

**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**

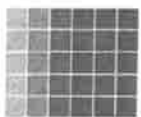
Prepared For:

**MINISTRY OF TRANSPORTATION
CENTRAL REGION**

Prepared by:

SHAHEEN & PEAKER LIMITED

**Project: SPT1076
July 8, 2003**



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Table of Contents

| | |
|---|----------|
| 1. INTRODUCTION | 1 |
| 2. SITE DESCRIPTION AND PHYSIOGRAPHY | 1 |
| 3. INVESTIGATION PROCEDURES | 2 |
| 4. SUBSURFACE CONDITIONS | 3 |
| 4.1 Pavement Fill | 3 |
| 4.2 Topsoil..... | 4 |
| 4.3 Fill | 4 |
| 4.3.1 Clayey Silt Fill..... | 4 |
| 4.3.2 Sand Fill..... | 5 |
| 4.4 Clayey Silt Till | 5 |
| 4.5 Silty Sand Till..... | 6 |
| 4.6 Sandy Silt Till..... | 7 |
| 4.7 Sand And Silt | 8 |
| 4.8 Sand Some Silt | 8 |
| 4.9 Groundwater Conditions..... | 9 |

DRAWINGS

DRAWING No.

BOREHOLE LOCATION PLANS

1 TO 4

APPENDICES

APPENDIX A: RECORD OF BOREHOLE SHEETS

APPENDIX B: MTO RECORD OF BOREHOLE SHEETS

APPENDIX C: LABORATORY TEST RESULTS

APPENDIX D: EXPLANATION OF TERMS USED IN REPORT

**FOUNDATION INVESTIGATION REPORT
PROPOSED HIGH MAST LIGHT POLES
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W.P. 321-96-00**

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 Wisconsin 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 (unstablisised) 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

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

Z.S. Ozden

Z.S. Ozden, M.A.Sc., P.Eng.

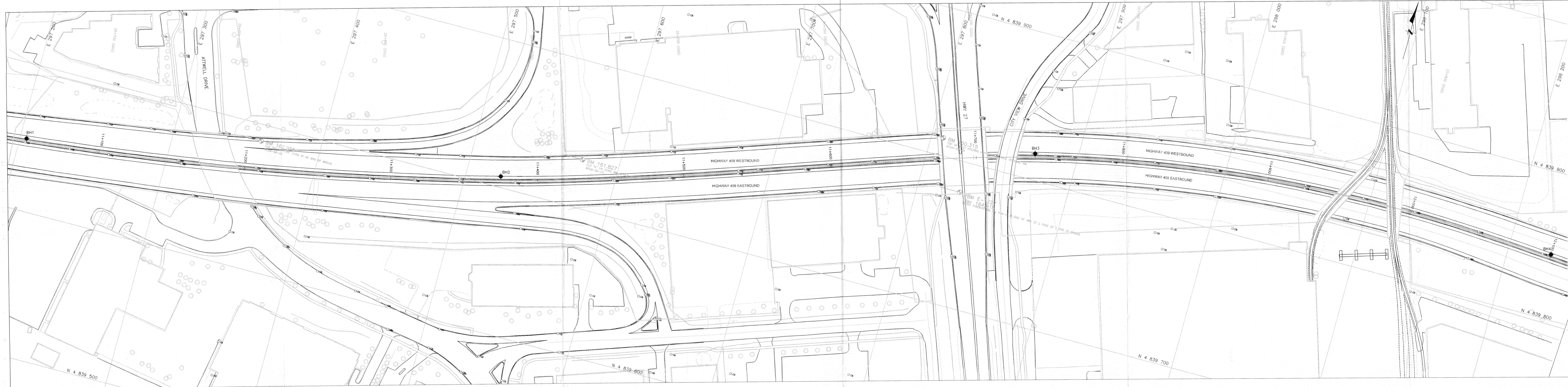
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*Project: SPT1076
Ministry of Transportation, Central Region*

*Foundation Investigation Report
Proposed Highmast Light Poles
Highway 409 Rehabilitation from Highway 401 to
Highway 409/427 Interchange
Toronto, Ontario*

Drawings



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

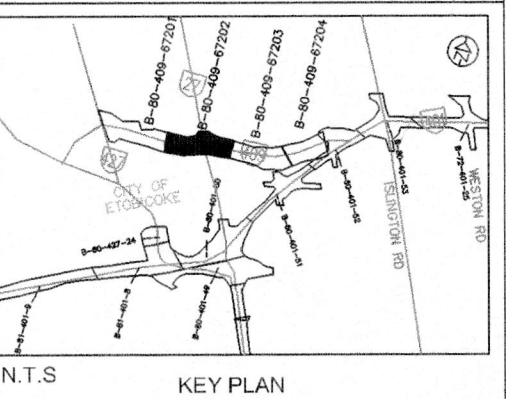
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WP: 321-96-00

HIGHWAY 409
REHABILITATION FROM
HWY 401 TO HWY 427/409
INTERCHANGE
BORE HOLE LOCATIONS

SHEET
1 of 4

SHAHEEN & PEAKER LIMITED



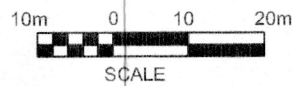
LEGEND

● Bore Hole

| No. | ELEV. | CO-ORDINATES | |
|------|--------|--------------|-----------|
| | | NORTH | EAST |
| BH1 | 164.55 | 4839649.20 | 297204.47 |
| BH2 | 161.60 | 4839707.55 | 297523.50 |
| BH3 | 158.09 | 4839817.93 | 297871.26 |
| BH4 | 161.81 | 4839844.08 | 298229.26 |
| BH5 | 159.88 | 4839851.78 | 298577.65 |
| 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 | 4840580.10 | 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.

| REV. | DATE | BY | DESCRIPTION |
|-------------|------------|----------------|-------------|
| | | | |
| Geocres No. | | | |
| HWY No. 409 | | | DIST |
| SUBMD ZO | CHECKED RA | DATE Mar. 2003 | SITE |
| DRAWN JZ | CHECKED | APPROVED | DWG 1 |



METRIC

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

CONT No.

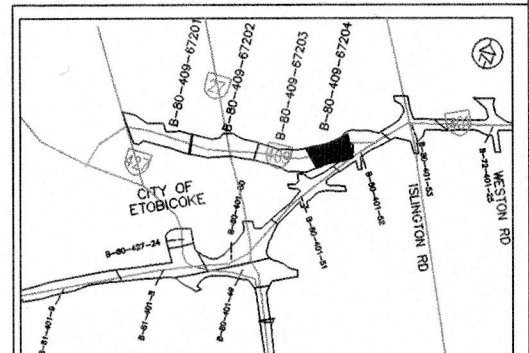
WP: 321-96-00

HIGHWAY 409
REHABILITATION FROM
HWY 401 TO HWY 427/409
INTERCHANGE
BORE HOLE LOCATIONS

SHEET

3 of 4

SHAHEEN & PEAKER LIMITED



N.T.S. KEY PLAN

LEGEND

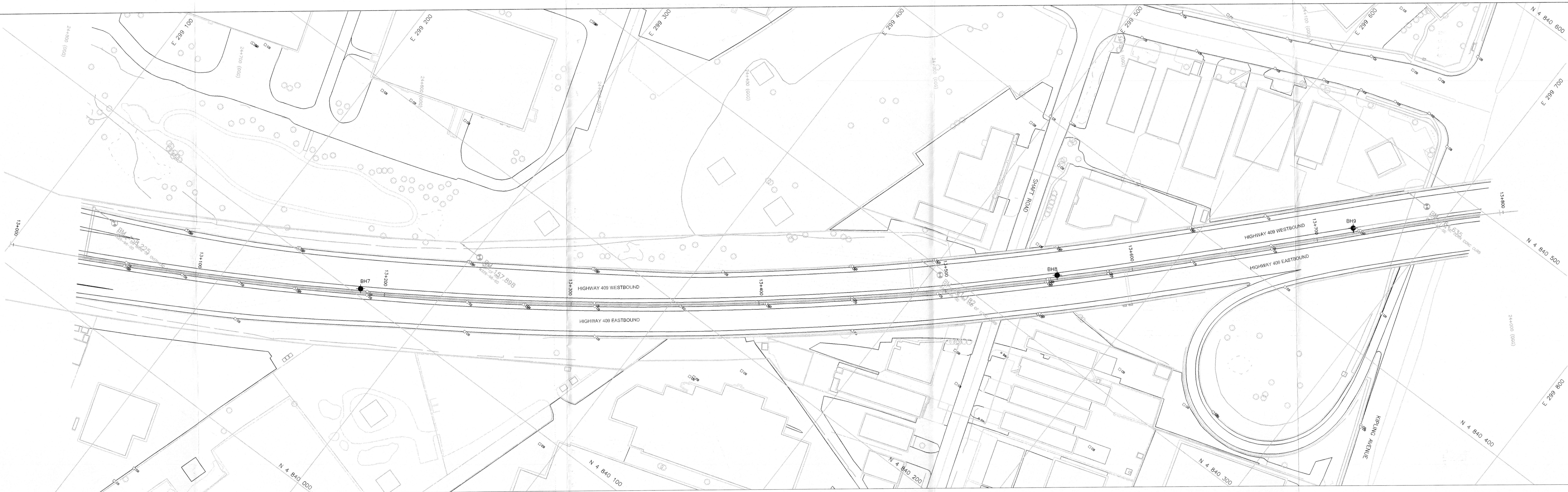
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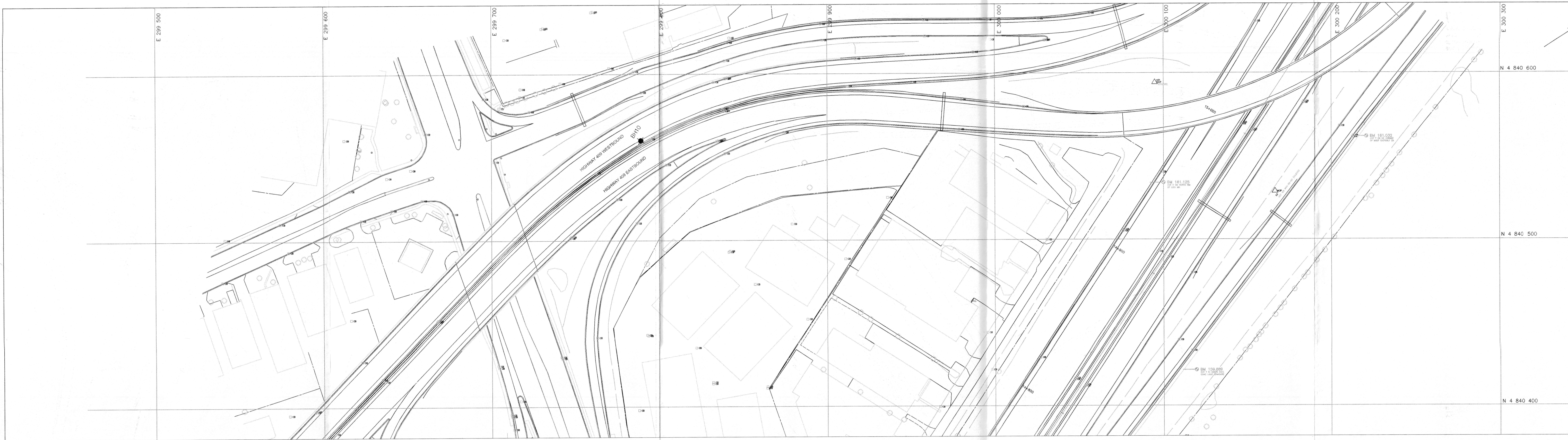
| No. | ELEV. | CO-ORDINATES | |
|------|--------|--------------|-----------|
| | | NORTH | EAST |
| BH1 | 164.55 | 4839649.20 | 297204.47 |
| BH2 | 161.60 | 4839707.55 | 297523.50 |
| BH3 | 158.09 | 4839817.93 | 297871.26 |
| BH4 | 161.81 | 4839844.08 | 298229.26 |
| BH5 | 159.88 | 4839851.78 | 298577.85 |
| BH6 | 157.20 | 4839962.07 | 298886.40 |
| BH7 | 158.70 | 4840103.72 | 299263.43 |
| BH8 | 162.40 | 4840335.01 | 299554.53 |
| BH9 | 164.00 | 4840451.13 | 299864.43 |
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| REV. | DATE | BY | DESCRIPTION |
|-------------|------------|----------------|-------------|
| 1 | | | |
| Geocres No. | | | |
| HWY No. 409 | | | DIST |
| SUBMD ZO | CHECKED RA | DATE Mar, 2003 | SITE |
| DRAWN JZ | CHECKED | APPROVED | DWG 3 |

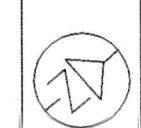
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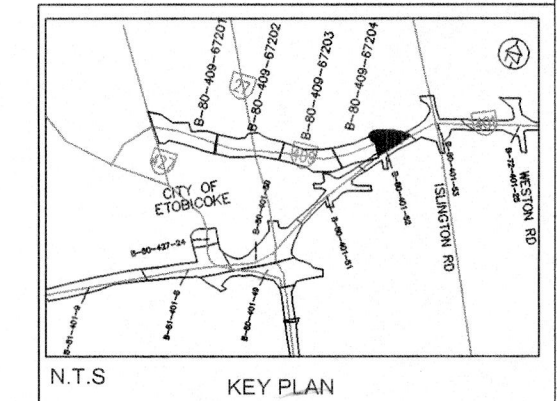
METRIC
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CONT No.
WP: 321-96-00
HIGHWAY 409
REHABILITATION FROM
HWY 401 TO HWY 427/409
INTERCHANGE
BORE HOLE LOCATIONS



SHEET
4 of 4

SHAHEEN & PEAKER LIMITED



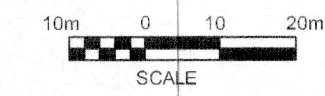
N.T.S. KEY PLAN

LEGEND

| Bore Hole | | | |
|-----------|--------|--------------|-----------|
| No. | ELEV. | CO-ORDINATES | |
| | | NORTH | EAST |
| BH1 | 164.55 | 4839649.20 | 297204.47 |
| BH2 | 161.60 | 4839707.55 | 297523.50 |
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|-------------|------------|----------------|-------------|
| | | | |
| Geocres No. | | | |
| HWY No. 409 | | | DIST |
| SUBM'D 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.

| 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 ○ UNCONFINED + FIELD VANE ● POCKET PENETR. × LAB VANE | | | | | | | |
| 164.6 | Ground Surface | | | | | | | 20 40 60 80 100 | | | | | | | |
| 0.0 | 100 mm Asphalt, over Sand and Gravel (FILL) | | 1 | SS | 32 | * | | | | | | | | | |
| 164.2 | light brown, dense | | 2 | SS | 19 | | | | | | | | | | |
| 0.4 | Mixed Clayey Silt, trace gravel, some sand (FILL) | | | | | | | | | | | | | | |
| 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 | | | | | | | | | | |
| | | | 4 | SS | 16 | | | | | | | | | | |
| | | | 5 | SS | 20 | | | | | | | | | | |
| | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | |
| | | | 6 | SS | 15 | | | | | | | | | | |
| | | | | | | | | | | | | | | | |
| | | | 7 | SS | 21 | | | | | | | | | | |
| | | | | | | | | | | | | | | | |
| | | | 8 | SS | 20 | | | | | | | | | | |
| | | | | | | | | | | | | | | | |
| | | 9 | SS | 49 | | | | | | | | | | | |
| 154.2 | | | 10 | SS | 31 | | | | | | | | | | |
| 10.4 | 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

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 | | | UNIT WEIGHT γ kN/m ³ | REMARKS & GRAIN SIZE DISTRIBUTION (%) | |
|---------------|--|------------|---------|------|------------|----------------------------|-----------------|---|--------------|-----------------------------|--|---|------------|
| ELEV DEPTH | DESCRIPTION | STRAT PLOT | NUMBER | TYPE | "N" VALUES | | | SHEAR STRENGTH kPa | | | | | |
| | | | | | | | | ○ UNCONFINED | + FIELD VANE | ● POCKET PENETR. × LAB VANE | | | |
| | | | | | | | 20 40 60 80 100 | | | | | | |
| 161.6 | Ground Surface | | | | | | | | | | | | |
| 161.3 | 100 mm Asphalt, over Sand and Gravel (FILL) light brown, damp, compact | | 1 | SS | 25 | | | | | | | 21.7 | |
| 0.3 | | | 2 | SS | 23 | | | | | | | | |
| | Mixed Clayey Silt, some sand, trace gravel, (FILL) brown to grey/brown, stiff to very stiff | | 3 | SS | 20 | | | | | | | 21.7 | 2 29 49 20 |
| | | | 4 | SS | 14 | | | | | | | | |
| | | | 5 | SS | 10 | | | | | | | | |
| 157.9 | | | 6 | SS | 12 | | | | | | | 19.3 | |
| 3.7 | | | 7 | SS | 25 | | | | | | | 21.0 | 6 21 50 23 |
| | | | 8 | SS | 29 | | | | | | | 21.5 | |
| | | | 9 | SS | 39 | | | | | | | 21.9 | |
| | | | 10 | SS | 31 | | | | | | | 21.2 | 5 37 44 14 |
| | | | 11 | SS | 32 | | | | | | | 19.0 | |
| 151.9 | | | 12 | SS | 14 | | | | | | | 4 46 46 4 | |
| 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 | | | | | | | | | | | | |

+ 3, x 3: Numbers refer to
Sensitivity

20
15 5
10 (%) STRAIN AT FAILURE



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 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 (%) |
| | | | | | | | | ○ UNCONFINED | + FIELD VANE | | | | | | |
| | | | | | | | | ● POCKET PENETR. | × LAB VANE | | | | | | |
| 158.1 | Ground Surface | | | | | | | | | | | | | | |
| 0.0 | 100 mm Asphalt, over Sand and Gravel (FILL) light brown, damp, compact | | 1 | SS | 14 | | 158 | | | ○ | | | | | |
| 157.4 | | | | | | | | | | | | | | | |
| 0.7 | Mixed Clayey Silt, trace to some sand, occasional fine gravel, (FILL) grey | | 2 | SS | 10 | | 157 | | | ○ | | | | | |
| | | | | | | | | | | | | | | | |
| 156.0 | | | 3 | SS | 3 | | 156 | | | ○ | | | | | |
| 2.1 | | | | | | | | | | | | | | | |
| | | | 4 | SS | 9 | | 155 | | | ○ | | | 21.8 | | |
| | | | | | | | | | | | | | | | |
| | | | 5 | SS | 11 | | 154 | | | ○ | | | 20.9 | | |
| | | | | | | | | | | | | | | | |
| | | | 6 | SS | 14 | | 153 | | | ○ | | | 19.6 | | |
| | | | | | | | | | | | | | | | |
| | | | 7 | SS | 9 | | 152 | | | ○ | | | 19.2 | 5 30 44 21 | |
| 152.5 | | | | | | | | | | | | | | | |
| 5.6 | | | | | | | | | | | | | | | |
| | | | 8 | SS | 84 | | 151 | | | ○ | | | 22.7 | | |
| | | | | | | | | | | | | | | | |
| | | | 9 | SS | 50/10 | | 150 | | | ○ | | | 22.3 | | |
| 149.5 | | | | | | | | | | | | | | | |
| 8.6 | | | | | | | | | | | | | | | |
| | | | 10 | SS | 53 | | 149 | | | ○ | | | 21.6 | | |
| 148.0 | | | | | | | | | | | | | | | |
| 10.1 | | | | | | | | | | | | | | | |
| 147.1 | | | 11 | SS | 50/15 | | 148 | | | | | | | | |
| 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 5
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 NATURAL MOISTURE CONTENT LIQUID LIMIT | | UNIT WEIGHT γ kN/m ³ | REMARKS & GRAIN SIZE DISTRIBUTION (%) |
|---------------|---|------------|---------|------|------------|----------------------------|-----------------|---|----------|--|-------------------|---|---|
| ELEV DEPTH | DESCRIPTION | STRAT PLOT | NUMBER | TYPE | "N" VALUES | | | 20 40 60 80 100 | 20 40 60 | W _P W W _L | WATER CONTENT (%) | | |
| 181.8 | Ground Surface | | | | | | | | | | | | |
| 161.5 | 100 mm Asphalt, over Sand and Gravel (FILL) light brown, damp, compact | | 1 | SS | 13 | | | | | | | | |
| 0.3 | | | 2 | SS | 17 | | 161 | | | | | 21.5 | |
| | very stiff | | 3 | SS | 9 | | 160 | | | | | 21.0 | |
| | Heterogeneous mixture of Clayey Silt, some sand, trace gravel, silty below 7.1 m (CLAYEY SILT TILL) grey | | 4 | SS | 9 | | 159 | | | | | 21.0 | |
| | | | 5 | SS | 12 | | 158 | | | | | 21.1 | 5 29 44 22 |
| | stiff | | 6 | SS | 22 | | 157 | | | | | 21.5 | |
| | very stiff | | 7 | SS | 14 | | 156 | | | | | | |
| | stiff | | 8 | SS | 23 | | 155 | | | | | | |
| 153.1 | | | 9 | SS | | | 154 | | | | | 3 22 61 14 | |
| 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 321-98-00 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 (%) |
|---------------|---|------------|---------|-------|------------|----------------------------|-----------------|---|-------------------|----------|---|---|
| ELEV DEPTH | DESCRIPTION | STRAT PLOT | NUMBER | TYPE | "N" VALUES | | | SHEAR STRENGTH kPa | | | | |
| | | | | | | | | 20 40 60 80 100 | 40 80 120 160 200 | 20 40 60 | | |
| 159.9 | Ground Surface | | | | | | | | | | | |
| 0.0 | 100 mm Asphalt, over | | 1 | SS | 50/15 | | | | | | | |
| 159.5 | Sand and Gravel (FILL) | | 2 | SS | 13 | | | | | | | |
| 0.4 | light brown, dry, very dense | | 3 | SS | 21 | | | | | | | |
| | Heterogeneous mixture of Clayey Silt, some sand, trace gravel, (CLAYEY SILT TILL) grey, stiff to very stiff | | 4 | SS | 15 | | | | | | | |
| | | | 5 | SS | 15 | | | | | | | |
| | | | 6 | SS | 13 | | | | | | | |
| | | | 7 | SS | 10 | | | | | | | |
| 154.7 | | 8 | SS | 21 | | | | | | | | |
| 5.2 | Heterogeneous mixture of Silt, some sand, occasional fine gravel, (SILTY SAND TILL) grey, wet, compact to dense | 9 | SS | 47 | | | | | | | | |
| 152.8 | | | | | | | | | | | | |
| 7.1 | SAND with some gravel and silt, grey, wet, very dense | 10 | SS | 70 | | | | | | | | |
| 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 | | | | | | | | |
| 150.0 | | 12 | SS | 60/3 | | | | | | | | |
| 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 | | | | | | | | | | | |

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 kN/m ³ | REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL |
|---------------|--|------------|---------|-------|------------|----------------------------|---|---|-----------------|-------------------------------|------------------------------------|-------------------------------------|-----------------------------------|--|--|
| ELEV DEPTH | DESCRIPTION | STRAT PLOT | NUMBER | TYPE | "N" VALUES | | | SHEAR STRENGTH kPa | | | | | | | |
| | | | | | | | | ○ UNCONFINED + FIELD VANE | 20 40 60 80 100 | | | | | | |
| 157.2 | Ground Surface | | | | | | ● POCKET PENETR. × LAB VANE <td colspan="2">40 80 120 160 200<td colspan="3">WATER CONTENT (%) 20 40 60</td><td></td><td></td></td> | 40 80 120 160 200 <td colspan="3">WATER CONTENT (%) 20 40 60</td> <td></td> <td></td> | | WATER CONTENT (%) 20 40 60 | | | | | |
| 0.0 | 100 mm Asphalt, over | | 1 | SS | 16 | 157 | | | | | | | 21.7 | | |
| 156.8 | Sand and Gravel (FILL) | | 2 | SS | 16 | 156 | | | | | | | | 22.6 | |
| 0.4 | light brown, damp, compact | | 3 | SS | 13 | 155 | | | | | | | | 22.6 | |
| | Heterogeneous mixture of Clayey Silt, some sand, trace gravel, (CLAYEY SILT TILL) grey, stiff to very stiff | | 4 | SS | 20 | 154 | | | | | | | | 22.5 | |
| 153.8 | | | 5 | SS | 55 | 153 | | | | | | | | 21.5 | |
| 3.4 | Inferred boulder at 3.7 m | | | | | 152 | | | | | | | 20.3 | 16 53 27 4 | |
| | Heterogeneous mixture of Sand with silt, some gravel, trace clay, (SILTY SAND TILL) occasional sand seams grey, moist to wet, dense | 6 | SS | 41 | 151 | | | | | | | | 22.4 | | |
| 151.6 | gravelly sand layer at 5.4 m | | | | | 150 | | | | | | | 22.6 | 8 55 31 6 | |
| 5.6 | Heterogeneous mixture of Clayey Silt, some sand, trace gravel, (CLAYEY SILT TILL) grey, hard | 7 | SS | 49 | 149 | | | | | | | | 22.7 | 6 62 29 3 | |
| 150.1 | | | | | | 148 | | | | | | | | | |
| 7.1 | Inferred boulder at 7.3 m | | | | | 147 | | | | | | | | | |
| | Heterogeneous mixture of Sand with silt, trace gravel, trace clay, (SILTY SAND TILL) moist to wet, grey, very dense | 8 | SS | 50/11 | | | | | | | | | | | |
| | | 9 | SS | 50/13 | | | | | | | | | | | |
| 146.4 | | | | | | | | | | | | | | | |
| 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 | | | | | | | | | | | | | | |



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 kN/m ³ | REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL |
|---------------------|---|-----------------------------|---------|------|------------|----------------------------|-----------------|--|--|------------------------------------|-------------------------------------|-----------------------------------|--|--|
| ELEV DEPTH | DESCRIPTION | STRAT PLOT | NUMBER | TYPE | "N" VALUES | | | SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● POCKET PENETR. x LAB VANE | | | | | | |
| 158.7 | Ground Surface | | | | | | | | | | | | | |
| 0.0 158.4 0.3 | 100 mm Asphalt, over Sand and Gravel (FILL) light brown, damp, very loose | | 1 | SS | 4 | | | | | | | | | |
| | Mixed Clayey Silt, with sand, occasional fine gravel (FILL) grey, stiff | | 2 | SS | 9 | | | | | | | | 20.0 | 2 28 46 24 |
| | | | 3 | SS | 10 | | | | | | | | 20.0 | |
| 156.8 | | | 4 | SS | 30 | | | | | | | | 22.8 | |
| 2.1 | | | 5 | SS | 35 | | | | | | | | 22.3 | |
| | | very stiff to hard brown | | | | | | | | | | | | |
| | | grey hard | 6 | SS | 42 | | | 225 | | | | | 22.8 | 4 39 43 14 |
| | Heterogeneous mixture of Clayey Silt, with sand, trace gravel, (CLAYEY SILT TILL) | | 7 | SS | 48 | | | | | | | | | |
| | | | 8 | SS | 50/13 | | | | | | | | | |
| 150.1 | | | | | | | | | | | | | | |
| 8.6 | SAND some silt, grey, wet, | | 9 | SS | 7 | | | | | | | | | |
| | | 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, x 3: Numbers refer to
Sensitivity

20
15 10 5
(%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 8

1 OF 1

METRIC

WP 321-98-00 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 | | 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 (%) |
| | | | | | | | | ○ UNCONFINED ● POCKET PENETR. | + FIELD VANE x LAB VANE | | | |
| 162.4 | Ground Surface | | | | | | 20 40 60 80 100 | W _P W W _L | | | | |
| 162.1 | 100 mm Asphalt, over Sand and Gravel (FILL) light brown, dry | | 1 | SS | 50/15 | ** | 162 | ○ | | | | |
| 0.3 | | | 2 | SS | 6 | | 161 | ○ | | | 2 84 11 3 | |
| | loose very loose | | 3 | SS | 3 | | 160 | ○ | | | | |
| 159.8 | Sand, some silt (FILL) brown, damp to moist | | 4 | SS | 10 | | 159 | ○ | | | | |
| 2.6 | Mixed Clayey Silt, trace sand, trace fine gravel, occasional cinder inclusions, grey, stiff (FILL) | | 5 | SS | 11 | | 158 | ○ | | 21.6 | | |
| 159.5 | | | 6 | SS | 15 | | 157 | ○ | | 19.3 | 2 33 46 19 | |
| 2.9 | | | 7 | SS | 11 | | 156 | ○ | | 20.0 | | |
| | 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 | | 155 | ○ | | 21.4 | | |
| | stiff to very stiff hard | | 9 | SS | 55 | | 154 | ○ | | 23.0 | | |
| | | | 10 | SS | 36 | | 153 | ○ | | 20.6 | | |
| | | | 11 | SS | 46 | | 152 | ○ | | | | |
| 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 | | | | | | | | | | | |



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 299 664.4 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.

| SOIL PROFILE | | | SAMPLES | | | GROUND WATER CONDITIONS | DYNAMIC CONE PENETRATION RESISTANCE PLOT | | | PLASTIC LIMIT W _p | NATURAL MOISTURE CONTENT W | LIQUID LIMIT W _L | UNIT WEIGHT γ kN/m ³ | REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL |
|---------------|--|------------|---------|------|------------|----------------------------|--|----|----|------------------------------------|-------------------------------------|-----------------------------------|--|--|
| ELEV DEPTH | DESCRIPTION | STRAT PLOT | NUMBER | TYPE | "N" VALUES | | SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● POCKET PENETR. × LAB VANE | | | | | | | |
| 164.0 | Ground Surface | | | | | | 20 | 40 | 60 | 80 | 100 | | | |
| 0.0 | 100 mm Asphalt, over | | | | | | | | | | | | | |
| 163.7 | Sand and Gravel (FILL), light brown, dry to damp, loose to compact | | 1 | SS | 10 | | | | | | | | | |
| 0.3 | | | 2 | SS | 23 | ** | | | | | | | 21.7 | |
| | Mixed Clayey Silt, trace sand, trace fine gravel, (FILL) brown to 1.4 m, grey below | | 3 | SS | 24 | | | | | | | | | |
| | very stiff 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 | | | | | | | | 21.7 | 7 31 44 18 |
| | | | 7 | SS | 14 | | | | | | | | 21.8 | |
| | | | 8 | SS | 16 | | | | | | | | | |
| 157.0 | SAND some silt, trace gravel, grey, wet very dense | | | | | | | | | | | | | |
| 155.4 | | | 10 | SS | 30 | | | | | | | | 21.9 | |
| 8.6 | Heterogeneous mixture of Clayey Silt with sand, trace gravel, (CLAYEY SILT TILL) grey, hard | | 11 | SS | 42 | | | | | | | | | 7 31 46 16 |
| 153.6 | | | | | | | | | | | | | | |
| 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, × ³: Numbers refer to
Sensitivity20
15
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 4 840 560.0; 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 | | UNIT WEIGHT γ kN/m ³ | REMARKS & GRAIN SIZE DISTRIBUTION (%) | | |
|---------------|--|------------|---------|------|------------|----------------------------|-----------------|---|------------------------------------|---|---|--|--|
| ELEV DEPTH | DESCRIPTION | STRAT PLOT | NUMBER | TYPE | "N" VALUES | | | SHEAR STRENGTH kPa | | | | | |
| 163.2 | Ground Surface | | | | | | | 20 40 60 80 100 | PLASTIC LIMIT W _P | NATURAL MOISTURE CONTENT W | LIQUID LIMIT W _L | | |
| 0.0 | 100 mm Asphalt, over | | 1 | SS | 17 | | | | | | | | |
| 162.8 | Sand and Gravel (FILL), light brown | | 2 | SS | 20 | | | | | | | | |
| 0.4 | damp, compact | | 3 | SS | 14 | | | | | | | | |
| | trace asphalt pieces | | 4 | SS | 21 | | | | | | | | |
| | asphalt | | 5 | SS | 26 | | | | | | | | |
| | Mixed Clayey Silt, some sand, | | 6 | SS | 28/3 | | | | | | | | |
| | trace to some gravel, with asphalt | | 7 | SS | 28/3 | | | | | | | | |
| | inclusions (FILL) | | 8 | SS | 24 | | | | | | | | |
| | stiff to hard | | 9 | SS | 30 | | | | | | | | |
| | gray to gray brown | | 10 | SS | 18 | | | | | | | | |
| 155.7 | | | 11 | SS | 40 | | | | | | | | |
| 7.5 | Heterogeneous mixture | | 12 | SS | 64 | | | | | | | | |
| | of Clayey Silt with sand, | | 13 | SS | 40 | | | | | | | | |
| | trace fine gravel, | | | | | | | | | | | | |
| | (CLAYEY SILT TILL) | | | | | | | | | | | | |
| | brown to 9.8 m, greyish brown below, | | | | | | | | | | | | |
| | hard | | | | | | | | | | | | |
| 152.8 | | | | | | | | | | | | | |
| 10.4 | End of borehole | | | | | | | | | | | | |
| | * Hole dry (not stabilized) and open to full | | | | | | | | | | | | |
| | depth on completion | | | | | | | | | | | | |

+³, X³: Numbers refer to
Sensitivity

20
15-10-5
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 | | UNIT WEIGHT γ kN/m ³ | REMARKS & GRAIN SIZE DISTRIBUTION (%) | | | | |
|---------------|---|------------|---------|------|------------|----------------------------|-----------------|---|-------------------------------|---|---|-------------------------------------|-----------------------------------|--|--|
| ELEV DEPTH | DESCRIPTION | STRAT PLOT | NUMBER | TYPE | "N" VALUES | | | SHEAR STRENGTH kPa | | | | WATER CONTENT (%) | | | |
| | | | | | | | | UNCONFINED ○ POCKET PENETR. | FIELD VANE + LAB VANE × | | | | | | |
| | | | | | | | | | | | | | | | |
| 160.5 | Ground Surface | | | | | 20 | 40 | 60 | 80 | 100 | PLASTIC LIMIT W _P | NATURAL MOISTURE CONTENT W | LIQUID LIMIT W _L | | |
| 160.4 0.1 | 0.1 m Topsoil | | 1 | SS | 18 | | | | | | | | | | |
| | very stiff | | 2 | SS | 49 | | | | | | | | | | |
| | hard | | 3 | SS | 65 | | | | | | | | | | |
| | Heterogeneous mixture of Clayey Silt with sand, trace to some gravel, (CLAYEY SILT TILL) brown to 2.1 m, grey below | | 4 | SS | 58 | | | | | | | | | | |
| | | | 5 | SS | 32 | | | | | | | | | | |
| | | | 6 | SS | 23 | | | | | | | | | | |
| | | | 7 | SS | 23 | | | | | | | | | | |
| | very stiff | | | | | | | | | | | | | | |
| | firm to stiff | | 8 | SS | 9 | | | | | | | | | | |
| 153.4 | | | | | | | | | | | | | | | |
| 7.1 | SAND with some gravel and silt, trace clay, grey, wet, compact | | 9 | SS | 12 | | | | | | | | | | |
| 151.8 | | | | | | | | | | | | | | | |
| 8.7 | Heterogeneous mixture of Sand with silt, some gravel, (SANDY SILT TILL) grey, very dense | | 10 | SS | 50/10 | | | | | | | | | | |
| | | | | | | | | | | | | | | | |
| 149.5 | | | 11 | SS | 50/13 | | | | | | | | | | |
| 11.0 | End of borehole * Water level at 4.9 m (not stabilized) and hole open to 7.1 m depth on completion | | | | | | | | | | | | | | |



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.

| SOIL PROFILE | | | SAMPLES | | | GROUND WATER CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION RESISTANCE PLOT | | | | PLASTIC LIMIT W _p | NATURAL MOISTURE CONTENT W | LIQUID LIMIT W _L | UNIT WEIGHT γ kN/m ³ | REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL |
|---------------|---|-----------------------|---------|------|------------|----------------------------|-----------------|---|-----------------------------|----------|--|------------------------------------|-------------------------------------|-----------------------------------|--|--|
| ELEV DEPTH | DESCRIPTION | STRAT PLOT | NUMBER | TYPE | "N" VALUES | | | SHEAR STRENGTH kPa | | | | | | | | |
| | | | | | | | | 20 40 60 80 100 | 40 80 120 160 200 | 20 40 60 | | | | | | |
| | | | | | | | | ○ UNCONFINED + FIELD VANE | ● POCKET PENETR. × LAB VANE | | | | | | | |
| 160.6 | Ground Surface | | | | | | | | | | | | | | | |
| 160.5 0.1 | 0.1 m Topsoil, | | 1 | SS | 21 | * | | | | | | | | 22.3 | | |
| | | | 2 | SS | 64 | | 160 | | | | | | | 22.7 | | |
| | | | 3 | SS | 51 | | 159 | | | | | | | 22.6 | 4 36 44 16 | |
| | | | 4 | SS | 22 | | 158 | | | | | | | 21.3 | | |
| | | very stiff to hard | 5 | SS | 22 | | 157 | | | | | | | 23.1 | 4 36 44 16 | |
| | | very stiff | 6 | SS | 17 | | 156 | | | | | | | 21.4 | | |
| | Heterogeneous mixture of Clayey Silt with sand, trace gravel, (CLAYEY SILT TILL) brown to 2.1 m, grey below | | 7 | SS | 15 | | 155 | | | | | | | 22.4 | | |
| | | hard | 8 | SS | 66 | | 154 | | | | | | | 22.8 | 6 38 37 19 | |
| 153.5 | | | | | | | 153 | | | | | | | 22.8 | 13 39 39 9 | |
| 7.1 | Heterogeneous mixture of Sand and silt, some gravel, trace clay, (SANDY SILT TILL) grey, very dense | | 9 | SS | 50/15 | | 152 | | | | | | | | | |
| | | | 10 | SS | 50/8 | | 151 | | | | | | | | | |
| 149.8 | | | 11 | SS | 50/10 | | 150 | | | | | | | 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
10
(%) STRAIN AT FAILURE

Appendix B

MTO Record of Borehole Sheets

FOUNDATION SECTION

ORIGINATED BY VK

COMPILED BY

CHECKED BY HL

[illegible]

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 3

FOUNDATION SECTION

JOB 71-110/0

LOCATION Co-ords. 877,294 N; 976,805 E

ORIGINATED BY VE

W.P. 276-65

BORING DATE July 1, 1971

COMPILED BY YN

DATUM Geodetic

BOREHOLE TYPE Auger & sample with Pundhill

CHECKED BY

| SOIL PROFILE | | | SAMPLES | | | DYNAMIC PENETRATION RESISTANCE | | LIQUID LIMIT | | BULK DENSITY | REMARKS | |
|--------------|-------|---|---------|------|------------|--------------------------------|----|--------------|----|--------------|---------|-----|
| ELEV. (m) | DEPTH | DESCRIPTION | NUMBER | TYPE | BLOWS/FOOT | 20 | 40 | 60 | 80 | | | 100 |
| 151.1 | 149.0 | Ground Level | | | | | | | | | | |
| | 149.0 | Surficial material - silty sand, compact | 1 | SS | 27 | | | | | | | |
| | 149.0 | 2.0 Het. mix. of clayey silt with sand & traces of gravel. Hard | 2 | SS | 100 | | | | | | | |
| | 149.0 | Brown | 3 | SS | 41 | | | | | | | |
| | 149.0 | Grey | 4 | SS | 38 | | | | | | | |
| 149.5 | 148.0 | Very stiff to hard | 5 | SS | 15 | | | | | | | |
| | 148.0 | Het. mix. of silt, sand & gravel, trace of clay | 6 | SS | 31 | | | | | | | |
| | 148.0 | Grey | 7 | SS | 67 | | | | | | | |
| | 148.0 | Compact to Very Dense | 8 | SS | 220 | | | | | | | |
| | 148.0 | Glacial Till | 9 | SS | 257 | | | | | | | |
| | 148.0 | (with shale fragments below el. 1470.) | 10 | SS | 100 | | | | | | | |
| 141.5 | 144.2 | Weathered Shale | 11 | SHL | 100 | | | | | | | |
| | 144.2 | Sound Shale Bedrock | 12 | BXL | 100 | | | | | | | |
| 138.7 | 142.9 | End of Borehole | 13 | BXL | 100 | | | | | | | |

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 5

FOUNDATION SECTION

JOB 71-11010

LOCATION Gr. and 877-285 N. 971, 740 E.

ORIGINATED BY VT

W.P. 276-65

BORING DATE June 30, 1971

COMPILED BY WK

DATUM Gneiss

BOREHOLE TYPE Auger & sample with Penet. II

CHECKED BY

| ELEV (m) | SOIL PROFILE | | SAMPLES | | | ELEV SCALE | DYNAMIC PENETRATION RESISTANCE | | LIQUID LIMIT | | BULK DENSITY | REMARKS |
|----------|--------------|---|-------------|--------|------|------------|--------------------------------|------------|---------------|---------------|--------------|-------------|
| | ELEV. DEPTH | DESCRIPTION | STRAT. UNIT | NUMBER | TYPE | | BLOWS / FOOT | RESISTANCE | WATER CONTENT | PLASTIC LIMIT | | |
| 157.5 | 157.0 | Ground Level | | | | | | | | | | |
| 150.6 | 150.0 | Artificial material | | | | | | | | | | |
| | 149.0 | Hot mix of clayey silt with sand and gravel | | 1 | SS | 70 | | | | | | 150.3 |
| 148.1 | 148.0 | Hard Gray | | 2 | SS | 34 | | | | | | |
| | 146.0 | Hot mix of silt, sand & gravel, trace of clay (thin seams or layers of clayey silt) | | 3 | SS | 45 | | | | | | |
| | 144.0 | Hot mix of silt, sand & gravel, trace of clay (thin seams or layers of clayey silt) | | 4 | SS | 20 | | | | | | 0.77 (23) |
| | 142.0 | Compact to Very Dense Glacial Till | | 5 | SS | 100 | | | | | | |
| 143.9 | 142.0 | Hot mix of clayey silt, sand & gravel | | 6 | SS | 200 | | | | | | 21.44 21.11 |
| | 140.0 | Hard Gray | | 7 | SS | 150 | | | | | | |
| 142.0 | 138.0 | Weathered Shale | | 8 | BXL | 100 | | | | | | |
| | 136.0 | Solid Shale | | 9 | BXL | 100 | | | | | | |
| 139.1 | 135.5 | End of Borehole | | 10 | BXL | 100 | | | | | | |
| | 130.5 | | | 11 | BXL | 100 | | | | | | |
| | 125.5 | | | 12 | BXL | 100 | | | | | | |

OFFICE REPORT ON SOIL EXPLORATION

JOB 71-11640

W.P. 276-65

DATUM Geodetic

ORIGINATED BY: VV

| ELEV (m) | 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. DEPTH | DESCRIPTION | STRAT. LOT | NUMBER | TYPE | | BLOWS/FOOT | 20 | 40 | 60 | 80 | 100 | w_p — w_L WATER CONTENT % 15 30 45 | | | |
| 151.5 | 497.0 | Ground Level | | | | | | | | | | | | | | |
| 149.8 | 491.5 | 0.0 Surficial material (silty sand with grav. & traces of clay) loose | | 1 | SS | 11 | | | | | | | | | P.C.F. GR. SA. SJ. CL. γ 1494.8 | |
| | 5.5 | Het. mix. of clayey silt with traces of sand & gravel; occ. layers of silt. Very Stiff to Hard Gray | | 2 | SS | 187 | 490 | | | | | | | | | |
| | | | | 3 | SS | 31 | | | | | | | | | | |
| 146.3 | 480.0 | Glacial Till | | 4 | SS | 216 | | | | | | | | | | |
| | 17.0 | Het. mix. of silt, sand & gravel, trace of clay. Very Dense | | 5 | SS | 10 | 480 | | | | | | | | | |
| | | | | 6 | SS | 58 | | | | | | | | | | |
| | | | | 7 | SS | 168 | 460 | | | | | | | | | |
| 143.3 | 470.0 | | | 8 | SS | 100 | 470 | | | | | | | | | |
| | 27.0 | Het. mix. of clayey silt with some sand & gravel. Hard | | 9 | SS | 111 | 450 | | | | | | | | | |
| 142.0 | 466.0 | | | 10 | BXL | 70% | | | | | | | | | | |
| | 31.0 | Weathered Shale | | 11 | BXL | 100% | | | | | | | | | | |
| 140.4 | 460.5 | Solid Shale Bedrock | | | | | | | | | | | | | | |
| | 36.5 | End of Borehole | | | | | 460 | | | | | | | | | |

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 7

JOB 71-11040

W. P. 276-65

DATUM Geodetic

ORIGINATED BY

COMPILED BY

CHECKED BY

| SOIL PROFILE | | SAMPLES | | | ELEV. SCALE | DYNAMIC PENETRATION RESISTANCE | | LIQUID LIMIT ——— w_L PLASTIC LIMIT ——— w_P WATER CONTENT ——— w | | BULK DENSITY P.C.F. | REMARKS | |
|--------------|-------------|--|------------|--------|-------------|--------------------------------|--------------|--|---|----------------------------|------------------------------------|-----------------------------|
| ELEV. (m) | ELEV. DEPTH | DESCRIPTION | STRAL PIOT | NUMBER | | TYPE | BLOWS / FOOT | SHEAR STRENGTH P.S.F. | | | | WATER CONTENT % 15 20 25 |
| | | | | | | | | 30 40 60 80 100 | • UNCONFINED • FIELD VANE • QUICK TRIAXIAL • LAB. VANE | | | |
| 151.4 | 496.7 | Ground Level | | | | | | | | | | |
| 149.9 | 491.7 | 0.0 Surficial Material (silty sand, some grav.) Compact. Brown | X | 1 | SS | 12 | | | | | GR. S&S CL ↓ 42.2 5 42 43 12 | |
| 149.6 | 484.2 | 5.0 Het. mix. of clayey silt with trace sand and gravel. Firm to Stiff Grey | X | 2 | SS | 9 | | | | | | |
| | | | X | 3 | SS | 5 | | | | | | |
| | | | X | 4 | SS | 20 | | | | | | |
| | 12.5 | Het. mix. of silt, sand & gravel, trace of clay. | X | 5 | SS | 60 | | | | | | |
| | | Glacial Till | | 6 | SS | 135.5" | | | | | | |
| | | Very Dense | | 7 | SS | 170.5" | | | | | | |
| 143.8 | 471.7 | Grey | | 8 | SS | 230.5" | | | | | | |
| | 25.0 | Het. mix. of clayey silt traces of sand & grav. | | 9 | SS | 130.6" | | | | | | |
| 141.3 | 463.7 | Hard. Grey | | 10 | SS | 100.7" | | | | | | |
| | 33.0 | Weathered & fractured Shale | | 10 | BXL | 100.7" | | | | | | |
| | 35.5 | Solid Shale | | 11 | BXL | 100.7" | | | | | | |
| 139.2 | 456.7 | End of Borehole | | | | | | | | | | |
| | 40.0 | | | | | | | | | | | |
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DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 1

FOUNDATION SECTION

JOB 71-11049

LOCATION Co-ords 877, 110 N. 974, 486 E.

ORIGINATED BY VS

W.P. 276-65

BORING DATE July 15, 1971

COMPILED BY

DATUM Geodetic

BOREHOLE TYPE Shore with diamond drill

CHECKED BY

[illegible]

DEPARTMENT OF HIGHWAYS, ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 11

FOUNDATION SECTION

JOB 71-11610

LOCATION Co. roads, 879, Old N. 971 749 E

ORIGINATED BY VK

W.P. 276-65

BORING DATE July 21, 1971

COMPILED BY VK

DATUM Goodetic

BOREHOLE TYPE Washbore with diamond drill

CHECKED BY

| ELEV. (m) | ELEV. DEPTH | SOIL PROFILE DESCRIPTION | STRAPELOT | SAMPLES | | | ELEV. SCALE | DYNAMIC PENETRATION RESISTANCE | | | | LIQUID LIMIT | | | BULK DENSITY | REMARKS |
|-----------|-------------|--|-----------|---------|------|------------|-------------|--------------------------------|----|----|----|--------------|----------------|----------------|--------------|---------|
| | | | | NUMBER | TYPE | BLOWS/FOOT | | BLOWS/FOOT | 20 | 40 | 80 | 100 | W _L | W _P | | |
| 151.9 | 0.0 | Ground Level | | | | | | | | | | | | | | |
| 150.5 | 0.8 | Surficial Material (silty sand with trace of gravel and clay) | | 1 | SS | 1 | | | | | | | | | | |
| | 1.5 | Het. mix. of clayey silt sand & grav. Brown Grey | | 2 | SS | 50 | | | | | | | | | | |
| 147.9 | 485.3 | | | 3 | SS | 105 | 490 | | | | | | | | | |
| | 13.0 | Het. mix. of silt, sand and gravel, trace of clay. Dense to Very Dense | | 4 | SS | 93 | | | | | | | | | | |
| | | | | 5 | SS | 113 | 480 | | | | | | | | | |
| | | | | 6 | SS | 55 | | | | | | | | | | |
| 142.7 | 468.3 | Glacial till | | 7 | SS | 107 | 470 | | | | | | | | | |
| | 30.0 | End of Borehole | | 8 | SS | 100 | 460 | | | | | | | | | |

492.0
12.36 42.10

18.47 (35)

RECORD OF BOREHOLE No. 13

FOUNDATION SECTION

LOCATION: Co-ords. 877, 319 N; 974, 269 E

ORIGINATED BY VK

W.P. 276-65

BORING DATE July 14, 1971

COMPILED BY

DATUM Node+10

BOREHOLE TYPE Washbor line with diamond drill

CHECKED BY

[illegible]

DEPARTMENT OF HIGHWAYS- ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 15

FOUNDATION SECTION

JOB 71-11249

LOCATION Co-ord. R77,327 N. 973,867 E.

ORIGINATED BY VT

W. P. 276-65

BORING DATE July 20, 1971

COMPILED BY

DATE Gedette

BOREHOLE TYPE Washbore with diamond drill

CHECKED BY

[illegible]

DESIGN SERVICES BRANCH

RECORD OF BOREHOLE NO 101

FOUNDATIONS OFFICE

JOB 72-11100

LOCATION Co-ords. 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 | | | | LIQUID LIMIT | | BULK DENSITY | REMARKS |
|--------------|---|------------|---------|------|------------|-------------|--|----|----|----|--------------|----------------|--------------|------------|
| ELEV. DEPTH | DESCRIPTION | STRAT. PLT | NUMBER | TYPE | BLOWS/FOOT | | 20 | 40 | 60 | 80 | 100 | W _p | | |
| 535.0 | Ground Level | | | | | | | | | | | | | |
| 535.0 | Fill Material | | | | | | | | | | | | | |
| 161.1 | Clayey silt, with some sand & gravel, trace of organics. Firm to stiff. | | 1 | SS | 9 | 530 | | | | | | | | 531.0 |
| 528.5 | | | 2 | SS | 14 | | | | | | | | | |
| 6.5 | | | 3 | SS | 77 | | | | | | | | | |
| | Brown Grey | | 4 | SS | 60/2" | 520 | | | | | | | | |
| | Het. mix. of clayey silt, some sand & trace of gravel. | | 5 | SS | 76 | | | | | | | | | |
| | (Glacial Till) | | 6 | SS | 61 | | | | | | | | | |
| | | | 7 | SS | 45 | 510 | | | | | | | | |
| 153.9 | Very stiff to Hard | | 8 | SS | 39 | | | | | | | | | |
| 505.0 | | | | | | | | | | | | | | |
| 153.6 | Silty sand. Very Dense. | | 9 | SS | 67 | 500 | | | | | | | | 7 42 40 11 |
| 501.5 | | | | | | | | | | | | | | |
| 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 | | | | LIQUID LIMIT | | | BULK DENSITY | REMARKS | |
|--------------|-------------|--------------|-------------|-----------------------------|------|------------|-------------|--------------------------------|----|----|---------------------|-----------------|-------------|--|--------------|---------|--|
| ELEV. (m) | ELEV. DEPTH | DESCRIPTION | STRAT. PLOT | NUMBER | TYPE | BLOWS/FOOT | | BLOWS / FOOT | | | | WATER CONTENT % | | | | | |
| | | | | | | | | 20 | 40 | 60 | 80 | 100 | Wp — W — Wl | | | | |
| | | | | | | | | SHEAR STRENGTH P.S.F. | | | | WATER CONTENT % | | | | | |
| | | | | O UNCONFINED + FIELD VANE | | | | 10 20 30 | | | P.C.F. GRISA SI. CL | | | | | | |
| | | | | ● QUICK TRIAXIAL * LAB VANE | | | | | | | | | | | | | |
| 163.1 | 535.0 | Ground Level | | | | | | | | | | | | | | | |
| | 0.0 | | | | | | | | | | | | | | | | |
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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 12

OFFICE REPORT ON SOIL EXPLORATION

| SOIL PROFILE | | | SAMPLES | | | ELEV. SCALE | DYNAMIC PENETRATION RESISTANCE | | | | LIQUID LIMIT — w_L | | | BULK DENSITY | REMARKS | |
|--------------|-------------|---------------------|-------------|--------|------|-------------|--------------------------------|--------------|----|----|----------------------|-----------------------|---------------------|------------------------|---------|--|
| ELEV. (M) | ELEV. DEPTH | DESCRIPTION | STRAT. PLOT | NUMBER | TYPE | | BLOWS/FOOT | BLOWS / FOOT | | | | PLASTIC LIMIT — w_p | | | | |
| | | | | | | | | 20 | 40 | 60 | 80 | 100 | WATER CONTENT — w | | | |
| | | | | | | | SHEAR STRENGTH P.S.F. | | | | WATER CONTENT % | | | | | |
| | | | | | | | ○ UNCONFINED + FIELD VANE | | | | w_p — w — w_L | | | | | |
| | | | | | | | ● QUICK TRIAXIAL × LAB VANE | | | | 10 20 30 | | | P.C.F. GR. SA. SI. CL. | | |
| 162.9 | 534.7 | Ground Level | | | | | | | | | | | | | | |
| | 0.0 | | | 1 | SS | 58 | | | | | | | | | | |
| | | | | 2 | SS | 48 | | | | | | | | | | |
| | | Brown | | 3 | SS | 44 | | | | | | | | | | |
| | | Grey | | 4 | SS | 30 | | | | | | | | | | |
| | | Het. mix. of clayey | | 5 | SS | 43 | | | | | | | | | | |
| | | silt, some sand and | | 6 | SS | 37 | | | | | | | | | | |
| | | trace of gravel. | | 7 | SS | 37 | | | | | | | | | | |
| | | (Glacial Till) | | 8 | SS | 30 | | | | | | | | | | |
| | | Very Stiff to Hard | | | | | | | | | | | | | | |
| 153.4 | 503.2 | | | 9 | SS | 77 | | | | | | | | | | |
| | 31.5 | End of Borehole | | | | | | | | | | | | | | |

20
15 ± 5 % STRAIN AT FAILURE
10

FOUNDATIONS : OFFICE

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

BORING DATE Sept. 7, 1972

BOREHOLE TYPE Auger and Cone Test

ORIGINATED BY VK

COMPILED BY VK

CHECKED BY:

OFFICE REPORT SOIL EXPLORATION

15 \pm 5 % STRAIN AT FAILURE

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

| SOIL PROFILE | | | SAMPLES | | | DYNAMIC PENETRATION RESISTANCE | | | | | LIQUID LIMIT | | | BULK DENSITY | REMARKS |
|--------------|-------|--|-------------|--------|------|--------------------------------|-------------|------------|----|----|--------------|----|-----|--------------|------------|
| ELEV. (m) | DEPTH | DESCRIPTION | STRAT. PLT. | NUMBER | TYPE | BLOWS/FOOT | ELEV. SCALE | BLOWS/FOOT | 20 | 40 | 60 | 80 | 100 | | |
| 162.7 | 533.8 | Ground Level | | | | | | | | | | | | | |
| | 0.0 | | | 1 | SS | 25 | 530 | | | | | | | | |
| | | | | 2 | SS | 29 | | | | | | | | | |
| | | Brown Grey | | 3 | SS | 77 | | | | | | | | | |
| | | Het. mix. of clayey silty | | 4 | SS | 37 | | | | | | | | | |
| | | some sand and trace of gravel. | | 5 | SS | 40 | | | | | | | | | |
| | | (glacial Till) | | 6 | SS | 34 | | | | | | | | | |
| | | | | 7 | SS | 30 | | | | | | | | | |
| 154.2 | 505.8 | Very Stiff to Hard | | 8 | SS | 32 | | | | | | | | | |
| 153.1 | 502.3 | Het. mix. of silty sand gravel & clay. Gray Very Dense | | 9 | SS | 64 | | | | | | | | | |
| | 31.5 | End of Borehole | | | | | | | | | | | | | 21.54 (25) |

OFFICE REPORT ON SOIL EXPLORATION

20
 15 \pm 5 % STRAIN AT FAILURE
 10

FOUNDATIONS OFFICE

JOB 72-11100

LOCATION Co-ords. 878,118 N; 980,101 E.

ORIGINATED BY: CSP

W.P. 218-65-01

BORING DATE August 23, 1972

COMPILED BY: VK

DATUM: Geodetic

BOREHOLE TYPE Auger and Cone Test

CHECKED BY _____

15.5 ²⁰ % STRAIN AT FAILURE
10

FOUNDATIONS OFFICE

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

BORING DATE Aug. 23, 1972

ORIGINATED BY GSP

BOREHOLE TYPE Auger and Cone Test

COMPILED BY VX .

CHECKED BY

15-20 % STRAIN AT FAILURE

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

ORIGINATED BY CST

DATUM Geodetic

BOREHOLE TYPE Auger and Cone Test

COMPILED BY VK

CHECKED BY

OFFICE REPORT ON SOIL EXPLORATION

| SOIL PROFILE | | SAMPLES | | | ELEV SCALE | DYNAMIC PENETRATION RESISTANCE | | LIQUID LIMIT | | BULK DENSITY | REMARKS |
|--------------|-------------|---|------------|--------|------------|--------------------------------|---------------------------------|-----------------------|-----------------|--------------|---------|
| ELEV. (m) | ELEV. DEPTH | DESCRIPTION | STRAT. PLT | NUMBER | TYPE | BLOWS/FOOT | BLOWS / FOOT 20 40 60 80 100 | SHEAR STRENGTH P.S.F. | WATER CONTENT % | | |
| 164.2 | 538.7 | Ground Level | | | | | | | | | |
| | 0.0 | | | 1 | SS | 50 | | | | | |
| | | | | 2 | SS | 48 | | | | | |
| | | | | 3 | SS | 48 | | | | | |
| | | Brown | | 4 | SS | 48 | | | | | |
| | | Grey | | 5 | SS | 25 | | | | | |
| | | Het. mix. of clayey silt, some sand and trace of gravel (Glacial Till) | | 6 | SS | 32 | | | | | |
| | | | | 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.

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

OFFICE REPORT ON SOIL EXPLORATION

| SOIL PROFILE | | SAMPLES | | | ELEV. SCALE | DYNAMIC PENETRATION RESISTANCE | | LIQUID LIMIT w_L | | BULK DENSITY γ | REMARKS |
|--------------|-------------|--|------------|--------|-------------|--------------------------------|---------------------------------|---------------------|-------------------|-----------------------|---------|
| ELEV. (m) | ELEV. DEPTH | DESCRIPTION | STRAT. PLT | NUMBER | TYPE | BLOWS/FOOT | BLOWS / FOOT 20 40 60 80 100 | PLASTIC LIMIT w_p | WATER CONTENT w | | |
| 165.4 | 542.6 | Ground Level | | | | | | | | | |
| | 0.0 | | | 1 | SS | 24 | | | | | |
| | | | | 2 | SS | 75 | | | | | |
| | | | | 3 | SS | 75 | | | | | |
| | | Brown Grey | | 4 | SS | 38 | | | | | |
| | | Het. mix. of clayey silt, some sand and trace of gravel (Glacial Till) | | 5 | SS | 24 | | | | | |
| | | | | 6 | SS | 70 | | | | | |
| | | | | 7 | SS | 32 | | | | | |
| | | | | 8 | SS | 42 | | | | | |
| | | Very Stiff to Hard | | 9 | SS | 42 | | | | | |
| 155.6 | 510.6 | | | 10 | SS | 25 | | | | | |
| | 32.0 | Het. mix. of silty sand gravel and clay | | 11 | SS | 59 | | | | | |
| | | | | 12 | SS | 80/6" | | | | | |
| | | Grey | | 13 | SS | 78 | | | | | |
| | | Very Dense | | 14 | SS | 100/3" | | | | | |
| 145.6 | 477.6 | | | | | | | | | | |
| | 65.0 | End of Borehole | | | | | | | | | |

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

ORIGINATED BY VK

DATUM Geodetic

BOREHOLE TYPE Auger and Cane Test

COMPILED BY VK

CHECKED BY

OFFICE REPORT ON 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 w_L WATER CONTENT % 10 20 30 | BULK DENSITY P.C.F. GR. SA. SI. GL. | REMARKS |
|--------------------|-------------|--|--------|------|-------------|---|--|--|---------|
| ELEV. (m) DEPTH | DESCRIPTION | STRAT. PLOT | NUMBER | TYPE | | | | | |
| 160.0 | 0.0 | Ground Level | | | | | | | |
| 158.2 | 1.8 | Fill Material Clayey silt, some sand & trace of organics. | | 1 | SS | 8 | | | |
| | 6.0 | | | 2 | SS | 33 | | | |
| | | | | 3 | SS | 50 | | | |
| | | Brown Grey | | 4 | SS | 46 | | | |
| | | Het. mix. of clayey silt, some sand and trace of gravel. (Glacial Till) | | 5 | SS | 36 | | | |
| | | | | 6 | SS | 36 | | | |
| | | | | 7 | SS | 50 | | | |
| 151.5 | 47.0 | | | 8 | SS | 56 | | | |
| | 28.0 | | | | | | | | |
| 149.2 | 10.8 | Silty sand | | 9 | SS | 17 | | | |
| | 35.5 | | | 10 | SS | 93 | | | |
| 147.4 | 12.6 | Stiff to Hard | | | | | | | |
| | 41.5 | End of Borehole | | | | | | | |

20
15 $\frac{1}{2}$ 9 % STRAIN AT FAILURE
10

DESIGN SERVICES BRANCH

RECORD OF BOREHOLE N^o 122

FOUNDATIONS OFFICE

JOB 72-11100

LOCATION Co-ords. 877,658 N; 976,030 E.

W.P. 218-65-01

BORING DATE Sept. 5, 1972

ORIGINATED BY VK

DATUM Geodetic

BOREHOLE TYPE Auger and Cone Test

COMPILED BY VK

CHECKED BY

| SOIL PROFILE | | | SAMPLIES | | | 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 | PLASTIC LIMIT | WATER CONTENT | | |
| | | | | | | | SHEAR STRENGTH P.S.F. | | | | | W _p — W — W _L | | | | |
| | | | | | | | ○ UNCONFINED + FIELD VANE | | | | | WATER CONTENT % | | | | |
| | | | | | | | ● QUICK TRIAXIAL X LAB VANE | | | | | 10 20 30 | | | | |
| ELEV. (m) 154.8 | 508.0 | Ground Level | | | | | | | | | | | | γ | P.C.F. | GR. SA. SI. CL. |
| | 0.0 | | | | | | | | | | | | | | | 506.0 |
| | | | | | | | | | | | | | | | | |
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OFFICE REPORT ON SOIL EXPLORATION

20
15 5 % STRAIN AT FAILURE
10

ORIGINATED BY TE

COMPILED BY W.

CHECKED BY

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

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 VK

DATUM Geodetic

BOREHOLE TYPE Auger and Cone Test

COMPILED BY VK

CHECKED BY

OFFICE REPORTING SOIL EXPLORATION

| SOIL PROFILE | | | SAMPLES | | | ELEV. SCALE | DYNAMIC PENETRATION RESISTANCE | | | | | LIQUID LIMIT — W _L PLASTIC LIMIT — W _P WATER CONTENT — W | | | BULK DENSITY γ P.C.P. | REMARKS | |
|--------------|-------------|--------------|-------------|--------|------|-------------|--------------------------------|---------------------------------|--|--|--|--|---|--|-----------------------------|---------|-----------------------------|
| ELEV. (m) | ELEV. DEPTH | DESCRIPTION | STRAT. PLOT | NUMBER | TYPE | | BLOWS/FOOT | BLOWS / FOOT 20 40 60 80 100 | | | | | SHEAR STRENGTH P.S.F. ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE | | | | WATER CONTENT % 10 20 30 |
| 159.7 | 524.0 | Ground Level | | | | | | | | | | | | | | | |
| | 0.0 | | | | | | | | | | | | | | | | |
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20
15 5 % STRAIN AT FAILURE
10

DESIGN SERVICES BRANCH

RECORD OF BOREHOLE NO 126

FOUNDATIONS OFFICE

JOB 72-11100

LOCATION Co-ords. 877,510 N; 975,078 E.

W.P. 218-65-01

BORING DATE Sept. 5, 1972

ORIGINATED BY VK

DATUM Geodetic

BOREHOLE TYPE Auger and Cone Test

COMPILED BY VK

CHECKED BY

OFFICE REPORT ON SOIL EXPLORATION

| SOIL PROFILE | | | SAMPLES | | | ELEV. SCALE | DYNAMIC PENETRATION RESISTANCE | | | | | LIQUID LIMIT w_L | | | BULK DENSITY | REMARKS |
|--------------|-------------|--|-------------|--------|------|-------------|--------------------------------|----|----|----|----|--------------------|---------------------|-------------------|--------------|---------|
| ELEV. (m) | ELEV. DEPTH | DESCRIPTION | STRAT. PLOT | NUMBER | TYPE | | BLOWS / FOOT | 20 | 40 | 60 | 80 | 100 | PLASTIC LIMIT w_p | WATER CONTENT w | | |
| 154.8 | 517.7 | Ground Level | | | | | | | | | | | | | | |
| | 0.0 | | | | | | | | | | | | | | | |
| | | | | 1 | SS | | 43 | | | | | | | | | |
| | | | | 2 | SS | | 53 | | | | | | | | | |
| | | | | 3 | SS | | 52 | | | | | | | | | |
| | | Brown Grey | | 4 | SS | | 38 | | | | | | | | | |
| | | | | 5 | SS | | 46 | | | | | | | | | |
| | | Het. mix. of clayey silt, some sand and trace of gravel. | | 6 | SS | | 68 | | | | | | | | | |
| | | (Glacial Till) | | 7 | SS | | 60/4" | | | | | | | | | |
| | | | | 8 | SS | | 60/4" | | | | | | | | | |
| | | Hard | | 9 | SS | | 87 | | | | | | | | | |
| | | | | 10 | SS | | 21 | | | | | | | | | |
| | | Silty sand | | 11 | SS | | 95 | | | | | | | | | |
| | | | | 12 | SS | | 97 | | | | | | | | | |
| | | End of Borehole | | | | | | | | | | | | | | |

20
15 \diamond 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

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 P.C.F. GR SA SI CL | REMARKS |
|--------------|-------------|---|-------------|--------|-------------|--|----|----|----|----|--|-------|-----|--|---------|
| ELEV. (m) | ELEV. DEPTH | DESCRIPTION | STRAT. PLOT | NUMBER | TYPE | BLOWS/FOOT | 20 | 40 | 60 | 80 | 100 | w_p | w | w_L | |
| 151.8 | 498.0 | Ground Level | | | | | | | | | | | | | |
| | 0.0 | | | 1 | SS | 7 | | | | | | | | | |
| | | Brown Grey | | 2 | SS | 34 | | | | | | | | | |
| | | Het. mix. of clayey silt, some sand and trace of gravel. (Glacial Till) | | 3 | SS | 60/71 | | | | | | | | | |
| | | Firm to Hard | | 4 | SS | 38 | | | | | | | | | |
| 144.5 | 480.5 | | | 5 | SS | 46 | | | | | | | | | |
| | 17.5 | Het. mix. of silty sand gravel and clay. Grey | | 6 | SS | 40 | | | | | | | | | |
| | | | | 7 | SS | 72 | | | | | | | | | |
| 143.2 | 471.5 | Dense to Very Dense | | 8 | SS | 60/70 | | | | | | | | | |
| | 26.5 | End of Borehole | | | | | | | | | | | | | |

20
15 \div 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

| SOIL PROFILE | | SAMPLES | | | ELEV. SCALE | DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT | | | | | LIQUID LIMIT — w_L PLASTIC LIMIT — w_p WATER CONTENT — w | | | BULK DENSITY γ P.C.F. GR. SA. SI. G. | REMARKS | | |
|--------------|----------------|-------------------------|-------------|--------|-------------|--|------------|--|--|--|--|--|---------------------|---|---------|--|--|
| ELEV. (m) | ELEV. DEPTH | DESCRIPTION | STRAT. PLOT | NUMBER | | TYPE | BLOWS/FOOT | SHEAR STRENGTH P.S.F. | | | | | WATER CONTENT % | | | | |
| | | | | | | | | | | | | | | | | | |
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| | | | | | | | | 20 40 60 80 100 | | | | | w_p — w — w_L | | | | |
| | | | | | | | | ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE | | | | | | | | | |
| | | | | | | | | | | | | | 10 20 30 | | | | |
| 151.7 | 0.0 | Ground Level | | | | | | | | | | | | | | | |
| | | Brown | | 1 | SS | 7 | | | | | | | | | | | |
| | | Grey | | 2 | SS | 106 | | | | | | | | | | | |
| | | Het. mix. of clayey | | 3 | SS | 34 | | | | | | | | | | | |
| | | silt, some sand and | | 4 | SS | 32 | | | | | | | | | | | |
| | | trace of gravel | | | | | | | | | | | | | | | |
| | | (Glacial Till) | | | | | | | | | | | | | | | |
| 147.1 | 142.7 | Firm to Hard | | 5 | SS | 28 | | | | | | | | | | | |
| | 15.0 | Het. mix. of silty sand | | 6 | SS | 71 | | | | | | | | | | | |
| | | gravel and clay. | | | | | | | | | | | | | | | |
| | | Grey | | 7 | SS | 60 | | | | | | | | | | | |
| 145.0 | 175.7 | Correct to Very Dense | | | | | | | | | | | | | | | |
| | 22.0 | End of Borehole | | | | | | | | | | | | | | | |
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OFFICE REPORT ON SOIL EXPLORATION

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE NO 129

JOB 72-11100

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

ORIGINATED BY VE

W.P. 218-65-01

BORING DATE Sept. 6, 1972

COMPILED BY TK

DATUM Geodetic

BOREHOLE TYPE Auger and Cone Test

CHECKED BY AB

| SOIL PROFILE | | | SAMPLES | | | ELEV. SCALE | DYNAMIC PENETRATION RESISTANCE | | LIQUID LIMIT | | BULK DENSITY | REMARKS |
|--------------|-------|---|-------------|--------|------|-------------|--------------------------------|-----------------------------|---------------------------------|---------------------------------|--------------|--------------|
| ELEV. (ft) | DEPTH | DESCRIPTION | STRAT. PLT. | NUMBER | TYPE | | BLOWS/FOOT | BLOWS / FOOT | PLASTIC LIMIT | WATER CONTENT | | |
| 157.3 | 496.5 | Ground Level | | | | | | 20 40 60 80 100 | W _p — W _L | W _p — W _L | | |
| | | | | | | | | SHEAR STRENGTH P.S.F. | | WATER CONTENT % | | |
| | | | | | | | | O UNCONFINED + FIELD VANE | | W _p — W _L | | |
| | | | | | | | | X QUICK TRIAXIAL X LAB VANE | | 10 20 30 | | |
| 149.2 | 489.5 | Fill Material | X | 1 | SS | 2 | 490 | | | | | GR: A, S, CL |
| | | Silty sand and trace of clay and organics | X | 2 | SS | 25 | | | | | | |
| 149.2 | 489.5 | Very Loose to Loose | X | 3 | SS | 35 | | | | | | |
| | | Mixture of clayey silt, some sand and trace of gravel | X | 4 | SS | 51 | | | | | | |
| | | (Glacial Till) | X | 5 | SS | 71 | 480 | | | | | |
| | | Grey | X | 6 | SS | 56 | | | | | | 6 to 43 18 |
| 144.5 | 474.0 | Hard | X | 7 | SS | 92 | | | | | | |
| | 22.5 | End of Borehole | | | | | 470 | | | | | |

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

| 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 w_L | WATER CONTENT % 10 20 30 | BULK DENSITY γ | REMARKS |
|--------------|-------------|---|------------|--------|------|-------------|---|---|-----------------------------|--------------------------|---------|
| ELEV. (m) | ELEV. DEPTH | DESCRIPTION | STRAT. PLT | NUMBER | TYPE | | | | | | |
| 155.5 | 0.0 | Ground Level | | | | | | | | | |
| | 0.0 | Het. mix. of clayey silt, some sand and trace of gravel. (Glacial Till) | | 1 | SS | 16 | | | | | |
| | | | | 2 | SS | 25 | | | | | |
| | | | | 3 | SS | 42 | | | | | |
| | | | | 4 | SS | 89 | | | | | |
| | | | | 5 | SS | 60 1/4 | | | | | |
| | | Brown Gray | | 6 | SS | 70 | | | | | |
| | | | | 7 | SS | 98 | | | | | |
| | | Very Stiff to Hard | | 8 | SS | 101 | | | | | |
| 146.7 | 181.2 | End of Borehole | | | | | | | | | |
| | 29.0 | | | | | | | | | | |

OFFICE REPORT ON SOIL EXPLORATION

20
15 \diamond 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 MT

W.P. 218-55-01

BORING DATE May 6, 1971

COMPILED BY WA

DATUM Geodetic

BOREHOLE TYPE Diamond Drill, washboring, BX Casing

CHECKED BY 6

| SOIL PROFILE | | | SAMPLES | | | ELEV. SCALE | DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT | | LIQUID LIMIT — W _L PLASTIC LIMIT — W _P WATER CONTENT — W ₁ — W ₂ — W ₃ | | BULK DENSITY P.C.F. | REMARKS |
|--------------|----------------|--|-------------|--------|------|-------------|--|--|---|--|---------------------------|---------|
| ELEV. (M) | ELEV. DEPTH | DESCRIPTION | STRAT. PLOT | NUMBER | TYPE | | SHEAR STRENGTH P.S.F. ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL * LAB. VANE | | WATER CONTENT % 10 20 30 | | | |
| 160.0 | 525.0 | Ground Level | | | | | | | | | | |
| | 0.0 | Net mix of clayey silt, fine sand and trace of gravel. (Glacial Till) Very Stiff to Hard | | 1 | SS | 47 | | | | | | |
| | | | | 2 | SS | 33 | | | | | | |
| | | | | 3 | SS | 26 | | | | | | |
| | | | | 4 | SS | 57 | | | | | | |
| | | Brown Grey | | 5 | SS | 39 | | | | | | |
| | | | | 6 | SS | 22 | | | | | | |
| | | | | 7 | SS | 24 | | | | | | |
| | | | | 8 | SS | 41 | | | | | | |
| 162.3 | 493.0 | | | 9 | SS | 150 | 6" | | | | | |
| | 32.0 | 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 | End of Borehole | | | | | | | | | | |

20
15 5 % STRAIN AT FAILURE
10

FOUNDATIONS OFFICE

LOCATION Co-ords. 878,147 N; 979,358 E.

BORING DATE August 24, 1972

BOREHOLE TYPE Auger and Cone Test

ORIGINATED BY CSP

COMPILED BY: VK

CHECKED BY _____

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

DESIGN SERVICES BRANCH

RECORD OF BOREHOLE NO. 111

FOUNDATIONS OFFICE

JOB 72-11100 LOCATION Co-ords. 878,099 N; 979,165 E.
W.P. 18-65-01 BORING DATE August 25, 1972
DATUM Geodetic BOREHOLE TYPE Auger and Cone Test

ORIGINATED BY DSP
COMPILED BY VK
CHECKED BY

OFFICE REPORT ON SOIL EXPLORATION

ELEV.
(m)

166.8

SOIL PROFILE

ELEV.
DEPTH

547.4

DESCRIPTION

Ground Level.

STRAT. PLT

SAMPLES

NUMBER

TYPE

BLOWS/FOOT

ELEV. SCALE

DYNAMIC PENETRATION RESISTANCE
BLOWS / FOOT

20 40 60 80 100

SHEAR STRENGTH: P. 5 F.

O UNCONFINED + FIELD VANE

X QUICK TRIAXIAL X LAB VANE

LIQUID LIMIT — W_L

PLASTIC LIMIT — W_P

WATER CONTENT — W₁

W_P W_L W₁

WATER CONTENT %

10 20 30

BULK
DENSITY

REMARKS

0.0

Brown
Grey

Het. mix. of clayey silty
some sand and trace
of gravel.

(Glacial Till)

Very Stiff to Hard

1

SS

36

2

SS

81

3

SS

73

4

SS

71 1/2"

5

SS

31

6

SS

51

7

SS

74

8

SS

71

9

SS

60

10

SS

33

11

SS

30

12

SS

19

13

SS

61

14

SS

50 1/2"

15

SS

60 2/5"

Het. mix. of silty
sand, gravel & clay.

Grey

Very Dense

511.2

154.4

506.4

41.6

145.5

477.4

70.0

End of Borehole

470

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.

W.P. 218-65-01

BORING DATE Aug. 25, 1972

ORIGINATED BY CSP

DATUM Geodetic

BOREHOLE TYPE Auger and Cone Test

COMPILED BY VK

CHECKED BY

| SOIL PROFILE | | | SAMPLES | | | ELEV. SCALE | DYNAMIC PENETRATION RESISTANCE | | | | LIQUID LIMIT | | BULK DENSITY | REMARKS |
|--------------|-------------|--------------|-------------|--------|------|-------------|--------------------------------|----|----|-----|---------------------------------|----------------|--------------|---------|
| ELEV. (m) | ELEV. DEPTH | DESCRIPTION | STRAT. PLAT | NUMBER | TYPE | | BLOWS / FOOT | | | | W _L | W _P | | |
| 167.2 | 550.3 | Ground Level | | | | | 20 | 40 | 60 | 100 | WATER CONTENT | | | |
| | 0.0 | | | | | | SHEAR STRENGTH, P.S.F. | | | | W _p - W _L | | | |
| | | | | | | | ○ UNCONFINED + FIELD VANE | | | | W _p - W _L | | | |
| | | | | | | | ● QUICK TRIAXIAL x LAB VANE | | | | WATER CONTENT % | | | |
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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]

OFFICE REPORT ON SOIL EXPLORATION

| SOIL PROFILE | | SAMPLES | | | DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT | | | | LIQUID LIMIT — w_L PLASTIC LIMIT — w_p WATER CONTENT — w | | | | BULK DENSITY γ | REMARKS |
|--------------|----------------|--|-------------|--------|--|------------|-------------|--|--|--|--|--|-----------------------------|------------|
| ELEV. (m) | ELEV. DEPTH | DESCRIPTION | STRAT. PLOT | NUMBER | TYPE | BLOWS/FOOT | ELEV. SCALE | SHEAR STRENGTH, P.S.F. ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE | WATER CONTENT % 10 20 30 | | | | P.C.F. | |
| 168.2 | 552.0 | Ground Level | | | | | | | | | | | | |
| | 0.0 | | | 1 | SS | 24 | 550 | | | | | | | |
| | | Brown Grey | | 2 | SS | 38 | | | | | | | | |
| | | Het. mix. of clayey silt, some sand and trace of gravel. | | 3 | SS | 39 | | | | | | | | |
| | | (Glacial Till) | | 4 | SS | 35 | 540 | | | | | | | 5.11.6 |
| | | Very Stiff to Hard | | 5 | SS | 27 | | | | | | | | |
| | | | | 6 | SS | 32 | | | | | | | | |
| | | | | 7 | SS | 36 | 530 | | | | | | | |
| | | | | 8 | SS | 20 | | | | | | | | |
| 158.8 | 521.0 | | | 9 | SS | 32 | | | | | | | | |
| 158.2 | 519.0 | Silty sand | | 10 | SS | 31 | 520 | | | | | | | 0.34.17.19 |
| | 33.0 | | | 11 | SS | 26 | | | | | | | | |
| | | | | 12 | SS | 16 | | | | | | | | |
| | | | | 13 | SS | 27 | 510 | | | | | | | |
| 154.5 | 507.0 | | | 14 | SS | 31 | | | | | | | | |
| | 45.0 | | | 15 | SS | 25 | | | | | | | | 0.26.12.38 |
| | | Het. mix. of sandy silt, clay and gravel. | | 16 | SS | 1(3) 5" | 500 | | | | | | | |
| | | | | 17 | SS | 75/4" | | | | | | | | |
| | | Grey | | | | | 490 | | | | | | | |
| | | Compact to Very Dense | | 18 | SS | 147 | | | | | | | | |
| | | | | | | | 480 | | | | | | | |
| 144.2 | 473.2 | | | | | | | | | | | | | |
| 78.8 | | Bedrock - Shale with limestone layers. | | 19 | RO RIL | 95% | 470 | | | | | | | |
| 142.7 | 468.2 | Dark Grey | | 20 | RO RIL | 100% | | | | | | | | |
| 83.8 | | End of Borehole | | | | | 460 | | | | | | | |

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

| 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 $w_p \quad w \quad w_L$ | BULK DENSITY γ P.C.F. | REMARKS |
|--------------|-------------|--------------------------|------------|-------------|---|---|------------------------------------|---------|
| ELEV. (m) | ELEV. DEPTH | DESCRIPTION | STRAT. PLT | | | | | |
| 168.3 | 552.2 | Ground Level | | | | | | |
| | 0.0 | | | 550 | | | | |
| | | | 1 | SS | 29 | | | |
| | | | 2 | SS | 27 | | | |
| | | Brown | 3 | SS | 41 | | | |
| | | Grey | 4 | SS | 23 | | | |
| | | Het. mix. of clayey | 5 | SS | 20 | | | |
| | | silt, some sand and | 6 | SS | 16 | | | |
| | | trace of gravel. | 7 | SS | 17 | | | |
| | | (Glacial Till) | 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 | | | |
| | 47.9 | Het. mix. of silty sand, | 16 | SS | 80 | | | |
| | | gravel and clay. | 17 | SS | 97 | | | |
| | | Grey | | | | | | |
| | | Very Dense | 18 | SS | 100 5" | | | |
| 145.5 | 477.2 | | | | | | | |
| | 75.0 | End of Borehole | | | | | | |

20
15 \pm 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: CSP

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 BLOWS / FOOT | | | | | LIQUID LIMIT — w_L PLASTIC LIMIT — w_p WATER CONTENT — w | | | BULK DENSITY γ P.C.F. | REMARKS |
|--------------------|--|------------|---------|------|------------|-------------|--|----|----|----|-----|--|-----|-------|------------------------------------|---------|
| ELEV. DEPTH (m) | DESCRIPTION | STRAT. PLT | NUMCER | TYPE | BLOWS/FOOT | | 20 | 40 | 60 | 80 | 100 | w_p | w | w_L | | |
| 168.5 | 552.7 | | | | | | | | | | | | | | | |
| 0.0 | Ground Level | | | | | | | | | | | | | | | |
| | | | 1 | SS | 40 | 550 | | | | | | | | | | |
| | | | 2 | SS | 43 | | | | | | | | | | | |
| | Brown Grey | | 3 | SS | 65 | | | | | | | | | | | |
| | Het. mix. of clayey silt, some sand and trace of gravel. | | 4 | SS | 47 | 540 | | | | | | | | | | |
| | (Glacial Till) | | 5 | SS | 18 | | | | | | | | | | | |
| | Stiff to Hard | | 6 | SS | 15 | 530 | | | | | | | | | | |
| | | | 7 | SS | 13 | | | | | | | | | | | |
| | | | 8 | SS | 19 | 520 | | | | | | | | | | |
| | | | 9 | SS | 13 | | | | | | | | | | | |
| | | | 10 | SS | 24 | | | | | | | | | | | |
| | | | 11 | SS | 26 | | | | | | | | | | | |
| | | | 12 | SS | 29 | 510 | | | | | | | | | | |
| 154.1 | 505.1 | | 13 | SS | 14 | | | | | | | | | | | |
| 147.0 | | | | | | | | | | | | | | | | |
| | Het. mix. of silty sand gravel and clay. | | 14 | SS | 27 | 500 | | | | | | | | | | |
| | Grey | | 15 | SS | 98 | | | | | | | | | | | |
| | Compact to Very Dense | | | | | 490 | | | | | | | | | | |
| | | | | | | 480 | | | | | | | | | | |
| 145.0 | 475.7 | | | | | | | | | | | | | | | |
| 77.0 | End of Borehole | | | | | 470 | | | | | | | | | | |

20
15 \div 5 % STRAIN AT FAILURE
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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

ORIGINATED BY: SP

DATUM: Geodetic

BOREHOLE TYPE: Auger and Cone Test

COMPILED BY: UK

CHECKED BY: 10

OFFICE REPORT SOIL EXPLORATION

| SOIL PROFILE | | SAMPLES | | | ELEV. SCALE | DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT | | | | | LIQUID LIMIT w_L | | | BULK DENSITY | REMARKS |
|--------------|-------------|--|------------|--------|-------------|--|----|----|----|----|--------------------|---------------------|-------------------|--------------|---------|
| ELEV. (m) | ELEV. DEPTH | DESCRIPTION | STRAT. PLT | NUMBER | TYPE | BLOWS/FOOT | 20 | 40 | 60 | 80 | 100 | PLASTIC LIMIT w_p | WATER CONTENT w | | |
| 166.3 | 545.5 | Ground Level | | | | | | | | | | | | | |
| | 0.0 | | | 1 | SS | 29 | | | | | | | | | |
| | | Brown Grey | | 2 | SS | 34 | | | | | | | | | |
| | | | | 3 | SS | 60 | | | | | | | | | |
| | | Het. mix. of clayey silt, some sand and trace of gravel. | | 4 | SS | 17 | | | | | | | | | |
| | | (Glacial Till) | | 5 | SS | 24 | | | | | | | | | |
| | | | | 6 | SS | 13 | | | | | | | | | |
| | | Stiff to Hard | | 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. | | 12 | SS | 16 | | | | | | | | | |
| | | Grey | | 13 | SS | 20 | | | | | | | | | |
| 149.4 | 490.0 | Compact to Very Dense | | 14 | SS | 100/6" | | | | | | | | | |
| | 55.5 | End of Borehole | | | | | | | | | | | | | |

20
15 \pm 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

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

20
15 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

| SOIL PROFILE | | SAMPLES | | | ELEV. SCALE | DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT | | | | | LIQUID LIMIT w_L PLASTIC LIMIT w_p WATER CONTENT w | | | BULK DENSITY γ P.C.F. | REMARKS |
|--------------|-------|--|------------|--------|-------------|--|----|----|----|----|--|-------|-----|------------------------------------|---------|
| ELEV. (m) | DEPTH | DESCRIPTION | STRAT. PLT | NUMBER | TYPE | BLOWS/FOOT | 20 | 40 | 60 | 80 | 100 | w_p | w | w_L | |
| 165.2 | 542.0 | Ground Level | | | | | | | | | | | | | |
| | 0.0 | | | 1 | SS | 20 | | | | | | | | | |
| | | | | 2 | SS | 34 | | | | | | | | | |
| | | Brown Grey | | 3 | SS | 27 | | | | | | | | | |
| | | Het. mix. of clayey silt, some sand and trace of gravel. | | 4 | SS | 18 | | | | | | | | | |
| | | (Glacial Till) | | 5 | SS | 29 | | | | | | | | | |
| | | | | 6 | SS | 14 | | | | | | | | | |
| | | Stiff to Hard | | 7 | SS | 17 | | | | | | | | | |
| | | | | 8 | SS | 25 | | | | | | | | | |
| | | | | 9 | SS | 22 | | | | | | | | | |
| | | | | 10 | SS | 19 | | | | | | | | | |
| | | | | 11 | SS | 22 | | | | | | | | | |
| 153.0 | 502.0 | | | 12 | SS | 12 | | | | | | | | | |
| 151.0 | 499.0 | Silty Sand | | 13 | SS | 113 | | | | | | | | | |
| 148.7 | 488.0 | | | 14 | SS | 100 | | | | | | | | | |
| | 54.0 | End of Borehole | | | | | | | | | | | | | |

20
15 \pm 5 % STRAIN AT FAILURE
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ORIGINATED BY VK

COMPILED BY VK

CHECKED BY

15 ²⁰ 5 % STRAIN AT FAILURE
10

OFFICE REPORT SOIL EXPLORATION

JOB 72-11100

LOCATION Co-ords. 677,652 N; 976,398 E.

W F. 218-65-01

BORING DATE August 31, 1972

DATUM Geodetic

• BOREHOLE TYPE Auger and Cone Test

ORIGINATED BY FX

COMPILED BY _____ VIK

CHECKED BY 42

15 \pm 5 % STRAIN AT FAILURE

DESIGN SERVICES BRANCH

RECORD OF BOREHOLE NO 132 (B.H. 4, 71-11038)

FOUNDATIONS OFFICE

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

| 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 | PLASTIC LIMIT | WATER CONTENT | | |
| 162.5 | 53.0 | Ground Level | | | | | | | | | | |
| 0.0 | | Het. mixture of clayey silt with some sand and traces of gravel. | | 1 | SS | 47 | | | | | | |
| | | | | 2 | SS | 37 | | | | | | |
| | | | | 3 | SS | 60 | | | | | | |
| | | | | 4 | SS | 30 | | | | | | |
| | | | | 5 | SS | 40 | | | | | | |
| | | Very Stiff to Hard | | 6 | SS | 29 | | | | | | |
| | | (Glacial Till) | | 7 | SS | 35 | | | | | | |
| | | | | 8 | SS | 63 | | | | | | |
| | | | | 9 | SS | 92 | | | | | | |
| | | | | 10 | SS | 57 | | | | | | |
| | | | | 11 | SS | 114 | | | | | | |
| | | | | 12 | SS | 100.5 | | | | | | |
| | | | | 13 | SS | 116 | | | | | | |
| | | | | 14 | SS | 175.6 | | | | | | |
| 141.5 | 161.3 | Fragments of shale | | 15 | SS | 150.13 | | | | | | |
| 68.7 | | End of Borehole | | | | | | | | | | |

20
15 5 % STRAIN AT FAILURE
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ORIGINATED BY VI

COMPILED BY HS

CHECKED BY

15 ²⁰ 5. % 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.

ORIGINATED BY VS

W.P. 218-65-01

BORING DATE May 31 and June 1, 1971

COMPILED BY HS

DATUM Geodetic

BOREHOLE TYPE Power Auger-Washboring-BX Casing-BX Rock Core

CHECKED BY

| SOIL PROFILE | | SAMPLES | | DYNAMIC PENETRATION RESISTANCE | | LIQUID LIMIT | | BULK DENSITY | REMARKS |
|--------------|--|-------------|--------|--------------------------------|--------------|-----------------|---------------|--------------|---------|
| ELEV. DEPTH | DESCRIPTION | STRAT. PLT. | NUMBER | TYPE | BLOWS / FOOT | WATER CONTENT % | PLASTIC LIMIT | | |
| 166.9 | Ground Level | | | | | | | | |
| 166.9 | Ret. mixture of clayey silt with some sand and traces of gravel. | | 1 | SS | 14 | | | | |
| | | | 2 | SS | 46 | | | | |
| | | | 3 | SS | 51 | | | | |
| | | | 4 | SS | 50 | | | | |
| | | | 5 | SS | 31 | | | | |
| | Stiff to Hard. | | 6 | SS | 37 | | | | |
| | | | 7 | SS | 16 | | | | |
| | (Glacial Till) | | 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 | | 18 | SS | 130/3" | | | | |
| | 75.5 | | 19 | EC | 50% | | | | |
| | | | 20 | EC | 54% | | | | |
| | | | 21 | EC | 75% | | | | |
| 140.0 | 159.3 | | | | | | | | |
| | 88.5 | | | | | | | | |
| | End of Borehole | | | | | | | | |

20
15 \div 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

| SOIL PROFILE | | SAMPLES | | | ELEV. SCALE | DYNAMIC PENETRATION RESISTANCE | | LIQUID LIMIT - W _p | | BULK DENSITY | REMARKS |
|--------------|-------------|---|------------|--------|-------------|--------------------------------|-----------------|--------------------------------|--------------------------------|--------------|---------|
| ELEV. (m) | ELEV. DEPTH | DESCRIPTION | STRAT. LOT | NUMBER | TYPE | BLOWS/FOOT | 20 40 60 80 100 | PLASTIC LIMIT - W _p | WATER CONTENT - W _p | | |
| 168.3 | 552.2 | Ground Level | | | | | | | | | |
| | 0.0 | Het. mixture of clayey silt with some sand and traces of gravel. (Glacial Till) | | 1 | SS | 42 | | | | | |
| | | | | 2 | SS | 45 | | | | | |
| | | | | 3 | SS | 59 | | | | | |
| | | | | 4 | SS | 58 | | | | | |
| | | | | 5 | SS | 36 | | | | | |
| | | Very Stiff to Hard | | 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 | | | | | | | | | | |
| | 50.2 | Het. mixture of silty sand to sandy silt with traces of gravel. | | 13 | SS | 25 | | | | | |
| | | | | 14 | SS | 109 | | | | | |
| | | Compact to Very Dense | | 15 | SS | 109 | | | | | |
| | | | | 16 | SS | 125 | 6" | | | | |
| 146.2 | 479.7 | | | 17 | SS | 160 | 6" | | | | |
| 145.3 | 476.7 | Clayey silt with pockets of silty ss & fragments of shale. | | 18 | SS | 255 | 6" | | | | |
| | 75.5 | End of Borehole | | | | | | | | | |

20
15 0-5 % STRAIN AT FAILURE
10

DESIGN SERVICES BRANCH

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

FOUNDATIONS OFFICE

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

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 P.C.F. | REMARKS |
|--------------|-------------|---|-------------|--------|------|-------------|--|----|----|----|-----|--|-----|-------|------------------------------------|------------|
| ELEV. (m) | ELEV. DEPTH | DESCRIPTION | STRAT. PLAT | NUMBER | TYPE | | 20 | 40 | 60 | 80 | 100 | w_p | w | w_L | | |
| 168.4 | 552.5 | Ground Level | | | | | | | | | | | | | | |
| | 0.0 | Het. mix. of clayey silt, sand and trace of gravel. | | 1 | SS | 36 | | | | | | | | | | 551.5 |
| | | | | 2 | SS | 46 | | | | | | | | | | |
| | | Very Stiff - Hard | | 3 | SS | 63 | | | | | | | | | | |
| | | Brown | | 4 | SS | 40 | | | | | | | | | | 4.28 52.16 |
| | | Grey | | 5 | SS | 32 | | | | | | | | | | |
| | | | | 6 | SS | 30 | | | | | | | | | | |
| | | (Glacial Till) | | 7 | SS | 34 | | | | | | | | | | 3.23 56.18 |
| | | | | 8 | SS | 44 | | | | | | | | | | |
| | | | | 9 | SS | 22 | | | | | | | | | | |
| | | | | 10 | SS | 68 | | | | | | | | | | |
| | | | | 11 | SS | 25 | | | | | | | | | | |
| 157.1 | 505.5 | | | 12 | SS | 33 | | | | | | | | | | |
| | 47.0 | Het. mix. of silt, sand and trace of gravel and clay. | | 13 | SS | 100/5" | | | | | | | | | | 7.42 12.9 |
| | | Very Dense | | 14 | SS | 100/5" | | | | | | | | | | |
| 146.8 | 481.5 | | | 15 | SS | 100/2" | | | | | | | | | | 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

GRAIN SIZE IN MICROMETERS

1

100

90

80

70

60

50

40

30

20

10

0

PERCENT PASSING

0.001

0.01

0.1

1

10

30

50

75

100

1

3

5

10

30

50

75

100

1

3

5

10

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100

1

3

5

10

30

50

75

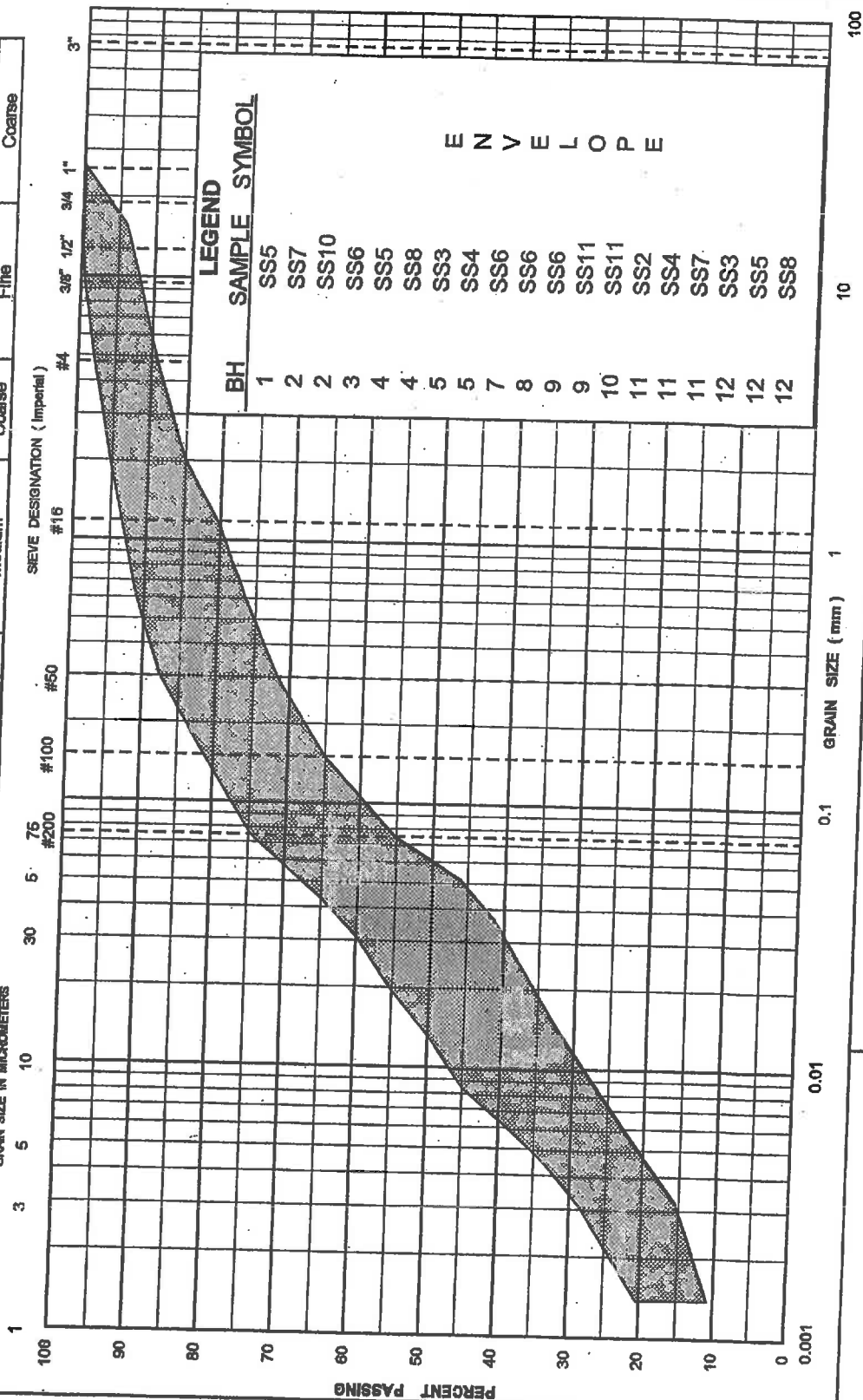
100

1

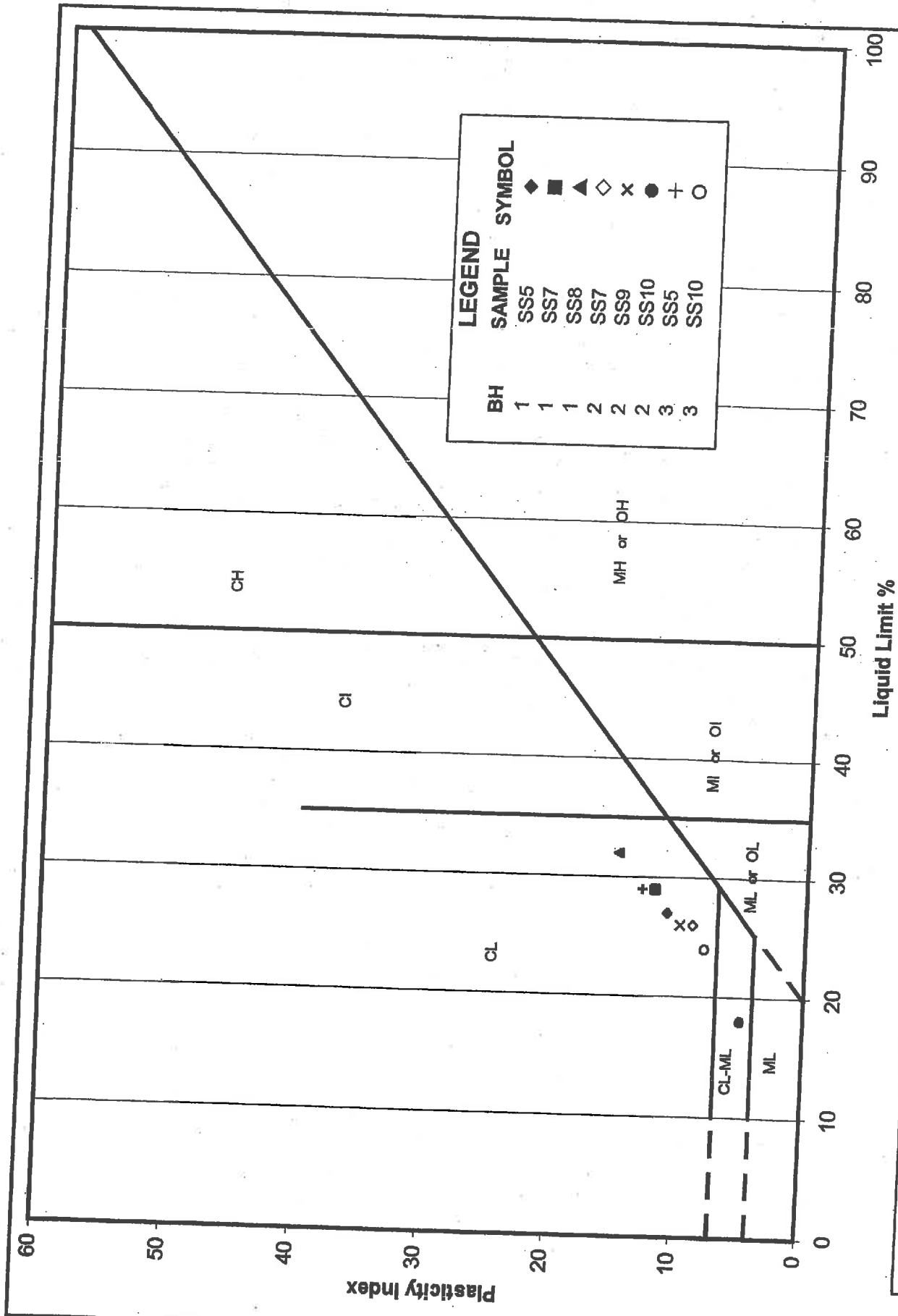
3

| | |
|--------|--------|
| GRAVEL | |
| | Coarse |

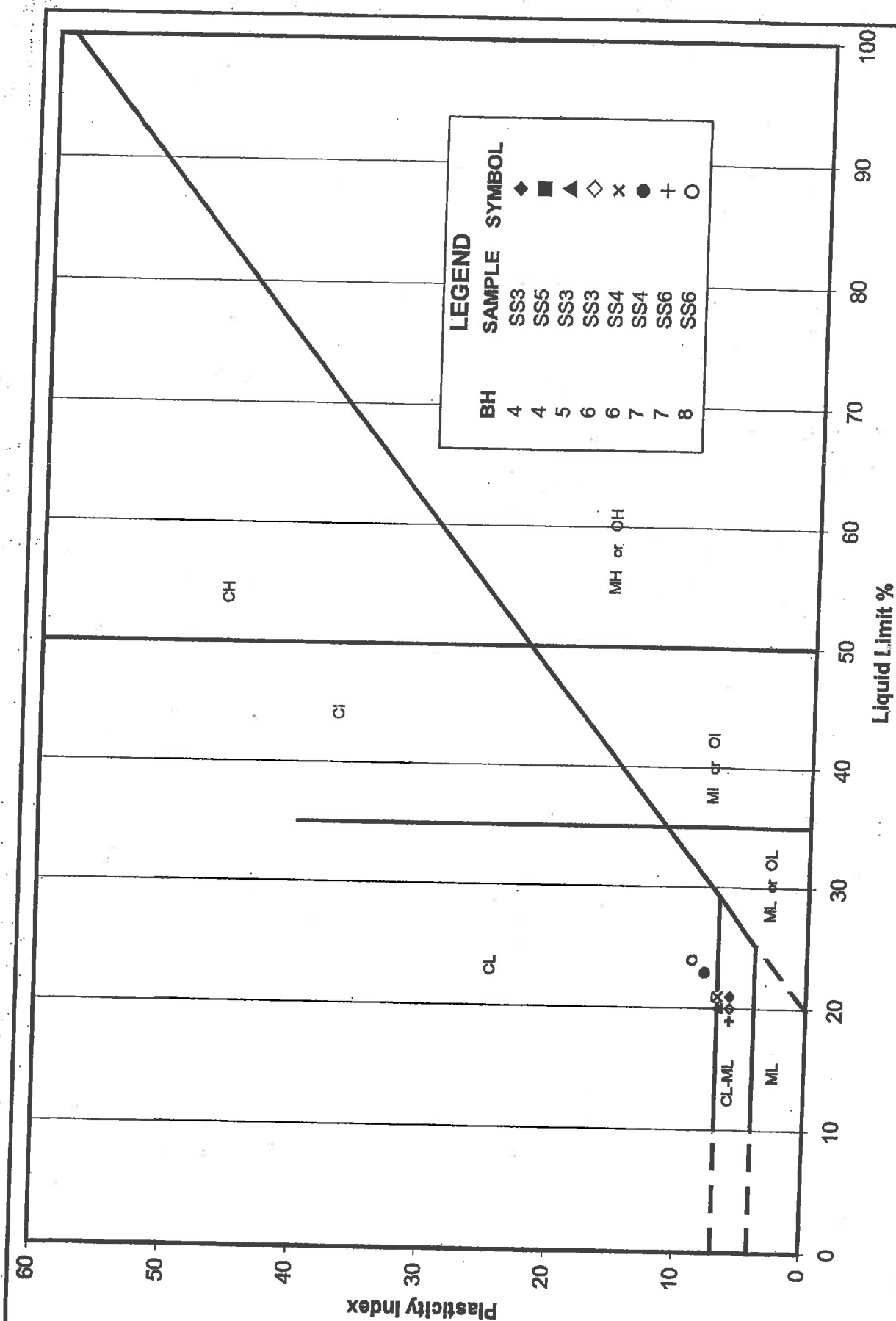
GRAIN SIZE IN MICROMETERS



FEBRUARY, 2003



| | | |
|-----------------------------|--------------------------------------|------------|
| SHAHEEN & PEAKER LIMITED | PLASTICITY CHART CLAYEY SILT TILL | Fig. No. 4 |
| | WP: 321-96-00 | |

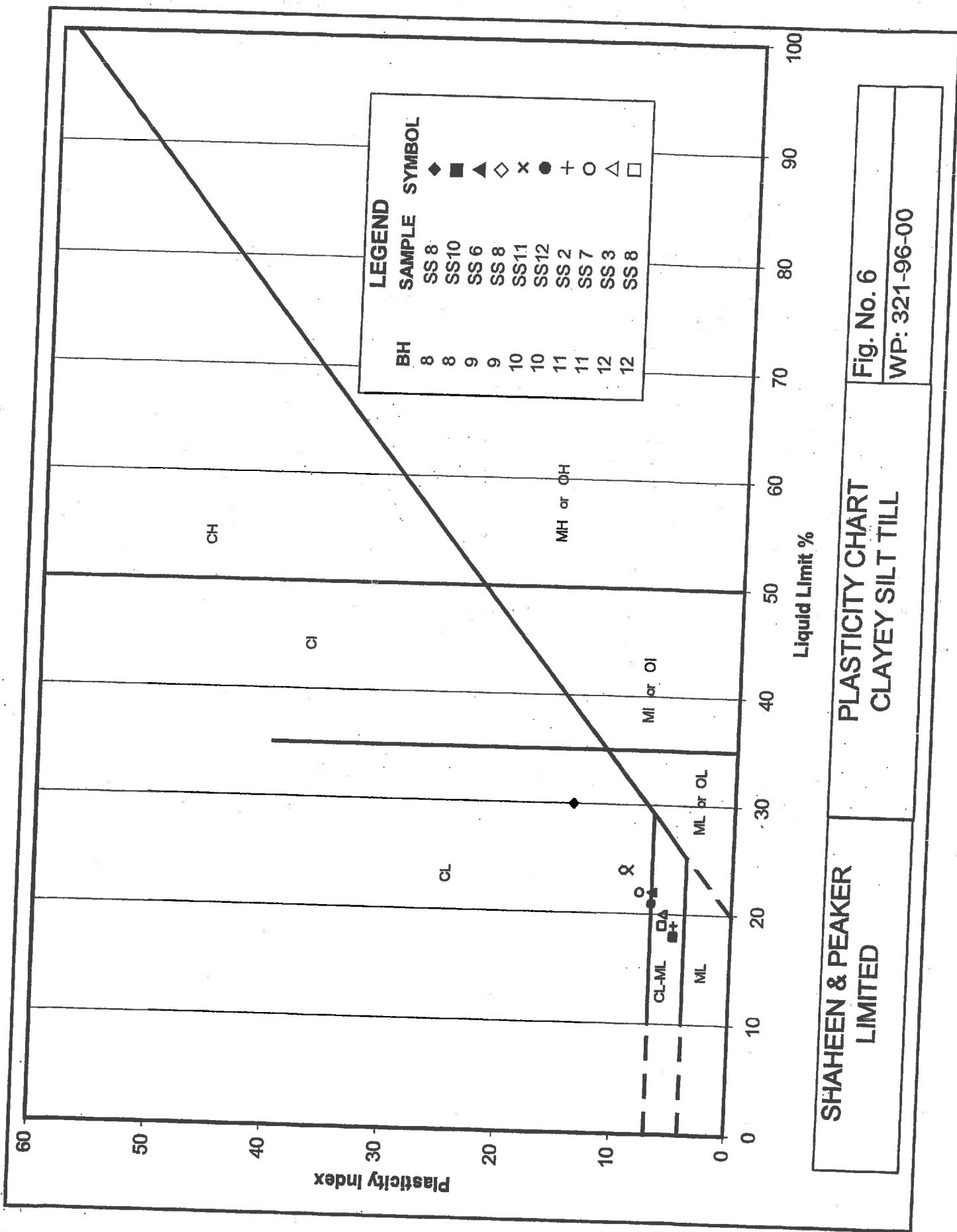


**SHAHEEN & PEAKER
LIMITED**

**PLASTICITY CHART
CLAYEY SILT TILL**

Fig. No. 5

WP: 321-96-00



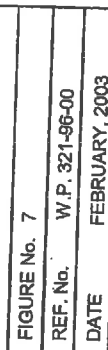
**SHAHEEN & PEAKER
LIMITED**

**PLASTICITY CHART
CLAYEY SILT TILL**

Fig. No. 6

WP: 321-96-00

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



SHAHEEN & PEAKER LIMITED

UNIFIED SOIL CLASSIFICATION SYSTEM

CLAY AND SILT

GRAIN SIZE IN MICROMETERS

SAND

Fine

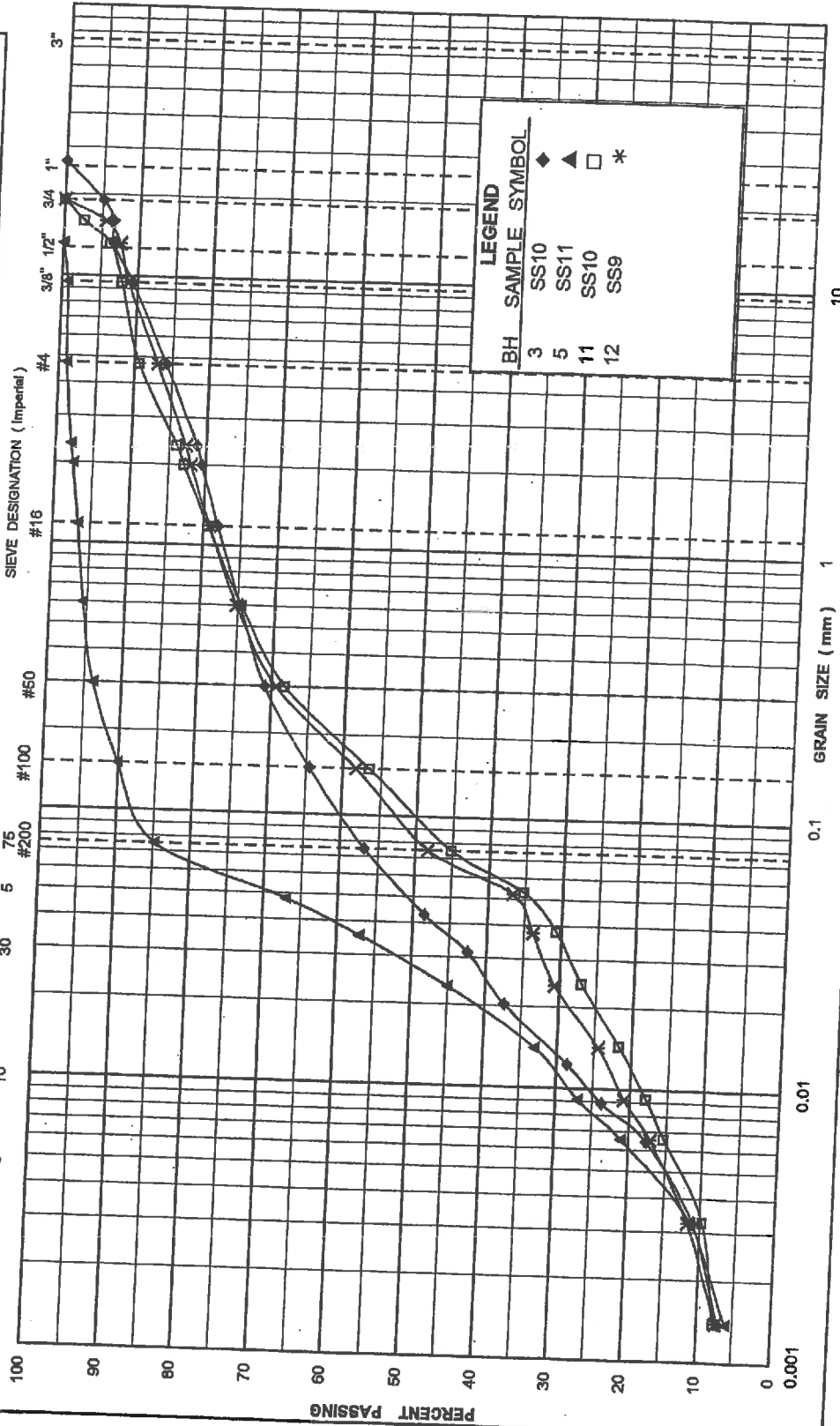
Medium

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

GRAIN SIZE IN MICROMETERS

SAND

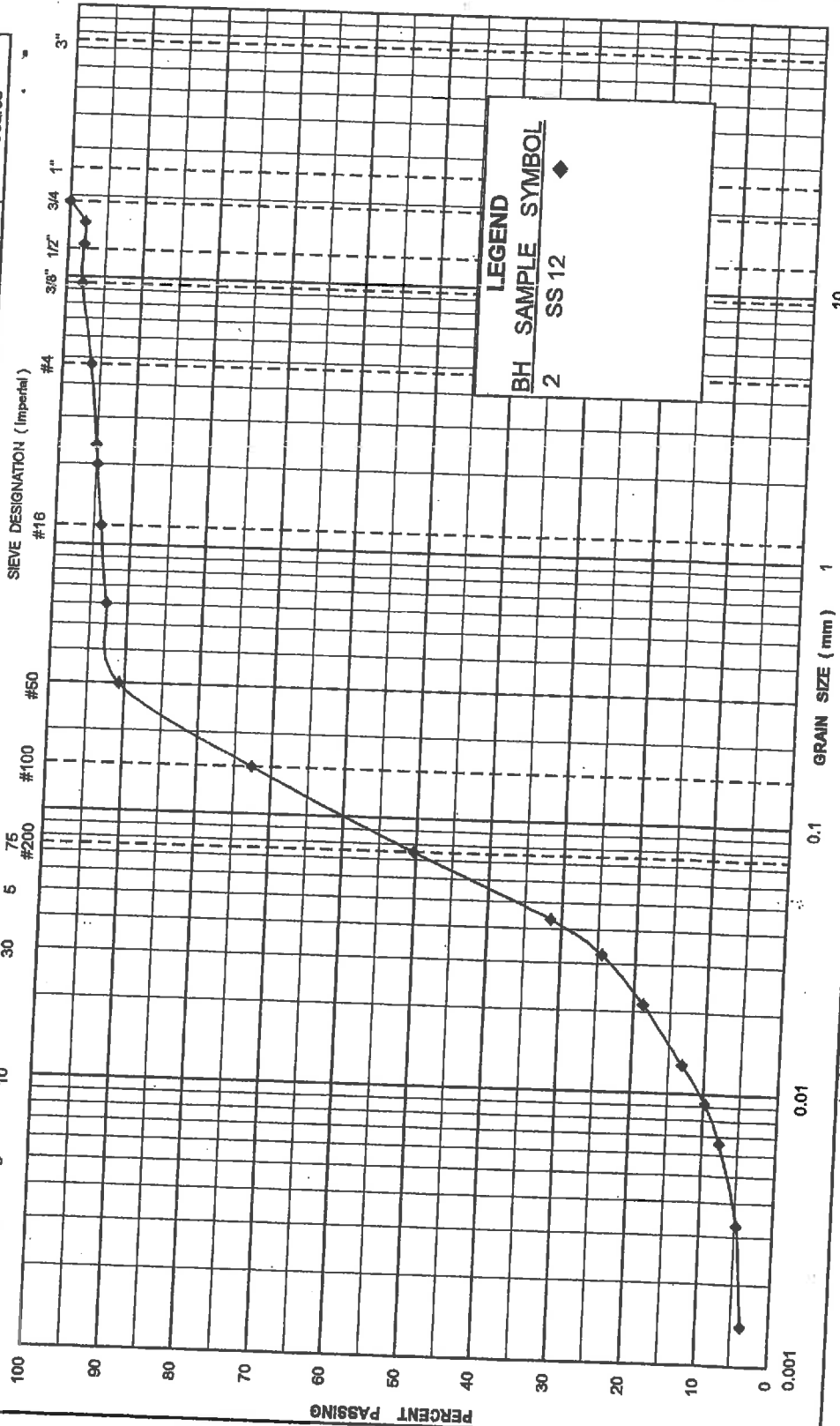
Fine

Medium

Coarse

Fine

Coarse

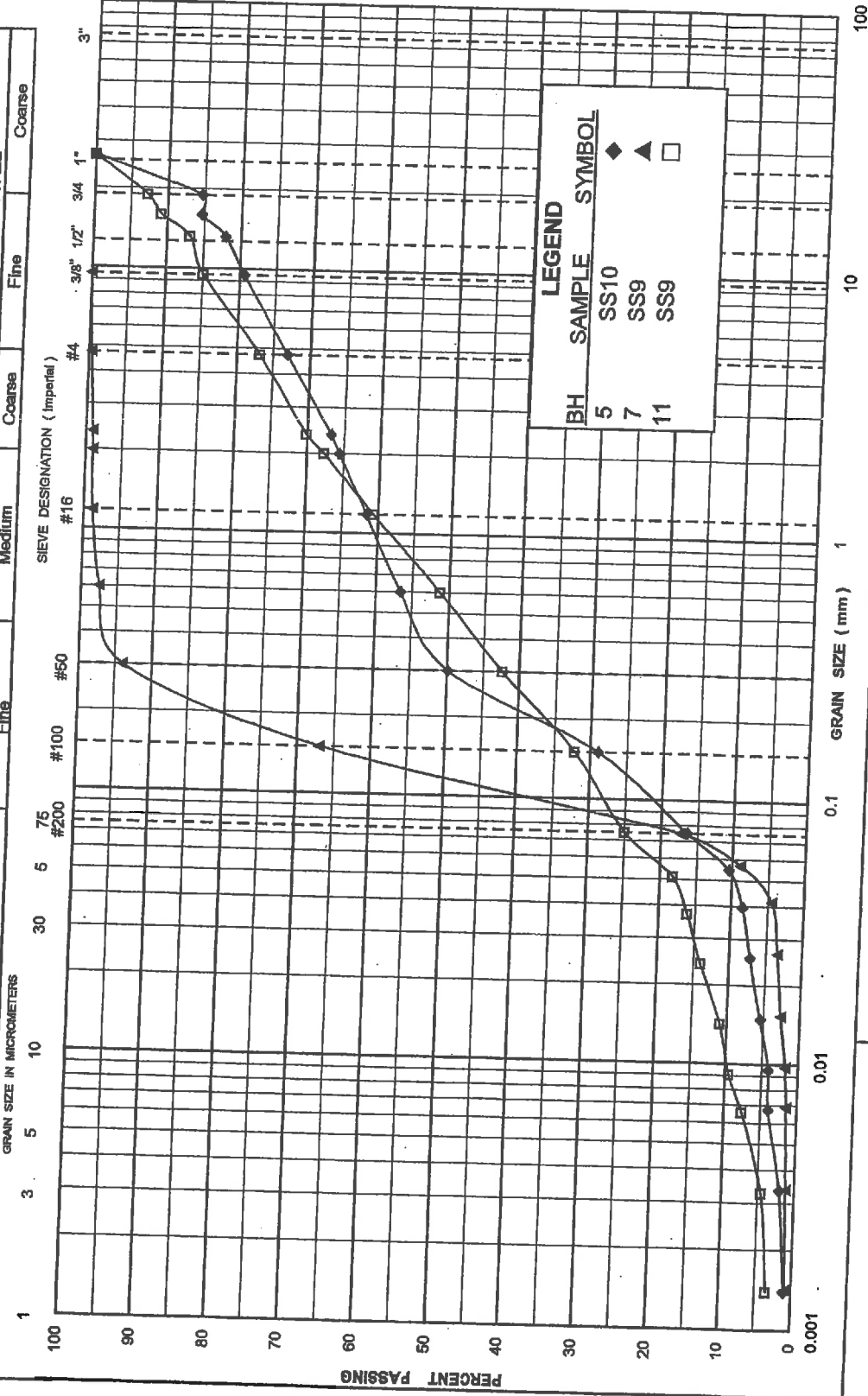


UNIFIED SOIL CLASSIFICATION SYSTEM

CLAY AND SILT

SAND

| GRAVEL | | | |
|--------|------|--------|--------|
| Coarse | Fine | Medium | Coarse |



SHAHEEN & PEAKER LIMITED

GRAIN SIZE DISTRIBUTION

Sand, some Silt

FIGURE No. 10

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

**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**

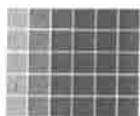
Prepared For:

**MINISTRY OF TRANSPORTATION
CENTRAL REGION**

Prepared by:

SHAHEEN & PEAKER LIMITED

**Project: SPT1076
July 8, 2003**



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limited

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Toronto, Ontario
M9W 1A4**

**Tel: (416) 213-1255
Fax: (416) 213-1260**

WEB SITE: WWW.SHAHEENPEAKER.CA

Table of Contents

| | |
|---|-----------|
| 5. DISCUSSION AND RECOMMENDATIONS | 10 |
| 5.1 Summarized Subsurface Conditions | 10 |
| 5.2 Design Consideration..... | 11 |
| 5.3 Construction Comments..... | 13 |
| 6.0 CLOSURE | 15 |

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 (unstablisised) 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 ($q_u = 2 \times C_u$) 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 = 2x C_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.

SHAHEEN & PEAKER LIMITED



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ZO:tr/idrive

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.

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