	14 – 44 %
Silt:	36 – 77 %
Clay:	8 – 9 %

Because of its mode of deposition, the sandy silt till deposit can be expected to contain random cobbles and boulders.

The natural moisture content of representative samples from this deposit ranged from 7 to 11 % and the bulk unit weight ranged from 21.9 to 22.8 kN/m³.

4.7 SAND AND SILT

The clayey silt till in Borehole 2 is underlain by a layer of sand and silt containing traces of gravel and clay. This deposit was contacted at a depth of 9.7 m (El. 151.9 m) and it extends to the termination depth of the Borehole i.e. 10.4 m (El. 151.2 m) and possibly beyond.

A Standard Penetration test conducted in this deposit gave an N-value of 14 blows/0.3 m, indicating a compact relative density.

The results of a grain-size distribution analysis carried out on a representative sample retrieved from this deposit are given in Figure 9 in Appendix C.

The results show the following grain-size distribution:

Gravel:	4 %
Sand:	46 %
Silt:	46 %
Clay:	4 %

The measured natural moisture content of a sample from this deposit was of the order of 27 %.

4.8 SAND SOME SILT

In Boreholes 5, 7, 9 and 11, a stratum of sand with some silt and traces to some gravel content was contacted at depths ranging from 7.0 m (El. 157.0 m) to 8.6 m (El. 150.1 m). It extends to depths ranging from 8.7 m (El. 151.8 m) to 10.4 m (El. 148.3 m i.e. the termination depth of Borehole 7). In Boreholes 5, 9 and 11, the thickness of this basically granular (i.e. cohesionless) deposit ranged from 1.5 m to 1.6 m, while Borehole 7 was terminated in this unit after penetrating it for a vertical distance of 1.8 m.

Standard Penetration tests conducted in this deposit gave N-values ranging from 7 to more than 50 blows/0.3 m. In Boreholes 7 and 11 the N-values ranged from 7 to 25 blows/0.3 m indicating a loose to compact condition and in Boreholes 5 and 9 the N-values ranged from 70 to more than 50 blows/0.3 m indicating a very dense relative density.

The results of grain-size distribution analyses carried out on three representative samples from this deposit are given in Figure 10 in Appendix C. The results show the following grain-size distribution:

Gravel:	0 – 27 %
Sand:	49 – 83 %
Silt:	15 – 21 %
Clay:	1 – 4 %

The natural moisture content of representative samples retrieved from this deposit ranged from 11 to 21 %.

4.9 GROUNDWATER CONDITIONS

Groundwater conditions in the open boreholes were observed during the drilling and after completing each borehole.

Boreholes 1, 3, 10 and 12 were observed to be dry and open to their full depths upon completion. The measured (unstablised) water levels in Boreholes 2, 4, 5, 6, 7, 8, 9, and 11 after drilling ranged from El. 157.7 m to 151.6 m.

In Boreholes 2, 7, 8, 9, 10, 11 and 12 a colour change in the soil matrix from brown to grey was noted at elevations ranging from about El. 163 m to El. 154 m.

Based on the water level observations in the open boreholes, the change of the colour of the native soil from brown to grey and the moisture contents of the soil samples, the groundwater table at the site is believed to range generally between El. 163 m and 155 m.

It should be pointed out that the groundwater can be expected to fluctuate seasonally and in response to major weather events. In addition, a perched water condition could occur due to the accumulation of surface water within the surficial fill or basically granular deposits overlying the relatively impervious clayey silt till.

SHAHEEN & PEAKER LIMITED



Rehman Abdul, M.S., P.Eng.



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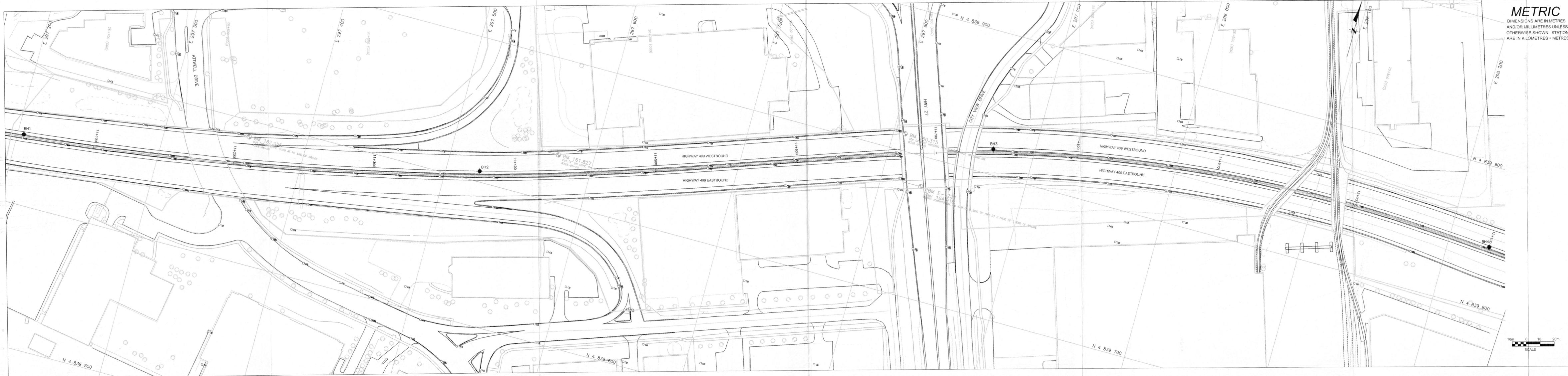
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*Project: SPT1076
Ministry of Transportation, Central Region*

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Drawings



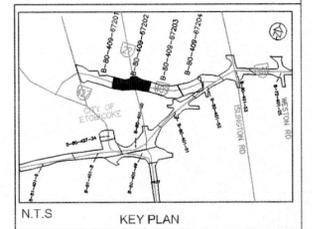
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CONT No.
 WP: 321-96-00
 HIGHWAY 409
 REHABILITATION FROM
 HWY 401 TO HWY 427/409
 INTERCHANGE
 BORE HOLE LOCATIONS



SHEET
 1 of 4

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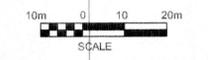
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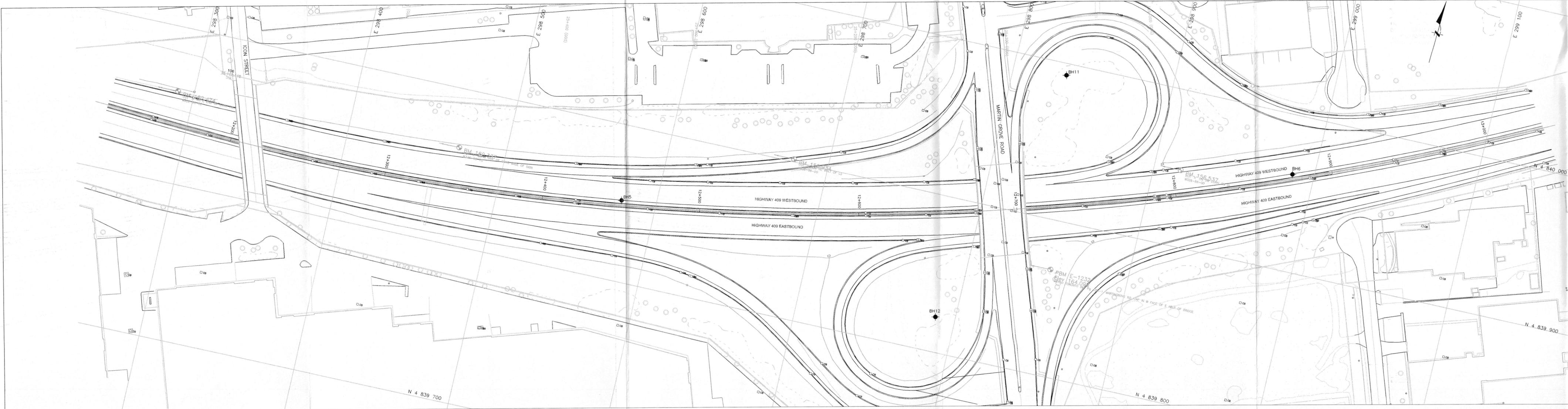
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BH4	161.81	4839844.08	298229.26
BH5	159.88	4839851.78	298577.85
BH6	157.20	4839962.07	298986.40
BH7	158.70	4840103.72	299263.43
BH8	162.40	4840335.01	299554.53
BH9	164.00	4840451.13	299864.43
BH10	163.21	4840560.10	299788.90
BH11	160.52	4839992.44	298833.33
BH12	160.59	4839822.46	298787.31

NOTE: The complete foundation investigation and design report for this project and other related documents may be examined at the Materials Engineering and Research Office, Downsview. Information contained in this report and related documents are specifically excluded in accordance with the conditions of Section GC 2.01 of OPS Gen. Cond.

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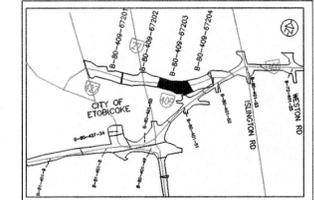
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SHEET
 2 of 4

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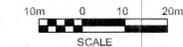
N.T.S. KEY PLAN

LEGEND

◆ Bore Hole

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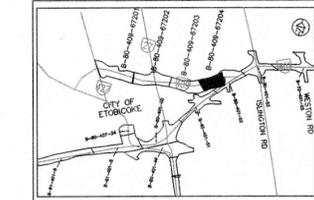
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SHEET
 3 of 4

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N.T.S KEY PLAN

LEGEND

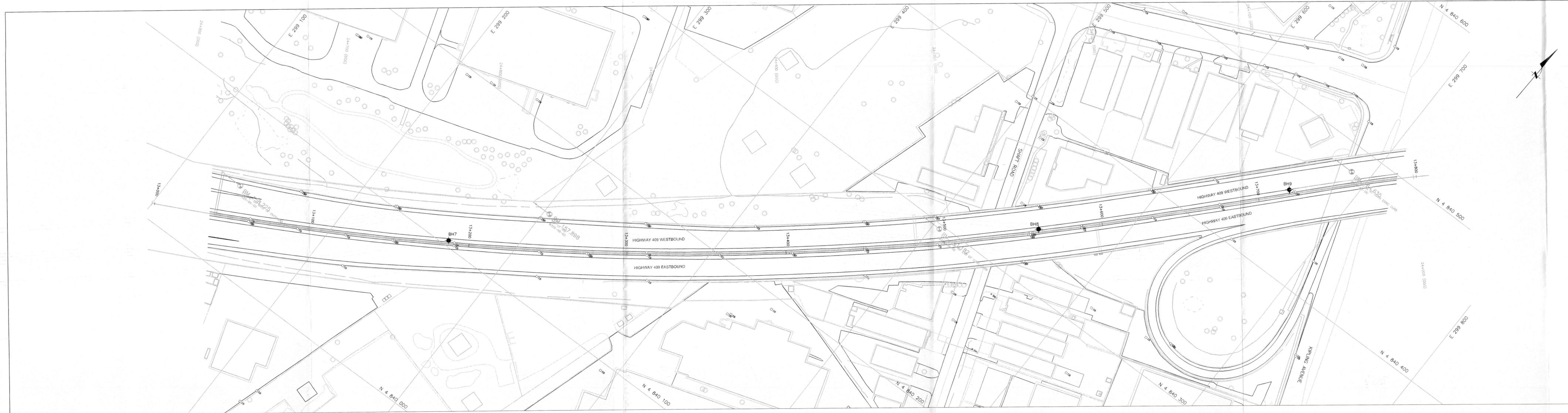
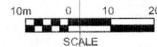
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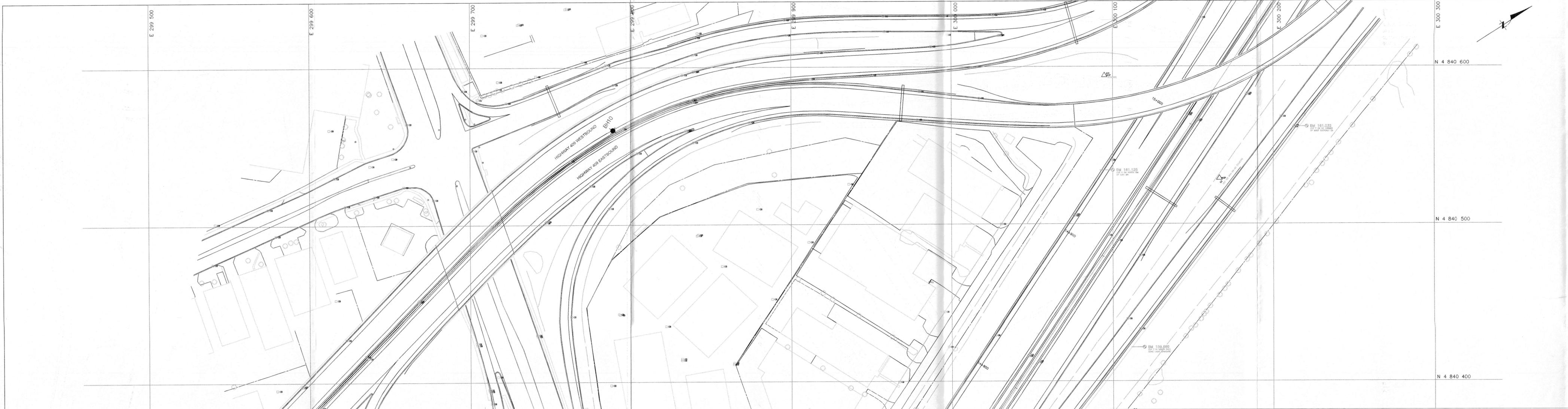
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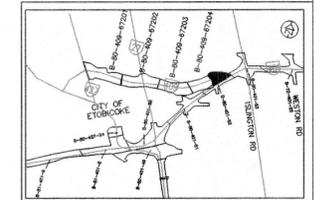
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SHEET
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SHAHEEN & PEAKER LIMITED



N.T.S. KEY PLAN

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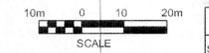
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BH11	160.52	4839992.44	298833.33
BH12	160.59	4839822.46	298787.31

NOTE: The complete foundation investigation and design report for this project and other related documents may be examined at the Materials Engineering and Research Office, Downsview. Information contained in this report and related documents are specifically excluded in accordance with the conditions of Section GC 2.01 of OPS Gen. Cond.

REV.	DATE	BY	DESCRIPTION

Geocres No.
 HWY No. 409 DIST
 SUBMID ZO CHECKED RA DATE Mar. 2003 SITE
 DRAWN JZ CHECKED APPROVED DWG 4



Appendix A

Record of Borehole Sheets

RECORD OF BOREHOLE No 1

1 OF 1

METRIC

WP 321-96-00 LOCATION From Highway 401 to Highway 427, Toronto, ON - Coords: N 4 839 649.2; E 297 204.5 ORIGINATED BY M.L.
 DIST Central HWY 409 BOREHOLE TYPE Solid Stem Augers COMPILED BY G.T.
 DATUM Geodetic DATE 12/7/2002 CHECKED BY R.A.

ELEV DEPTH	SOIL PROFILE DESCRIPTION	STRAT PLOT	SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT				PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
			NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa								
							20 40 60 80 100	40 80 120 160 200	20 40 60							
164.6	Ground Surface															
0.0	100 mm Asphalt, over Sand and Gravel (FILL)		1	SS	32	*								22.1		
164.2	light brown, dense															
0.4	Mixed Clayey Silt, trace gravel, some sand (FILL)		2	SS	19		164							21.3	2 26 47 25	
163.2	brown, damp, very stiff															
1.4	Heterogeneous mixture of Clayey Silt, some sand, trace gravel, (CLAYEY SILT TILL) gray/brown, damp, stiff to hard		3	SS	13		163							21.0		
			4	SS	16		162							21.1		
			5	SS	20		161							21.4	5 26 45 24	
			6	SS	15		160							21.0		
			7	SS	21		159									
			8	SS	20		157							21.1		
			9	SS	49		156									
			10	SS	31		155							21.6		
154.2		End of borehole													21.5	
10.4		* Hole dry (not stabilized) and open to full depth on completion														

+³, x³: Numbers refer to Sensitivity 20 15 10 5 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 2

1 OF 1

METRIC

WP 321-96-00 LOCATION From Highway 401 to Highway 427, Toronto, ON - Coords: N 4 839 707.6; E 297 573.5 ORIGINATED BY G.I
 DIST Central HWY 409 BOREHOLE TYPE Solid Stem Augers COMPILED BY G.T
 DATUM Geodetic DATE 12/7/2002 CHECKED BY R.A.

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	NUMBER	TYPE	"N" VALUES			20	40	60	80						100	W P
161.6	Ground Surface																
161.3	100 mm Asphalt, over Sand and Gravel (FILL) light brown, damp, compact	1	SS	25													
0.3		2	SS	23													
	Mixed Clayey Silt, some sand, trace gravel, (FILL) brown to grey/brown, stiff to very stiff	3	SS	20													
		4	SS	14													
		5	SS	10													
157.9		6	SS	12													
3.7		7	SS	25													
		8	SS	29													
	Heterogeneous mixture of Clayey Silt, some sand, trace gravel, (CLAYEY SILT TILL) brown to 7.1 m, grey below, stiff to hard	9	SS	39													
		10	SS	31													
		11	SS	32													
151.9		12	SS	14													
9.7	SAND AND SILT: trace gravel, trace clay, grey, wet, compact																
151.2																	
10.4	End of borehole * Water level at 10.0 m (not stabilized) and hole open to full depth on completion																

RECORD OF BOREHOLE No 3

1 OF 1

METRIC

WP 321-96-00 LOCATION From Highway 401 to Highway 427, Toronto, ON - Coords: N 4 839 817.9; E 297 871.3 ORIGINATED BY S.T.
 DIST Central HWY 409 BOREHOLE TYPE Solid Stem Augers COMPILED BY G.T.
 DATUM Geodetic DATE 12/7/2002 CHECKED BY R.A.

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	40	60	20
158.1	Ground Surface																			
0.0	100 mm Asphalt, over Sand and Gravel (FILL) light brown, damp, compact		1	SS	14	*														
157.4																				
0.7	Mixed Clayey Silt, trace to some sand, occasional fine gravel, (FILL) grey		2	SS	10															
156.0		stiff soft	3	SS	3															
2.1			4	SS	9															
152.5	Heterogeneous mixture of Clayey Silt, some sand, trace gravel, (CLAYEY SILT TILL) grey, stiff		5	SS	11															
			6	SS	14															
			7	SS	9															
153																				
			8	SS	84															
5.6	Heterogeneous mixture of Sand and Silt, trace to some gravel, (SILTY SAND TILL) grey, damp, very dense		9	SS	50/10															
149.5																				
8.6	Heterogeneous mixture of Clayey Silt, some sand, trace gravel, (CLAYEY SILT TILL) grey, hard		10	SS	53															
148.0																				
10.1	Heterogeneous mixture of Silt with sand, some gravel, trace clay, (SANDY SILT TILL) grey, moist, very dense																			
147.1			11	SS	50/15															
11.0	End of borehole * Borehole dry (not stabilized) and hole open to full depth on completion																			

+ 3, x 3: Numbers refer to Sensitivity
 20
 15
 10
 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 4

1 OF 1

METRIC

WP 321-96-00 LOCATION From Highway 401 to Highway 427, Toronto, ON - Coords: N 4 839 844.1; E 298 229.3 ORIGINATED BY M.L.
 DIST Central HWY 409 BOREHOLE TYPE Solid Stem Augers COMPILED BY G.T.
 DATUM Geodetic DATE 12/7/2002 CHECKED BY R.A.

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	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa						
181.8	Ground Surface												
0.0													
161.5	100 mm Asphalt, over Sand and Gravel (FILL) light brown, damp, compact	1	SS	13									
0.3		2	SS	17									
		3	SS	9									
	Heterogeneous mixture of Clayey Silt, some sand, trace gravel, silty below 7.1 m (CLAYEY SILT TILL) grey	4	SS	9									
		5	SS	12									
		6	SS	22									
		7	SS	14									
		8	SS	23									
153.1		9	SS										
8.7	End of borehole. Auger refusal at 8.7 m probably on a boulder * Water level at 6.1 m (not stabilized) and hole open to full depth on completion ** Sampler bouncing probably on a boulder												

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

RECORD OF BOREHOLE No 5

1 OF 1

METRIC

WP 321-96-00 LOCATION From Highway 401 to Highway 427, Toronto, ON - Coords: N 4 839 851.8; E 298 577.8 ORIGINATED BY G.I
 DIST Central HWY 409 BOREHOLE TYPE Solid Stem Augers COMPILED BY G.T
 DATUM Geodetic DATE 12/7/2002 CHECKED BY R.A.

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT				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	PLASTIC LIMIT W _P	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L				
159.9	Ground Surface												
0.0	100 mm Asphalt, over Sand and Gravel (FILL)		1	SS	50/15								
159.5	light brown, dry, very dense		2	SS	13								
0.4	Heterogeneous mixture of Clayey Silt, some sand, trace gravel, (CLAYEY SILT TILL) grey, stiff to very stiff		3	SS	21						21.9	3 34 46 17	
			4	SS	15							21.6	2 39 46 13
			5	SS	15							21.9	
			6	SS	13							21.3	
			7	SS	10							21.0	
154.7		Heterogeneous mixture of Silt, some sand, occasional fine gravel, (SILTY SAND TILL) grey, wet, compact to dense		8	SS	21							
5.2				9	SS	47							
152.8													
7.1	SAND with some gravel and silt, grey, wet, very dense		10	SS	70							27 57 15 1	
151.3													
8.6	Heterogeneous mixture of Silt, some sand, trace gravel, trace clay, (SANDY SILT TILL) grey, wet, very dense		11	SS	60/14							1 14 77 8	
150.0													
9.9	End of borehole * Water level at 7.6 m (not stabilized) and hole open to full depth on completion ** Sampler bouncing probably on a cobble or boulder		12	CG	60/3								

+³, X³: Numbers refer to Sensitivity
 20
 15 10 5
 10 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 6

1 OF 1

METRIC

WP 321-98-00 LOCATION From Highway 401 to Highway 427, Toronto, ON - Coords: N 4 839 982.1; E 298 986.4 ORIGINATED BY S.T.
 DIST Central HWY 409 BOREHOLE TYPE Solid Stem Augers COMPILED BY G.T.
 DATUM Geodetic DATE 12/7/2002 CHECKED BY R.A.

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
157.2	Ground Surface													
0.0	100 mm Asphalt, over Sand and Gravel (FILL)		1	SS	16							21.7		
158.8	light brown, damp, compact		2	SS	16							22.8		
0.4			3	SS	13							22.6		
	Heterogeneous mixture of Clayey Silt, some sand, trace gravel, (CLAYEY SILT TILL) grey, stiff to very stiff		4	SS	20							22.5		
153.8			5	SS	55							21.5		
3.4	Inferred boulder at 3.7 m													
	Heterogeneous mixture of Sand with silt, some gravel, trace clay, (SILTY SAND TILL) occasional sand seams grey, moist to wet, dense		6	SS	41							20.3	16 53 27 4	
151.6	gravelly sand layer at 5.4 m													
5.6			7	SS	49							22.4		
	Heterogeneous mixture of Clayey Silt, some sand, trace gravel, (CLAYEY SILT TILL) grey, hard													
150.1			8	SS	50/11							22.6	8 55 31 6	
7.1	Inferred boulder at 7.3 m													
	Heterogeneous mixture of Sand with silt, trace gravel, trace clay, (SILTY SAND TILL) moist to wet, grey, very dense		9	SS	50/13							22.7	6 62 29 3	
146.4			10	SS	50/10									
10.8	End of borehole * Water level at 4.6 m (not stabilized) and hole open to 6.1 m depth on completion ** Auger refusal on boulder at 3.7 m Hole moved 2.0 m East refusal again at 7.3 m. Hole moved 2.0 m West of original location													

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

SPT 1076

RECORD OF BOREHOLE No 7 1 OF 1 **METRIC**

WP 321-98-00 LOCATION From Highway 401 to Highway 427, Toronto, ON - Coords: N 4 840 103.7; E 299 263.4 ORIGINATED BY M.L.
 DIST Central HWY 409 BOREHOLE TYPE Solid Stem Augers COMPILED BY G.T.
 DATUM Geodetic DATE 12/7/2002 CHECKED BY R.A.

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					
158.7	Ground Surface												
158.4	100 mm Asphalt, over Sand and Gravel (FILL) light brown, damp, very loose		1	SS	4								
0.3			2	SS	9								
	Mixed Clayey Silt, with sand, occasional fine gravel (FILL) grey, stiff		3	SS	10							20.0	2 28 46 24
156.8			4	SS	30							20.0	
2.1			5	SS	35							22.8	
	very stiff to hard brown grey hard		6	SS	42							22.3	
			7	SS	48								
	Heterogeneous mixture of Clayey Silt, with sand, trace gravel, (CLAYEY SILT TILL)		8	SS	50/13							22.8	4 39 43 14
150.1			9	SS	7								
8.8	SAND some silt, grey, wet, loose compact		10	SS	25							0 83 13 1	
148.3													
10.4	End of borehole * Water level at 6.1 m (not stabilized) and hole open to full depth on completion												

+³, x³: Numbers refer to Sensitivity 20
15 10 5 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 8

1 OF 1

METRIC

WP 321-86-00 LOCATION From Highway 401 to Highway 427, Toronto, ON - Coords: N 4 840 335.0; E 299 554.5 ORIGINATED BY M.L.
 DIST Central HWY 409 BOREHOLE TYPE Solid Stem Augers COMPILED BY G.T.
 DATUM Geodetic DATE 12/7/2002 CHECKED BY R.A.

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	NUMBER	TYPE	"N" VALUES			20	40						60	80	100	20
162.4	Ground Surface																
162.1	100 mm Asphalt, over Sand and Gravel (FILL) light brown, dry	1	SS	50/15	**												
0.3	loose Sand, some silt (FILL) brown, damp to moist	2	SS	6										2	84	11	3
	very loose	3	SS	3													
159.8		4	SS	10													
2.6	Mixed Clayey Silt, trace sand, trace fine gravel, occasional cinder inclusions, grey, stiff (FILL)	5	SS	11													
159.5		6	SS	15													
2.9		7	SS	11													
	Heterogeneous mixture of Clayey Silt with sand, trace gravel, (CLAYEY SILT TILL) grey brown to brown to 8.6 m, grey below	8	SS	18													
	stiff to very stiff	9	SS	55													
	hard	10	SS	36													
		11	SS	48													
152.0	End of borehole																
10.4	* Water level at 4.7 m (not stabilized) and hole open to full depth on completion ** Sampler refusal probably on a cobble																

+³, X³: Numbers refer to Sensitivity
 20
 15 10 5
 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 9

1 OF 1

METRIC

WP 321-96-00 LOCATION From Highway 401 to Highway 427, Toronto, ON - Coords: N 4 840 451.1; E 299 684.4 ORIGINATED BY G.I
 DIST Central HWY 409 BOREHOLE TYPE Solid Stem Augers COMPILED BY G.T
 DATUM Geodetic DATE 12/7/2002 CHECKED BY R.A.

ELEV DEPTH	SOIL PROFILE DESCRIPTION	STRAT PLOT	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 (%)
			NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa	WATER CONTENT (%)					
164.0	Ground Surface													
0.0 163.7	100 mm Asphalt, over Sand and Gravel (FILL), light brown, dry to damp, loose to compact		1	SS	10									
0.3	Mixed Clayey Silt, trace sand, trace fine gravel, (FILL) brown to 1.4 m, grey below		2	SS	23	**		>225				21.7		
	very stiff		3	SS	24			>225						
	stiff		4	SS	10							21.1		
161.1			5	SS	19							21.6		
2.9	Heterogeneous mixture of Clayey Silt with sand, trace gravel, (CLAYEY SILT TILL) brown, stiff to very stiff		6	SS	18			>225				21.7	7 31 44 18	
			7	SS	14							21.8		
			8	SS	16			>225						
157.0	SAND some silt, trace gravel, grey, wet very dense		9	SS	80/9									
155.4	Heterogeneous mixture of Clayey Silt with sand, trace gravel, (CLAYEY SILT TILL) grey, hard		10	SS	30			>225				21.9		
153.6			11	SS	42			>225					7 31 46 16	
10.4	End of borehole * Water level at 6.7 m (not stabilized) and hole open to 8.5 m depth on completion ** Slight hydrocarbon odor													

+³, X³: Numbers refer to Sensitivity
 20
 15 5
 10 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 10

1 OF 1

METRIC

WP 321-96-00 LOCATION From Highway 401 to Highway 427, Toronto, ON - Coords: N 4 840 580.0; E 299 788.9 ORIGINATED BY G.I
 DIST Central HWY 409 BOREHOLE TYPE Solid Stem Augers COMPILED BY G.T
 DATUM Geodetic DATE 12/7/2002 CHECKED BY R.A.

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	SHEAR STRENGTH kPa								WATER CONTENT (%)	
						20	40	60	80	100	20	40	80				
183.2	Ground Surface																
0.0	100 mm Asphalt, over Sand and Gravel (FILL), light brown damp compact		1	SS	17									21.5			
162.8			2	SS	20										21.2	3 31 46 20	
0.4			3	SS	14												
			4	SS	21												
			5	SS	26												
			6	SS	00/0											15 62 19 4	
			7	SS	00/0												
			8	SS	24												
			9	SS	30												
			10	SS	18												
155.7			Mixed Clayey Silt, some sand, trace to some gravel, with asphalt inclusions (FILL) stiff to hard grey to grey brown		11	SS	40									21.3	2 31 46 21
7.5					12	SS	64									21.3	2 31 46 21
					13	SS	40									21.3	
152.8	Heterogeneous mixture of Clayey Silt with sand, trace fine gravel, (CLAYEY SILT TILL) brown to 9.8 m, greyish brown below, hard																
10.4																	
	End of borehole * Hole dry (not stabilized) and open to full depth on completion																

+³, ×³: Numbers refer to Sensitivity
 20
 15-φ-5
 10 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 11

1 OF 1

METRIC

WP 321-98-00 LOCATION From Highway 401 to Highway 427, Toronto, ON - Coords: N 4 839 992.4; E 298 833.3 ORIGINATED BY R.A.
 DIST Central HWY 409 BOREHOLE TYPE Solid Stem Augers COMPILED BY G.T.
 DATUM Geodetic DATE 12/18/2002 CHECKED BY R.A.

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 (%)				
FLEV DEPTH	DESCRIPTION	NUMBER	TYPE	"N" VALUES			20	40	60						80	100	40	60
160.5	Ground Surface																	
160.4 0.1	0.1 m Topsoil	1	SS	18									22.3					
	very stiff																	
	hard	2	SS	49									22.2	4	41	42	13	
		3	SS	65									22.0					
	Heterogeneous mixture of Clayey Silt with sand, trace to some gravel, (CLAYEY SILT TILL) brown to 2.1 m, grey below	4	SS	58									22.3	4	32	48	16	
		5	SS	32									21.5					
		6	SS	23									21.9					
		7	SS	23									22.8	11	30	41	18	
	very stiff																	
	firm to stiff	8	SS	9									20.5					
153.4																		
7.1	SAND with some gravel and silt, trace clay, grey, wet, compact	9	SS	12										26	49	21	4	
151.8																		
8.7	Heterogeneous mixture of Sand with silt, some gravel, (SANDY SILT TILL) grey, very dense	10	SS	50/10										11	44	36	9	
149.5																		
11.0	End of borehole * Water level at 4.9 m (not stabilized) and hole open to 7.1 m depth on completion	11	SS	50/13									22.1					

RECORD OF BOREHOLE No 12

1 OF 1

METRIC

WP 321-98-00 LOCATION From Highway 401 to Highway 427, Toronto, ON - Coords: N 4 839 822.5; E 298 787.3 ORIGINATED BY R.A.
 DIST Central HWY 409 BOREHOLE TYPE Solid Stem Augers COMPILED BY G.T.
 DATUM Geodetic DATE 12/16/2002 CHECKED BY R.A.

ELEV DEPTH	SOIL PROFILE DESCRIPTION	STRAT PLOT	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
			NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa								
							20 40 60 80 100	○ UNCONFINED	+ FIELD VANE	WATER CONTENT (%)						
								● POCKET PENETR.	× LAB VANE	40 80 120 160 200	20 40 60					
160.6	Ground Surface															
160.5 0.1	0.1 m Topsoil,		1	SS	21	*								22.3		
			2	SS	64									22.7		
			3	SS	51									22.6	4 36 44 16	
			4	SS	22									21.3		
	very stiff to hard		5	SS	22									23.1	4 36 44 16	
	very stiff		6	SS	17									21.4		
	Heterogeneous mixture of Clayey Silt with sand, trace gravel, (CLAYEY SILT TILL) brown to 2.1 m, grey below		7	SS	15									22.4		
	hard		8	SS	66									22.8	6 38 37 19	
153.5			9	SS	50/15									22.8	13 39 39 9	
7.1	Heterogeneous mixture of Sand and silt, some gravel, trace clay, (SANDY SILT TILL) grey, very dense		10	SS	50/8											
149.8			11	SS	50/10									21.9		
10.8	End of borehole * Hole dry (not stabilized) and open to full depth on completion															

+³, ×³: Numbers refer to Sensitivity
 20
 15 5
 10 (%) STRAIN AT FAILURE

Appendix B

MTO Record of Borehole Sheets

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 5

FOUNDATION SECTION

JOB 71-1100 LOCATION Gr. cont. 877, 285 N. 974, 740 E.

W.P. 276-65 BORING DATE June 30, 1971

ORIGINATED BY VT

DATUM Gneottic BOREHOLE TYPE Auger & sample with Penet. II

COMPILED BY WK

CHECKED BY

ELEV. (m)	SOIL PROFILE		SAMPLES			BIEV. SCALE	DYNAMIC PENETRATION RESISTANCE		LIQUID LIMIT		BULK DENSITY	REMARKS
	ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE		BLOWS/FOOT	BLOWS / FT. OF	PLASTIC LIMIT	WATER CONTENT		
157.5	157.0	Ground Level										
150.6	150.0	Artificial material										
148.1	148.0	Het. mix. of clayey silt with sand and gravel		1	SS	70						148.3
	146.0	Hard Grey		2	SS	34						
	141.0	Het. mix. of silt, sand & gravel, trace of clay (thin seams or layers of clayey silt)		3	SS	55						
				4	SS	29						141.77 (23)
				5	ST	118						
143.9	142.0	Compact to Very Dense Glacial Till		6	SS	107						
	137.0			7	SS	200						137.44 (21) 11
	125.0	Het. mix. of clayey silt, sand & gravel		8	SS	200						
142.0	146.0	Hard Grey		9	SS	151						
	143.0	Weathered Shale		10	BXL	100						
	141.0	Solid Shale		11	BXL	100						
139.1	140.5	End of Borehole		12	BXL	100						

DEPARTMENT OF HIGHWAYS, ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 11

FOUNDATION SECTION

JOB T-11610

LOCATION Co. roads, 877, Old N. 971 749 E

ORIGINATED BY VK

W.P. 276-65

BORING DATE July 21, 1971

COMPILED BY TR

DATUM Goodetic

BOREHOLE TYPE Washbore with diamond drill

CHECKED BY

ELEV. (m)	SOIL PROFILE		SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT				LIQUID LIMIT		REMARKS
	ELEV. DEPTH	DESCRIPTION	STRAT. PL. NO.	NUMBER	TYPE		20	40	80	100	W _L	W _P	
151.9	151.9	Ground Level											
150.5	149.8	0.0 Surficial Material (silty sand with trace of gravel and clay)		1	SS								
147.9	148.3	1.5 Het. mix. of clayey silt sand & grav. Brown Grey		2	SS								
				3	SS	490							
				4	SS								
				5	SS								
				6	SS								
142.7	142.3	13.0 Het. mix. of silt, sand and gravel, trace of clay. Dense to Very Dense		7	SS	480							
				8	SS								
				9	SS								
				10	SS								
				11	SS								
				12	SS								
				13	SS								
				14	SS								
				15	SS								
				16	SS								
				17	SS								
				18	SS								
				19	SS								
				20	SS								
				21	SS								
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				124	SS								
				125	SS								
				126	SS								
				127	SS								
				128	SS								
				129	SS								
				130	SS								
				131	SS								
				132	SS								
				133	SS								
				134	SS								
				135	SS								
				136	SS								
				137	SS								

DESIGN SERVICES BRANCH

RECORD OF BOREHOLE NO 101

FOUNDATIONS OFFICE

JOB 72-11100

LOCATION Co-grds. 879,231 N; 980,027 E.

ORIGINATED BY VE

W.P. 218-65-01

BORING DATE Sept. 11, 1972

COMPILED BY VK

DATUM Geodetic

BOREHOLE TYPE Auger and Cone Test

CHECKED BY

SOIL PROFILE		SAMPLES		ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT 20 40 60 80 100	LIQUID LIMIT PLASTIC LIMIT WATER CONTENT	SHEAR STRENGTH P.S.F. ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL K-LAB VANE	WATER CONTENT % 10 20 30	BULK DENSITY P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER TYPE							
535.0	Ground Level									
0.0	Fill Material									
161.1	Clayey silt, with some sand & gravel, trace of organics. Firm to stiff		1 SS 9							531.0
528.5			2 SS 11							
6.5			3 SS 77							
	Brown Grey		4 SS 60/9							
	Het. mix. of clayey silt, some sand & trace of gravel.		5 SS 76							
	(Glacial Till)		6 SS 61							
			7 SS 45							
153.9	Very stiff to Hard		8 SS 39							
505.0										
163.6	Silty sand, Very Dense		9 SS 67							7 42 40 11
31.5	End of Borehole									

OFFICE REPORT SOIL EXPLORATION

20
15 5 % STRAIN AT FAILURE
10

DESIGN SERVICES BRANCH

RECORD OF BOREHOLE NO 102

FOUNDATIONS OFFICE

JOB 72-11100

LOCATION Co-ords. 879,094 N; 980,064 E.

W.P. 218-65-01

BORING DATE Sept. 8, 1972

DATUM Geodetic

BOREHOLE TYPE Auger and Cone Test

ORIGINATED BY VK

COMPILED BY VK

CHECKED BY VK

OFFICE REPORT SOIL EXPLORATION

SOIL PROFILE		SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT 20 40 60 80 100	LIQUID LIMIT — W _L PLASTIC LIMIT — W _P WATER CONTENT — W W _p — W _L W _P	BULK DENSITY P.C.F. GR: SA: SL: CL	REMARKS
ELEV. (m)	ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER					
163.1	535.0	Ground Level							
	0.0								
		Brown Grey		1	SS	41			
				2	SS	39			
				3	SS	65			
		Het. mix. of clayey silt, some sand and trace of gravel.		4	SS	38			
		(Glacial Till)		5	SS	44			
				6	SS	60/64			
				7	SS	40			
		Hard		8	SS	73			
				9	SS	72			
153.5	503.5	End of Borehole							
	31.5								

20
15 5 % STRAIN AT FAILURE
10

DESIGN SERVICES BRANCH

RECORD OF BOREHOLE NO 103

FOUNDATIONS OFFICE

JOB 72-11100

LOCATION Co-ords. 878,900 N; 980,129 E.

ORIGINATED BY VR

W.P. 218-65-01

BORING DATE Sept. 7, 1972

COMPILED BY VR

DATUM Geodetic

BOREHOLE TYPE Auger and Cone Test

CHECKED BY *VR*

OFFICE REPORT ON SOIL EXPLORATION

SOIL PROFILE		SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT				LIQUID LIMIT — W _L PLASTIC LIMIT — W _P WATER CONTENT — W			BULK DENSITY γ	REMARKS	
ELEV. (M)	DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER		TYPE	BLOWS / FOOT	20	40	60	80	100			W _p
162.9	534.7	Ground Level													
0.0				1	SS	58									
				2	SS	18									
		Brown		3	SS	11									
		Grey		4	SS	30									
		Net. mix. of clayey silt, some sand and trace of gravel.		5	SS	13									
		(Glacial Till)		6	SS	37									
		Very Stiff to Hard		7	SS	37									
				8	SS	30									
153.4	503.2			9	SS	77									
31.5		End of Borehole													

20
15-5 % STRAIN AT FAILURE
10

DESIGN SERVICES BRANCH

RECORD OF BOREHOLE NO 104

FOUNDATIONS OFFICE

JOB 72-11100

LOCATION Co-ords. 878,710 N; 980,191 E.

ORIGINATED BY VK

W.P. 218-65-01

BORING DATE Sept. 7, 1972

COMPILED BY VK

DATUM Geodetic

BOREHOLE TYPE Auger and Cone Test

CHECKED BY *so*

ELEV. (m)
162.9

OFFICE REPORT SOIL EXPLORATION

ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	SAMPLES		ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT 20 40 60 80 100	LIQUID LIMIT w_L PLASTIC LIMIT w_p WATER CONTENT w	SHEAR STRENGTH P.S.F. ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE	WATER CONTENT % 10 20 30	BULK DENSITY γ P.C.F.	REMARKS
			NUMBER	TYPE							
0.0	Ground Level										
534.4			1	SS	29						
			2	SS	37						
			3	SS	79						
	Brown Grey		4	SS	57						
	Het. mix. of clayey silty some sand and trace of gravel. (Glacial Till)		5	SS	56						
			6	SS	63						
			7	SS	39						
506.4	Very Stiff to Hard		8	SS	29						
28.0	Het. mix. of silty sand, gravel & clay.										
153.3	Grey Dense		9	SS	41						
31.5	End of Borehole										

20
15 \diamond 5 % STRAIN AT FAILURE
10

DESIGN SERVICES BRANCH

RECORD OF BOREHOLE No 105

FOUNDATIONS OFFICE

JOB 72-11100 LOCATION Co-ords. 876,573 N; 980,232 E.
 W.P. 218-65-01 BORING DATE Sept. 6, 1972
 DATUM Geodetic BOREHOLE TYPE Auger and Cone Test

ORIGINATED BY YK
 COMPILED BY YK
 CHECKED BY *LB*

ELEV (m)
162.7

OFFICE REPORT SOIL EXPLORATION

SOIL PROFILE		SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS/FOOT 20 40 60 80 100	LIQUID LIMIT — w_L PLASTIC LIMIT — w_p WATER CONTENT — w	SHEAR STRENGTH — P.S.F. ○ UNCONFINED × FIELD VANE ● QUICK TRIAXIAL * LAB VANE	WATER CONTENT % 10 20 30	BULK DENSITY γ	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE							
0.0	Ground Level										
154.2	505.8		1	SS	25	530					
			2	SS	29						
			3	SS	77						
			4	SS	37						
			5	SS	40						
			6	SS	34						
			7	SS	30						
			8	SS	32						
153.1	502.3		9	SS	64						
31.5	End of Borehole					500					

20
15 + 5 % STRAIN AT FAILURE
10

529.5

21.54 (25)

DESIGN SERVICES BRANCH

RECORD OF BOREHOLE NO 106

FOUNDATIONS OFFICE

JOB 72-1100

LOCATION Og-ords. 678, 118 N; -980, 101 E.

ORIGINATED BY CSP

W.P. 218-58-01

BORING DATE August 23, 1972

COMPILED BY VK

DATUM Geodetic

BOREHOLE TYPE Auger and Cone Test

CHECKED BY

ELEV. DEPTH (m)	SOIL PROFILE DESCRIPTION	STRAT. PLOT	SAMPLES		BLOWS/FOOT	ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS/FOOT				FLUID LIMIT			BULK DENSITY	REMARKS
			NUMBER	TYPE			20	40	60	80	100	W _p	W _L		
163.6	Ground Level														
0.0			1	SS	34										
			2	SS	49										
			3	SS	63										
	Brown Grey		4	SS	27										
	Het. mix. of clayey silt, some sand and trace of gravel. (Glacial Fill)		5	SS	40										
			6	SS	35										
			7	SS	34										
			8	SS	26										
153.4	Very Stiff to Hard		9	SS	19										
33.0			10	SS	65										
	Het. mix. of silty sand, gravel & clay.		11	SS	120	6"									
147.3	Very Dense		12	SS	130										
16.5															
	with shale fragments below El. 190.														
144.5															
62.3	End of Borehole														

OFFICE REPORT ON SOIL EXPLORATION

20
15-5 % STRAIN AT FAILURE
10

DESIGN SERVICES BRANCH

RECORD OF BOREHOLE NO 107

FOUNDATIONS OFFICE

JOB 72-11103

LOCATION Co-ords. 878,305 N; 980,012 E.

ORIGINATED BY GSP

W.P. 218-65-01

BORING DATE Aug. 23, 1972

COMPILED BY VK

DATUM Geodetic

BOREHOLE TYPE Auger and Cone Test

CHECKED BY *10*

OFFICE REPORT ON SOIL EXPLORATION

ELEV (m)	ELEV DEPTH	SOIL PROFILE DESCRIPTION	STRAT. PLOT	SAMPLES		ELEV SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS/FOOT					LIQUID LIMIT — w _L PLASTIC LIMIT — w _p WATER CONTENT — w			BULK DENSITY	REMARKS
				NUMBER	TYPE		20	40	60	80	100	w _p	w	w _L		
163.6	536.9	Ground Level														
	0.0															
				1	SS	18										
				2	SS	38	530									
				3	SS	47										
		Brown Grey		4	SS	68										
		Het. mixture of clayey silt, some sand and trace of gravel. (Glacial Till)		5	SS	38	520									
				6	SS	39										
				7	SS	79										
				8	SS	38	510									
				9	SS	32										
152.9	501.9															
	35.0	Het. mix. of silty sand, gravel & clay. Grey		10	SS	69	500								9 1/4 42 5	
				11	SS	100.5"										
149.0	488.9	Very Dense					490									
	48.0	with shale fragments below El. 487.		12	SS	125										
145.9	478.0						480									
144.7	471.9	Bedrock - Shale with limestone layers. Dark Grey		13	RG BXL	60%										
	62.0	End of Borehole					470									

20
15 + 5 % STRAIN AT FAILURE
10

DESIGN SERVICES BRANCH

RECORD OF BOREHOLE NO 108

FOUNDATIONS OFFICE

JOB 72-11100 LOCATION Co-ords. 575,258 N; 579,817 E.
 W.P. 218-65-01 BORING DATE August 24, 1972
 DATUM Geodetic BOREHOLE TYPE Auger and Cone Test

ORIGINATED BY GST
 COMPILED BY VK
 CHECKED BY [Signature]

OFFICE REPORT ON SOIL EXPLORATION

ELEV. (m)	ELEV. DEPTH	SOIL PROFILE DESCRIPTION	STRAT. PLOT	SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS/FOOT 20 40 60 80 100	LIQUID LIMIT w_L PLASTIC LIMIT w_p WATER CONTENT w	SHEAR STRENGTH P.S.F. ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE	WATER CONTENT % 10 20 30	BULK DENSITY γ	REMARKS
				NUMBER	TYPE	BLOWS/FOOT							
164.2	538.7	Ground Level											
	0.0			1	SS	50							
				2	SS	48							
				3	SS	48							
		Brown		4	SS	44							
		Grey		5	SS	25							
		Het. mix. of clayey silt, some sand and trace of gravel (Glacial Till)		6	SS	22							
				7	SS	26							
				8	SS	30							
		Very Stiff to Hard		9	SS	11							
153.5	503.7			10	SS	90							
	35.0	Het. mix. of silty sand gravel and clay with shale fragments below el. 489.)		11	SS	70							
		Grey											
		Very Dense		12	SS	50							
147.4	483.7												
	55.0	End of Borehole											

20
15 5 % STRAIN AT FAILURE
10

DESIGN SERVICES BRANCH

RECORD OF BOREHOLE No 109

FOUNDATIONS OFFICE

JOB 72-11100

LOCATION Co-ords. 878,196 N; 979,554 E.

ORIGINATED BY GP

W.P. 218-65-01

BORING DATE August 24, 1972

COMPILED BY VE

DATUM Geodetic

BOREHOLE TYPE Auger and Cone Test

CHECKED BY

OFFICE REPORT ON SOIL EXPLORATION

ELEV. (m)	ELEV. DEPTH	SOIL PROFILE DESCRIPTION	STRAT. PLOT	SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT					LIQUID LIMIT		BULK DENSITY	REMARKS
				NUMBER	TYPE	BLOWS/FOOT		20	40	60	80	100	W _L	W _P		
165.4	512.6	Ground Level														
	0.0						510									
				1	SS	24										
				2	SS	75										
				3	SS	75										
		Brown Grey		4	SS	38	530									
		Het. mix. of clayey silt, some sand and trace of gravel (Glacial Till)		5	SS	24										
				6	SS	70										
				7	SS	32	520									
				8	SS	42										
		Very Stiff to Hard		9	SS	42										
155.6	510.6			10	SS	25	510									
	32.0	Het. mix. of silty sand gravel and clay		11	SS	59										
				12	SS	80/6"	500									
		Grey		13	SS	78										
		Very Dense		14	SS	100/3"	490									
145.6	477.6						480									
	65.0	End of Borehole					470									

20
15-5 % STRAIN AT FAILURE
10

DESIGN SERVICES BRANCH

RECORD OF BOREHOLE NO 121

FOUNDATIONS OFFICE

JOB 72-11100 LOCATION Co-ords. 877,578 W; -976,184 E
 W.R. 218-65-01 BORING DATE Sept. 1, 1972
 DATUM Geodetic BOREHOLE TYPE Auger and Cone Test

ORIGINATED BY VK
 COMPILED BY VK
 CHECKED BY *[Signature]*

OFFICE REPORT ON SOIL EXPLORATION

ELEV. (m)	ELEV. DEPTH	SOIL PROFILE DESCRIPTION	STRAT. PLOT	SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT				LIQUID LIMIT PLASTIC LIMIT WATER CONTENT			BULK DENSITY	REMARKS
				NUMBER	TYPE	BLOWS/FOOT		20	40	60	80	100	W _L	W _P		
160.0	0.0	Ground Level														
158.2	519.0	Fill Material: Clayey silt, some sand & trace of organics.		1	SS	8										
	6.0	Het. mix. of clayey silt, some sand and trace of gravel. (Glacial Till)		2	SS	33										
			Brown Grey		3	SS	50									
					4	SS	46									
					5	SS	36									
					6	SS	36									
					7	SS	50									
					8	SS	56									
151.5	497.0	Silty sand		9	SS	17										
149.2	35.5			10	SS	93										
147.4	483.5	Stiff to Hard														
	41.5	End of Borehole														

20
 15 $\frac{1}{2}$ % STRAIN AT FAILURE
 10

DESIGN SERVICES BRANCH

RECORD OF BOREHOLE NO 122

FOUNDATIONS OFFICE

JOB 72-11100 LOCATION Co-ords. 877,658 N; 976,030 E.
 W.P. 228-65-01 BORING DATE Sept. 5, 1972
 DATUM Geodetic BOREHOLE TYPE Auger and Cone Test

ORIGINATED BY VK
 COMPILED BY VK
 CHECKED BY

SOIL PROFILE		SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE					LIQUID LIMIT			BULK DENSITY	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE		BLOWS/FOOT	20	40	60	80	100	W _L	W _P		
154.8	Ground Level														
0.0			1	SS	69										
			2	SS	39										
			3	SS	9										
			4	SS	31										
			5	SS	23										
			6	SS	76										
			7	SS	107										
			8	SS	84										
145.2	Stiff to Hard		9	SS	103										
176.5	End of Borehole														
31.5															

OFFICE REPORT ON SOIL EXPLORATION

ELEV. (m)
154.8

Brown
Grey

Het. mxd. of clayey silt, some sand and trace of gravel. (Glacial Till)

20 40 60 80 100

W_L W_P W

10 20 30

UNCONFINED + FIELD VANE QUICK TRIAXIAL X LAB VANE

20 40 60 80 100

W_L W_P W

10 20 30

UNCONFINED + FIELD VANE QUICK TRIAXIAL X LAB VANE

20 40 60 80 100

W_L W_P W

10 20 30

UNCONFINED + FIELD VANE QUICK TRIAXIAL X LAB VANE

20 40 60 80 100

W_L W_P W

10 20 30

UNCONFINED + FIELD VANE QUICK TRIAXIAL X LAB VANE

20 40 60 80 100

W_L W_P W

10 20 30

UNCONFINED + FIELD VANE QUICK TRIAXIAL X LAB VANE

20 40 60 80 100

W_L W_P W

10 20 30

UNCONFINED + FIELD VANE QUICK TRIAXIAL X LAB VANE

20 40 60 80 100

W_L W_P W

10 20 30

UNCONFINED + FIELD VANE QUICK TRIAXIAL X LAB VANE

20 40 60 80 100

W_L W_P W

10 20 30

UNCONFINED + FIELD VANE QUICK TRIAXIAL X LAB VANE

20 40 60 80 100

W_L W_P W

10 20 30

UNCONFINED + FIELD VANE QUICK TRIAXIAL X LAB VANE

20 40 60 80 100

W_L W_P W

10 20 30

UNCONFINED + FIELD VANE QUICK TRIAXIAL X LAB VANE

20 40 60 80 100

W_L W_P W

10 20 30

UNCONFINED + FIELD VANE QUICK TRIAXIAL X LAB VANE

20
15 5 % STRAIN AT FAILURE
10

DESIGN SERVICES BRANCH

RECORD OF BOREHOLE No 123

FOUNDATIONS OFFICE

JOB 72-1110

LOCATION Co-ords. 877,815 N; 975,537 E.

W.P. 218-65-01

BORING DATE Sept. 1, 1972

DATUM Geodetic

BOREHOLE TYPE Auger and Cone Test

ORIGINATED BY VE

COMPILED BY VR

CHECKED BY

OFFICE REPORT ON SOIL EXPLORATION

ELEV. (M)	SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE					LIQUID LIMIT		BULK DENSITY	REMARKS
	ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT		BLOWS / FOOT	20	40	60	80	100	W _L		
159.7	524.0	Ground Level														
	0.0	Fill Material														
		Clayey silt with trace of gravel & organics.		1	SS	9										
				2	SS	5										
				3	SS	11										
				4	SS	10										
		Soft to Stiff		5	SS	6										
158.6	504.0			6	SS	11										
	20.0	Het. mix. of clayey silt, some sand and trace of gravel. (Glacial Till) (with silty sand layers throughout)		7	SS	100										
				8	SS	36										
				9	SS	95										
				10	SS	120										
147.5	484.0	Grey Hard		11	SS	105										
	40.0	Het. mix. of sandy silt, gravel and clay.														
145.5	477.5	Grey Very Dense		12	SS	112										
	46.5	End of Borehole														

20
15 \diamond 5 % STRAIN AT FAILURE
10

DESIGN SERVICES BRANCH

RECORD OF BOREHOLE NO 124

FOUNDATIONS OFFICE

JOB 72-11100

LOCATION Co-ords. 877,552 N; 975,624 E.

W.P. 218-65-01

BORING DATE Sept. 1, 1972

ORIGINATED BY VIK

DATUM Geodetic

BOREHOLE TYPE Auger and Cone Test

COMPILED BY VIK

CHECKED BY *[Signature]*

OFFICE REPORTING SOIL EXPLORATION

SOIL PROFILE		SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE					LIQUID LIMIT			BULK DENSITY	REMARKS	
ELEV. (m)	ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER		TYPE	BLOWS/FOOT	BLOWS / FOOT					PLASTIC LIMIT			
159.7	524.0	Ground Level					20	40	60	80	100	W _p	W	W _t		
0.0				1	SS	21										
				2	SS	39										
				3	SS	93										
				4	SS	59										
		Brown Grey		5	SS	34										
		Het. mix. of clayey silt, some sand and trace of gravel. (Glacial Till)		6	SS	20										
				7	SS	71										
				8	SS	99										
				9	SS	30										
		Very Stiff to Hard		10	SS	100										
				11	SS	110										
145.5	177.5			12	SS	60										
16.5		End of Borehole														

20
15 \diamond 5 % STRAIN AT FAILURE
10

DESIGN SERVICES BRANCH

RECORD OF BOREHOLE NO 125

FOUNDATIONS OFFICE

JOB 72-11100 LOCATION Co-ords. 877,501 N; 975,280 E.
 W.P. 218-65-01 BORING DATE Sept. 5, 1972
 DATUM Geodetic BOREHOLE TYPE Auger and Cone Test

ORIGINATED BY: VK
 COMPILED BY: VK
 CHECKED BY: *[Signature]*

OFFICE REPORT SOIL EXPLORATION

SOIL PROFILE		SAMPLES		ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT 20 40 60 80 100	LIQUID LIMIT — W _L PLASTIC LIMIT — W _P WATER CONTENT — W	SHEAR STRENGTH P.S.F. ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB. VANE	WATER CONTENT % 10 20 30	BULK DENSITY γ	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER							
160.2	Ground Level									
0.0			1	SS	23					
			2	SS	29					
	Brown		3	SS	19					
	Grey		4	SS	22					
	Het. mix. of clayey		5	SS	26					
	silt, some sand and		6	SS	21					
	trace of gravel.		7	SS	20					
	(Glacial Till)		8	SS	16					
	Very Stiff to Hard		9	SS	60/7"					
			10	SS	60/7"					
186.5			11	SS	11					
39.0	Silty sand		12	SS	58					
181.5			13	SS	101					
141.0										
171.0	End of Borehole									
51.5										

20
15-5 % STRAIN AT FAILURE
10

DESIGN SERVICES BRANCH

RECORD OF BOREHOLE NO 127

FOUNDATIONS OFFICE

JOB 72-11100

LOCATION Co-ords. 877,522 N; 974,836 E.

ORIGINATED BY VK

W.P. 218-65-01

BORING DATE Sept. 5, 1972

COMPILED BY VK

DATUM Geodetic

BOREHOLE TYPE Auger and Cone Test

CHECKED BY [Signature]

OFFICE RECORD OF SOIL EXPLORATION

SOIL PROFILE		SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE					LIQUID LIMIT			BULK DENSITY	REMARKS
ELEV. (m)	ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER		TYPE	BLOWS/FOOT	20	40	60	80	100	W _p		
151.8	0.0	Ground Level													
	0.0	Brown Grey Het. mix. of clayey silt, some sand and trace of gravel. (Glacial Till) Firm to Hard		1	SS	7									
				2	SS	34									
				3	SS	60/71									
				4	SS	38									
144.5	148.5			5	SS	46									
	17.5	Het. mix. of silty sand gravel and clay. Grey		6	SS	40									
				7	SS	72									
143.9	171.5	Dense to Very Dense		8	SS	60/70									
	26.5	End of Borehole													

20
15 $\frac{1}{2}$ 5 % STRAIN AT FAILURE
10

DESIGN SERVICES BRANCH

RECORD OF BOREHOLE NO 128

FOUNDATIONS OFFICE

JOB 72-11100

LOCATION Co-ords. 877,479 N; 974,784 E.

W.P. 218-65-01

BORING DATE Sept. 6, 1972

ORIGINATED BY VK

DATUM Geodetic

BOREHOLE TYPE Auger and Cone Test

COMPILED BY VK

CHECKED BY *LS*

SOIL PROFILE		SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE					LIQUID LIMIT			BULK DENSITY	REMARKS
ELEV. (M)	ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER		TYPE	BLOWS/FOOT	20	40	60	80	100	W _p		
151.7	0.0	Ground Level													
		Brown Grey Het. mix. of clayey silt, some sand and trace of gravel (Glacial Till) Firm to Hard		1	SS	7									
				2	SS	106									
				3	SS	34									
147.1	1.82.7			4	SS	32									
	15.0	Het. mix. of silty sand, gravel and clay.		5	SS	28									
		Grey Cons. t. to Very Dense		6	SS	71									
145.0	1.75.7			7	SS	60									
	22.0	End of Borehole													

OFFICE REPORT ON SOIL EXPLORATION

20
15 $\frac{5}{10}$ % STRAIN AT FAILURE
10

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE NO 129

JOB 72-11100

LOCATION

Co-ords. 877,621 N; 974,955 E.

W.P. 218-65-01

BORING DATE

Sept. 6, 1972

ORIGINATED BY VE

DATUM Geodetic

BOREHOLE TYPE

Auger and Cone Test

COMPILED BY TK

CHECKED BY *AS*

CHANGE RECORD SOIL EXPLANATION

SOIL PROFILE		SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE					LIQUID LIMIT			BULK DENSITY	REMARKS
ELEV. (M)	DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER		TYPE	FOOT	20	40	60	80	100	W _L		
157.3	496.5	Ground Level													
	0.0	Fill Material													
149.2	489.5	Silty sand and trace of clay and organics. Very Loose to Loose		1	SS	2									6 to 43
	7.0	Mixture of clayey silt, some sand and trace of gravel. (Glacial Till)		2	SS	24									
				3	SS	35									
				4	SS	51									
				5	SS	31									
144.5	474.9	Grey Hard		6	SS	56									
	22.5	End of Borehole		7	SS	92									

20
15-0.5 % STRAIN AT FAILURE
10

DESIGN SERVICES BRANCH

RECORD OF BOREHOLE NO 130

FOUNDATIONS OFFICE

JOB 72-11100

LOCATION Co-ords. 877,700 N; 975,052 E.

ORIGINATED BY VK

W.P. 218-65-01

BORING DATE Sept. 6, 1972

COMPILED BY JK

DATUM Geodetic

BOREHOLE TYPE Auger and Cone Test

CHECKED BY *[Signature]*

ELEV. (m)	ELEV. DEPTH	SOIL PROFILE DESCRIPTION	STRAT. PLT	SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE					LIQUID LIMIT			BULK DENSITY	REMARKS	
				NUMBER	TYPE	BLOWS/FOOT		BLOWS / FOOT					W _p	W _L	W			
155.5	0.0	Ground Level					510	20	40	60	80	100						
	0.0	Het. mix. of clayey silt, some sand and trace of gravel. (Glacial Till) Brown Gray Very Stiff to Hard		1	SS	16	500	[Graph showing blow counts vs depth]										
				2	SS	25												
				3	SS	42												
				4	SS	89												
				5	SS	60/4"												
				6	SS	70												
				7	SS	98												
				8	SS	101												
146.7	101.2	End of Borehole					490											
	29.0						180											

OFFICE REPORT ON SOIL EXPLORATION

20
15 5 % STRAIN AT FAILURE
10

DESIGN SERVICES BRANCH

RECORD OF BOREHOLE NO 131 (B.H. 6, 71-11039)

FOUNDATIONS OFFICE

JOB 72-11100

LOCATION Co-ords 877,506 N; 975,474 E.

ORIGINATED BY MK

W.P. 218-65-01

BORING DATE May 6, 1971

COMPILED BY WA

DATUM Geodetic

BOREHOLE TYPE Diamond Drill, washboring, BK Casing

CHECKED BY

SOIL PROFILE		SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT	LIQUID LIMIT - WL	PLASTIC LIMIT - WP	WATER CONTENT - W	SHEAR STRENGTH P.S.F.	REMARKS
ELEV. (M)	ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER							
160.0	525.0	Ground Level									
0.0	525.0	Net mix of clayey silt, fine sand and trace of gravel (Glacial Till)		1	SS	17					
		Very Stiff to Hard		2	SS	33					
				3	SS	26					
		Brown Grey		4	SS	57					
				5	SS	39					
				6	SS	22					
				7	SS	24					
				8	SS	41					
162.5	523.0			9	SS	150	6"				
32.0	520.0	Net mix of silt, sand and gravel, trace of clay		10	SS	175	11"				
				11	SS	62					
				12	SS	182	14"				
147.0	165.0										
60.0	160.0	End of Borehole									

20
15 - 5 % STRAIN AT FAILURE
10

DESIGN SERVICES BRANCH

RECORD OF BOREHOLE NO 110

FOUNDATIONS OFFICE

JOB 72-11100. LOCATION Co-ords. 878,117 R; 979,358 E.
 W.P. 218-65-01 BORING DATE August 24, 1972
 DATUM Geodetic BOREHOLE TYPE Auger and Cone Test

ORIGINATED BY CSP
 COMPILED BY VK
 CHECKED BY

ELEV. (m)	SOIL PROFILE		SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS/FOOT				LIQUID LIMIT		BULK DENSITY	REMARKS	
	ELEV. BERTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE		BLOWS/FOOT	20	40	60	80	100			W _p
166.4	515.8	Ground Level													
	0.0			1	SS	36									
				2	SS	37									
				3	SS	61									
		Brown-Grey		4	SS	115									
		Net. mix. of clayey silt, some sand and trace of gravel.		5	SS	111									
		(Glacial Till)		6	SS	118									
				7	SS	117									
158.7	520.8			8	SS	31									
158.1	518.8	Sandy silt		9	SS	116									
	27.0			10	SS	32									
		Very Stiff to Hard		11	SS	25									
153.9	501.8			12	SS	35									
	11.0			13	SS	66									
		Net. mix. of silty sand gravel and clay (with shale fragments below el. 490.)		14	SS	118									
		Grey													
		Very Dense													
146.4	180.3			15	SS	100/60									
	65.5	End of Borehole													

20
15 5 % STRAIN AT FAILURE
10

OFFICE REPORT SOIL EXPLORATION

DESIGN SERVICES BRANCH

RECORD OF BOREHOLE NO. 111

FOUNDATIONS OFFICE

JOB 72-11100 LOCATION Co-ords. 878,099 N; 979,165 E.
 W.P. 18-65-D1 BORING DATE August 25, 1972
 DATUM Geodetic BOREHOLE TYPE Auger and Cone Test

ORIGINATED BY DSP
 COMPILED BY VK
 CHECKED BY

ELEV. (m)	SOIL PROFILE		SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT		LIQUID LIMIT		BULK DENSITY	REMARKS
	ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE		BLOWS/FOOT	20 40 60 80 100	PLASTIC LIMIT	WATER CONTENT		
166.8	517.4	Ground Level										
	0.0			1	SS	56						
				2	SS	81						
		Brown		3	SS	73						
		Grey		4	SS	71 1/2"						
		Het. mix. of clayey silt some sand and trace of gravel.		5	SS	31						
		(Glacial Till)		6	SS	51						
				7	SS	74						
				8	SS	71						
		Very Stiff to Hard		9	SS	60						
				10	SS	33						
				11	SS	30						
				12	SS	19						
	154.4			13	SS	61						
	41.6	Het. mix. of silty sand, gravel & clay.		14	SS	50 1/2"						
		Grey		15	SS	60 2/5"						
		Very Dense										
	145.5											
	177.4											
	70.0	End of Borehole										

OFFICE REPORT ON SOIL EXPLORATION

20
15 5 % STRAIN AT FAILURE
10

DESIGN SERVICES BRANCH

RECORD OF BOREHOLE NO 112

FOUNDATIONS OFFICE

JOB 72-11100

LOCATION co-ords. 878,089 N; 978,970 E.

ORIGINATED BY GSP

W.P. 218-65-01

BORING DATE Aug. 25, 1972

COMPILED BY VE

DATUM Geodetic

BOREHOLE TYPE Auger and Cone Test

CHECKED BY

SOIL PROFILE		SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE				LIQUID LIMIT		BULK DENSITY	REMARKS	
ELEV. (m)	ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER		TYPE	BLOWS/FOOT	20	40	60	80			100
167.7	0.0	Ground Level		1	SS	12								
	0.0			2	SS	14								
		Brown Grey		3	SS	67								
		Het. mix. of clayey silty sand and trace of gravel.		4	SS	32								
		(Glacial Till)		5	SS	33								
		Stiff to Hard		6	SS	23								
				7	SS	29								
				8	SS	31								
				9	SS	21								
				10	SS	23								
				11	SS	36								
				12	SS	31								
				13	SS	40								
153.4	503.3			14	SS	143								
	17.0	Het. mix. of silty sand, gravel & clay.		15	SS	160								
		Grey												
		Very Dense		16	SS	95								
146.2	479.8			17	SS	100								
	70.5	End of Borehole												

OFFICE REPORT SOIL EXPLORATION

20
15 5 % STRAIN AT FAILURE
10

DESIGN SERVICES BRANCH

RECORD OF BOREHOLE NO 113

FOUNDATIONS OFFICE

JOB: 72-11100 LOCATION: Co-ords. 878,079N, 978,772 E.
 W.P. 218-65-01 BORING DATE: Aug. 28, 1972
 DATUM: Geodetic BOREHOLE TYPE: Auger and Cone Test

ORIGINATED BY: GSP
 COMPILED BY: VE
 CHECKED BY: [Signature]

ELEV. (m)	ELEV. DEPTH	SOIL PROFILE DESCRIPTION	STRAT. PLOT	SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS/FOOT				LIQUID LIMIT - W _L			BULK DENSITY	REMARKS
				NUMBER	TYPE	BLOWS/FOOT		20	40	60	80	100	W _p	W		
168.2	552.0	Ground Level														
	0.0	Brown Grey Het. mix. of clayey silt, some sand and trace of gravel. (Glacial Till) Very Stiff to Hard		1	SS	24										
				2	SS	38										
				3	SS	39										
				4	SS	35										
				5	SS	27										
				6	SS	32										
				7	SS	36										
				8	SS	20										
				9	SS	32										
158.9	521.0			10	SS	31										
158.2	519.0	Silty sand		11	SS	26									0.34 17 19	
	33.0			12	SS	16										
				13	SS	27										
154.5	507.0			14	SS	31										
	45.0	Het. mix. of sandy silt, clay and gravel.		15	SS	25									0.26 12 30	
				16	SS	130.5										
				17	SS	75.4										
		Grey Compact to Very Dense		18	SS	117										
144.2	473.2															
	78.8	Bedrock - Shale with limestone layers.		19	RC	95%										
142.7	468.2	Dark Grey		20	RC	100%										
	83.8	End of Borehole														

OFFICE RECORD IN SOIL EXPLORATION

20
15-5 % STRAIN AT FAILURE
10

DESIGN SERVICES BRANCH

RECORD OF BOREHOLE NO 114

FOUNDATIONS OFFICE

JOB 72-11100

LOCATION Co-ords. 878,012 N; 978,438 E.

W.P. 218-65-01

BORING DATE Aug. 28, 1972

ORIGINATED BY OSP

DATUM Geodetic

BOREHOLE TYPE Auger and Cone Test

COMPILED BY VK

CHECKED BY *Lo*

OFFICE REPORT SOIL EXPLORATION

ELEV. (m)	SOIL PROFILE		SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE					LIQUID LIMIT			BULK DENSITY	REMARKS
	ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE		BLOWS/FOOT	BLOWS / FOOT	20	40	60	80	100	W _L		
168.3	552.2	Ground Level														
	0.0			1	SS	29										
				2	SS	27										
		Brown Grey		3	SS	11										
		Het. mix. of clayey silt, some sand and trace of gravel. (Glacial Till)		4	SS	23										
				5	SS	20										
				6	SS	16										
				7	SS	17										
				8	SS	13										
				9	SS	13										
		Stiff to Hard.		10	SS	16										
				11	SS	26										
				12	SS	34										
				13	SS	22										
				14	SS	22										
153.2	505.2			15	SS	20										
	17.9	Het. mix. of silty sand, gravel and clay.		16	SS	80										
				17	SS	97										
		Grey														
		Very Dense		18	SS	100 5"										
145.5	477.2															
	75.0	End of Borehole														

20
15-5 % STRAIN AT FAILURE
10

DESIGN SERVICES BRANCH

RECORD OF BOREHOLE NO 115

FOUNDATIONS OFFICE

JOB: 72-11100

LOCATION: Co-ords. 878,027 N; 978,238 E.

ORIGINATED BY: GSP

W.P. 218-65-01

BORING DATE: Aug. 29, 1972

COMPILED BY: VR

DATUM: Geodetic

BOREHOLE TYPE: Auger and Core Test

CHECKED BY: [Signature]

OFFICE REPORT SOIL EXPLORATION

SOIL PROFILE		SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE				LIQUID LIMIT — W _L			BULK DENSITY	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMCFR	TYPE		BLOWS/FOOT	BLOWS / FOOT				WATER CONTENT — W _p			
168.5	552.7	Ground Level				20	40	60	80	100	W _p	W	W _L	
						SHEAR STRENGTH P.S.F.				WATER CONTENT %				
						○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB. VANE				30	20	30	P.C.F.	GR. S.A. S.I. C.
0.0			1	SS	40									
			2	SS	43									
		Brown Grey	3	SS	65									
		Het. mix. of clayey silt, some sand and trace of gravel.	4	SS	47									
		(Glacial Till)	5	SS	18									
		Stiff to Hard	6	SS	15									
			7	SS	13									
			8	SS	19									
			9	SS	13									
			10	SS	24									
			11	SS	26									
			12	SS	29									
154.1	505.7		13	SS	14									
17.0			14	SS	27									
		Het. mix. of silty sand gravel and clay.	15	SS	98									
		Grey												
		Compact to Very Dense												
145.0	475.7													
77.0		End of Borehole												

20
15 5 % STRAIN AT FAILURE
10

DESIGN SERVICES BRANCH

RECORD OF BOREHOLE NO 116

FOUNDATIONS OF PILE

JOB: 72-11100 LOCATION: Co-ords. 878,015 N; 977,779 E.
 W.P. 218-65-01 BORING DATE: Aug. 29, 1972
 DATUM: Geodetic BOREHOLE TYPE: Auger and Cone Test

ORIGINATED BY: SP
 COMPILED BY: UK
 CHECKED BY: [Signature]

OFFICE REPORT - SOIL EXPLORATION

ELEV. (m)	ELEV. DEPTH	SOIL PROFILE DESCRIPTION	STRAT. PLOT	SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE					LIQUID LIMIT			BULK DENSITY	REMARKS
				NUMBER	TYPE	BLOWS/FOOT		BLOWS / FOOT (20, 40, 60, 80, 100)					PLASTIC LIMIT				
							SHEAR STRENGTH P.S.F.					WATER CONTENT %			P.C.F.		
							○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE					W _p W _L ————					
166.3	545.5	Ground Level															
0.0				1	SS	29											
		Brown Grey		2	SS	34											
		Het. mix. of clayey silt, some sand and trace of gravel. (Glacial Till)		3	SS	60											
				4	SS	17										3-26-47-21	
				5	SS	24											
		Stiff to Hard		6	SS	13											
				7	SS	10											
				8	SS	13											
				9	SS	14											
				10	SS	23											
152.6	500.5			11	SS	13											
	415.0	Het. mix. of silty sand gravel and clay. Grey		12	SS	16											
				13	SS	20											
149.4	490.0	Compact to Very Dense		14	SS	100/6"											
	55.5	End of Borehole															

20
 15 \diamond 5 % STRAIN AT FAILURE
 10

DESIGN SERVICES BRANCH

RECORD OF BOREHOLE NO 117

FOUNDATIONS OFFICE

JOB 72-11100 LOCATION Co-ords. 877,983 N; 977,580 E.
 W.P. 218-65-01 BORING DATE August 30, 1972
 DATUM Geodetic BOREHOLE TYPE Auger and Cone Test

ORIGINATED BY VK
 COMPILED BY VK
 CHECKED BY *[Signature]*

ELEV. (m)	ELEV. DEPTH	SOIL PROFILE DESCRIPTION	STRAT. PLOT	SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT				LIQUID LIMIT - PLASTIC LIMIT			BULK DENSITY P.C.F.	REMARKS
				NUMBER	TYPE	BLOWS/FOOT		20	40	60	80	100	W _L	W _P		
165.5	512.9	Ground Level														
	0.0			1	SS	28	51.0									
		Brown Grey		2	SS	26										
				3	SS	37										
		Het. mix. of clayey silt, some sand and trace of gravel (Glacial Till)		4	SS	40	53.0									
				5	SS	26										
				6	SS	22										
				7	SS	27	52.0									
				8	SS	15										
				9	SS	19	51.0									
		Stiff to Hard		10	SS	24										
				11	SS	12	50.0									
153.4	499.9			12	SS	87										
	43.0	Silty sand.														
150.5	493.9	Very Dense														
	49.0			13	SS	106	49.0									
148.6	487.4			14	SS	103										
	55.5	End of Borehole					48.0									

OFFICE RECORD - SOIL EXPLORATION

20
 15 ϕ 5 % STRAIN AT FAILURE
 10

DESIGN SERVICES BRANCH

RECORD OF BOREHOLE NO 118

FOUNDATIONS OFFICE

JOB 72-11100

LOCATION Co-ords. 877,942 N; 977,239 E.

W.P. 218-65-01

BORING DATE August 30, 1972

ORIGINATED BY VK

DATUM Geodetic

BOREHOLE TYPE Auger and Cone Test

COMPILED BY VK

CHECKED BY

OFFICE REPORT NO. SOIL EXPLORATION

ELEV. (M)	ELEV. DEPTH	SOIL PROFILE DESCRIPTION	STRAT. PLOT	SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE					LIQUID LIMIT			BULK DENSITY	REMARKS		
				NUMBER	TYPE	BLOWS/FOOT		BLOWS / FOOT					W _L	W _P	W				
165.2	542.0	Ground Level						20	40	60	80	100							
	0.0			1	SS	20	540												
		Brown Grey		2	SS	34													
		Het. mix. of clayey silt, some sand and trace of gravel. (Glacial Till) Stiff to Hard		3	SS	27	530												
				4	SS	18													
				5	SS	29													
				6	SS	14													
				7	SS	17	520												
				8	SS	25													
				9	SS	22													
				10	SS	19	510												
				11	SS	22													
153.0	502.0																		
	40.0																		
152.1	499.0	Silty Sand		12	SS	12	500												
	43.0			13	SS	113													
148.7	488.0			14	SS	100	490												
	54.0	End of Borehole																	
							180												

20
15 \pm 5 % STRAIN AT FAILURE
10

537.8

DESIGN SERVICES BRANCH

RECORD OF BOREHOLE NO 120

FOUNDATIONS OFFICE

JOB 72-11100

LOCATION Co-ords. 877,652 N; 976,398 E.

ORIGINATED BY VK

W.P. 218-65-01

BORING DATE August 31, 1972

COMPILED BY VK

DATUM Geodetic

BOREHOLE TYPE Auger and Cone Test

CHECKED BY 42

ELEV. (m)	SOIL PROFILE		STRAT. PLOT	SAMPLES		ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE FLOWS / FOOT				LIQUID LIMIT — W _L			BULK DENSITY	REMARKS
	ELEV. DEPTH	DESCRIPTION		NUMBER	TYPE		20	40	60	80	100	PLASTIC LIMIT — W _P	WATER CONTENT — W		
							SHEAR STRENGTH P.S.F.				W _p — W — W _L				
							<input type="checkbox"/> UNCONFINED + FIELD VANE <input type="checkbox"/> QUICK TRIAXIAL * LAB VANE				WATER CONTENT %				
											10	20	30		
162.3	522.5	Ground Level													
	0.0	Ret. mix. of clayey silt, some sand and trace of gravel. (Glacial Till)		1	SS	25									
				2	SS	20									
				3	SS	22									
		Brown Grey		4	SS	18									
				5	SS	13									
		Stiff to Hard		6	SS	18									
				7	SS	30									
155.0	508.5	Layered clayey silt and silty sand		8	SS	38									
	21.0														
152.2	499.5			9	SS	23									
	33.0														
				10	SS	25									
				11	SS	43									
				12	SS	74									
147.1	482.5	Silty sand		13	SS	20									
	50.0														
146.5	480.5														
	52.0														
145.1	476.0	End of Borehole		14	SS	100/5"									
	56.5														

OFFICE REPORT ON SOIL EXPLORATION

522-2

9 45 40 6

20
15 \diamond 5 % STRAIN AT FAILURE
10

DESIGN SERVICES BRANCH FOUNDATIONS OFFICE
RECORD OF BOREHOLE NO 132 (B.H. 4, 71-11038)
 JOB: 72-11100 LOCATION: Co-ords. 877,735 N; 976,534 E. ORIGINATED BY: YK
 W.P. 218-65-01 BORING DATE: May 13, 1971 COMPILED BY: HS
 DATUM: Geodetic BOREHOLE TYPE: Power Auger (Penndrill) - Cone Test CHECKED BY: /O

ELEV. DEPTH (m)	SOIL PROFILE DESCRIPTION	STRAT. PLOT	SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT			LIQUID LIMIT PLASTIC LIMIT WATER CONTENT			BULK DENSITY	REMARKS
			NUMBER	TYPE	BLOWS/FOOT		20	40	60 - 80	100	W _L	W _P		
533.0	Ground Level													
0.0	Het. mixture of clayey silt with some sand and traces of gravel.		1	SS	117									In open SH May 13/71 7 30 13 20
	Very Stiff to Hard (Glacial Till)		2	SS	37									
			3	SS	60									
			4	SS	30									
			5	SS	140									
			6	SS	29									
			7	SS	35									
			8	SS	63									
			9	SS	93									
			10	SS	57									
			11	SS	111									
			12	SS	100.5"									
			13	SS	116									
			14	SS	175.6"									
141.5	Fragments of shale		15	SS	150.14"									
60.7	End of Borehole													

OFFICE REPORT ON SOIL EXPLORATION

20
15
10
% STRAIN AT FAILURE

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE NO 133 (B.H. 11, 71-11038)

JOB 72-11100

LOCATION Co-ords. 877,663 N; 977,005 E.

ORIGINATED BY VI

W.P. 218-65-01

BORING DATE May 21, 1971

COMPILED BY BS

DATUM Geodetic

BOREHOLE TYPE Power Auger (Pend-11); Cone Test

CHECKED BY [Signature]

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE				LIQUID LIMIT			BULK DENSITY	REMARKS
ELEV. (MS)	ELEV. DEPTH	DESCRIPTION	STRAT. PILOT	NUMBER	TYPE		BLOWS/FOOT	20	40	60	80	100	W _p		
							SHEAR STRENGTH - P.S.F.				WATER CONTENT %				
							o - UNCONFINED * FIELD VANE				10 20 30				
							e - QUICK TRIAXIAL x - LAB VANE								
163.2	535.5	Ground Level													
		Net mixture of clayey silt with some sand and traces of gravel.		1	SS	11									
				2	SS	11									
				3	SS	15									
				4	SS	25									
		Stiff to Hard (Glacial Till)		5	SS	20									
				6	SS	21									
				7	SS	26									
				8	SS	29									
				9	SS	19									
				10	SS	156	0"								
				11	SS	100	3"								
				12	SS	300	5"								
				13	SS	80									
181.0	511.0			14	SS	74	4"								
		Sandy silt with traces of clay and gravel.		15	SS	300	3"								
192.5	474.0	Very Dense													
201.5	61.5	End of borehole													

OFFICE REPORT ON SOIL EXPLORATION

20
15 - 3. % STRAIN AT FAILURE
10

DESIGN SERVICES BRANCH

RECORD OF BOREHOLE NO. 134 (B.H. 7, 71-11036)

FOUNDATIONS OFFICE

JOB: 72-11100 LOCATION: Co-ords. 878,031 N; 977,940 E.
 W.P. 218-65-01 BORING DATE: May 31 and June 1, 1971
 DATUM: Geodetic BOREHOLE TYPE: Power Auger-Washboring-BX Casing-BX Rock Core

ORIGINATED BY: VS
 COMPILED BY: HS
 CHECKED BY: [Signature]

ELEV. (m)	ELEV. DEPTH	SOIL PROFILE DESCRIPTION	STRAT. PLOT	SAMPLES		BLOWS/FOOT	ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT				LIQUID LIMIT PLASTIC LIMIT WATER CONTENT			BULK DENSITY	REMARKS
				NUMBER	TYPE			20	40	60	80	100	W _p	W _L		
166.9	517.8	Ground Level														
		Ret. mixture of clayey silt with some sand and traces of gravel.		1 SS	34											
				2 SS	46											
				3 SS	51											
				4 SS	50											
				5 SS	31											
		Stiff to Hard.		6 SS	37											
		(Glacial Till)		7 SS	16											
				8 SS	18											
				9 SS	19											
				10 SS	25											
				11 SS	13											
				12 SS	15											
				13 SS	91											
				14 SS	85											
				15 SS	112											
		silty sand with some gravel		16 SS	91											
				17 SS	178											
143.9	172.3	Bedrock - Shale		18	SS	130/3"										
	75.5	Weathered		19	RC	50%										
				20	RC	51%										
140.0	159.3	Sound		21	RC	75%										
	88.5	End of Borehole														

OFFICE RECORD ON SOIL EXPLORATION

20
15 ± 5 % STRAIN AT FAILURE
10

DESIGN SERVICES BRANCH

RECORD OF BOREHOLE NO 135 (B.H. 13, 71-11036)

FOUNDATIONS OFFICE

JOB: 72-11100 LOCATION: Co-ords. 878,030 N; 978,119 E.
 W.P.: 218-65-01 BORING DATE: June 3 and 4, 1971
 DATUM: Geodetic BOREHOLE TYPE: Cont. Flight Auger; Cone Test

ORIGINATED BY: RK
 COMPILED BY: JS
 CHECKED BY: CR

OFFICE REPORT ON SOIL EXPLORATION

ELEV (m)	ELEV. DEPTH	SOIL PROFILE DESCRIPTION	SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE					PLASTIC LIMIT			BULK DENSITY	REMARKS
			STRAT. PILOT	NUMBER	TYPE		BLOWS/FOOT	20	40	60	80	100	W _p	W _L		
168.3	552.2	Ground Level														
	0.0	Het. mixture of clayey silt with some sand and traces of gravel. (Glacial Till) Very Stiff to Hard		1	SS	42										511.5
				2	SS	45										
				3	SS	59										
				4	SS	58										
				5	SS	76										
				6	SS	27										
				7	SS	31										
		Occasional seams of silt up to 1/4" thick throughout.		8	SS	28										
				9	SS	42										
				10	SS	36										
				11	SS	30										
				12	SS	21										
153.0	502.0			13	SS	25										765 (90)
	50.2	Het. mixture of silty sand to sandy silt with traces of gravel. Compact to Very Dense		14	SS	109										
				15	SS	109										
				16	SS	125	6"									
				17	SS	160	6"									
146.2	479.7			18	SS	155	6"									
145.3	476.7	Clayey silt with pockets of silty ss. & fragments of shale.		19	SS	155	6"									
	75.5	End of Borehole														

20
15-5 % STRAIN AT FAILURE
10

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE No 136 (B.H.2, 71-11037)

JOB 72-11100

LOCATION Co-ords. 877,992 N; 978,701 E.

ORIGINATED BY VK

W.P. 218-65-01

BORING DATE April 27, 1971

COMPILED BY SO

DATUM Geodetic

BOREHOLE TYPE Pendrill

CHECKED BY [Signature]

OFFICE REPORT ON SOIL EXPLORATION

ELEV. (m)	ELEV. DEPTH	SOIL PROFILE DESCRIPTION	STRAT. PLOT	SAMPLES		ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT					LIQUID LIMIT w_L			BULK DENSITY γ	REMARKS	
				NUMBER	TYPE		20	40	60	80	100	PLASTIC LIMIT w_p	WATER CONTENT w				
							SHEAR STRENGTH P.S.F.					WATER CONTENT %			P.C.F. GR. SA. SI. CL.		
							○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE					w_p — w — w_L 10 20 30					
168.4	552.5	Ground Level															
	0.0	Het. mix. of clayey silt, sand and trace of gravel.		1	SS	36	550									551.5	
		Very Stiff - Hard Brown Grey (Glacial Till)		2	SS	46											
					3	SS	63										
					4	SS	60	540									28 52 16
					5	SS	32										
					6	SS	30										
					7	SS	34	530									23 56 18
					8	SS	44										
					9	SS	22										
					10	SS	68	520									
					11	SS	25										
					12	SS	33	510									
157.1	505.5			13	SS	100 5"	500									7 42 12 9	
	17.0	Het. mix. of silt, sand and trace of gravel and clay.		14	SS	100 5"	490										
		Very Dense															
146.8	481.5			15	SS	100 2"	480									9 58 24 11	
	71.0	End of Borehole															

20
15 ϕ 5 % STRAIN AT FAILURE
10

Appendix C

Laboratory Test Results

UNIFIED SOIL CLASSIFICATION SYSTEM

CLAY AND SILT

SAND

GRAVEL

1 100 98 80 70 60 50 40 30 20 10 0

GRAIN SIZE IN MICROMETERS

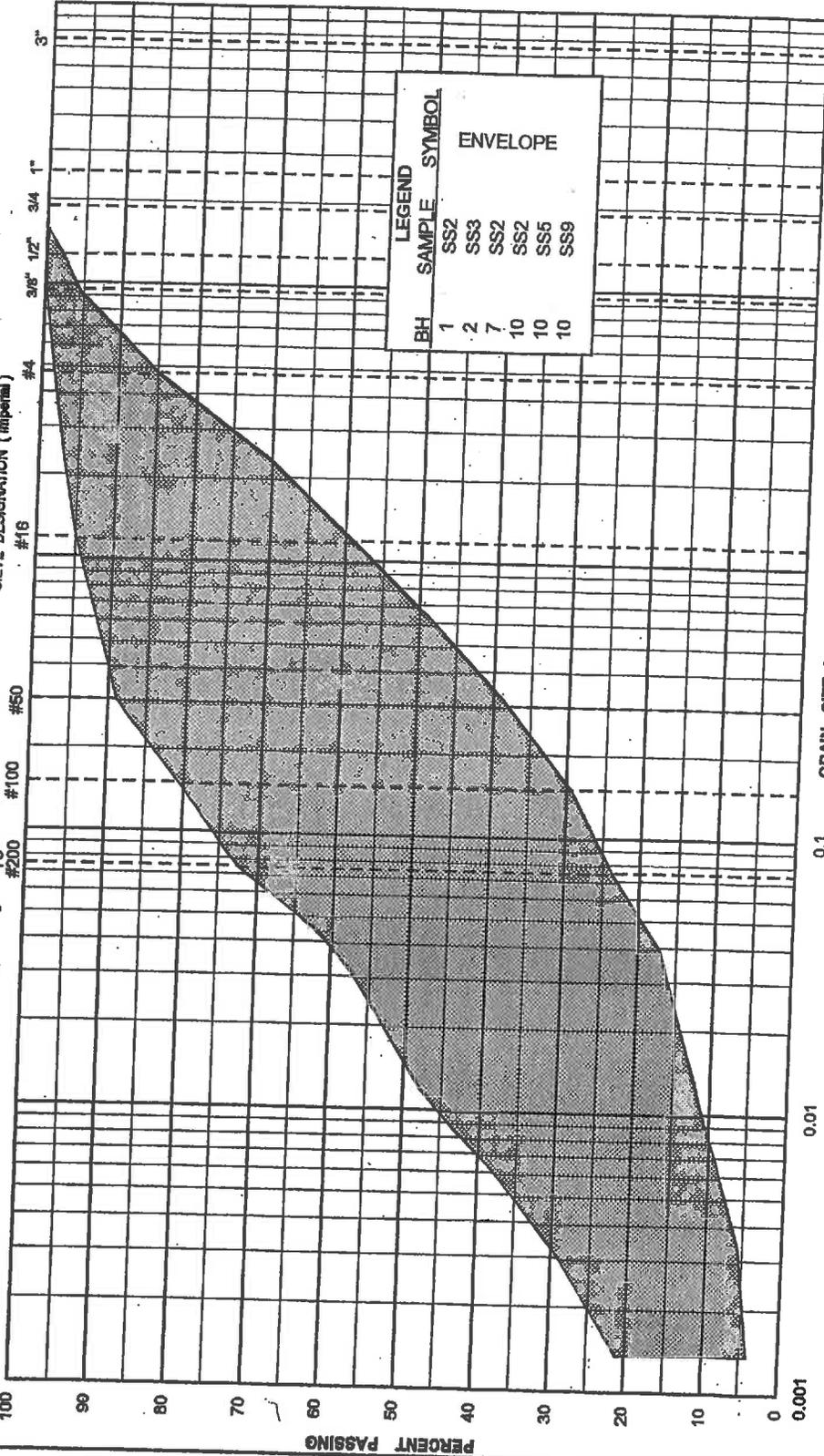
3 5 10 30 5 75 #200

100 #100 #50

#16 #4

3/8" 1/2" 3/4" 1" 3"

Fine Coarse



SHAHEEN & PEAKER LIMITED

GRAIN SIZE DISTRIBUTION

Clayey Silt (FIH)

FIGURE No. 1

REF. No. W.P. 321-96-00

DATE FEBRUARY, 2003

UNIFIED SOIL CLASSIFICATION SYSTEM

CLAY AND SILT

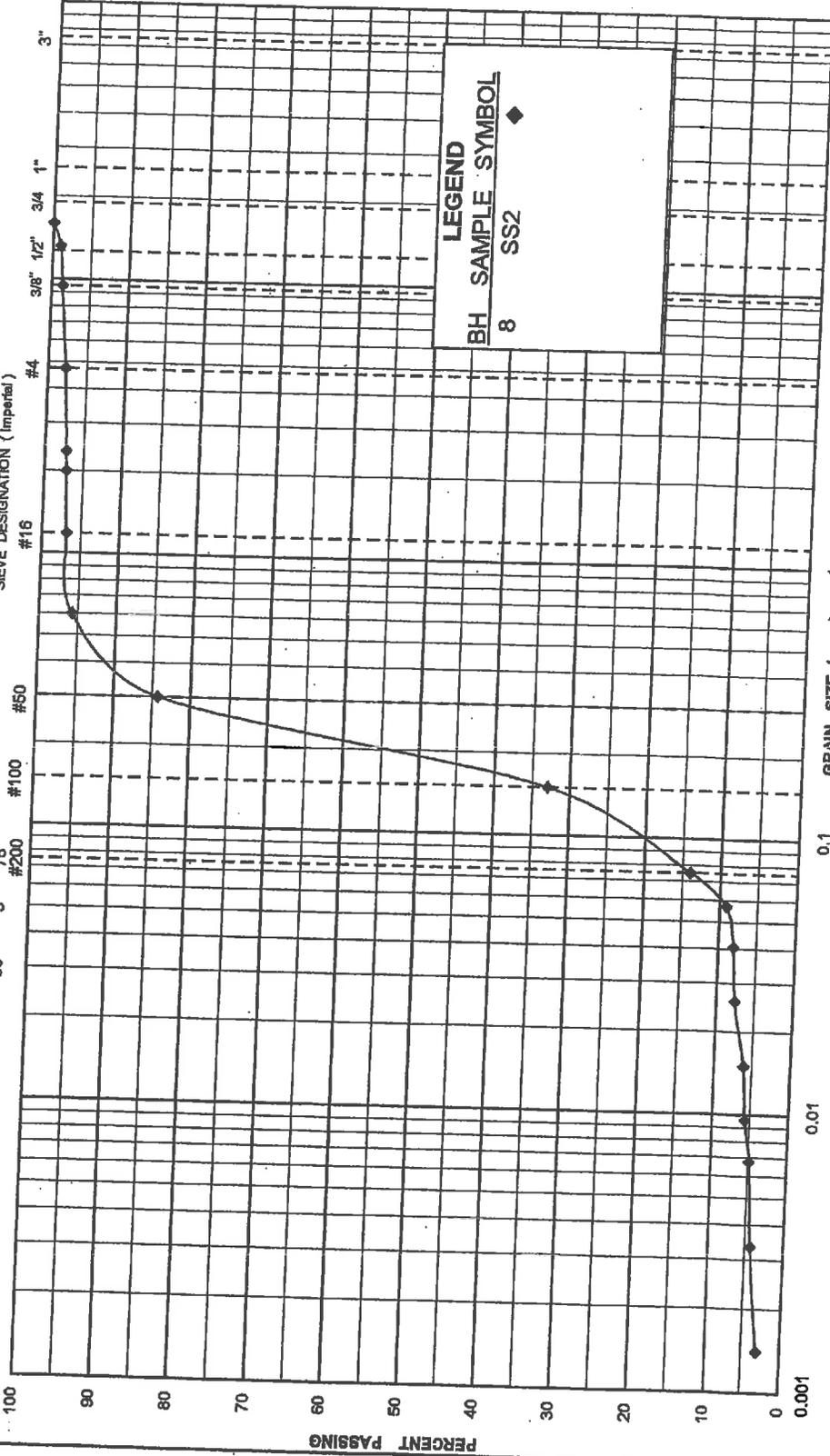
GRAIN SIZE IN MICROMETERS

SAND

Fine Medium Coarse

GRAVEL

Fine Coarse



LEGEND
BH SAMPLE SYMBOL
8 SS2 ◆

SHAHEEN & PEAKER LIMITED

GRAIN SIZE DISTRIBUTION

Sand some Silt (Fill)

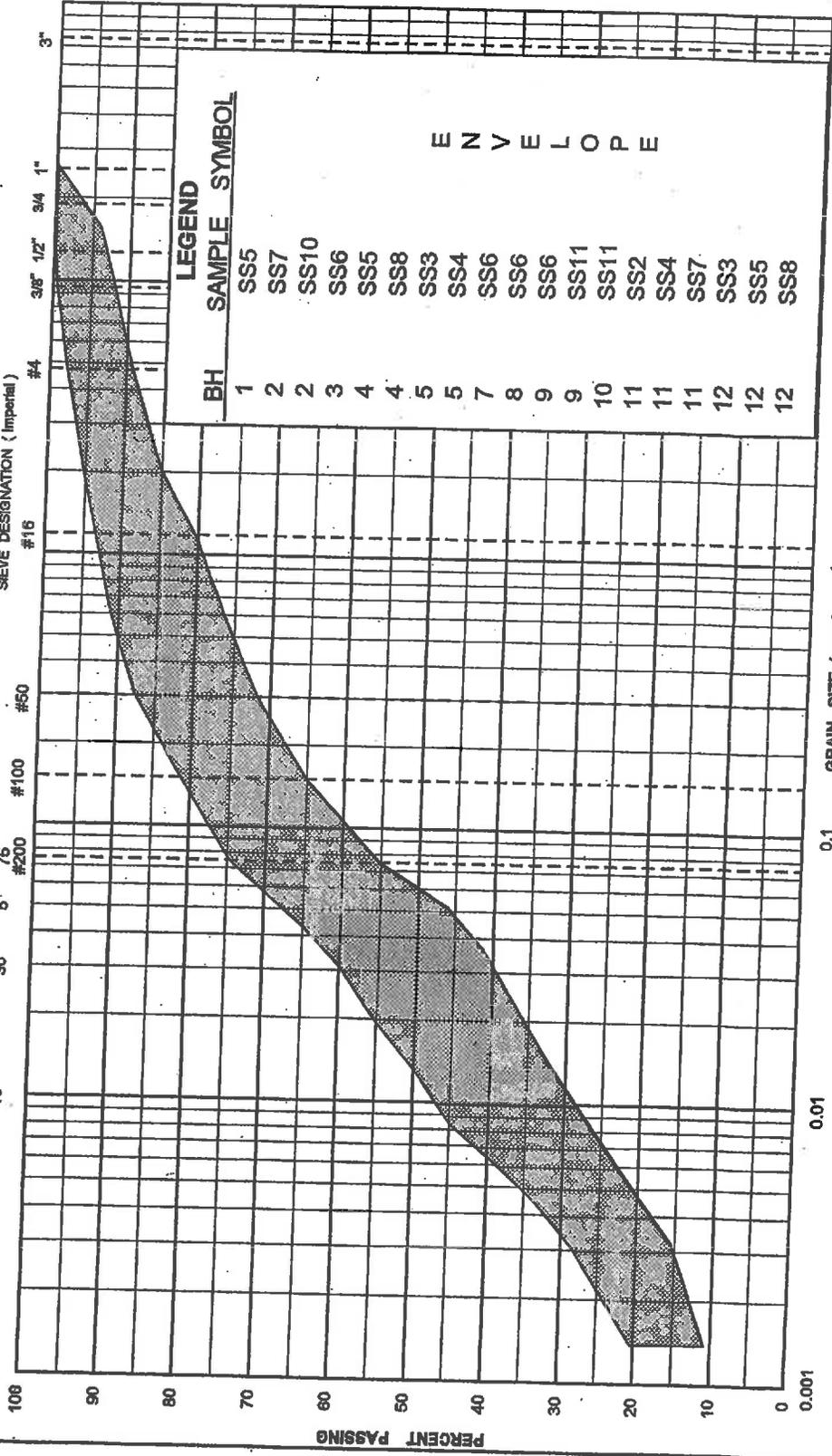
FIGURE No. 2

REF. No. W.P. 321-96-00

DATE FEBRUARY, 2003

UNIFIED SOIL CLASSIFICATION SYSTEM

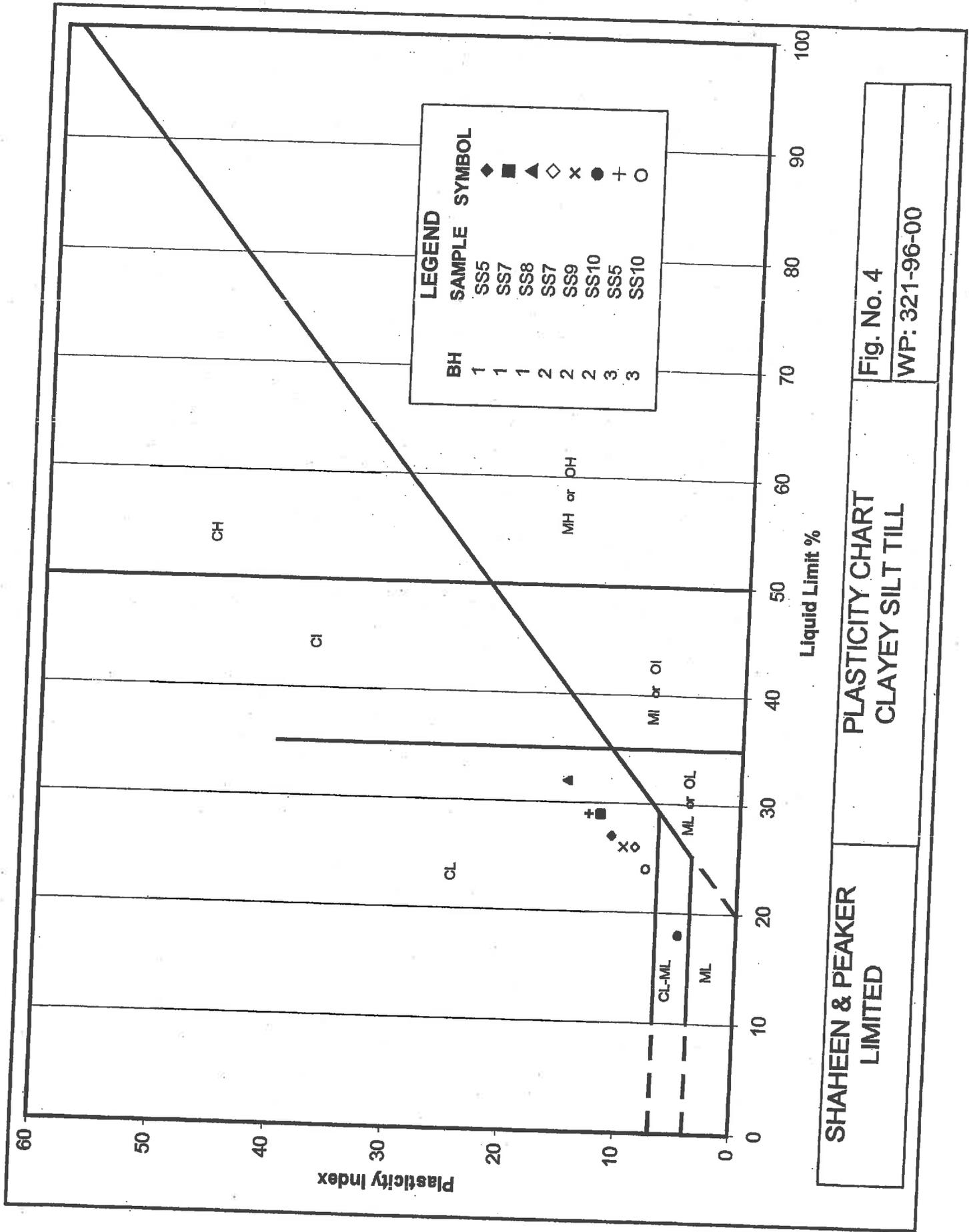
CLAY AND SILT GRAIN SIZE IN MICROMETERS		SAND			GRAVEL		
		Fine	Medium	Coarse	Fine	Coarse	



SHAHEEN & PEAKER LIMITED

GRAIN SIZE DISTRIBUTION
Clayey Silt Till

FIGURE No. 3
REF. No. W.P. 321-96-00
DATE FEBRUARY, 2003

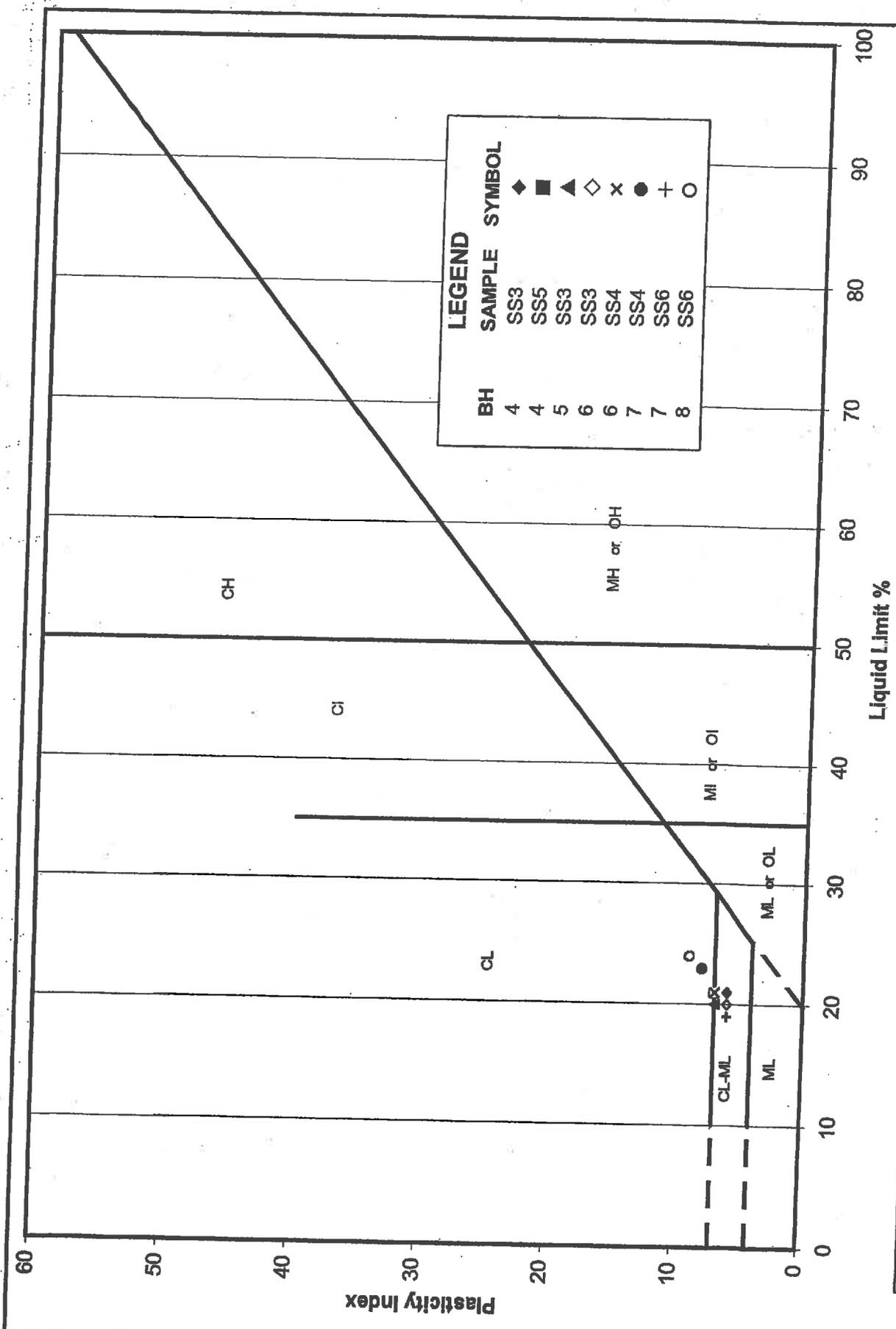


SHAHEEN & PEAKER LIMITED

PLASTICITY CHART
CLAYEY SILT TILL

Fig. No. 4

WP: 321-96-00

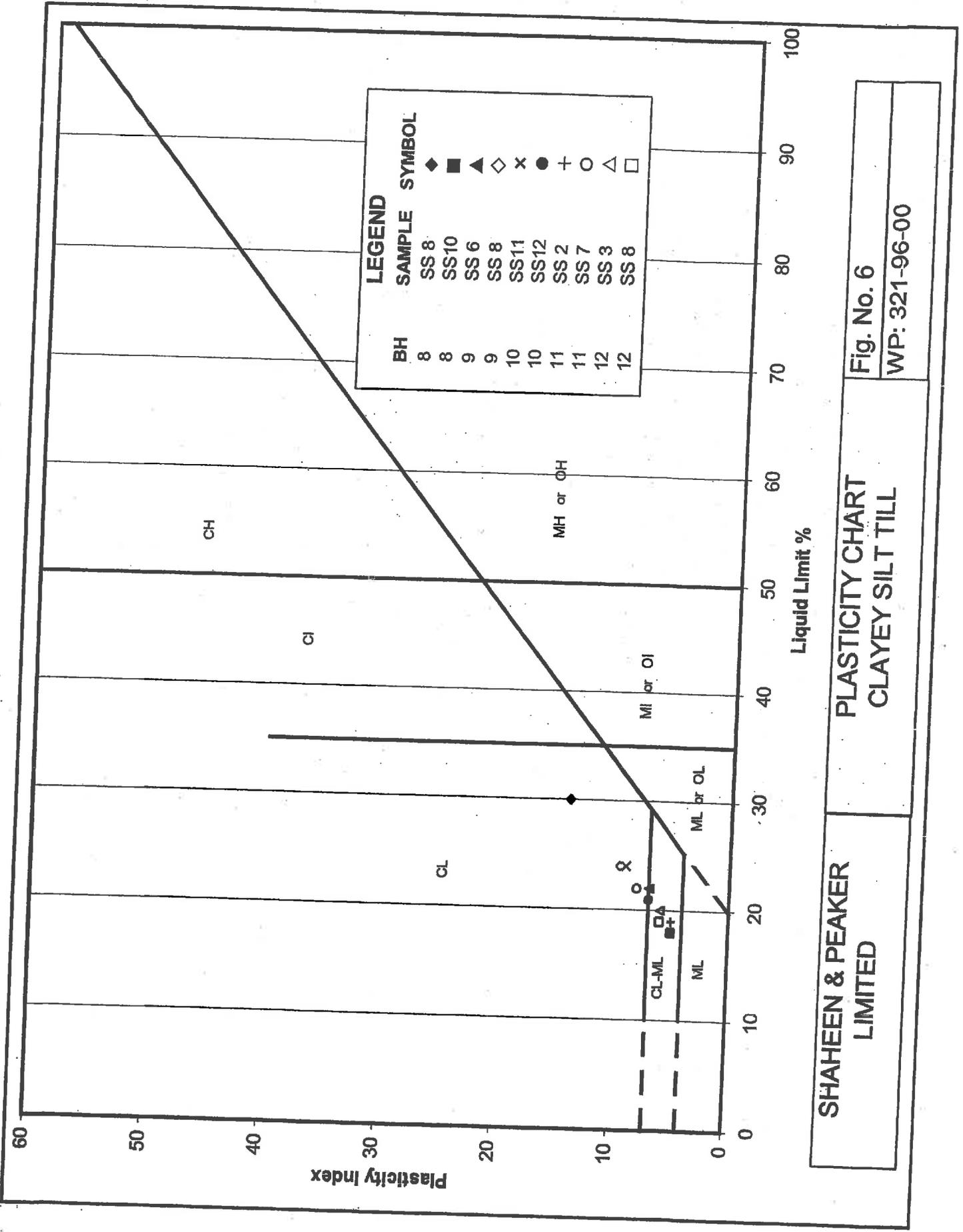


SHAHEEN & PEAKER LIMITED

**PLASTICITY CHART
CLAYEY SILT TILL**

Fig. No. 5

WP: 321-96-00



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LIMITED

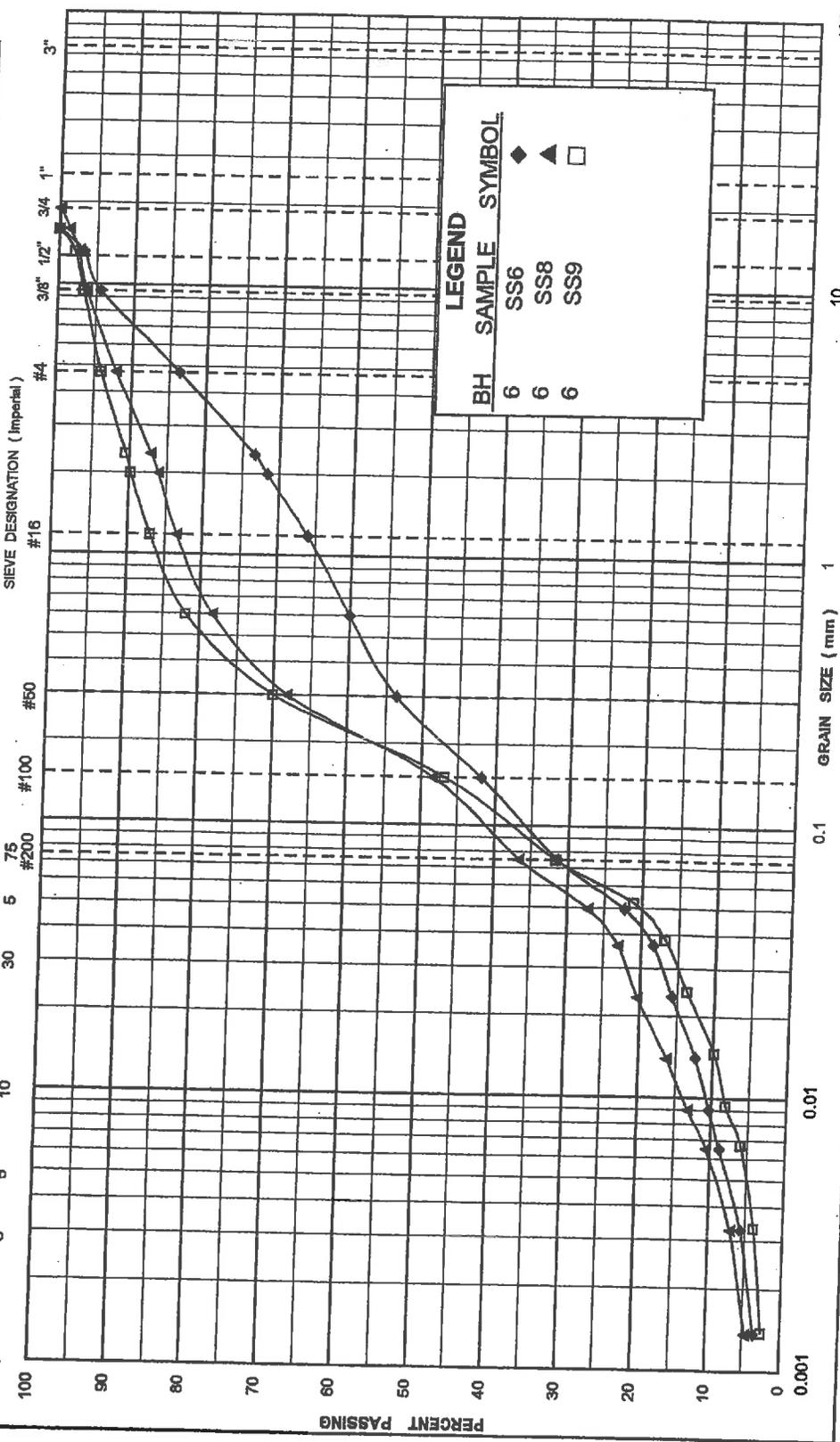
PLASTICITY CHART
CLAYEY SILT TILL

Fig. No. 6

WP: 321-96-00

UNIFIED SOIL CLASSIFICATION SYSTEM

CLAY AND SILT		SAND			GRAVEL		
GRAIN SIZE IN MICROMETERS		Fine	Medium	Coarse	Fine	Coarse	



GRAIN SIZE DISTRIBUTION
Silty Sand Till

SHAHEEN & PEAKER LIMITED

FIGURE No. 7
REF. No. W.P. 321-96-00
DATE FEBRUARY, 2003

UNIFIED SOIL CLASSIFICATION SYSTEM

CLAY AND SILT

GRAIN SIZE IN MICROMETERS

SAND

Fine

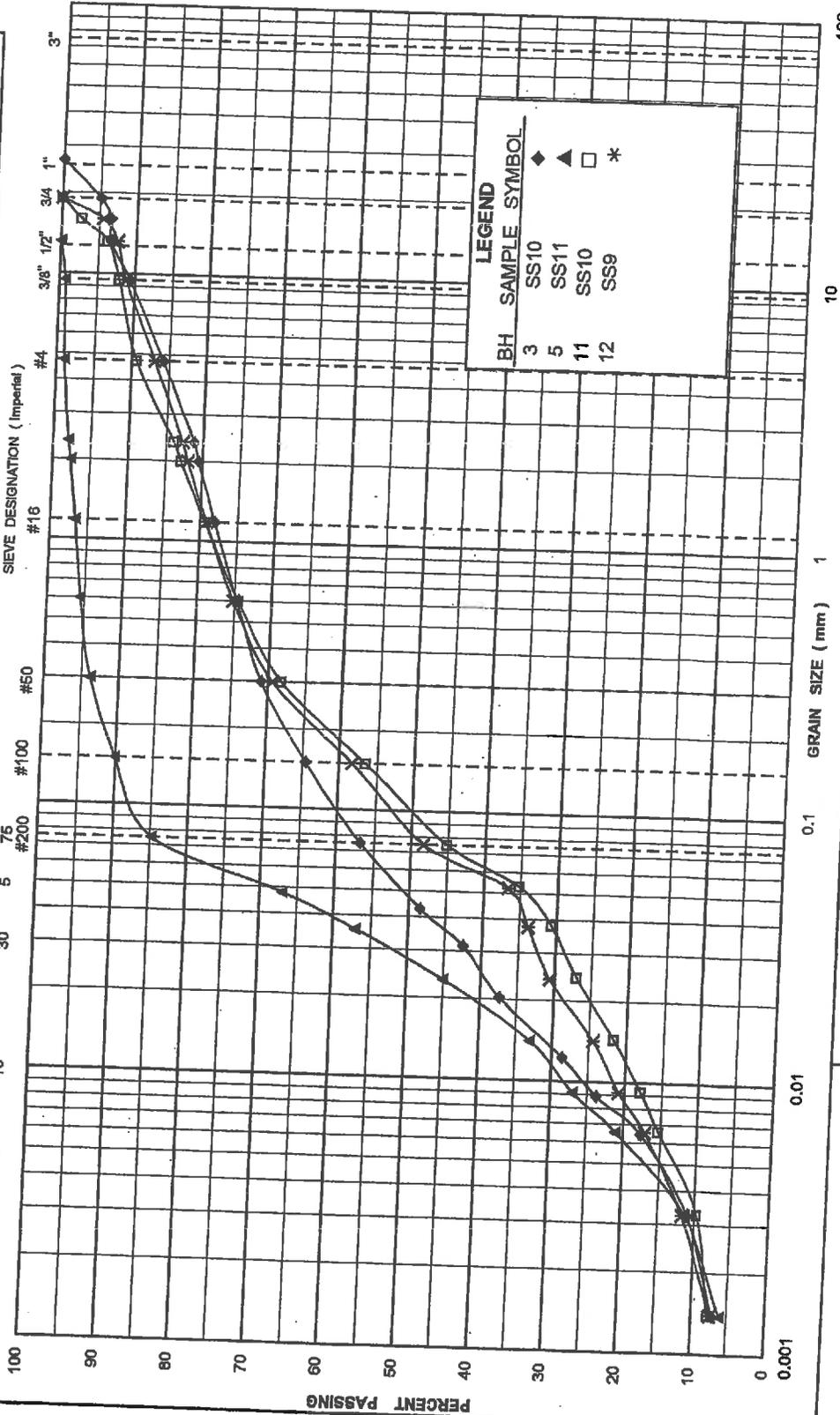
Medium

Coarse

GRAVEL

Fine

Coarse



SHAHEEN & PEAKER LIMITED

GRAIN SIZE DISTRIBUTION

Sandy Silt Till

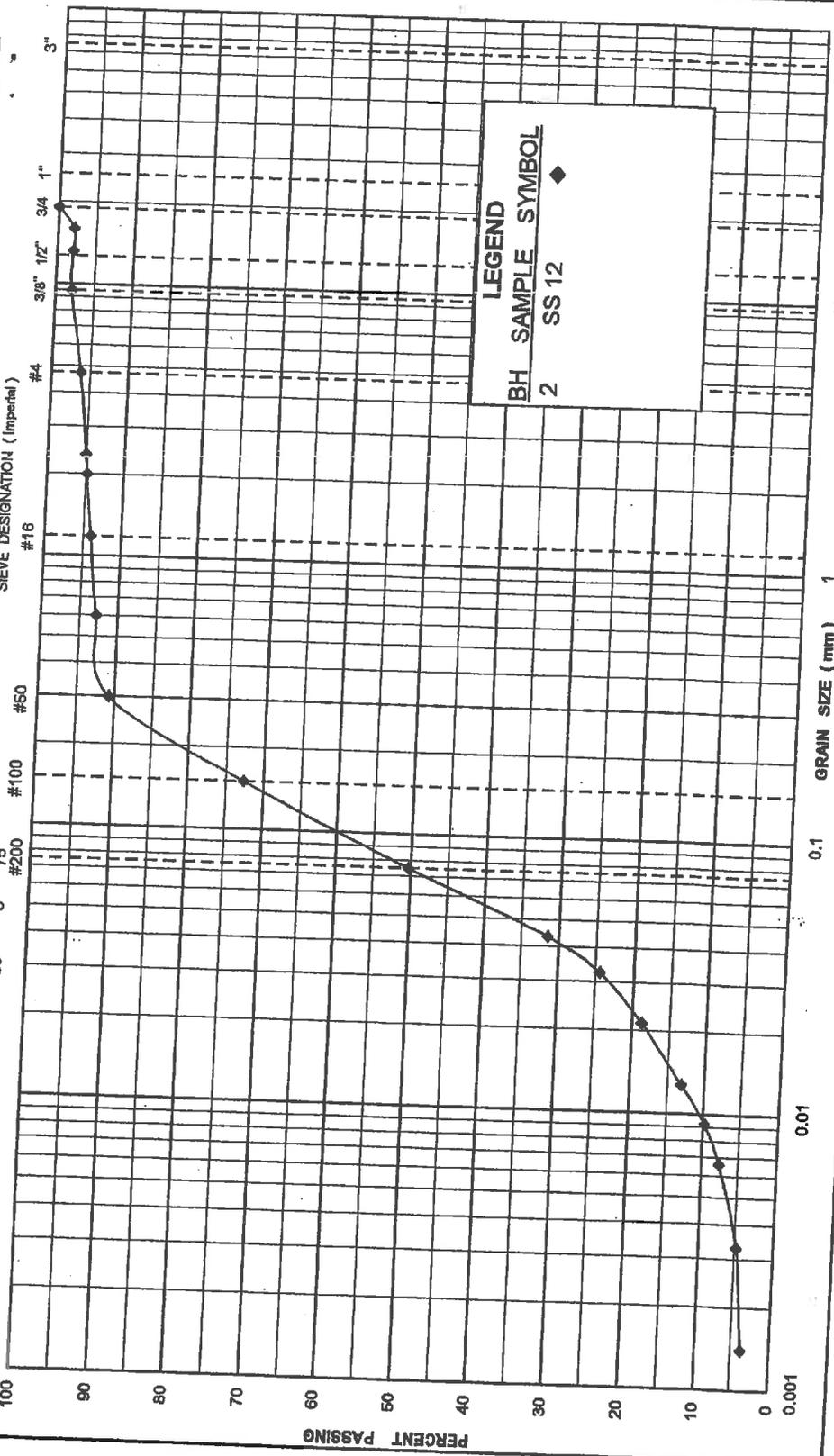
FIGURE No. 8

REF. No. W.P. 321-96-00

DATE FEBRUARY, 2003

UNIFIED SOIL CLASSIFICATION SYSTEM

CLAY AND SILT		SAND				GRAVEL		
GRAIN SIZE IN MICROMETERS		Fine	Medium	Coarse	Fine	Coarse		
1								



LEGEND
 BH SAMPLE SYMBOL
 2 SS 12 ◆

GRAIN SIZE DISTRIBUTION
 Sand and Silt

SHAHEEN & PEAKER LIMITED

FIGURE No. 9
 REF. No. W.P. 321-96-00
 DATE FEBRUARY, 2003

Appendix D

Explanation of Terms Used in Report

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 475J 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 (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

SS	SPLIT SPOON	TP	THINWALL PISTON
WS	WASH SAMPLE	OS	OSTERBERG SAMPLE
ST	SLOTTED TUBE SAMPLE	RC	ROCK CORE
BS	BLOCK SAMPLE	PH	TW ADVANCED HYDRAULICALLY
CS	CHUNK SAMPLE	PM	TW ADVANCED MANUALLY
TW	THINWALL OPEN	FS	FOIL SAMPLE

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

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_r	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 = c_u / τ_r

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

**FOUNDATION DESIGN REPORT
PROPOSED HIGH MAST LIGHT POLES
HIGHWAY 409 REHABILITATION
FROM HIGHWAY 401 WESTERLY TO
HIGHWAY 409/427 INTERCHANGE
TORONTO, ONTARIO
W.P. 321-96-00**

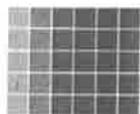
Prepared For:

**MINISTRY OF TRANSPORTATION
CENTRAL REGION**

Prepared by:

SHAHEEN & PEAKER LIMITED

**Project: SPT1076
July 8, 2003**



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APPENDICES

APPENDIX E: LIMITATIONS OF REPORT

**FOUNDATION DESIGN REPORT
PROPOSED HIGH MAST LIGHT POLES
HIGHWAY 409 REHABILITATION
FROM HIGHWAY 401 WESTERLY TO
HIGHWAY 409/427 INTERCHANGE
TORONTO, ONTARIO
W.P. 321-96-00**

5. DISCUSSION AND RECOMMENDATIONS

The project entails the construction of approximately twenty three high mast light (HML) poles to be installed along the alignment of new tall wall concrete median barriers proposed to be constructed during the rehabilitation of Highway 409. The route commences from the eastern limit of the project at the bull nose of the E-N/S ramp to Belfield/Kipling Road and concludes at the western limit i.e. the centre line of the underpass at Highway 427 located at Station 10+000.

It should be pointed out that new high mast light poles are already installed along the median center line of Highway 409 from the project west limits to just west of Mimico Creek. Consequently, no boreholes were drilled for high mast light poles west of Mimico Creek. This was pointed out to MTO in our progress report No. 4 dated November 18, 2002.

5.1 SUMMARIZED SUBSURFACE CONDITIONS

A granular layer of pavement fill was encountered in Boreholes 1 to 10 advanced through the paved asphalt shoulder of Highway 409. This granular fill is generally underlain by a basically cohesive fill material consisting of mixed clayey silt with sand and traces of gravel that extends to a maximum depth of 7.5 m below ground surface in Borehole 10. The granular pavement fill and the cohesive clayey silt fill are further underlain by a major deposit of basically cohesive glacial till which consists of clayey silt with sand and traces of gravel. This clayey silt till is either subdivided or underlain by grey water bearing deposits of sand and silt, sandy silt till, silty sand till and sand.

The measured (unstablised) water levels in Boreholes 2, 4, 5, 6, 7, 8, 9, and 11 after drilling ranged from El. 157.7 m to 151.6 m. The colour change in the soil matrix from brown to grey was noted at elevations ranging from El. 163.0 m to El. 153.4 m.

Based on the observations in the open boreholes, the change of the colour of the native soil matrix from brown to grey and the moisture contents of the soil samples, the groundwater table at the site is believed to range between El. 163.0 m and 155.0 m. It is however expected to be subject to seasonal fluctuations and fluctuations due to major weather events. In addition, perched water conditions could occur due to the accumulation of

surface water in the surficial fills or more pervious soils overlying the practically impervious clayey silt till.

Details of the subsurface conditions encountered in the borehole are given on the Record of Borehole Sheets in Appendix A. The Record of Borehole Sheets (MTO 1971, W.P. 276-65 and MTO 1972, W.P. 218-65-01) are shown in Appendix B.

5.2 DESIGN CONSIDERATION

Generally, each HML can be supported on a single caisson (i.e. drilled and cast-in-place concrete pile) foundation and the depth of the caisson is typically 8 to 9 m, but would vary depending on the height of the HML and the subsurface conditions encountered at each location. According to MTO practice, the design can be carried out in accordance with the method described by Broms, as detailed in the following papers.

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

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

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

Based on the results of the twelve boreholes, the soil parameters at each pole location are given in Table 5.2.1. The following notations have been adopted:

ϕ = apparent angle of friction for cohesionless soils in degrees.

q_u = unconfined compressive strength in kPa ($q_u=2x C_u$) for
cohesive soils and C_u is the undrained shear strength.

γ = bulk unit weight in kN/m³.

TABLE 5.2.1

BH No.	Elevation (m)		Type of Soil	Consistency or Compactness Condition	q _u (kPa) *	φ (degrees) **	γ (kN/m ³) ***	Water Level depth (Elevation) (m)
	From	To						
1	164.5	164.2	Fill	Dense	-	33	21.0	1.6 * (163.0) *
	164.2	163.2	Fill	Very stiff	100	-	20.5	
	163.2	154.2	Cohesive	Stiff to Hard	350	-	21.0	
2	161.5	161.3	Fill	Compact	-	33	20.5	6.1 * (155.5) *
	161.3	157.9	Fill	Stiff to Very stiff	100	-	19.0	
	157.9	157.0	Cohesive	Stiff	240	-	20.0	
	157.0	151.9	Cohesive	Very stiff to Hard	360	-	20.5	
	151.9	151.2	Cohesionless	Compact	-	30	19.5	
3	158.0	157.4	Fill	Compact	-	33	20.5	1.6 * (156.5) *
	157.4	156.0	Fill	Stiff to Soft	60	-	18.0	
	156.0	152.5	Cohesive	Stiff	150	-	19.5	
	152.5	149.5	Cohesionless	Very dense	-	35	22.0	
	149.5	148.0	Cohesive	Hard	400	-	21.5	
	148.0	147.1	Cohesionless	Very dense	-	34	22.0	
4	161.7	161.5	Fill	Compact	-	33	20.5	0.8 * (161.0) *
	161.5	160.5	Cohesive	Very stiff	300	-	21.0	
	160.5	153.1	Cohesive	Stiff to Very stiff	160	-	20.5	
5	159.8	159.5	Fill	Very Dense	-	33	21.0	0.4 * (159.5) *
	159.5	156.0	Cohesive	Stiff to Very stiff	300	-	21.5	
	156.0	154.7	Cohesive	Stiff	150	-	21.0	
	154.7	152.8	Cohesionless	Compact to Dense	-	33	21.5	
	152.8	151.3	Cohesionless	Very dense	-	34	21.5	
	151.3	150.0	Cohesionless	Very dense	-	34	22.0	
6	157.1	156.8	Fill	Compact	-	33	20.5	0.7 * (156.5) *
	156.8	155.5	Cohesive	Stiff to Very stiff	300	-	21.0	
	155.5	153.8	Cohesive	Very stiff	400	-	21.5	
	153.8	151.6	Cohesionless	Dense	-	33	21.5	
	151.6	150.1	Cohesive	Hard	400	-	22.0	
	150.1	146.4	Cohesionless	Very dense	-	34	22.5	
7	158.6	158.4	Fill	Very Loose	-	31	20.0	3.2 * (155.5) *
	158.4	156.6	Fill	Stiff	70	-	19.0	
	156.6	154.5	Cohesive	Very stiff to Hard	320	-	21.5	
	154.5	150.1	Cohesive	Hard	400	-	22.0	
	150.1	148.3	Cohesionless	Loose to Compact	-	31	20.0	
8	162.3	162.1	Fill	Very Dense	-	33	21.0	2.4 * (160.0) *
	162.1	159.8	Fill	Loose to Very loose	-	28	18.0	
	159.8	159.5	Fill	Stiff	60	-	18.0	
	159.5	155.0	Cohesive	Stiff to Very stiff	200	-	20.0	
	155.0	152.0	Cohesive	Hard	400	-	21.5	
9	163.9	163.7	Fill	Loose to Compact	-	32	20.5	2.0 * (162.0) *
	163.7	161.1	Fill	Very stiff to Stiff	100	-	21.0	
	161.1	157.0	Cohesive	Stiff to Very stiff	250	-	21.5	
	157.0	155.4	Cohesionless	Very dense	-	33	21.0	
	155.4	153.6	Cohesive	Hard	400	-	21.5	
10	163.1	162.8	Fill	Compact	-	32	21.0	7.2 * (156.0) *
	162.8	155.7	Fill	Stiff to Hard	100	-	20.0	
	155.7	152.8	Cohesive	Hard	400	-	21.0	

BH No.	Elevation (m)		Type of Soil	Consistency or Compactness Condition	q _u (kPa) *	φ (degrees) **	γ (kN/m ³) ***	Water Level depth (Elevation) (m)
	From	To						
11	160.4	157.0	Cohesive	Hard	400	-	22.0	2.0 * (158.5) *
	157.0	155.5	Cohesive	Very stiff	350	-	22.0	
	155.0	153.4	Cohesive	Firm to Stiff	100	-	20.0	
	153.4	151.8	Cohesionless	Compact	-	31	20.0	
	151.8	149.5	Cohesionless	Very dense	-	34	22.0	
12	160.5	158.0	Cohesive	Very stiff to Hard	400	-	22.0	1.6 * (159.0) *
	158.0	156.0	Cohesive	Very stiff	320	-	21.5	
	156.0	153.5	Cohesive	Very stiff to Hard	240	-	21.5	
	153.5	149.8	Cohesionless	Very dense	-	34	22.0	

* q_u = unconfined compressive strength in kPa (q_u = 2xC_u) for cohesive soils

** φ = angle of internal friction for cohesionless (i.e. granular) soils in degrees

*** γ = bulk unit weight of soil in kN/m³

♦ = estimated

The contribution to lateral resistance of the soil within the frost depth (i.e. 1.2 m) should not be included in the calculations, except of course, for the weight of the soil. Research shows, however, that restraint (fixity) provided at the ground surface level plays a significant role in the performance of high pole structures and, therefore, the placement of well compacted, competent material at and near the ground surface immediately around the pole is recommended.

5.3 CONSTRUCTION COMMENTS

The borehole shows the presence of some surficial fill deposits followed by essentially competent overburden to the full depths of investigation.

The clayey silt till deposit can be expected to be self-supporting and should not yield significant amounts of water in the short term, in caisson holes, even below the groundwater table. However, the concrete should be poured expeditiously on completion of the caisson hole, without undue delay. At locations where relatively more pervious water bearing soils (i.e. silty sand till, sandy silt till, silty sand and sand and silt e.g. below 9.7 m in Borehole 2, or sand seams/layers in the till deposits e.g. at 5.4 m in Borehole 6) were encountered below the groundwater table, problems may occur during the installation of the caissons, as discussed below.

Water bearing layers can be expected to yield significant amount of water and may cause instability problems during the installation of the caissons. Where these layers are rather thin and the soil is relatively fine grained, it may be possible to effect construction by pouring the concrete rapidly upon the completion of the excavation of the caisson hole. In other cases, however, the coarse tills and the sand layers may cause cave-ins or excessive groundwater seepage in unlined caisson holes and will necessitate special precautions.

The use of dewatering techniques to lower the groundwater table during construction is unlikely to be economically viable due to the limited construction effort required and space limitations on Highway 409.

Within the coarse textured till and the silty sand layers below the water table the soil is susceptible to disturbance due to the unbalanced hydrostatic head and seepage and will likely become unstable, especially with increased depth of excavation below the water table. The contractor should maintain the stability of the soil at the sides and bases of the holes for the concrete footings, at all times from the commencement of excavation to the completion of the pouring of the concrete.

In view of these, we recommend that the following special provisions be included in the contract documents:

- The contractor shall install concrete foundations in earth for HML foundations. At the various foundation locations, strata may consist of fill, clayey silt till, sandy silt till, silty sand till, sand and silt and sand. Groundwater is likely to be encountered above the base of the excavations.
- At various foundation locations, soil deposits may consist of silty sand till, sandy silt till, sand and silt and sand. In such cases where the soil is susceptible to conditions of unbalanced hydrostatic head and seepage forces, "boiling" or a quick condition may occur and the soil may become unstable.
- The contractor shall maintain the stability of the soil along the sides and in the bases of the holes for the concrete footings at all times from the commencement of their construction to the placing of the concrete.
- Dewatering may be required to maintain a sufficiently dry condition for proper installation of the caisson hole and the placement of concrete.

Being of glacial origin, the glacial till deposits can be expected to contain random cobbles and boulders. In fact, the presence of cobbles and boulders was inferred during the drilling of some of the boreholes. The contractor should be made aware that the presence of cobbles and boulders can always be expected which can cause problems during the installation of the caissons, such as increasing the time required for drilling, the employment of special equipment etc.

6.0 CLOSURE

The Limitations of Report, as quoted in Appendix E, is an integral part of this report.

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Appendix E

Limitations of Report

LIMITATIONS OF REPORT

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

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

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

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