

DOCUMENT MICROFILMING IDENTIFICATION

GEOCRES No. 30 M14-212

DIST. 6 REGION

W.P. No. 265-87-00 (B)

CONT. No. 92-86

W. O. No.

STR. SITE No.

HWY. No. 401

LOCATION Express & E.B. Collector Lanes  
Neilson Rd to Hwy 2A

No of PAGES - Roadway Protection

=====

OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT.

REMARKS:



Ministry  
of  
Transportation

---

## **FOUNDATION DESIGN SECTION**

**foundation  
investigation and  
design report**

ENGINEERING MATERIALS OFFICE  
FOUNDATION DESIGN SECTION

*CONT 92-86*

WP 265-87-00

DIST 6

HWY 401

STR SITE N/A

Roadway Protection for Sewer Installation  
Hwy. 401 - Express and EB Collector Lanes  
Neilson Road to Hwy. 2A

DISTRIBUTION

V.F. Boehnke (3)

G. Cautillo

J. Cullen (2)

A. Wittenberg

K.G. Bassi

S.J. Dunham

E.A. Joseph

I. Harrod (Cover Only)

F. Bacchus (Cover Only)

File ✓

# MEMORANDUM

(416) 235-3731

To: G. Cautillo  
Head, Geotechnical Section  
2nd Floor, Atrium Tower  
Central Region

Date: 1992 02 07


Attn.: K. Ganesh

From: Foundation Design Section  
Room 315, Central Building  
Downsview, Ontario

Re: Roadway Protection for Sewer Installation  
W.P. 265-87-00, Site: N/A  
Hwy 401 - Express and EB Collector Lanes  
Neilson Road to Hwy 2A  
Highway 401, District 6, Toronto

We refer to your memorandum dated 91 11 06. The attached report provides recommendations for roadway protection for the above-noted project.

We believe that the report is adequate for your present purposes. However, should you have any further questions, please advise.



D. Kwok, P. Eng.  
Foundation Engineer

For

D.H. Dundas, P. Eng.  
Sr. Foundation Engineer

## Distribution

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

FOUNDATION INVESTIGATION REPORT  
For  
Roadway Protection for Sewer Installation  
W.P. 265-87-00, Site: N/A  
Hwy 401 - Express and EB Collector Lanes  
Neilson Road to Hwy 2A  
Highway 401, District 6, Toronto

---

INTRODUCTION

A detailed field investigation was carried out in February 1991 for the recommendations of roadway protection at Hwy 401 WB between Neilson Road and Meadowvale Road. The information presented in this report are based on this previous field investigation [WP 264-87-00 (a)]. The borehole logs BH1 to BH 41 and plans showing borehole locations (Drawing 1 to Drawing 4) are attached.

SUBSURFACE CONDITIONS

In general, the subsurface stratigraphy comprises of a surficial layer of non-cohesive fill overlying native soils. The native soils are typically non-cohesive although a cohesive layer of clayey silt was encountered in some areas. The strength of the subsoil generally varies from compact to very dense. The groundwater level ranges from 0.5m to 4.3m below existing grade and is typically located within the native material.

### RECOMMENDATIONS

It is proposed to install sewer lines along Hwy 401 Eastbound express and collector lanes between Neilson Road & Hwy 2A. The following recommendations for roadway protection is for excavations up to 6m deep.

Where inverts of excavations are outside a 1H:1V plane defined by the Jersey barriers restricting traffic, construction can proceed with a concurrent excavation/backfill operation. Excavations should not exceed 5m in length prior to complete backfilling, and no excavation should be left open for more than 8 hours.

Where inverts of excavations are within a 1H:1V plane defined by the Jersey barriers restricting traffic, road protection will be required. Although it is envisaged that road protection could be a combination of trench boxes and soldier pile/timber lagging shoring, it is conceivable that traffic may be temporarily restricted to fulfil the geometric requirements that do not require road protection. It is noted that this occurred at the WB contract 91-28. In any case, design of road protection is the responsibility of the Contractor. The Contractor should submit his proposal for review a minimum of 10 working days prior to construction of road protection.

The following parameters should be used for shoring design:

Angle of internal friction =  $30^{\circ}$

Bulk Unit Weight =  $21 \text{ kN/m}^3$

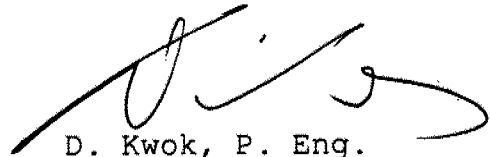
Position of groundwater table to be assumed half way between excavation invert and ground surface.

Where groundwater is encountered above the invert of excavations, a dewatering scheme will be required. A dewatering SP should require that the groundwater be lowered below the invert of excavations prior to excavating. Since the subsoil at the site is typically non-cohesive, the Contractor should be cautioned, through the SP, that non-cohesive soils are susceptible to disturbance under conditions of unbalanced hydrostatic head. Although it is the responsibility of the Contractor to ensure the stability of the excavation by adopting the appropriate dewatering method, it is anticipated that sheet piling could be used to permit dewatering without disturbing the soil. The Contractor should submit his proposal for review a minimum of 10 working days prior to the commencement of excavation.

MISCELLANEOUS

The recommendations given in this report are based on previous field investigation carried out under WP 264-87-00 (a). The field investigation was conducted by McClymont & Rak Engineers, Inc. The equipment was owned and operated by Master Soils Investigation Limited.

This report was written by D. Kwok and K. Ahmad Foundation Engineers and reviewed by D. Dundas, Senior Foundation Engineer.



D. Kwok, P. Eng.  
Foundation Engineer

For

D.H. Dundas, P. Eng.  
Sr. Foundation Engineer

## APPENDIX



## EXPLANATION OF TERMS USED IN REPORT

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

**DYNAMIC CONE PENETRATION TEST:** CONTINUOUS PENETRATION OF A CONICAL STEEL POINT (51mm O.D 60° CONE ANGLE) DRIVEN BY 475 J IMPACT ENERGY ON '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

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

### MECHANICAL PROPERTIES OF SOIL

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

### STRESS AND STRAIN

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

### PHYSICAL PROPERTIES OF SOIL

|                       |                        |                                |            |      |   |            |                        |  |
|-----------------------|------------------------|--------------------------------|------------|------|---|------------|------------------------|--|
| $\rho_s$              | $\text{kg}/\text{m}^3$ | DENSITY OF SOLID PARTICLES     | e          | 1, % | VOID RATIO                                | $e_{\min}$ | 1, %                   | VOID RATIO IN DENSEST STATE                                |
| $\gamma_s$            | $\text{kN}/\text{m}^3$ | UNIT WEIGHT OF SOLID PARTICLES | n          | 1, % | POROSITY                                  | $I_D$      | 1                      | DENSITY INDEX = $\frac{e_{\max} - e}{e_{\max} - e_{\min}}$ |
| $\rho_w$              | $\text{kg}/\text{m}^3$ | DENSITY OF WATER               | w          | 1, % | WATER CONTENT                             | D          | mm                     | GRAIN DIAMETER   |
| $\gamma_w$            | $\text{kN}/\text{m}^3$ | UNIT WEIGHT OF WATER           | $s_r$      | %    | DEGREE OF SATURATION                      | $D_n$      | mm                     | n PERCENT - DIAMETER                                       |
| $\rho$                | $\text{kg}/\text{m}^3$ | DENSITY OF SOIL                | $w_L$      | %    | LIQUID LIMIT                              | $C_u$      | 1                      | UNIFORMITY COEFFICIENT                                     |
| $\gamma$              | $\text{kN}/\text{m}^3$ | UNIT WEIGHT OF SOIL            | $w_p$      | %    | PLASTIC LIMIT                             | h          | m                      | HYDRAULIC HEAD OR POTENTIAL                                |
| $\rho_d$              | $\text{kg}/\text{m}^3$ | DENSITY OF DRY SOIL            | $w_s$      | %    | SHRINKAGE LIMIT                           | q          | $\text{m}^3/\text{s}$  | RATE OF DISCHARGE  |
| $\gamma_d$            | $\text{kN}/\text{m}^3$ | UNIT WEIGHT OF DRY SOIL        | $I_p$      | %    | PLASTICITY INDEX = $w_L - w_p$            | v          | m/s                    | DISCHARGE VELOCITY   |
| $\rho_{\text{sat}}$   | $\text{kg}/\text{m}^3$ | DENSITY OF SATURATED SOIL      | $I_L$      | 1    | LIQUIDITY INDEX = $\frac{w - w_p}{I_p}$   | i          | 1                      | HYDRAULIC GRADIENT   |
| $\gamma_{\text{sat}}$ | $\text{kN}/\text{m}^3$ | UNIT WEIGHT OF SATURATED SOIL  | $I_C$      | 1    | CONSISTENCY INDEX = $\frac{w_L - w}{I_p}$ | k          | m/s                    | HYDRAULIC CONDUCTIVITY                                     |
| $\rho'$               | $\text{kg}/\text{m}^3$ | DENSITY OF SUBMERGED SOIL      | $e_{\max}$ | 1, % | VOID RATIO IN LOOSEST STATE               | j          | $\text{kN}/\text{m}^2$ | SEEPAGE FORCE  |
| $\gamma'$             | $\text{kN}/\text{m}^3$ | UNIT WEIGHT OF SUBMERGED SOIL  |            |      |   |            |                        |  |



W.P. 265-87-00  
formerly

# RECORD OF BOREHOLE No 1

METRIC

W.P. 264-87-00(a)

LOCATION Station 20 + 775m, 1.5m N of W shoulder pavement edge

ORIGINATED BY SM

DIST 6 HWY 401

BOREHOLE TYPE Solid stem auger

COMPILED BY CB

DATUM Geodetic

DATE February 22, 1991

CHECKED BY SB

| SOIL PROFILE  |  |            | SAMPLES |      |            | GROUND WATER<br>CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT |                |   |                |                   | PLASTIC NATURAL LIQUID<br>LIMIT MOISTURE CONTENT LIMIT |  |  | UNIT<br>WEIGHT<br>Y | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%)<br>GR SA SI CL |
|---------------|--|------------|---------|------|------------|----------------------------|-----------------|---|----------------|---|----------------|-------------------|--|--|--|---------------------|--|
| ELEV<br>DEPTH | DESCRIPTION  | STRAT PLOT | NUMBER  | TYPE | 'N' VALUES |                            |                 | 20 40 60 80 100                             | W <sub>p</sub> | W | W <sub>L</sub> | WATER CONTENT (%) |  |  |  |                     |  |
| 138.7         | Ground surface   |            |         |      |            |                            |                 |   |                |   |                |                   |  |  |  |                     |  |
| 0.0           | Granular: 300 mm<br>SILTY SAND<br>compact to dense     |            | 1       | SS   | 39         |                            | 138             |   |                |   |                |                   |  |  |  |                     |  |
|               |  |            | 2       | SS   | 19         |                            |                 |   |                |   |                |                   |  |  |  |                     |  |
| 137.2         |  |            |         |      |            |                            |                 |   |                |   |                |                   |  |  |  |                     |  |
| 1.5           | Het. mixture of sand<br>and silt with gravel,<br>dense |            | 3       | SS   | 44         |                            | 137             |   |                |   |                |                   |  |  |  |                     |  |
| 136.6         |  |            |         |      |            |                            |                 |   |                |   |                |                   |  |  |  |                     |  |
| 2.1           | SAND<br>some silt and<br>gravel,<br>compact to dense   |            | 4       | SS   | 27         |                            | 136             |   |                |   |                |                   |  |  |  |                     |  |
|               |  |            | 5       | SS   | 21         |                            |                 |   |                |   |                |                   |  |  |  |                     |  |
|               |  |            |         |      |            |                            | 135             |   |                |   |                |                   |  |  |  |                     |  |
|               |  |            | 6       | SS   | 32         |                            |                 |   |                |   |                |                   |  |  |  |                     |  |
|               |  |            |         |      |            |                            |                 |   |                |   |                |                   |  |  |  |                     |  |
|               | Wet below 4.3m   |            |         |      |            |                            |                 |   |                |   |                |                   |  |  |  |                     |  |
| 133.7         |  |            | 7       | SS   | 16         |                            | 134             |   |                |   |                |                   |  |  |  |                     |  |
| 5.0           | End of Borehole  |            |         |      |            |                            |                 |   |                |   |                |                   |  |  |  |                     |  |

OFFICE REPORT ON SOIL EXPLORATION



formerly

## METRIC

W P 264-87-00(a)

LOCATION Station 20 + 800m, 1.4m N of W shoulder pavement edge

ORIGINATED BY 5X

DIST 6 HWY 401

BOREHOLE TYPE Solid stem auger

COMPILED BY SB

DATUM Geodetic

DATE February 22, 1991

CHECKED BY CE

OFFICE REPORT ON SOIL EXPLORATION

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

W.P. 265-87-00

RECORD OF TEST PIT No 3

METRIC

W.P. 264-87-00(a) LOCATION Station 20 + 850m, 1.0m N of W shoulder pavement edge ORIGINATED BY SM  
DIST 6 HWY 401 BOREHOLE TYPE Back-hoe COMPILED BY SM  
DATUM Geodetic DATE February 27, 1991 CHECKED BY SM

| SOIL PROFILE  |  |            | SAMPLES |      |            | GROUND WATER<br>CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT |    |    |    |     | PLASTIC<br>LIMIT<br>W <sub>p</sub> | NATURAL<br>MOISTURE<br>CONTENT<br>W | LIQUID<br>LIMIT<br>W <sub>L</sub> | UNIT<br>WEIGHT<br>Y | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%)<br>GR SA SI CL |
|---|--|------------|---------|------|------------|----------------------------|-----------------|---|----|----|----|-----|------------------------------------|-------------------------------------|-----------------------------------|---------------------|--|
| ELEV<br>DEPTH   | DESCRIPTION                                  | STRAT PLOT | NUMBER  | TYPE | 'N' VALUES |                            |                 | 20  | 40 | 60 | 80 | 100 |                                    |                                     |                                   |                     |  |
| 137.2   | Ground surface                               |            |         |      |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |  |
| 0.0   | Topsoil: 300 mm<br>SILTY SAND<br>some gravel |            |         |      |            |                            | 137             |   |    |    |    |     |                                    |                                     |                                   |                     |  |
| 135.5   | (FILL)                                       |            |         |      |            |                            | 136             |   |    |    |    |     |                                    |                                     |                                   |                     |  |
| 1.7   | Organic stained silt,<br>roots               |            | 1       | SS   |            |                            | 135             |   |    |    |    |     |                                    |                                     |                                   |                     |  |
| 135.1   |  |            |         |      |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |  |
| 2.1   | SAND<br>some silt,<br>dense                  |            | 2       | SS   |            |                            | 135             |   |    |    |    |     |                                    |                                     |                                   |                     | 10 89 (1)  |
| 134.0   |  |            | 3       | SS   |            |                            | 134             |   |    |    |    |     |                                    |                                     |                                   |                     |  |
| 3.2   | GRAVELLY SAND<br>wet                         |            | 4       | SS   |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     | 33 59 (8)  |
| 133.5   |  |            |         |      |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |  |
| 3.7   | End of Test Pit                              |            |         |      |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |  |
| NOTES:<br>1) Water level at 3.3m after 3/4 hour from completion.<br>2) Dense to hand probing, at base of test-pit.<br>3) Side slopes excavated at 60° to horizontal,<br>were stable during the period (45 min.) the<br>test pit was open. |  |            |         |      |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |  |

OFFICE REPORT ON SOIL EXPLORATION

W.P. 265-87-00

RECORD OF BOREHOLE No 4

METRIC

W.P. 264-87-00(a) LOCATION Station 20 + 900m, 2.8m N of W shoulder pavement edge ORIGINATED BY SM  
DIST 6 HWY 401 BOREHOLE TYPE Solid stem auger COMPILED BY JB  
DATUM Geodetic DATE February 22, 1991 CHECKED BY JB

OFFICE REPORT ON SOIL EXPLORATION

| SOIL PROFILE  |   | SAMPLES    |        |      | GROUND WATER<br>CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT |    |    |    |    | PLASTIC NATURAL LIQUID<br>LIMIT MOISTURE CONTENT LIMIT |                |   | UNIT<br>WEIGHT<br>Y | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%)<br>GR SA SI CL |
|---------------|---|------------|--------|------|----------------------------|-----------------|---|----|----|----|----|--|----------------|---|---------------------|--|
| ELEV<br>DEPTH | DESCRIPTION   | STRAT PLOT | NUMBER | TYPE |                            |                 | 'N' VALUES                                  | 20 | 40 | 60 | 80 | 100  | W <sub>p</sub> | W |                     |  |
| 137.6         | Ground surface  |            |        |      |                            |                 |   |    |    |    |    |  |                |   |                     |  |
| 0.0           | Granular fill: 400 mm   |            | 1      | SS   | 42                         |                 |   |    |    |    |    |  |                |   |                     |  |
|               | SAND<br>trace to some<br>silt and gravel,<br>compact to very<br>dense |            | 2      | SS   | 27                         |                 |   |    |    |    |    |  |                |   |                     |  |
|               |   |            | 3      | SS   | 13                         |                 |   |    |    |    |    |  |                |   |                     |  |
|               |   |            | 4      | SS   | 20                         |                 |   |    |    |    |    |  |                |   |                     |  |
|               |   |            | 5      | SS   | 46                         |                 |   |    |    |    |    |  |                |   |                     |  |
|               | Wet below 3.8m  |            | 6      | SS   | 57                         |                 |   |    |    |    |    |  |                |   |                     |  |
|               |   |            | 7      | SS   | 24                         |                 |   |    |    |    |    |  |                |   |                     |  |
| 132.6         | End of Borehole   |            |        |      |                            |                 |   |    |    |    |    |  |                |   |                     |  |

W.P. 265-87-00

# RECORD OF BOREHOLE No 5

METRIC

W.P. 264-87-00(a) LOCATION Station 20 + 947m, 0.2m N of W shoulder pavement edge  
 DIST 6 HWY 401 BOREHOLE TYPE Solid stem auger  
 DATUM Geodetic DATE February 22, 1991  
 ORIGINATED BY SY  
 COMPILED BY SB  
 CHECKED BY SB

OFFICE REPORT ON SOIL EXPLORATION

| SOIL PROFILE |   |            | SAMPLES |      |            | GROUND WATER CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION RESISTANCE PLOT |    | NATURAL MOISTURE CONTENT |    |     | UNIT WEIGHT<br>Y | REMARKS & GRAIN SIZE DISTRIBUTION (%)<br>GR SA SI CL |
|--------------|---|------------|---------|------|------------|-------------------------|-----------------|--|----|--------------------------|----|-----|------------------|--|
| ELEV DEPTH   | DESCRIPTION   | STRAT PLOT | NUMBER  | TYPE | 'N' VALUES |                         |                 | 20                                       | 40 | 60                       | 80 | 100 |                  |  |
| 137.3        | Ground surface  |            |         |      |            |                         |                 |  |    |                          |    |     |                  |  |
| 0.0          | Sand and gravel, some silt (FILL)                         |            |         |      |            |                         | 137             |  |    |                          |    |     |                  |  |
| 136.4        | Topsoil: 50 mm  |            |         |      |            |                         |                 |  |    |                          |    |     |                  |  |
| 0.9          | SAND trace to some silt and gravel, compact to very dense |            | 1       | SS   | 41         |                         | 136             |  |    |                          |    |     |                  |  |
|              |   |            | 2       | SS   | 35         |                         | 135             |  |    |                          |    |     |                  |  |
|              |   |            | 3       | SS   | 36         |                         | 134             |  |    |                          |    |     |                  |  |
|              |   |            | 4       | SS   | 39         |                         | 133             |  |    |                          |    |     |                  |  |
|              | Wet below 3.8m  |            | 5       | SS   | 21         |                         |                 |  |    |                          |    |     |                  |  |
|              |   |            | 6       | SS   | 76         |                         |                 |  |    |                          |    |     |                  |  |
| 132.3        | End of Borehole   |            |         |      |            |                         |                 |  |    |                          |    |     |                  |  |
| 5.0          | *Stabilized ground water level at 3.8m depth.             |            |         |      |            |                         |                 |  |    |                          |    |     |                  |  |

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

20  
15  
10  
5 (%) STRAIN AT FAILURE

W.P. 265-87-00  
formerly

# RECORD OF BOREHOLE No 6

METRIC

W.P. 264-87-00(a) LOCATION Station 21 + 000m, 0.2m N of W shoulder pavement edge ORIGINATED BY  
DIST 6 HWY 401 BOREHOLE TYPE Solid stem auger COMPLETED BY  
DATUM Geodetic DATE February 22, 1991 CHECKED BY

OFFICE REPORT ON SOIL EXPLORATION

| SOIL PROFILE  |   |            | SAMPLES |      |            | GROUND WATER<br>CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT |  |  | UNIT<br>WEIGHT<br>γ | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%) |
|---------------|---|------------|---------|------|------------|----------------------------|-----------------|---|--|--|---------------------|---|
| ELEV<br>DEPTH | DESCRIPTION   | STRAT PLOT | NUMBER  | TYPE | 'N' VALUES |                            |                 | 20 40 60 80 100                             |  |  |                     |   |
|               |   |            |         |      |            |                            |                 | SHEAR STRENGTH kPa                          |  |  |                     |   |
|               |   |            |         |      |            |                            |                 |   |  |  |                     |   |
|               |   |            |         |      |            |                            |                 |   |  |  |                     |   |
| 136.7         | Ground surface  |            |         |      |            |                            |                 |   |  |  |                     |   |
| 0.0           | Sand and gravel<br>some silt<br>(FILL)                                | ⊗          | 1       | CS   |            |                            | 136             |   |  |  |                     |   |
| 135.8         |   | ⊗          |         |      |            |                            |                 |   |  |  |                     |   |
| 0.9           | SAND<br>trace to some<br>silt and gravel,<br>compact to very<br>dense | ⋯          | 2       | SS   | 46         |                            | 135             |   |  |  |                     | 0 95 (5)  |
|               |   | ⋯          | 3       | SS   | 26         |                            |                 |   |  |  |                     |   |
|               |   | ⋯          | 4       | SS   | 50/15cm    |                            | 134             |   |  |  |                     |   |
|               |   | ⋯          | 5       | SS   | 40         |                            |                 |   |  |  |                     |   |
|               |   | ⋯          | 6       | SS   | 23         |                            | 133             |   |  |  |                     | 22 65 (13)  |
|               |   | ⋯          | 7       | SS   | 15         |                            | 132             |   |  |  |                     |   |
| 131.7         |   |            |         |      |            |                            |                 |   |  |  |                     |   |
| 5.0           | End of Borehole   |            |         |      |            |                            |                 |   |  |  |                     |   |

+3, x5: Numbers refer to  
Sensitivity

20  
15  
10  
5 (%) STRAIN AT FAILURE



W.P. 265-87-00  
formerly

# RECORD OF BOREHOLE No 7

METRIC

W P 264-87-00(a) LOCATION Station 21 + 050m, 0.2m N of W shoulder pavement edge ORIGINATED BY SM  
DIST 6 HWY 401 BOREHOLE TYPE Solid stem auger COMPILED BY TB  
DATUM Geodetic DATE February 22, 1991 CHECKED BY EB

| SOIL PROFILE  |   |            | SAMPLES |      |            | GROUND WATER<br>CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT |    |    |    |     | PLASTIC<br>LIMIT<br>W <sub>p</sub> | NATURAL<br>MOISTURE<br>CONTENT<br>W | LIQUID<br>LIMIT<br>W <sub>L</sub> | UNIT<br>WEIGHT<br>Y | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%)<br>GR SA SI CL |
|---------------|---|------------|---------|------|------------|----------------------------|-----------------|---|----|----|----|-----|------------------------------------|-------------------------------------|-----------------------------------|---------------------|--|
| ELEV<br>DEPTH | DESCRIPTION   | STRAT PLOT | NUMBER  | TYPE | 'N' VALUES |                            |                 | 20  | 40 | 60 | 80 | 100 |                                    |                                     |                                   |                     |  |
| 136.4         | Ground surface  |            |         |      |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |  |
| 0.0           | Sand and gravel<br>some silt<br>(FILL)                                | ⊗          | 1       | CS   |            |                            | 136             |   |    |    |    |     | 0                                  |                                     |                                   |                     |  |
| 135.8         |   |            |         |      |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |  |
| 0.6           | SAND<br>trace to some<br>silt and gravel,<br>compact to very<br>dense | ⋯          | 2       | SS   | 38         |                            |                 |   |    |    |    |     | 0                                  |                                     |                                   |                     |  |
|               |   |            |         |      |            |                            | 135             |   |    |    |    |     | 0                                  |                                     |                                   |                     |  |
|               |   |            |         |      |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |  |
|               |   |            | 3       | SS   | 29         |                            | 134             |   |    |    |    |     | 0                                  |                                     |                                   |                     |  |
|               |   |            |         |      |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |  |
|               |   |            | 4       | SS   | 29         |                            |                 |   |    |    |    |     | 0                                  |                                     |                                   |                     |  |
|               |   |            |         |      |            |                            | 133             |   |    |    |    |     |                                    | 0                                   |                                   |                     |  |
|               |   |            | 5       | SS   | 23         |                            |                 |   |    |    |    |     |                                    | 0                                   |                                   |                     |  |
|               |   |            |         |      |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |  |
|               |   |            | 6       | SS   | 31         |                            | 132             |   |    |    |    |     |                                    | 0                                   |                                   |                     |  |
|               |   |            |         |      |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |  |
| 131.4         |   |            | 7       | SS   | 59         |                            |                 |   |    |    |    |     | 0                                  |                                     |                                   |                     |  |
| 5.0           | End of Borehole   |            |         |      |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |  |

OFFICE REPORT ON SOIL EXPLORATION

+3, x5: Numbers refer to  
Sensitivity

20  
15  
10  
5 (%) STRAIN AT FAILURE



W.P. 265-87-00  
formerly

# RECORD OF TEST PIT No 8

METRIC

W.P. 264-87-00(a) LOCATION Station 21 + 100m, 1.5m N of W shoulder pavement edge ORIGINATED BY SY  
DIST 6 HWY 401 BOREHOLE TYPE Back-hoe COMPILED BY SB  
DATUM Geodetic DATE February 27, 1991 CHECKED BY SB

OFFICE REPORT ON SOIL EXPLORATION

| SOIL PROFILE   |   |            | SAMPLES |      |            | GROUND WATER<br>CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT |                |   |                |                   | PLASTIC NATURAL LIQUID<br>LIMIT MOISTURE CONTENT LIMIT |  |  | UNIT<br>WEIGHT<br>γ | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%) |
|--|---|------------|---------|------|------------|----------------------------|-----------------|---|----------------|---|----------------|-------------------|--|--|--|---------------------|---|
| ELEV<br>DEPTH  | DESCRIPTION   | STRAT PLOT | NUMBER  | TYPE | 'N' VALUES |                            |                 | 20 40 60 80 100                             | W <sub>p</sub> | W | W <sub>L</sub> | WATER CONTENT (%) |  |  |  |                     |   |
| 135.1  | Ground surface  |            |         |      |            |                            |                 |   |                |   |                |                   |  |  |  |                     |   |
| 0.0  | Topsoil: 560 mm<br>SAND<br>trace to some<br>silt and gravel,<br>dense |            | 1       | CS   |            |                            | 135             |   |                |   |                |                   |  |  |  | 7 89 (4)            |   |
| 132.7  |   |            |         |      |            |                            | 134             |   |                |   |                |                   |  |  |  |                     |   |
| 2.4  | GRAVELLY SAND<br>wet.<br>dense  |            | 2       | CS   |            |                            | 133             |   |                |   |                |                   |  |  |  | 33 63 (4)           |   |
| 131.4  |   |            |         |      |            |                            | 132             |   |                |   |                |                   |  |  |  |                     |   |
| 3.7  | End of Test Pit   |            |         |      |            |                            |                 |   |                |   |                |                   |  |  |  |                     |   |
| NOTES:<br>1) Water level at 2.4m after 1 1/2 hrs. from completion.<br>2) Dense to hand probing, at base of test-pit. |   |            |         |      |            |                            |                 |   |                |   |                |                   |  |  |  |                     |   |

W.P. 265-87-00  
formerly

# RECORD OF BOREHOLE No 9

METRIC

W.P. 264-87-00(a)

LOCATION Station 21 + 150m, 1.0m N of W shoulder pavement edge

ORIGINATED BY SM

DIST 6 HWY 401

BOREHOLE TYPE Solid stem auger

COMPILED BY SP

DATUM Geodetic

DATE February 22, 1991

CHECKED BY SP

OFFICE REPORT ON SOIL EXPLORATION

| SOIL PROFILE  |   |            | SAMPLES |      |            | GROUND WATER<br>CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT<br>20 40 60 80 100<br>SHEAR STRENGTH kPa<br>○ UNCONFINED + FIELD VANE<br>● QUICK TRIAXIAL x LAB VANE | PLASTIC LIMIT<br>W <sub>p</sub><br>NATURAL MOISTURE<br>CONTENT<br>W<br>LIQUID LIMIT<br>W <sub>L</sub><br>WATER CONTENT (%)<br>10 20 30 | UNIT WEIGHT<br>Y | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%)<br>GR SA SI CL |
|---------------|---|------------|---------|------|------------|----------------------------|-----------------|--|--|------------------|--|
| ELEV<br>DEPTH | DESCRIPTION   | STRAT PLOT | NUMBER  | TYPE | 'N' VALUES |                            |                 |  |  |                  |  |
| 135.3         | Ground surface  |            |         |      |            |                            |                 |  |  |                  |  |
| 0.0           | Granular Fill: 300 mm<br>SAND<br>trace to some silt,<br>dense to very dense |            | 1       | SS   | 35         |                            | 135             |  |  |                  |  |
|               |   |            | 2       | SS   | 41         |                            | 134             |  |  |                  |  |
|               |   |            | 3       | SS   | 50/15      |                            |                 |  |  |                  |  |
| 133.0         |   |            |         |      |            |                            |                 |  |  |                  |  |
| 2.3           | GRAVELLY SAND<br>wet,<br>dense to very dense                                |            | 4       | SS   | 74         |                            | 133             |  |  |                  |  |
|               |   |            | 5       | SS   | 36         |                            | 132             |  |  |                  |  |
| 131.3         |   |            |         |      |            |                            |                 |  |  |                  |  |
| 4.0           | SAND<br>some silt and<br>gravel, wet,<br>dense to very dense                |            | 6       | SS   | 75         |                            | 131             |  |  |                  |  |
| 130.3         |   |            | 7       | SS   | 33         |                            |                 |  |  |                  |  |
| 5.0           | End of Borehole   |            |         |      |            |                            |                 |  |  |                  |  |

+3, x5: Numbers refer to  
Sensitivity

20  
15  
10  
5 (% STRAIN AT FAILURE

W.P. 265-87-00  
formerly

# RECORD OF BOREHOLE No 10

METRIC

W.P. 264-87-00(a) LOCATION Station 21 + 200m, 0.2m N of W shoulder pavement edge ORIGINATED BY SM  
DIST 6 HWY 401 BOREHOLE TYPE Solid stem auger COMPILED BY SB  
DATUM Geodetic DATE February 22, 1991 CHECKED BY SB

| SOIL PROFILE  |   |            | SAMPLES |      |            | GROUND WATER<br>CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT $\frac{1}{2}$ |    |    |    |     | PLASTIC<br>LIMIT<br>W <sub>p</sub> | NATURAL<br>MOISTURE<br>CONTENT<br>W | LIQUID<br>LIMIT<br>W <sub>L</sub> | UNIT<br>WEIGHT<br>Y | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>[%] |
|---------------|---|------------|---------|------|------------|----------------------------|-----------------|---|----|----|----|-----|------------------------------------|-------------------------------------|-----------------------------------|---------------------|---|
| ELEV<br>DEPTH | DESCRIPTION   | STRAT PLOT | NUMBER  | TYPE | 'N' VALUES |                            |                 | 20  | 40 | 60 | 80 | 100 |                                    |                                     |                                   |                     |   |
| 135.0         | Ground surface  |            |         |      |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 0.0           | Granular Fill: 300 mm                                   | X          | 1       | SS   | 29         |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |
|               | SAND<br>trace to some<br>silt and gravel,<br>very dense |            | 2       | SS   | 73         |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |
|               |   |            | 3       | SS   | 53         |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |
|               | Wet below 2.3m  |            | 4       | SS   | 46         |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |
|               |   |            | 5       | SS   | 65         |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |
|               |   |            | 6       | SS   | 53         |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 130.4         |   |            | 7       | SS   | 84         |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 4.6           | Het. mixture of sand,                                   |            |         |      |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 130.0         | silt, gravel, very dense                                |            |         |      |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 5.0           | End of Borehole   |            |         |      |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |

OFFICE REPORT ON SOIL EXPLORATION

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

20  
15 5 (%) STRAIN AT FAILURE  
10



W.P. 265-87-00  
formerly

# RECORD OF BOREHOLE No II

METRIC

W P 264-87-00(a)

LOCATION Station 21 + 350m, 0.2m N of W shoulder pavement edge

ORIGINATED BY SM

DIST 6 HWY 401

BOREHOLE TYPE Solid stem auger

COMPILED BY SB

DATUM Geodetic

DATE February 22, 1991

CHECKED BY SB

| SOIL PROFILE  |   |            | SAMPLES |      |            | GROUND WATER<br>CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT |    |    |    |     | PLASTIC NATURAL LIQUID<br>LIMIT MOISTURE CONTENT LIMIT |   |                | UNIT<br>WEIGHT<br>Y | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%) |
|---------------|---|------------|---------|------|------------|----------------------------|-----------------|---|----|----|----|-----|--|---|----------------|---------------------|---|
| ELEV<br>DEPTH | DESCRIPTION   | STRAT PLOT | NUMBER  | TYPE | 'N' VALUES |                            |                 | 20  | 40 | 60 | 80 | 100 | W <sub>p</sub>   | W | W <sub>L</sub> |                     |   |
| 133.5         | Ground surface  |            |         |      |            |                            |                 |   |    |    |    |     |  |   |                |                     |   |
| 0.0           | Topsoil: 150 mm<br>SILTY SAND<br>some gravel,<br>very dense |            | 1       | CS   |            |                            | 133             |   |    |    |    |     | 0  |   |                |                     |   |
| 132.3         |   |            | 2       | SS   | 74         |                            |                 |   |    |    |    |     | 0  |   |                |                     |   |
| 1.2           | GRAVELLY SAND<br>trace of silt,<br>dense to very dense      |            | 3       | SS   | 50/10cm    |                            | 132             |   |    |    |    |     | 0  |   |                |                     |   |
|               |   |            | 4       | SS   | 56         |                            | 131             |   |    |    |    |     | 0  |   |                |                     |   |
|               | Wet below 3.0m  |            | 5       | SS   | 39         |                            | 130             |   |    |    |    |     | 0  |   |                |                     |   |
| 129.2         |   |            | 6       | SS   | 66         |                            |                 |   |    |    |    |     | 0  |   |                |                     |   |
| 4.3           | End of Borehole   |            |         |      |            |                            |                 |   |    |    |    |     |  |   |                |                     |   |

OFFICE REPORT ON SOIL EXPLORATION

+3, x5: Numbers refer to  
Sensitivity

20  
15  
10  
5 (%) STRAIN AT FAILURE

W.P. 265-87-00  
formerly  
264-87-00(a)

# RECORD OF BOREHOLE No 12

METRIC

W.P. 264-87-00(a) LOCATION Station 21 + 400, 0.2m N of W shoulder pavement edge  
DIST 6 HWY 401 BOREHOLE TYPE Solid stem auger  
DATUM Geodetic DATE February 22, 1991  
ORIGINATED BY SM  
COMPILED BY SB  
CHECKED BY SB

OFFICE REPORT ON SOIL EXPLORATION

| SOIL PROFILE  |  |            | SAMPLES |      |            | GROUND WATER<br>CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT |    |    |    |     | PLASTIC<br>LIMIT<br>W <sub>p</sub> | NATURAL<br>MOISTURE<br>CONTENT<br>W | LIQUID<br>LIMIT<br>W <sub>L</sub> | UNIF<br>WEIGHT<br>γ | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%) |
|---------------|--|------------|---------|------|------------|----------------------------|-----------------|---|----|----|----|-----|------------------------------------|-------------------------------------|-----------------------------------|---------------------|---|
| ELEV<br>DEPTH | DESCRIPTION  | STRAT PLOT | NUMBER  | TYPE | 'N' VALUES |                            |                 | 20  | 40 | 60 | 80 | 100 |                                    |                                     |                                   |                     |   |
| 133.2         | Ground surface   |            |         |      |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 0.0           | Granular: 250 mm<br>SILTY SAND<br>topsoil seams,<br>compact (FILL) |            |         |      |            |                            | 133             |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 132.3         |  |            |         |      |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 0.9           | GRAVELLY SAND<br>trace of silt,<br>compact to very<br>dense        |            | 1       | SS   | 38         |                            | 132             |   |    |    |    |     |                                    |                                     |                                   |                     | 11 72 (17)  |
|               |  |            | 2       | SS   | 50         |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |
|               |  |            | 3       | SS   | 81         |                            | 131             |   |    |    |    |     |                                    |                                     |                                   |                     |   |
|               |  |            | 4       | SS   | 22         |                            | 130             |   |    |    |    |     |                                    |                                     |                                   |                     | 33 62 (5)   |
|               |  |            | 5       | SS   | 30         |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 128.9         |  |            |         |      |            |                            | 129             |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 4.3           | End of Borehole  |            |         |      |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |

\*3, x5: Numbers refer to  
Sensitivity

20  
15  
10  
5 (%) STRAIN AT FAILURE

W.P. 265-87-00  
formerly

# RECORD OF TEST PIT No 13

METRIC

W.P. 264-87-00(a) LOCATION Station 21 + 450m, 0.9m N of W shoulder pavement edge ORIGINATED BY SM  
DIST 6 HWY 401 BOREHOLE TYPE Back-hoe COMPILED BY SB  
DATUM Geodetic DATE February 27, 1991 CHECKED BY SB

OFFICE REPORT ON SOIL EXPLORATION

| SOIL PROFILE   |  |            | SAMPLES |      |            | GROUND WATER<br>CONDITIONS | ELEVATION<br>SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT |    |    |    |     | PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT |   |                | UNIT<br>WEIGHT<br>Y | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%) |
|--|--|------------|---------|------|------------|----------------------------|--------------------|---|----|----|----|-----|---|---|----------------|---------------------|---|
| ELEV<br>DEPTH  | DESCRIPTION  | STRAT PLOT | NUMBER  | TYPE | 'N' VALUES |                            |                    | 20  | 40 | 60 | 80 | 100 | W <sub>p</sub>                                      | W | W <sub>L</sub> |                     |   |
| 132.0  | Ground surface   |            |         |      |            |                            |                    |   |    |    |    |     |   |   |                |                     |   |
| 0.0  | Topsoil: 250 mm  |            |         |      |            |                            |                    |   |    |    |    |     |   |   |                |                     |   |
| 131.5  | SANDY SILT (FILL)                                      |            |         |      |            |                            |                    |   |    |    |    |     |   |   |                |                     |   |
| 0.3  | Het. mixt. sand and silt                               |            | 1       | CS   |            |                            |                    |   |    |    |    |     |   |   |                |                     |   |
| 131.1  | with gravel (fill)                                     |            |         |      |            |                            |                    |   |    |    |    |     |   |   |                |                     |   |
| 0.9  | GRAVELLY SAND<br>gravel layers,<br>occ. cobbles, moist |            | 2       | CS   |            |                            |                    |   |    |    |    |     |   |   |                |                     |   |
|  |  |            |         |      |            |                            |                    |   |    |    |    |     |   |   |                |                     |   |
|  |  |            | 3       | CS   |            |                            |                    |   |    |    |    |     |   |   |                |                     |   |
| 129.3  |  |            |         |      |            |                            |                    |   |    |    |    |     |   |   |                |                     |   |
| 2.7  | End of Test Pit  |            |         |      |            |                            |                    |   |    |    |    |     |   |   |                |                     |   |
| <p>NOTES:</p> <p>1) Water level at the base of the test-pit, i.e. 2.7m.</p> <p>2) Side slopes excavated at 60° to horizontal, were stable during the period (30 min.) the test-pit was open.</p> <p>3) Dense to hand probing, at base of test-pit.</p> |  |            |         |      |            |                            |                    |   |    |    |    |     |   |   |                |                     |   |

+3, x5: Numbers refer to  
Sensitivity

20  
15  
10  
5 (%) STRAIN AT FAILURE

W.P. 265-87-00  
formerly

# RECORD OF BOREHOLE No 14

METRIC

W.P. 264-87-00(a) LOCATION Station 21 + 500m, 0.2m N of W shoulder pavement edge ORIGINATED BY SM  
DIST 6 HWY 401 BOREHOLE TYPE Solid stem auger COMPILED BY SB  
DATUM Geodetic DATE February 22, 1991 CHECKED BY SB

OFFICE REPORT ON SOIL EXPLORATION

| SOIL PROFILE  |   |            | SAMPLES |      |           | GROUND WATER<br>CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT |                    | PLASTIC<br>LIMIT<br>W <sub>p</sub> | NATURAL<br>MOISTURE<br>CONTENT<br>W | LIQUID<br>LIMIT<br>W <sub>L</sub> | UNIT<br>WEIGHT<br>γ | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%)<br>GR SA SI CL |
|---------------|---|------------|---------|------|-----------|----------------------------|-----------------|---|--------------------|------------------------------------|-------------------------------------|-----------------------------------|---------------------|--|
| ELEV<br>DEPTH | DESCRIPTION   | STRAT PLOT | NUMBER  | TYPE | N' VALUES |                            |                 | 20 40 60 80 100                             | SHEAR STRENGTH kPa |                                    |                                     |                                   |                     |  |
| 132.5         | Ground surface  |            |         |      |           |                            |                 |   |                    |                                    |                                     |                                   |                     |  |
| 0.0           | Granular fill: 400 mm   |            | 1       | SS   | 37        |                            | 132             |   |                    |                                    |                                     |                                   |                     |  |
|               | GRAVELLY SAND<br>some silt,<br>dense<br>(FILL)                    |            | 2       | SS   | 33        |                            |                 |   |                    |                                    |                                     |                                   |                     | 32 53 (15)   |
| 130.8         |   |            |         |      |           |                            | 131             |   |                    |                                    |                                     |                                   |                     |  |
| 1.7           | Het. mixture of silty<br>sand with gravel, dense<br>to very dense |            | 3       | SS   | 41        |                            |                 |   |                    |                                    |                                     |                                   |                     |  |
| 130.1         |   |            |         |      |           |                            |                 |   |                    |                                    |                                     |                                   |                     |  |
| 2.4           | GRAVELLY SAND<br>very dense                                       |            | 4       | SS   | 50/10cm   |                            | 130             |   |                    |                                    |                                     |                                   |                     |  |
| 129.3         |   |            |         |      |           |                            |                 |   |                    |                                    |                                     |                                   |                     |  |
| 3.2           | SAND<br>some gravel,<br>wet, dense to<br>compact                  |            | 5       | SS   | 46        |                            | 129             |   |                    |                                    |                                     |                                   |                     |  |
| 128.2         |   |            | 6       | SS   | 26        |                            |                 |   |                    |                                    |                                     |                                   |                     |  |
| 4.3           | End of Borehole   |            |         |      |           |                            |                 |   |                    |                                    |                                     |                                   |                     |  |

+3, x5: Numbers refer to  
Sensitivity

20  
15 5 (%) STRAIN AT FAILURE  
10

W.P. 265-87-00

RECORD OF BOREHOLE No 15

METRIC

W.P. 264-87-00(a) LOCATION Station 21 + 550m, 0.2m N of W shoulder pavement edge  
DIST 6 HWY 401 BOREHOLE TYPE Solid stem auger  
DATUM Geodetic DATE February 21, 1991  
ORIGINATED BY SM  
COMPILED BY SB  
CHECKED BY SB

OFFICE REPORT ON SOIL EXPLORATION

| SOIL PROFILE  |  |            | SAMPLES |      |            | GROUND WATER<br>CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT |    |    |    |     | PLASTIC<br>LIMIT<br>W <sub>p</sub> | NATURAL<br>MOISTURE<br>CONTENT<br>W | LIQUID<br>LIMIT<br>W <sub>L</sub> | UNIT<br>WEIGHT<br>Y | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%) |
|---------------|--|------------|---------|------|------------|----------------------------|-----------------|---|----|----|----|-----|------------------------------------|-------------------------------------|-----------------------------------|---------------------|---|
| ELEV<br>DEPTH | DESCRIPTION  | STRAT PLOT | NUMBER  | TYPE | 'N' VALUES |                            |                 | 20  | 40 | 60 | 80 | 100 |                                    |                                     |                                   |                     |   |
| 132.3         | Ground surface   |            |         |      |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 0.0           | Granular: 300 mm<br>GRAVELLY SAND TO<br>SILTY SAND<br>topsoil seams,<br>compact<br>(FILL)  |            | 1       | SS   | 20         |                            | 132             |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 130.9         |  |            | 2       | SS   | 31         |                            | 131             |   |    |    |    |     |                                    |                                     |                                   |                     | 21 67 (12)  |
| 1.4           | Het. mixture of<br>silty sand with<br>gravel, wet sand<br>seams, compact<br>(glacial till) |            | 3       | SS   | 31         |                            | 130             |   |    |    |    |     |                                    |                                     |                                   |                     | 16 68 (16)*                                       |
| 129.9         |  |            | 4       | SS   | 34         |                            | 129             |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 2.4           | SAND<br>some silt and<br>gravel,<br>very moist to wet,<br>dense to very<br>dense           |            | 5       | SS   | 50/15cm    |                            | 128             |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 127.9         |  |            | 6       | SS   | 68/22cm    |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 4.4           | Het. mixture of silty<br>sand with gravel, very<br>dense (glacial till)                    |            | 7       | SS   | 50/12cm    |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 127.3         |  |            |         |      |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 5.0           | End of Borehole  |            |         |      |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |





W.P. 265-87-00  
formerly

# RECORD OF BOREHOLE No 16

METRIC

W.P. 264-87-00(a) LOCATION Station 21 + 600m, 0.2m N of W shoulder pavement edge ORIGINATED BY SM  
DIST 6 HWY 401 BOREHOLE TYPE Solid stem auger COMPILED BY SB  
DATUM Geodetic DATE February 21, 1991 CHECKED BY SB

| SOIL PROFILE  |  |            | SAMPLES |      |            | GROUND WATER<br>CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT |    |    |    |     | PLASTIC<br>LIMIT<br>W <sub>p</sub> | NATURAL<br>MOISTURE<br>CONTENT<br>W | LIQUID<br>LIMIT<br>W <sub>L</sub> | UNIT<br>WEIGHT<br>Y | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%) |
|---------------|--|------------|---------|------|------------|----------------------------|-----------------|---|----|----|----|-----|------------------------------------|-------------------------------------|-----------------------------------|---------------------|---|
| ELEV<br>DEPTH | DESCRIPTION  | STRAT PLOT | NUMBER  | TYPE | 'N' VALUES |                            |                 | 20  | 40 | 60 | 80 | 100 |                                    |                                     |                                   |                     |   |
| 131.9         | Ground surface   |            |         |      |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 0.0           | GRANULAR SAND AND<br>GRAVEL TO SILTY SAND<br>topsoil seams,<br>compact<br>(FILL) | X          | 1       | SS   | 36         |                            | 131             |   |    |    |    |     | 0                                  |                                     |                                   |                     | 2 76 / 22   |
| 130.7         |  | X          | 2       | SS   | 16         |                            |                 |   |    |    |    |     | 0                                  |                                     |                                   |                     |   |
| 1.2           | SAND<br>some gravel and<br>silt,<br>compact<br><br>Wet below 3.3m                | .          | 3       | SS   | 26         | *                          | 130             |   |    |    |    |     | 0                                  |                                     |                                   |                     |   |
|               |  | .          | 4       | SS   | 27         |                            |                 |   |    |    |    |     | 0                                  |                                     |                                   |                     |   |
|               |  | .          | 5       | SS   | 33         |                            | 129             |   |    |    |    |     | 0                                  |                                     |                                   |                     |   |
|               |  | .          | 6       | SS   | 28         |                            | 128             |   |    |    |    |     | 0                                  |                                     |                                   |                     |   |
| 127.6         | End of Borehole  |            |         |      |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 4.3           | *Stabilized water<br>table at 3.3m depth.  |            |         |      |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |

OFFICE REPORT ON SOIL EXPLORATION



W.P. 265-87-00

formerly

# RECORD OF TEST PIT No 17

METRIC

W.P. 264-87-00(a)

LOCATION Station 21 + 650m, 2.0m N of W shoulder pavement edge

ORIGINATED BY SM

DIST 6 HWY 401

BOREHOLE TYPE Back-hoe

COMPILED BY SB

DATUM Geodetic

DATE February 27, 1991

CHECKED BY SB

| SOIL PROFILE   |   |            | SAMPLES |      |            | GROUND WATER<br>CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT |                |   |                |                   | PLASTIC NATURAL LIQUID<br>LIMIT MOISTURE CONTENT LIMIT |  |           | UNIT<br>WEIGHT<br>Y | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%)<br>GR SA SI CL |
|--|---|------------|---------|------|------------|----------------------------|-----------------|---|----------------|---|----------------|-------------------|--|--|-----------|---------------------|--|
| ELEV<br>DEPTH  | DESCRIPTION   | STRAT PLOT | NUMBER  | TYPE | 'N' VALUES |                            |                 | 20 40 60 80 100                             | W <sub>p</sub> | W | W <sub>L</sub> | WATER CONTENT (%) |  |  |           |                     |  |
| 130.9  | Ground surface  |            |         |      |            |                            |                 |   |                |   |                |                   |  |  |           |                     |  |
| 0.0  | Organic stained<br>sandy silt   |            |         |      |            |                            |                 |   |                |   |                |                   |  |  |           |                     |  |
| 130.1  |   |            |         |      |            |                            |                 |   |                |   |                |                   |  |  |           |                     |  |
| 0.8  | SAND<br>some gravel and<br>trace of silt,<br>fine to medium<br>becoming coarser<br>below 1.6m |            | 1       | CS   |            |                            |                 |   |                |   |                |                   |  |  | 2 95 (3)  |                     |  |
|  |   |            | 2       | CS   |            |                            |                 |   |                |   |                |                   |  |  |           |                     |  |
| 128.2  |   |            | 3       | CS   |            |                            |                 |   |                |   |                |                   |  |  | 29 67 (4) |                     |  |
| 2.7  | End of Test Pit   |            |         |      |            |                            |                 |   |                |   |                |                   |  |  |           |                     |  |
| <p>NOTES:<br/>1) Test pit wet below 2.4m. Water seepage<br/>significant below 2.4m depth.<br/>2) Dense to hand probing. at base of test-pit.</p> |   |            |         |      |            |                            |                 |   |                |   |                |                   |  |  |           |                     |  |

OFFICE REPORT ON SOIL EXPLORATION



W.P. 265-87-00

formerly

W.P. 264-87-00(a)

# RECORD OF BOREHOLE No 18

METRIC

LOCATION Station 21 + 700m, 1.4m N of W shoulder pavement edge  
DIST 6 HWY 401 BOREHOLE TYPE Solid stem auger  
DATUM Geodetic DATE February 21, 1991

ORIGINATED BY SM

COMPILED BY SB

CHECKED BY SB

| SOIL PROFILE  |  |            | SAMPLES |      |            | GROUND WATER<br>CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT |    |    |    |     | PLASTIC<br>LIMIT<br>W <sub>p</sub> | NATURAL<br>MOISTURE<br>CONTENT<br>W | LIQUID<br>LIMIT<br>W <sub>L</sub> | UNIT<br>WEIGHT<br>Y | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%) |
|---------------|--|------------|---------|------|------------|----------------------------|-----------------|---|----|----|----|-----|------------------------------------|-------------------------------------|-----------------------------------|---------------------|---|
| ELEV<br>DEPTH | DESCRIPTION  | STRAT PLOT | NUMBER  | TYPE | 'N' VALUES |                            |                 | 20  | 40 | 60 | 80 | 100 |                                    |                                     |                                   |                     |   |
| 131.3         | Ground surface   |            |         |      |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 0.0           | GRANULAR SAND AND<br>GRAVEL TO SILTY SAND<br>topsoil seams,<br>compact<br>(FILL) |            | 1       | SS   | 36         |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 130.1         |  |            | 2       | SS   | 27         |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 1.2           | SAND<br>some gravel and<br>silt,<br>dense to very<br>dense<br><br>Wet below 3.0m |            | 3       | SS   | 56         |                            | 130             |   |    |    |    |     |                                    |                                     |                                   |                     |   |
|               |  |            | 4       | SS   | 68         |                            | 129             |   |    |    |    |     |                                    |                                     |                                   |                     |   |
|               |  |            | 5       | SS   | 35         |                            | 128             |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 127.0         |  |            | 6       | SS   | 35         |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 4.3           | End of Borehole  |            |         |      |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |

OFFICE REPORT ON SOIL EXPLORATION

+3, x5: Numbers refer to  
Sensitivity

20  
15  
10  
5  
0  
(%) STRAIN AT FAILURE

W.P. 265-87-00  
formerly

RECORD OF BOREHOLE No 19

METRIC

W.P. 264-87-00(a) LOCATION Station 21 + 727m, 1.3m N of W shoulder pavement edge ORIGINATED BY SM  
DIST 6 HWY 401 BOREHOLE TYPE Solid stem auger COMPILED BY SB  
DATUM Geodetic DATE February 21, 1991 CHECKED BY SB

OFFICE REPORT ON SOIL EXPLORATION

| SOIL PROFILE  |  |            | SAMPLES |      |            | GROUND WATER<br>CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT |    |    |    |     | PLASTIC<br>LIMIT<br>W <sub>p</sub> | NATURAL<br>MOISTURE<br>CONTENT<br>W | LIQUID<br>LIMIT<br>W <sub>L</sub> | UNIT<br>WEIGHT<br>Y | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%) |
|---------------|--|------------|---------|------|------------|----------------------------|-----------------|---|----|----|----|-----|------------------------------------|-------------------------------------|-----------------------------------|---------------------|---|
| ELEV<br>DEPTH | DESCRIPTION  | STRAT PLOT | NUMBER  | TYPE | 'N' VALUES |                            |                 | 20  | 40 | 60 | 80 | 100 |                                    |                                     |                                   |                     |   |
| 131.3         | Ground surface   |            |         |      |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 0.0           | SAND AND GRAVEL<br>topsoil seams,<br>compact to very dense<br>(FILL)                         | X          | 1       | SS   | 22         |                            | 131             |   |    |    |    |     | 0                                  |                                     |                                   |                     |   |
| 129.8         |  | X          | 2       | SS   | 51         |                            | 130             |   |    |    |    |     | 0                                  |                                     |                                   |                     |   |
| 1.5           | SAND TO GRAVELLY SAND<br>some silt and<br>gravel,<br>compact to very dense<br>Wet below 2.9m | o          | 3       | SS   | 63         |                            | 129             |   |    |    |    |     | 0                                  |                                     |                                   |                     | 22 52 (24)  |
|               |  | o          | 4       | SS   | 79         |                            | 128             |   |    |    |    |     | 0                                  |                                     |                                   |                     |   |
|               |  | o          | 5       | SS   | 41         |                            |                 |   |    |    |    |     | 0                                  |                                     |                                   |                     |   |
| 127.0         |  | o          | 6       | SS   | 26         |                            |                 |   |    |    |    |     | 0                                  |                                     |                                   |                     |   |
| 4.3           | End of Borehole  |            |         |      |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |

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

20  
15 5 (%) STRAIN AT FAILURE  
10



Ministry  
of  
Transportation  
Ontario

W.P. 265-87-00

formerly

# RECORD OF BOREHOLE No 20

METRIC

W.P. 264-87-00(a)

LOCATION Station 22 + 750m, 0.2m N of W shoulder pavement edge

ORIGINATED BY SM

DIST 6 HWY 401

BOREHOLE TYPE Solid stem auger

COMPILED BY SB

DATUM Geodetic

DATE February 21, 1991

CHECKED BY SB

OFFICE REPORT ON SOIL EXPLORATION

| SOIL PROFILE  |   |            | SAMPLES |      |            | GROUND WATER<br>CONDITIONS | ELEVATION<br>SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT |                    | PLASTIC<br>LIMIT<br>W <sub>p</sub> | NATURAL<br>MOISTURE<br>CONTENT<br>W | LIQUID<br>LIMIT<br>W <sub>L</sub> | UNIT<br>WEIGHT<br>Y | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%) |
|---------------|---|------------|---------|------|------------|----------------------------|--------------------|---|--------------------|------------------------------------|-------------------------------------|-----------------------------------|---------------------|---|
| ELEV<br>DEPTH | DESCRIPTION   | STRAT PLOT | NUMBER  | TYPE | 'N' VALUES |                            |                    | 20 40 60 80 100                             | SHEAR STRENGTH kPa |                                    |                                     |                                   |                     |   |
| 125.3         | Ground surface  |            |         |      |            |                            |                    |   |                    |                                    |                                     |                                   |                     |   |
| 0.0           | Topsoil: 150 mm<br>Granular material: 250mm   |            | 1       | SS   | 34         |                            | 125                |   |                    |                                    |                                     |                                   |                     |   |
|               | SAND<br>trace to some silt<br>and gravel, organic<br>stained layers,<br>compact to dense<br>(FILL)  |            | 2       | SS   | 35         |                            | 124                |   |                    |                                    |                                     |                                   |                     |   |
|               |   |            | 3       | SS   | 21         |                            |                    |   |                    |                                    |                                     |                                   |                     |   |
| 123.2         |   |            |         |      |            |                            |                    |   |                    |                                    |                                     |                                   |                     |   |
| 2.1           | Heterogeneous<br>mixture of silt<br>and sand with<br>trace to some<br>gravel and clay,<br>occasional wet<br>sand seams,<br>very dense<br>(glacial till) |            | 4       | SS   | 53         |                            | 123                |   |                    |                                    |                                     |                                   | 23.3                |   |
|               |   |            | 5       | SS   | 70         |                            | 122                |   |                    |                                    |                                     |                                   | 23.8                |   |
|               |   |            |         |      |            |                            | 121                |   |                    |                                    |                                     |                                   |                     |   |
|               |   |            | 6       | SS   | 100/7cm    |                            | 120                |   |                    |                                    |                                     |                                   |                     |   |
|               |   |            |         |      |            |                            |                    |   |                    |                                    |                                     |                                   |                     |   |
| 118.9         |   |            | 7       | SS   | 50/15cm    |                            | 119                |   |                    |                                    |                                     |                                   |                     |   |
| 6.4           | End of Borehole   |            |         |      |            |                            |                    |   |                    |                                    |                                     |                                   |                     |   |

+3, x5: Numbers refer to  
Sensitivity

20  
15 5 (%) STRAIN AT FAILURE  
10



| W.P. 265-87-00<br><i>formally</i> |   |            |         |      |            |                         |                 |  |    | RECORD OF BOREHOLE No 21  |    |     |   |   |                |  |                                       |  |  | METRIC                  |  |  |  |  |  |  |  |  |  |
|-----------------------------------|---|------------|---------|------|------------|-------------------------|-----------------|--|----|---|----|-----|---|---|----------------|--|---------------------------------------|--|--|-------------------------|--|--|--|--|--|--|--|--|--|
| W.P. 264-87-00(a)                 |   |            |         |      |            |                         |                 |  |    | LOCATION Station 22, + 800m, 0.2m N of W shoulder pavement edge |    |     |   |   |                |  |                                       |  |  | ORIGINATED BY <u>BM</u> |  |  |  |  |  |  |  |  |  |
| DIST 6 HWY 401                    |   |            |         |      |            |                         |                 |  |    | BOREHOLE TYPE Solid stem auger                                  |    |     |   |   |                |  |                                       |  |  | COMPILED BY <u>SB</u>   |  |  |  |  |  |  |  |  |  |
| DATUM Geodetic                    |   |            |         |      |            |                         |                 |  |    | DATE February 21, 1991  |    |     |   |   |                |  |                                       |  |  | CHECKED BY <u>SB</u>    |  |  |  |  |  |  |  |  |  |
| SOIL PROFILE                      |   |            | SAMPLES |      |            | GROUND WATER CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION RESISTANCE PLOT |    |   |    |     | PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT |   |                | UNIT WEIGHT<br>$\gamma$<br>KN/m <sup>3</sup> | REMARKS & GRAIN SIZE DISTRIBUTION (%) |  |  |                         |  |  |  |  |  |  |  |  |  |
| ELEV DEPTH                        | DESCRIPTION   | STRAT PLOT | NUMBER  | TYPE | 'N' VALUES |                         |                 | 20                                       | 40 | 60  | 80 | 100 | W <sub>p</sub>                                      | W | W <sub>L</sub> |  |                                       |  |  |                         |  |  |  |  |  |  |  |  |  |
| 124.6                             | Ground surface  |            |         |      |            |                         |                 |  |    |   |    |     |   |   |                |  |                                       |  |  |                         |  |  |  |  |  |  |  |  |  |
| 0.0                               | SAND AND GRAVEL<br>some silt,<br>dense to very dense<br>(FILL)  |            | 1       | SS   | 44         |                         |                 |  |    |   |    |     |   |   |                |  |                                       |  |  |                         |  |  |  |  |  |  |  |  |  |
| 123.4                             | Topsoil: 120 mm   |            | 2       | SS   | 54         |                         |                 |  |    |   |    |     |   |   |                |  |                                       |  |  |                         |  |  |  |  |  |  |  |  |  |
| 1.2                               | CLAYEY SILT<br>organic stained,<br>some sand<br>very stiff  |            | 3       | SS   | 18         |                         |                 |  |    |   |    |     |   |   |                |  |                                       |  |  |                         |  |  |  |  |  |  |  |  |  |
| 121.7                             |   |            | 4       | SS   | 12         |                         |                 |  |    |   |    |     |   |   |                |  |                                       |  |  |                         |  |  |  |  |  |  |  |  |  |
| 2.9                               | Heterogeneous<br>mixture of silt<br>and sand with<br>trace to some<br>gravel and clay,<br>occasional wet<br>sand seams,<br>dense to very dense,<br>(glacial till) |            | 5       | SS   | 38         |                         |                 |  |    |   |    |     |   |   |                |  |                                       |  |  |                         |  |  |  |  |  |  |  |  |  |
|                                   |   |            | 6       | SS   | 51         |                         |                 |  |    |   |    |     |   |   |                |  |                                       |  |  |                         |  |  |  |  |  |  |  |  |  |
|                                   |   |            | 7       | SS   | 41         |                         |                 |  |    |   |    |     |   |   |                |  |                                       |  |  |                         |  |  |  |  |  |  |  |  |  |
| 118.1                             |   |            | 8       | SS   | 83         |                         |                 |  |    |   |    |     |   |   |                |  |                                       |  |  |                         |  |  |  |  |  |  |  |  |  |
| 6.5                               | End of Borehole   |            |         |      |            |                         |                 |  |    |   |    |     |   |   |                |  |                                       |  |  |                         |  |  |  |  |  |  |  |  |  |

OFFICE REPORT ON SOIL EXPLORATION



W.P. 265-87-00  
formerly

# RECORD OF TEST PIT No 22

METRIC

W.P. 264-87-00(a) LOCATION Station 22 + 850m, 1.5m N of W shoulder pavement edge ORIGINATED BY  
DIST 6 HWY 401 BOREHOLE TYPE Back-hoe COMPILED BY  
DATUM Geodetic DATE February 26, 1991 CHECKED BY

| SOIL PROFILE  |  | SAMPLES     |        |      | GROUND WATER CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION RESISTANCE PLOT |                 | PLASTIC NATURAL LIQUID LIMIT MOISTURE CONTENT |                                 |                   | UNIF. WEIGHT | REMARKS & GRAIN SIZE DISTRIBUTION (%) |
|---|--|-------------|--------|------|-------------------------|-----------------|--|-----------------|---|---------------------------------|-------------------|--------------|---------------------------------------|
| ELEV. DEPTH   | DESCRIPTION  | STRAT. PLOT | NUMBER | TYPE |                         |                 | VALUES                                   | 20 40 60 80 100 | W <sub>p</sub> W W <sub>L</sub>               | W <sub>p</sub> W W <sub>L</sub> | WATER CONTENT (%) |              |                                       |
| 123.2   | Ground surface   |             |        |      |                         |                 |  |                 |   |                                 |                   |              |                                       |
| 0.0   | Topsoil: 150 mm  |             |        |      |                         | 123             |  |                 |   |                                 |                   |              |                                       |
|   | CLAYEY SILT organic stained, some sand   |             | 1      | CS   |                         |                 |  |                 |   |                                 |                   |              |                                       |
| 122.0   |  |             |        |      |                         | 122             |  |                 |   |                                 |                   |              |                                       |
| 1.2   |  |             | 2      | CS   |                         |                 |  |                 |   |                                 |                   |              |                                       |
|   | Het. mixture of silt and sand with trace to some gravel and clay, wet sand seams between 1.8m and 2.7m, dense (glacial till) |             | 3      | CS   |                         | 121             |  |                 |   |                                 |                   |              |                                       |
|   |  |             | 4      | CS   |                         | 120             |  |                 |   |                                 |                   |              |                                       |
| 119.5   |  |             |        |      |                         |                 |  |                 |   |                                 |                   |              |                                       |
| 3.7   | End of Test Pit  |             |        |      |                         |                 |  |                 |   |                                 |                   |              |                                       |
| <p>NOTES:</p> <p>1) Water seepage from sand seams between 1.8m and 2.7m.</p> <p>2) Dense to hand probing, ab base of test-pit.</p> <p>3) The top 2.1m cut back at 45°, with the bottom 1.6m cut vertical. Very small pocket of sand at 2.3m, caved. The test pit was open for about 1hr. 45min.</p> |  |             |        |      |                         |                 |  |                 |   |                                 |                   |              |                                       |

OFFICE REPORT ON SOIL EXPLORATION

W.P. 265-87-00  
formerly

# RECORD OF BOREHOLE No 23

METRIC

W P 265-87-00(a) LOCATION Station 22 + 890m, 0.2m N of W shoulder pavement edge  
DIST 6 HWY 40 BOREHOLE TYPE Solid stem auger ORIGINATED BY SM  
DATUM Geodetic DATE February 21, 1991 COMPILED BY SB  
CHECKED BY SB

| SOIL PROFILE  |  |            | SAMPLES |      |            | GROUND WATER<br>CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT |    |    |    |     | PLASTIC<br>LIMIT<br>W <sub>p</sub> | NATURAL<br>MOISTURE<br>CONTENT<br>W | LIQUID<br>LIMIT<br>W <sub>L</sub> | UNIT<br>WEIGHT<br>Y | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%) |
|---------------|--|------------|---------|------|------------|----------------------------|-----------------|---|----|----|----|-----|------------------------------------|-------------------------------------|-----------------------------------|---------------------|---|
| ELEV<br>DEPTH | DESCRIPTION  | STRAT PLOT | NUMBER  | TYPE | 'N' VALUES |                            |                 | 20  | 40 | 60 | 80 | 100 |                                    |                                     |                                   |                     |   |
| 124.0         | Ground surface   |            |         |      |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 0.0           | SAND AND GRAVEL<br>some silt<br>(FILL)                             |            |         |      |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 123.0         |  |            |         |      |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 1.0           | CLAYEY SILT<br>organic stained,<br>roots,<br>some sand<br>v. stiff |            | 1       | SS   | 34         |                            | 123             |   |    |    |    |     |                                    |                                     |                                   | 20.1                | 4 49 44 12  |
| 121.7         |  |            | 2       | SS   | 18         |                            | 122             |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 2.3           |  |            | 3       | SS   | 44         |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |
|               |  |            | 4       | SS   | 61         |                            | 121             |   |    |    |    |     |                                    |                                     |                                   | 24.2                |   |
|               |  |            | 5       | SS   | 33         |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |
|               |  |            | 6       | SS   | 33         |                            | 120             |   |    |    |    |     |                                    |                                     |                                   |                     | 6 34 51 9   |
|               |  |            |         |      |            |                            | 119             |   |    |    |    |     |                                    |                                     |                                   |                     |   |
|               |  |            |         |      |            |                            | 118             |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 117.6         |  |            | 7       | SS   | 50/12cm    |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 6.4           | End of Borehole  |            |         |      |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |

OFFICE REPORT ON SOIL EXPLORATION





W.P. 265-87-00  
formerly

# RECORD OF BOREHOLE No 24

METRIC

W.P. 264-87-00(a) LOCATION Station 22 + 956m, 7.0m N of W shoulder pavement edge ORIGINATED BY SM  
DIST 6 HWY 401 BOREHOLE TYPE Solid stem auger COMPILED BY SB  
DATUM Geodetic DATE February 21, 1991 CHECKED BY SB

| SOIL PROFILE  |   |            | SAMPLES |      |            | GROUND WATER<br>CONDITIONS | ELEVATION<br>SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT |    |    |    |     | PLASTIC<br>LIMIT<br>W <sub>p</sub> | NATURAL<br>MOISTURE<br>CONTENT<br>W | LIQUID<br>LIMIT<br>W <sub>L</sub> | UNIT<br>WEIGHT<br>γ | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%) |
|---------------|---|------------|---------|------|------------|----------------------------|--------------------|---|----|----|----|-----|------------------------------------|-------------------------------------|-----------------------------------|---------------------|---|
| ELEV<br>DEPTH | DESCRIPTION   | STRAT PLOT | NUMBER  | TYPE | 'N' VALUES |                            |                    | 20  | 40 | 60 | 80 | 100 |                                    |                                     |                                   |                     |   |
| 123.5         | Ground surface  |            |         |      |            |                            |                    |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 0.0           | Mixture of silt,<br>clay and sand,<br>organic stained,<br>compact<br>(FILL)                                   |            | 1       | SS   | 19         |                            | 123                |   |    |    |    |     |                                    | 0                                   |                                   | 20.8                |   |
| 122.0         |   |            | 2       | SS   | 15         |                            | 122                |   |    |    |    |     |                                    | 0                                   |                                   |                     |   |
| 1.5           | CLAYEY SILT<br>some sand<br>v. stiff  |            | 3       | SS   | 18         |                            | 121                |   |    |    |    |     |                                    | 0                                   |                                   |                     | 0 41 54 5   |
| 121.1         |   |            |         |      |            |                            |                    |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 2.4           |   |            | 4       | SS   | 57         |                            | 120                |   |    |    |    |     |                                    | 0                                   |                                   | 23.2                |   |
|               | Net. mixture of<br>silt and sand with<br>gravel and clay,<br>occ. sand seams,<br>very dense<br>(glacial till) |            | 5       | SS   | 50/15cm    |                            | 119                |   |    |    |    |     |                                    | 0                                   |                                   |                     |   |
|               |   |            | 6       | SS   | 50/15cm    |                            | 118                |   |    |    |    |     |                                    | 0                                   |                                   |                     |   |
| 117.7         |   |            |         |      |            |                            |                    |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 5.8           | SILTY SAND  |            |         |      |            |                            |                    |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 117.1         | wet, very dense   |            | 7       | SS   | 50/5cm     |                            |                    |   |    |    |    |     |                                    | 0                                   |                                   |                     |   |
| 6.4           | End of Borehole   |            |         |      |            |                            |                    |   |    |    |    |     |                                    |                                     |                                   |                     |   |

OFFICE REPORT ON SOIL EXPLORATION

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

20  
15 5 (%) STRAIN AT FAILURE  
10



W.P. 265-87-00  
formerly

# RECORD OF BOREHOLE No 25

METRIC

W P 264-87-00(a) LOCATION Station 23 + 006, 5.0m N of W shoulder pavement edge ORIGINATED BY SY  
DIST 6 HWY 401 BOREHOLE TYPE Solid stem auger COMPILED BY SB  
DATUM Geodetic DATE February 21, 1991 CHECKED BY SB

| SOIL PROFILE  |   |            | SAMPLES |      |            | GROUND WATER<br>CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT |    |    |    |     | PLASTIC<br>LIMIT<br>W <sub>p</sub> | NATURAL<br>MOISTURE<br>CONTENT<br>W | LIQUID<br>LIMIT<br>W <sub>L</sub> | UNIT<br>WEIGHT<br>γ | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%) |
|---------------|---|------------|---------|------|------------|----------------------------|-----------------|---|----|----|----|-----|------------------------------------|-------------------------------------|-----------------------------------|---------------------|---|
| ELEV<br>DEPTH | DESCRIPTION   | STRAT PLOT | NUMBER  | TYPE | 'N' VALUES |                            |                 | 20  | 40 | 60 | 80 | 100 |                                    |                                     |                                   |                     |   |
| 122.3         | Ground surface  |            |         |      |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 0.0           | SAND AND GRAVEL<br>TO SAND<br>compact<br>(FILL)   |            | 1       | CS   |            |                            | 122             |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 121.1         | Topsoil: 100 mm   |            | 2       | SS   | 19         |                            | 121             |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 1.2           | Het. mixture of<br>silt and sand with<br>gravel and clay,<br>occ. sand seams,<br>very dense<br>(glacial till) |            | 3       | SS   | 67         |                            | 120             |   |    |    |    |     |                                    |                                     |                                   |                     |   |
|               |   |            | 4       | SS   | 100/7cm    |                            | 119             |   |    |    |    |     |                                    |                                     |                                   |                     |   |
|               |   |            | 5       | SS   | 100/10cm   |                            | 118             |   |    |    |    |     |                                    |                                     |                                   |                     |   |
|               |   |            | 6       | SS   | 100/10cm   |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 117.6         | End of Borehole   |            |         |      |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 4.7           |   |            |         |      |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |

OFFICE REPORT ON SOIL EXPLORATION

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

20  
15  
10  
5 (%) STRAIN AT FAILURE

W.P. 265-87-00  
formerly

# RECORD OF BOREHOLE No 26

METRIC

W.P. 264-87-00(a) LOCATION Station 23 + 050m, 0.2m N of W shoulder pavement edge  
DIST 6 HWY 401 BOREHOLE TYPE Solid stem auger ORIGINATED BY SM  
DATUM Geodetic DATE February 21 & 22, 1991 COMPILED BY SE  
CHECKED BY SE

| SOIL PROFILE |  |            | SAMPLES |      |            | GROUND WATER CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION RESISTANCE PLOT |    |    |    |     | PLASTIC LIMIT<br>W <sub>p</sub> | NATURAL MOISTURE CONTENT<br>W | LIQUID LIMIT<br>W <sub>L</sub> | UNIT WEIGHT<br>Y | REMARKS & GRAIN SIZE DISTRIBUTION (%) |
|--------------|--|------------|---------|------|------------|-------------------------|-----------------|--|----|----|----|-----|---------------------------------|-------------------------------|--------------------------------|------------------|---------------------------------------|
| ELEV DEPTH   | DESCRIPTION  | STRAT PLOT | NUMBER  | TYPE | 'N' VALUES |                         |                 | 20                                       | 40 | 60 | 80 | 100 |                                 |                               |                                |                  |                                       |
| 123.0        | Ground surface   |            |         |      |            |                         |                 |  |    |    |    |     |                                 |                               |                                |                  |                                       |
| 0.0          | Topsoil: 50 mm   |            | 1       | SS   | 55         |                         |                 |  |    |    |    |     |                                 |                               |                                |                  |                                       |
| 122.0        | SAND AND GRAVEL dense to very dense (FILL)   |            | 2       | SS   | 33         |                         | 122             |  |    |    |    |     |                                 |                               |                                |                  |                                       |
| 1.0          |  |            | 3       | SS   | 71         |                         | 121             |  |    |    |    |     |                                 |                               |                                |                  |                                       |
|              | Met. mixture of silt and sand with gravel and clay, occ. sand seams, very dense (glacial till) |            | 4       | SS   | 50/12cm    |                         | 120             |  |    |    |    |     |                                 |                               |                                |                  |                                       |
|              |  |            | 5       | SS   | 50/9cm     |                         | 119             |  |    |    |    |     |                                 |                               |                                |                  |                                       |
|              |  |            | 6       | SS   | 60/7cm     |                         | 118             |  |    |    |    |     |                                 |                               |                                |                  |                                       |
| 116.7        |  |            | 7       | SS   | 75/10cm    |                         | 117             |  |    |    |    |     |                                 |                               |                                |                  |                                       |
| 6.3          | End of Borehole  |            |         |      |            |                         |                 |  |    |    |    |     |                                 |                               |                                |                  |                                       |

OFFICE REPORT ON SOIL EXPLORATION



W.P. 265-87-00  
formerly

# RECORD OF BOREHOLE No 27

METRIC

W.P. 264-87-00(a)

LOCATION Station 23 + 100m, 0.2m N of W shoulder pavement edge

ORIGINATED BY SM

DIST 6 HWY 401

BOREHOLE TYPE Solid stem auger

COMPILED BY SE

DATUM Geodetic

DATE February 20, 1991

CHECKED BY SE

OFFICE REPORT ON SOIL EXPLORATION

| SOIL PROFILE  |  |            | SAMPLES |      |            | GROUND WATER<br>CONDITIONS | ELEVATION SCALE             | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT |    |    |    |     | PLASTIC<br>LIMIT<br>W <sub>p</sub> | NATURAL<br>MOISTURE<br>CONTENT<br>W | LIQUID<br>LIMIT<br>W <sub>L</sub> | UNIT<br>WEIGHT<br>Y | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%) |
|---------------|--|------------|---------|------|------------|----------------------------|-----------------------------|---|----|----|----|-----|------------------------------------|-------------------------------------|-----------------------------------|---------------------|---|
| ELEV<br>DEPTH | DESCRIPTION  | STRAT PLOT | NUMBER  | TYPE | 'N' VALUES |                            |                             | 20  | 40 | 60 | 80 | 100 |                                    |                                     |                                   |                     |   |
|               |  |            |         |      |            |                            |                             | SHEAR STRENGTH kPa                          |    |    |    |     |                                    |                                     |                                   |                     |   |
|               |  |            |         |      |            |                            | ○ UNCONFINED + FIELD VANE   |   |    |    |    |     |                                    |                                     |                                   |                     |   |
|               |  |            |         |      |            |                            | ● QUICK TRIAXIAL × LAB VANE |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 123.0         | Ground surface   |            |         |      |            |                            |                             |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 0.0           | SAND AND GRAVEL<br>TO SILTY SAND<br>some organics,<br>compact<br>(FILL)          |            | 1       | SS   | 30         |                            |                             |   |    |    |    | 0   |                                    |                                     |                                   |                     |   |
| 121.8         |  |            | 2       | SS   | 27         |                            |                             |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 1.2           | Het. mixture of<br>silt and sand with<br>gravel,<br>dense<br>(glacial till)      |            | 3       | SS   | 38         |                            |                             |   |    |    |    | 0   |                                    |                                     |                                   |                     |   |
|               |  |            | 4       | SS   | 45         |                            |                             |   |    |    |    | 0   |                                    |                                     | 22.5                              |                     |   |
| 120.0         |  |            |         |      |            |                            |                             |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 3.0           | SILTY SAND<br>wet,<br>very dense   |            | 5       | SS   | 65         |                            |                             |   |    |    |    | 0   |                                    |                                     |                                   |                     |   |
| 118.7         |  |            | 6       | SS   | 60         |                            |                             |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 4.3           | Het. mixture of<br>silt and sand with<br>gravel,<br>very dense<br>(glacial till) |            | 7       | SS   | 50/5cm     |                            |                             |   |    |    |    | 0   |                                    |                                     | 23.2                              |                     |   |
| 116.7         |  |            |         |      |            |                            |                             |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 6.3           | End of Borehole  |            | 8       | SS   | 50/5cm     |                            |                             |   |    |    |    | 0   |                                    |                                     |                                   |                     |   |

+3, x5: Numbers refer to  
Sensitivity

20  
15 5 (%) STRAIN AT FAILURE  
10



W.P. 265-87-00  
formerly

# RECORD OF BOREHOLE No 28

METRIC

W.P. 264-87-00(a) LOCATION Station 23 + 150m, 0.2m N of W shoulder pavement edge ORIGINATED BY SM  
DIST 6 HWY 401 BOREHOLE TYPE Solid stem auger COMPILED BY SB  
DATUM Geodetic DATE February 20, 1991 CHECKED BY SB

| SOIL PROFILE  |   |            | SAMPLES |      |            | GROUND WATER<br>CONDITIONS | ELEVATION<br>SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT |    |    |    |     | PLASTIC<br>LIMIT<br>W <sub>p</sub> | NATURAL<br>MOISTURE<br>CONTENT<br>W | LIQUID<br>LIMIT<br>W <sub>L</sub> | WATER CONTENT (%)<br>Y | UNIT<br>WEIGHT<br>γ | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%) |
|---------------|---|------------|---------|------|------------|----------------------------|--------------------|---|----|----|----|-----|------------------------------------|-------------------------------------|-----------------------------------|------------------------|---------------------|---|
| ELEV<br>DEPTH | DESCRIPTION   | STRAT PLOT | NUMBER  | TYPE | 'N' VALUES |                            |                    | 20  | 40 | 60 | 80 | 100 |                                    |                                     |                                   |                        |                     |   |
| 122.7         | Ground surface  |            |         |      |            |                            |                    |   |    |    |    |     |                                    |                                     |                                   |                        |                     |   |
| 0.0           | SAND AND GRAVEL<br>compact to very dense<br>(FILL)  |            | 1       | SS   | 27         |                            | 122                |   |    |    |    |     | 0                                  |                                     |                                   |                        |                     | 31 56 (13)  |
| 121.7         | Topsoil: 40 mm  |            | 2       | SS   | 92         |                            |                    |   |    |    |    |     |                                    | 0                                   |                                   |                        |                     |   |
| 1.0           | Het. mixture of<br>silt and sand with<br>gravel, dense to<br>very dense<br>(glacial till) |            | 3       | SS   | 41         |                            | 121                |   |    |    |    |     | 0                                  |                                     |                                   |                        | 22.7                |   |
|               |   |            | 4       | SS   | 92/20 cm   |                            | 120                |   |    |    |    |     | 0                                  |                                     |                                   |                        | 23.1                |   |
| 119.8         | SANDY SILT<br>wet, very dense   |            | 5       | SS   | 50/10 cm   |                            |                    |   |    |    |    |     |                                    | 0                                   |                                   |                        |                     | 1 34 (65)   |
| 118.9         |   |            |         |      |            |                            | 119                |   |    |    |    |     |                                    | 0                                   |                                   |                        |                     |   |
| 3.8           | Het. mixture of<br>silt and sand with<br>gravel, very<br>dense<br>(glacial till)          |            | 6       | SS   | 50/10 cm   |                            |                    |   |    |    |    |     |                                    | 0                                   |                                   |                        |                     |   |
|               |   |            | 7       | SS   | 50/10 cm   |                            | 118                |   |    |    |    |     |                                    | 0                                   |                                   |                        |                     |   |
|               |   |            |         |      |            |                            |                    |   |    |    |    |     |                                    |                                     |                                   |                        |                     |   |
| 116.4         |   |            | 8       | SS   | 50/10 cm   |                            | 117                |   |    |    |    |     |                                    | 0                                   |                                   |                        |                     |   |
| 6.3           | End of Borehole   |            |         |      |            |                            |                    |   |    |    |    |     |                                    |                                     |                                   |                        |                     |   |

OFFICE REPORT ON SOIL EXPLORATION

W.P. 265-87-00  
formerly

# RECORD OF BOREHOLE No 29

METRIC

W.P. 264-87-00(a) LOCATION Station 23 + 200m, 0.2m N of W shoulder pavement edge ORIGINATED BY SM  
DIST 6 HWY 401 BOREHOLE TYPE Solid stem auger COMPILED BY SB  
DATUM Geodetic DATE February 20, 1991 CHECKED BY SB

| SOIL PROFILE  |   |            | SAMPLES |      |            | GROUND WATER<br>CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE - PLOT |                    | PLASTIC<br>LIMIT<br>W <sub>p</sub> | NATURAL<br>MOISTURE<br>CONTENT<br>W | LIQUID<br>LIMIT<br>W <sub>L</sub> | UNIT<br>WEIGHT<br>Y | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%) |
|---------------|---|------------|---------|------|------------|----------------------------|-----------------|---|--------------------|------------------------------------|-------------------------------------|-----------------------------------|---------------------|---|
| ELEV<br>DEPTH | DESCRIPTION   | STRAT PLOT | NUMBER  | TYPE | 'N' VALUES |                            |                 | 20 40 60 80 100                               | SHEAR STRENGTH kPa |                                    |                                     |                                   |                     |   |
| 122.5         | Ground surface  |            |         |      |            |                            |                 | ○ UNCONFINED + FIELD VANE                     |                    |                                    |                                     |                                   |                     |   |
|               |   |            |         |      |            |                            |                 | ● QUICK TRIAXIAL x LAB VANE                   |                    |                                    |                                     |                                   |                     |   |
| 0.0           | SILTY SAND<br>compact<br>(FILL)   |            |         |      |            |                            | 122             |   |                    |                                    |                                     |                                   |                     |   |
| 121.0         |   |            | 1       | SS   | 26         |                            |                 |   |                    |                                    |                                     |                                   |                     |   |
| 1.5           |   |            | 2       | SS   | 40         |                            | 121             |   |                    |                                    |                                     |                                   |                     |   |
|               | Heterogenous<br>mixture of silt and<br>sand with gravel<br>and clay,<br>sand seams,<br>dense to<br>very dense<br>(glacial till) |            | 3       | SS   | 50/5cm     |                            | 120             |   |                    |                                    |                                     |                                   |                     |   |
|               |   |            | 4       | SS   | 50/10cm    |                            | 119             |   |                    |                                    |                                     |                                   |                     |   |
|               |   |            | 5       | SS   | 50/12cm    |                            |                 |   |                    |                                    |                                     |                                   |                     |   |
|               |   |            | 6       | SS   | 50/10cm    |                            | 118             |   |                    |                                    |                                     |                                   |                     |   |
|               |   |            |         |      |            |                            | 117             |   |                    |                                    |                                     |                                   |                     |   |
| 116.7         |   |            |         |      |            |                            |                 |   |                    |                                    |                                     |                                   |                     |   |
| 5.8           | SILTY SAND  |            |         |      |            |                            |                 |   |                    |                                    |                                     |                                   |                     |   |
| 116.2         | grey, wet, very dense   |            | 7       | SS   | 50/15cm    |                            |                 |   |                    |                                    |                                     |                                   |                     |   |
| 6.3           | End of Borehole   |            |         |      |            |                            |                 |   |                    |                                    |                                     |                                   |                     |   |

OFFICE REPORT ON SOIL EXPLORATION

W.P. 265-87-00  
formerly

# RECORD OF BOREHOLE No 30

METRIC

W.P. 264-87-00(a) LOCATION Station 23 + 250m, 0.2m N of W shoulder pavement edge ORIGINATED BY SM  
DIST 6 HWY 401 BOREHOLE TYPE Solid stem auger COMPILED BY SB  
DATUM Geodetic DATE February 20, 1991 CHECKED BY SB

| SOIL PROFILE  |  |            | SAMPLES |      |            | GROUND WATER<br>CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT |    |    |    |     | PLASTIC LIMIT<br>W <sub>p</sub> | NATURAL MOISTURE<br>CONTENT<br>W | LIQUID LIMIT<br>W <sub>L</sub> | UNIT WEIGHT<br>Y | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%) |
|---------------|--|------------|---------|------|------------|----------------------------|-----------------|---|----|----|----|-----|---------------------------------|----------------------------------|--------------------------------|------------------|---|
| ELEV<br>DEPTH | DESCRIPTION  | STRAT PLOT | NUMBER  | TYPE | 'N' VALUES |                            |                 | 20  | 40 | 60 | 80 | 100 |                                 |                                  |                                |                  |   |
| 122.4         | Ground surface   |            |         |      |            |                            |                 |   |    |    |    |     |                                 |                                  |                                |                  |   |
| 0.0           | SILTY SAND<br>organic stained<br>layers, moist to<br>very moist, compact<br>(FILL)   |            | 1       | CS   |            |                            | 122             |   |    |    |    |     |                                 | 0                                |                                |                  |   |
|               |  |            | 2       | SS   | 35         |                            | 121             |   |    |    |    |     |                                 | 0                                |                                |                  |   |
| 120.6         |  |            | 3       | SS   | 13         |                            | 120             |   |    |    |    |     |                                 | 0                                |                                |                  |   |
| 1.8           | Heterogenous<br>mixture of<br>silt and sand<br>with gravel and<br>traces of clay,<br>sand seams,<br>very dense<br>(glacial till) |            | 4       | SS   | 71         |                            | 119             |   |    |    |    |     |                                 | 0                                |                                |                  |   |
|               |  |            | 5       | SS   | 39         |                            | 118             |   |    |    |    |     |                                 | 0                                |                                |                  |   |
|               |  |            | 6       | SS   | 50/12cm    |                            | 117             |   |    |    |    |     |                                 | 0                                |                                |                  |   |
|               |  |            | 7       | SS   | 50/12cm    |                            |                 |   |    |    |    |     |                                 | 0                                |                                |                  |   |
| 116.0         | End of Borehole  |            |         |      |            |                            |                 |   |    |    |    |     |                                 |                                  |                                |                  |   |
| 6.4           |  |            |         |      |            |                            |                 |   |    |    |    |     |                                 |                                  |                                |                  |   |

OFFICE REPORT ON SOIL EXPLORATION

| W.P. 265-87-00<br><i>formerly</i>  |   | RECORD OF TEST PIT No 31                                       |        |                         |                 | METRIC                                   |            |                    |                                 |                               |                                |                  |                                       |
|--|---|--|--------|-------------------------|-----------------|--|------------|--------------------|---------------------------------|-------------------------------|--------------------------------|------------------|---------------------------------------|
| W P 264-87-00(a)   |   | LOCATION Station 23 + 300m, 1.0m N of W shoulder pavement edge |        |                         |                 | ORIGINATED BY SY                         |            |                    |                                 |                               |                                |                  |                                       |
| DIST 6 HWY 401   |   | BOREHOLE TYPE Back-hoe   |        |                         |                 | COMPILED BY SB                           |            |                    |                                 |                               |                                |                  |                                       |
| DATUM Geodetic   |   | DATE February 26, 1991   |        |                         |                 | CHECKED BY TB                            |            |                    |                                 |                               |                                |                  |                                       |
| SOIL PROFILE   |   | SAMPLES  |        | GROUND WATER CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION RESISTANCE PLOT |            |                    | PLASTIC LIMIT<br>W <sub>p</sub> | NATURAL MOISTURE CONTENT<br>W | LIQUID LIMIT<br>W <sub>L</sub> | UNIT WEIGHT<br>γ | REMARKS & GRAIN SIZE DISTRIBUTION (%) |
| ELEV DEPTH   | DESCRIPTION   | STRAT PLOT   | NUMBER |                         |                 | TYPE                                     | 'N' VALUES | SHEAR STRENGTH kPa |                                 |                               |                                |                  |                                       |
| 121.6  | Ground surface  |  |        |                         |                 |  |            |                    |                                 |                               |                                |                  |                                       |
| 0.0  | Topsoil: 100 mm SAND AND GRAVEL some silt                   |  | 1      | CS                      |                 |  |            |                    |                                 |                               |                                |                  |                                       |
| 120.6  | Organic stained soil: 200 mm                                |  | 2      | CS                      |                 |  |            |                    |                                 |                               |                                |                  |                                       |
| 1.0  | Het. mixture of silt and sand with trace of gravel and clay |  | 3      | CS                      |                 |  |            |                    |                                 |                               |                                |                  |                                       |
|  |   |  | 4      | CS                      |                 |  |            |                    |                                 |                               |                                |                  |                                       |
|  | 30mm thick wet sand seam at 2.4m                            |  |        |                         |                 |  |            |                    |                                 |                               |                                |                  |                                       |
| 118.3  | End of Test Pit   |  |        |                         |                 |  |            |                    |                                 |                               |                                |                  |                                       |
| NOTES:<br>1) Water seepage from 50mm thick wet sand seam at 2.4m.<br>2) Side slopes at 45°, were stable during the time (2 hrs.) the test pit was open.<br>3) Very dense to hand probing, at base of test-pit. |   |  |        |                         |                 |  |            |                    |                                 |                               |                                |                  |                                       |

OFFICE REPORT ON SOIL EXPLORATION



W.P. 265-87-00  
formerly

# RECORD OF BOREHOLE No 32

METRIC

W.P. 264-87-00(a) LOCATION Station 23 + 350m, 0.2m N of W shoulder pavement edge ORIGINATED BY SY  
DIST 6 HWY 401 BOREHOLE TYPE Solid stem auger COMPILED BY SS  
DATUM Geodetic DATE February 20, 1991 CHECKED BY SS

| SOIL PROFILE  |  |            | SAMPLES |      |            | GROUND WATER<br>CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT |    |    |    |     | PLASTIC<br>LIMIT<br>W <sub>p</sub> | NATURAL<br>MOISTURE<br>CONTENT<br>W | LIQUID<br>LIMIT<br>W <sub>L</sub> | UNIT<br>WEIGHT<br>Y | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%) |
|---------------|--|------------|---------|------|------------|----------------------------|-----------------|---|----|----|----|-----|------------------------------------|-------------------------------------|-----------------------------------|---------------------|---|
| ELEV<br>DEPTH | DESCRIPTION  | STRAT PLOT | NUMBER  | TYPE | 'N' VALUES |                            |                 | 20  | 40 | 60 | 80 | 100 |                                    |                                     |                                   |                     |   |
| 122.2         | Ground surface   |            |         |      |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 0.0           | Granular: 200 mm<br>Sandy topsoil: 120 mm  |            | 1       | SS   | 41         |                            | 122             |   |    |    |    |     |                                    |                                     |                                   |                     |   |
|               | SANDY SILT<br>grey, very moist<br>(FILL)   |            | 2       | SS   | 38         |                            | 121             |   |    |    |    |     |                                    |                                     |                                   |                     | 2 38 56 4   |
| 120.5         |  |            | 3       | SS   | 28         |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 1.7           |  |            | 4       | SS   | 55         |                            | 120             |   |    |    |    |     |                                    |                                     |                                   | 23.7                |   |
|               | Heterogeneous<br>mixture of silt<br>and sand with<br>trace of gravel<br>and clay,<br>sand seams,<br>compact to<br>very dense<br>(glacial till) |            | 5       | SS   | 50/15 cm   |                            | 119             |   |    |    |    |     |                                    |                                     |                                   | 24.0                |   |
|               |  |            | 6       | SS   | 50/12 cm   |                            | 118             |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 116.7         |  |            |         |      |            |                            | 117             |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 5.5           | SILTY SAND<br>grey, wet,<br>very dense   |            | 7       | SS   | 50/12 cm   |                            | 116             |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 115.9         |  |            |         |      |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 6.3           | End of Borehole  |            |         |      |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |

OFFICE REPORT ON SOIL EXPLORATION

+3, x5: Numbers refer to  
Sensitivity

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

W.P. 265-87-00  
formerly

# RECORD OF BOREHOLE No 33

METRIC

W.P. 264-87-00(a) LOCATION Station 23 + 400m, 0.2m N of W shoulder pavement edge ORIGINATED BY SP  
DIST 6 HWY 401 BOREHOLE TYPE Solid stem auger COMPILED BY PP  
DATUM Geodetic DATE February 18, 1991 CHECKED BY SP

| SOIL PROFILE  |   |            | SAMPLES |      |            | GROUND WATER<br>CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT |  |  |  |  | PLASTIC<br>LIMIT<br>W <sub>p</sub> | NATURAL<br>MOISTURE<br>CONTENT<br>W | LIQUID<br>LIMIT<br>W <sub>L</sub> | UNIT<br>WEIGHT<br>γ | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%) |  |  |  |                   |  |  |
|---------------|---|------------|---------|------|------------|----------------------------|-----------------|---|--|--|--|--|------------------------------------|-------------------------------------|-----------------------------------|---------------------|---|--|--|--|-------------------|--|--|
| ELEV<br>DEPTH | DESCRIPTION   | STRAT PLOT | NUMBER  | TYPE | 'N' VALUES |                            |                 | 20 40 60 80 100                             |  |  |  |  |                                    |                                     |                                   |                     |   | SHEAR STRENGTH kPa                                       |  |  | WATER CONTENT (%) |  |  |
|               |   |            |         |      |            |                            |                 |   |  |  |  |  |                                    |                                     |                                   |                     |   | ○ UNCONFINED + FIELD VANE<br>● QUICK TRIAXIAL × LAB VANE |  |  |                   |  |  |
| 122.1         | Ground surface  |            |         |      |            |                            |                 |   |  |  |  |  |                                    |                                     |                                   |                     |   |  |  |  |                   |  |  |
| 0.0           | Granular: 300 mm  |            |         |      |            |                            | 122             |   |  |  |  |  |                                    |                                     |                                   |                     |   |  |  |  |                   |  |  |
|               | SILTY SAND TO<br>SANDY SILT<br>some gravel,<br>very dense<br>(FILL)   |            | 1       | SS   | 57         |                            | 121             |   |  |  |  |  |                                    |                                     |                                   |                     |   |  |  |  |                   |  |  |
| 120.6         |   |            | 2       | SS   | 34         |                            |                 |   |  |  |  |  |                                    |                                     |                                   | 24.0                |   |  |  |  |                   |  |  |
| 1.5           |   |            | 3       | SS   | 50/15cm    |                            | 120             |   |  |  |  |  |                                    |                                     |                                   |                     |   |  |  |  |                   |  |  |
|               | Heterogeneous<br>mixture of<br>silt, sand, gravel<br>and trace of<br>clay, sand<br>seams,<br>dense to<br>very dense<br>(glacial till) |            | 4       | SS   | 50/12cm    |                            | 119             |   |  |  |  |  |                                    |                                     |                                   | 23.3                |   |  |  |  |                   |  |  |
|               |   |            | 5       | SS   | 50/8cm     |                            | 118             |   |  |  |  |  |                                    |                                     |                                   |                     | 20 33 37 10                                       |  |  |  |                   |  |  |
|               |   |            | 6       | SS   | 50/5cm     |                            | 117             |   |  |  |  |  |                                    |                                     |                                   |                     |   |  |  |  |                   |  |  |
|               | Very moist below<br>6.1m  |            |         |      |            |                            | 116             |   |  |  |  |  |                                    |                                     |                                   |                     |   |  |  |  |                   |  |  |
|               |   |            |         |      |            |                            | 115             |   |  |  |  |  |                                    |                                     |                                   |                     |   |  |  |  |                   |  |  |
| 114.3         |   |            | 7       | SS   | 50/7cm     |                            |                 |   |  |  |  |  |                                    |                                     |                                   |                     |   |  |  |  |                   |  |  |
| 7.8           | End of Borehole   |            |         |      |            |                            |                 |   |  |  |  |  |                                    |                                     |                                   |                     |   |  |  |  |                   |  |  |

OFFICE REPORT ON SOIL EXPLORATION

W.P. 265-87-00

# RECORD OF BOREHOLE No 34

METRIC

W.P. 264-87-00(a) LOCATION Station 23 + 450m, 0.2m N of W shoulder pavement edge ORIGINATED BY SM  
 DIST 6 HWY 401 BOREHOLE TYPE Solid stem auger COMPILED BY SB  
 DATUM Geodetic DATE February 20, 1991 CHECKED BY SB

| SOIL PROFILE |   |            | SAMPLES |      |            | GROUND WATER CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION RESISTANCE PLOT |    |    |    |     | PLASTIC LIMIT<br>W <sub>p</sub> | NATURAL MOISTURE CONTENT<br>W | LIQUID LIMIT<br>W <sub>L</sub> | UNIT WEIGHT<br>γ | REMARKS & GRAIN SIZE DISTRIBUTION (%) |
|--------------|---|------------|---------|------|------------|-------------------------|-----------------|--|----|----|----|-----|---------------------------------|-------------------------------|--------------------------------|------------------|---------------------------------------|
| ELEV DEPTH   | DESCRIPTION   | STRAT PLOT | NUMBER  | TYPE | 'N' VALUES |                         |                 | 20                                       | 40 | 60 | 80 | 100 |                                 |                               |                                |                  |                                       |
| 121.9        | Ground surface  |            |         |      |            |                         |                 |  |    |    |    |     |                                 |                               |                                |                  |                                       |
| 0.0          | Topsoil: 150 mm   |            | 1       | CS   |            |                         | 121             |  |    |    |    |     | 0                               |                               |                                |                  |                                       |
|              | SILTY SAND AND GRAVEL compact (FILL)  |            | 2       | SS   | 28         |                         |                 |  |    |    |    |     | 0                               |                               |                                |                  |                                       |
| 120.2        |   |            |         |      |            |                         |                 |  |    |    |    |     |                                 |                               |                                |                  |                                       |
| 1.7          |   |            | 3       | SS   | 20         |                         | 120             |  |    |    |    |     | 0                               |                               |                                | 23.2             |                                       |
|              |   |            | 4       | SS   | 50/10cm    |                         |                 |  |    |    |    |     | 0                               |                               |                                |                  |                                       |
|              | Heterogeneous mixture of silt and sand with gravel and trace of clay, sand seams (glacial till) |            | 5       | SS   | 81         |                         | 119             |  |    |    |    |     | 0                               |                               |                                |                  |                                       |
|              |   |            | 6       | SS   | 67         |                         | 118             |  |    |    |    |     | 0                               |                               |                                | 24.0             |                                       |
|              |   |            | 7       | SS   | 50/5cm     |                         | 117             |  |    |    |    |     | 0                               |                               |                                |                  |                                       |
|              | Very moist below 4.5m   |            |         |      |            |                         |                 |  |    |    |    |     |                                 |                               |                                |                  |                                       |
| 115.6        |   |            | 8       | SS   | 50/10cm    |                         | 116             |  |    |    |    |     | 0                               |                               |                                |                  |                                       |
| 6.3          | End of Borehole   |            |         |      |            |                         |                 |  |    |    |    |     |                                 |                               |                                |                  |                                       |

OFFICE REPORT ON SOIL EXPLORATION

+3, x5: Numbers refer to Sensitivity

20  
15  
10  
5  
5 (%) STRAIN AT FAILURE



W.P. 265-87-00

# RECORD OF BOREHOLE No 35

METRIC

W.P. 264-87-00(a)

LOCATION Station 23 + 500m, 0.2m N of W shoulder pavement edge

ORIGINATED BY SM

DIST 6 HWY 401

BOREHOLE TYPE Solid stem auger

COMPILED BY SE

DATUM Geodetic

DATE February 18, 1991

CHECKED BY SE

OFFICE REPORT ON SOIL EXPLORATION

| SOIL PROFILE  |   |            | SAMPLES |      |           | GROUND WATER<br>CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT |    |    |    |     | PLASTIC LIMIT<br>NATURAL MOISTURE<br>CONTENT LIQUID LIMIT |   |                | UNIT<br>WEIGHT<br>Y | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%) |
|---------------|---|------------|---------|------|-----------|----------------------------|-----------------|---|----|----|----|-----|---|---|----------------|---------------------|---|
| ELEV<br>DEPTH | DESCRIPTION   | STRAT PLOT | NUMBER  | TYPE | N' VALUES |                            |                 | 20  | 40 | 60 | 80 | 100 | W <sub>p</sub>  | W | W <sub>L</sub> |                     |   |
| 121.8         | Ground surface  |            | 1       | SS   | 33        |                            |                 |   |    |    |    |     |   |   |                |                     |   |
| 0.0           | Topsoil: 125 mm   |            | 2       | SS   | 35        |                            | 121             |   |    |    |    |     |   |   |                |                     |   |
| 120.1         | Topsoil: 125 mm   |            | 3       | SS   | 14        |                            | 120             |   |    |    |    |     |   |   |                |                     |   |
| 1.7           | Heterogeneous mixture of silt and sand, with trace of gravel and clay, wet sand seams, compact to very dense (glacial till) |            | 4       | SS   | 15        |                            | 119             |   |    |    |    |     |   |   |                |                     |   |
|               |   |            | 5       | SS   | 120       |                            | 118             |   |    |    |    |     |   |   |                |                     |   |
|               |   |            | 6       | SS   | 75/5cm    |                            | 117             |   |    |    |    |     |   |   |                |                     |   |
|               |   |            | 7       | SS   | 50/10cm   |                            | 116             |   |    |    |    |     |   |   |                |                     |   |
|               |   |            | 8       | SS   | 50/8cm    |                            | 115             |   |    |    |    |     |   |   |                |                     |   |
|               |   |            | 9       | SS   | 50/5cm    |                            | 114             |   |    |    |    |     |   |   |                |                     |   |
|               |   |            | 10      | SS   | 107       |                            |                 |   |    |    |    |     |   |   |                |                     |   |
| 113.8         |   |            | 11      | SS   | 95/23cm   |                            |                 |   |    |    |    |     |   |   |                |                     |   |
| 8.0           | End of Borehole   |            |         |      |           |                            |                 |   |    |    |    |     |   |   |                |                     |   |

+3, x5: Numbers refer to  
Sensitivity

20  
15  
10  
5  
0  
5  
10  
15  
20  
(%) STRAIN AT FAILURE

W. P. 265-87-00  
formerly

# RECORD OF BOREHOLE No 36

METRIC

W P 264-87-00(a) LOCATION Station 23 + 600m, 0.2m N of W shoulder pavement edge ORIGINATED BY SM  
DIST 6 HWY 401 BOREHOLE TYPE Solid stem auger COMPILED BY SB  
DATUM Geodetic DATE February 18, 1991 CHECKED BY SB

| SOIL PROFILE  |  |            | SAMPLES |      |            | GROUND WATER<br>CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT |  |  |  |  | PLASTIC LIMIT<br>NATURAL MOISTURE<br>LIQUID LIMIT |  |   | UNIT<br>WEIGHT<br><br>γ<br><br>KN/m <sup>3</sup> | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%)<br>GR SA SI CL |
|---------------|--|------------|---------|------|------------|----------------------------|-----------------|---|--|--|--|--|---|--|---|--|--|
| ELEV<br>DEPTH | DESCRIPTION  | STRAT PLOT | NUMBER  | TYPE | 'N' VALUES |                            |                 | 20 40 60 80 100                             | SHEAR STRENGTH kPa<br>○ UNCONFINED + FIELD VANE<br>● QUICK TRIAXIAL x LAB VANE |  |  |  |   | W <sub>p</sub> W W <sub>L</sub><br>WATER CONTENT (%) |   |  |  |
| 121.8         | Ground surface   |            |         |      |            |                            |                 |   |  |  |  |  |   |  |   |  |  |
| 0.0           | SANDY SILT<br>some gravel,<br>topsoil layers,<br>compact to<br>very dense<br>(FILL)                                    |            | 1       | SS   | 67         |                            | 121             |   |  |  |  |  |   | ○  |   |  |  |
| 120.4         |  |            | 2       | SS   | 22         |                            |                 |   |  |  |  |  |   | ○  |   |  |  |
| 1.4           | Heterogeneous<br>mixture of<br>silt, sand,<br>gravel and clay,<br>sand seams,<br>compact to dense<br><br>brown<br>grey |            | 3       | SS   | 19         |                            | 120             |   |  |  |  |  |   | ○  |   |  |  |
|               |  |            | 4       | SS   | 35         |                            | 119             |   |  |  |  |  |   | ○  |   |  |  |
|               |  |            | 5       | SS   | 27         |                            |                 |   |  |  |  |  |   | ○  |   | 24.4   |  |
|               |  |            |         |      |            |                            |                 |   |  |  |  |  |   |  |   |  |  |
|               |  |            |         |      |            |                            |                 | 118   |  |  |  |  |   |  | ○ |  | 24.4   |
| 117.6         |  |            | 6       | SS   | 15         |                            |                 |   |  |  |  |  |   | ○  |   |  |  |
| 4.2           | End of Borehole  |            |         |      |            |                            |                 |   |  |  |  |  |   |  |   |  |  |

OFFICE REPORT ON SOIL EXPLORATION

W.P. 265-87-00  
formerly

# RECORD OF TEST PIT No 37

METRIC

W.P. 264-87-00(a) LOCATION Station 23 + 650m, 3.0m N of W shoulder pavement edge ORIGINATED BY SM  
 DIST 6 HWY 401 BOREHOLE TYPE Back-hoe COMPILED BY SB  
 DATUM Geodetic DATE February 26, 1991 CHECKED BY SB

| SOIL PROFILE  |   | SAMPLES    |        |      | GROUND WATER<br>CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT |    |    |    |    | PLASTIC<br>LIMIT<br>W <sub>p</sub> | NATURAL<br>MOISTURE<br>CONTENT<br>W | LIQUID<br>LIMIT<br>W <sub>L</sub> | UNIT<br>WEIGHT<br>γ | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%) |
|---|---|------------|--------|------|----------------------------|-----------------|---|----|----|----|----|------------------------------------|-------------------------------------|-----------------------------------|---------------------|---|
| ELEV<br>DEPTH   | DESCRIPTION   | STRAT PLOT | NUMBER | TYPE |                            |                 | 'N' VALUES                                  | 20 | 40 | 60 | 80 |                                    |                                     |                                   |                     |   |
| 121.3   | Ground surface  |            |        |      |                            |                 |   |    |    |    |    |                                    |                                     |                                   |                     |   |
| 0.0   | SANDY SILT<br>organic stained<br>layers<br>(FILL)   |            | 2      | GS   |                            | 121             |   |    |    |    |    |                                    |                                     |                                   |                     |   |
| 120.4   |   |            |        |      |                            |                 |   |    |    |    |    |                                    |                                     |                                   |                     |   |
| 0.9   | Het. mixture of<br>silt and sand<br>with gravel and<br>occasional cobbles<br>(glacial till) |            | 3      | GS   |                            | 120             |   |    |    |    |    |                                    |                                     |                                   |                     |   |
|   |   |            |        |      |                            |                 |   |    |    |    |    |                                    |                                     |                                   |                     |   |
|   |   |            | 4      | GS   |                            | 119             |   |    |    |    |    |                                    |                                     |                                   |                     |   |
| 118.1   |   |            |        |      |                            |                 |   |    |    |    |    |                                    |                                     |                                   |                     |   |
| 3.2   | End of Test Pit   |            |        |      |                            |                 |   |    |    |    |    |                                    |                                     |                                   |                     |   |
| NOTES:<br>1) Test pit dry and no seepage from sand seams.<br>2) Side slopes were excavated at 45°. No sign of slope instability during the period (3 hrs.) the test pit was open.<br>3) Very dense to hand probing, below 1.0m. |   |            |        |      |                            |                 |   |    |    |    |    |                                    |                                     |                                   |                     |   |

OFFICE REPORT ON SOIL EXPLORATION

+3, x5: Numbers refer to  
Sensitivity

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

W.P. 265-87-00  
formerly

# RECORD OF BOREHOLE No 38

METRIC

W.P. 264-87-00(a) LOCATION Station 23 + 700m, 0.2m N of W shoulder pavement edge ORIGINATED BY SM  
DIST 6 HWY 401 BOREHOLE TYPE Solid stem auger COMPILED BY SB  
DATUM Geodetic DATE February 18, 1991 CHECKED BY SB

| SOIL PROFILE  |  |            | SAMPLES |      |            | GROUND WATER<br>CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT |    |    |    |     | PLASTIC<br>LIMIT<br>W <sub>p</sub> | NATURAL<br>MOISTURE<br>CONTENT<br>W | LIQUID<br>LIMIT<br>W <sub>L</sub> | UNIT<br>WEIGHT<br>Y | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%) |
|---------------|--|------------|---------|------|------------|----------------------------|-----------------|---|----|----|----|-----|------------------------------------|-------------------------------------|-----------------------------------|---------------------|---|
| ELEV<br>DEPTH | DESCRIPTION  | STRAT PLOT | NUMBER  | TYPE | 'N' VALUES |                            |                 | 20  | 40 | 60 | 80 | 100 |                                    |                                     |                                   |                     |   |
| 122.4         | Ground surface   |            |         |      |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 0.0           | SANDY SILT<br>some gravel,<br>dense<br>(FILL)  |            |         |      |            |                            | 122             |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 121.5         |  |            | 1       | SS   | 39         |                            | 121             |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 0.9           |  |            | 2       | SS   | 38         |                            | 120             |   |    |    |    |     |                                    |                                     |                                   |                     |   |
|               | Heterogeneous<br>mixture of<br>silt and sand<br>with trace of<br>gravel and clay,<br>sand seams,<br>compact to<br>very dense |            | 3       | SS   | 49         |                            | 119             |   |    |    |    |     |                                    |                                     |                                   |                     |   |
|               |  |            | 4       | SS   | 67         |                            | 118             |   |    |    |    |     |                                    |                                     |                                   |                     |   |
|               |  |            | 5       | SS   | 31         |                            | 117             |   |    |    |    |     |                                    |                                     |                                   |                     |   |
|               |  |            | 6       | SS   | 16         |                            | 116             |   |    |    |    |     |                                    |                                     |                                   |                     |   |
|               | More clayey below<br>5.2m<br>(very stiff to stiff)   |            | 7       | SS   | 13         |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 115.9         |  |            | 8       | SS   | 10         |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 6.5           | End of Borehole  |            |         |      |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |

OFFICE REPORT ON SOIL EXPLORATION

+3, x5: Numbers refer to  
Sensitivity

20  
15  
10  
5 (%) STRAIN AT FAILURE

W.P. 265-87-00  
formerly

# RECORD OF BOREHOLE No 39

METRIC

W P 264-87-00(a) LOCATION Station 23 + 750m, 0.2m N of W shoulder pavement edge ORIGINATED BY SM  
DIST 6 HWY 401 BOREHOLE TYPE Solid stem auger COMPILED BY SB  
DATUM Geodetic DATE February 18, 1991 CHECKED BY SB

| SOIL PROFILE  |   |            | SAMPLES |      |            | GROUND WATER<br>CONDITIONS | ELEVATION<br>SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT |    |    |    |     | PLASTIC<br>LIMIT<br>W <sub>p</sub> | NATURAL<br>MOISTURE<br>CONTENT<br>W | LIQUID<br>LIMIT<br>W <sub>L</sub> | UNIT<br>WEIGHT<br>Y | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%)<br>GR SA SI CL |
|---------------|---|------------|---------|------|------------|----------------------------|--------------------|---|----|----|----|-----|------------------------------------|-------------------------------------|-----------------------------------|---------------------|--|
| ELEV<br>DEPTH | DESCRIPTION   | STRAT PLOT | NUMBER  | TYPE | 'N' VALUES |                            |                    | 20  | 40 | 60 | 80 | 100 |                                    |                                     |                                   |                     |  |
| 122.5         | Ground surface  |            |         |      |            |                            |                    |   |    |    |    |     |                                    |                                     |                                   |                     |  |
| 0.0           | SAND AND SILT<br>some gravel,<br>very dense<br>(FILL)   |            | 1       | SS   | 59         |                            |                    |   |    |    |    |     |                                    |                                     |                                   | 17 40 39 4          |  |
| 120.7         | Topsoil: 250 mm   |            | 2       | SS   | 31         |                            |                    |   |    |    |    |     |                                    |                                     |                                   |                     |  |
| 1.8           | Heterogeneous<br>mixture of<br>silt and sand<br>with gravel<br>and clay,<br>sand seams,<br>compact<br>to dense<br>(glacial till)<br><br>brown<br>gray |            | 3       | SS   | 22         |                            |                    |   |    |    |    |     |                                    |                                     |                                   |                     |  |
|               |   |            | 4       | SS   | 38         |                            |                    |   |    |    |    |     |                                    |                                     |                                   | 23.1                |  |
|               |   |            | 5       | SS   | 13         |                            |                    |   |    |    |    |     |                                    |                                     |                                   |                     |  |
| 117.5         |   |            | 6       | SS   | 11         |                            |                    |   |    |    |    |     |                                    |                                     |                                   |                     |  |
| 5.0           | End of Borehole   |            |         |      |            |                            |                    |   |    |    |    |     |                                    |                                     |                                   |                     |  |

OFFICE REPORT ON SOIL EXPLORATION

+3, x5: Numbers refer to  
Sensitivity

20  
15  
10  
5 (%) STRAIN AT FAILURE



W.P. 265-87-00  
formerly

# RECORD OF TEST PIT No 40

METRIC

W.P. 264-87-00(a) LOCATION Station 23 + 800m, 2.0m N of W shoulder pavement edge  
DIST 6 HWY 401 BOREHOLE TYPE Back-hoe ORIGINATED BY SM  
DATUM Geodetic DATE February 26, 1991 COMPILED BY SB  
CHECKED BY SB

| SOIL PROFILE   |   |            | SAMPLES |      |            | GROUND WATER<br>CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT |    |    |    |     | PLASTIC<br>LIMIT<br>W <sub>p</sub> | NATURAL<br>MOISTURE<br>CONTENT<br>W | LIQUID<br>LIMIT<br>W <sub>L</sub> | UNIT<br>WEIGHT<br>γ | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%) |
|--|---|------------|---------|------|------------|----------------------------|-----------------|---|----|----|----|-----|------------------------------------|-------------------------------------|-----------------------------------|---------------------|---|
| ELEV<br>DEPTH  | DESCRIPTION   | STRAT PLOT | NUMBER  | TYPE | 'N' VALUES |                            |                 | 20  | 40 | 60 | 80 | 100 |                                    |                                     |                                   |                     |   |
| 121.8  | Ground surface  |            |         |      |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 0.0  | Sandy silt topsoil:<br>600 mm<br>SILTY SAND<br>some gravel (FILL)   |            |         |      |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 120.7  | Topsoil: 75 mm  |            | 1       | CS   |            |                            | 121             |   |    |    |    |     |                                    |                                     |                                   |                     | 9 47 38 6   |
| 1.1  | Net. mixture<br>of silt and sand<br>with gravel,<br>cobbles,<br>sand seams,<br>very dense<br>(glacial till) |            | 2       | CS   |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 118.9  |   |            | 3       | CS   |            |                            | 120             |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 2.9  | End of Test Pit   |            |         |      |            |                            | 119             |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| NOTES:<br>1) Below 1.1m, very dense to hand probing.<br>2) Minor seepage between topsoil and fill layer.<br>3) Side slopes were excavated at close to 60° to horizontal. The side slopes showed no sign of instability during the period (4 hrs.) the test pit was open. |   |            |         |      |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |

OFFICE REPORT ON SOIL EXPLORATION

W.P. 265-87-00  
formerly

# RECORD OF BOREHOLE No 41

METRIC

W.P. 264-87-00(a) LOCATION Station 23 + 850m, 2.0m N of W shoulder pavement edge ORIGINATED BY SM  
DIST 6 HWY 401 BOREHOLE TYPE Solid stem auger COMPILED BY SB  
DATUM Geodetic DATE February 18, 1991 CHECKED BY SB

| SOIL PROFILE  |   |            | SAMPLES |      |            | GROUND WATER<br>+ CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT |    |    |    |     | PLASTIC<br>LIMIT<br>W <sub>p</sub> | NATURAL<br>MOISTURE<br>CONTENT<br>W | LIQUID<br>LIMIT<br>W <sub>L</sub> | UNIT<br>WEIGHT<br>γ | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%) |
|---------------|---|------------|---------|------|------------|------------------------------|-----------------|---|----|----|----|-----|------------------------------------|-------------------------------------|-----------------------------------|---------------------|---|
| ELEV<br>DEPTH | DESCRIPTION   | STRAT PLOT | NUMBER  | TYPE | 'N' VALUES |                              |                 | 20  | 40 | 60 | 80 | 100 |                                    |                                     |                                   |                     |   |
| 122.4         | Ground surface  |            |         |      |            |                              |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 0.0           | SANDY SILT<br>some gravel,<br>topsoil layer,<br>very dense<br>(FILL)  |            | 1       | SS   | 73/23cm    |                              | 122             |   |    |    |    |     |                                    | 0                                   |                                   |                     |   |
| 121.0         |   |            |         |      |            |                              | 121             |   |    |    |    |     |                                    | 0                                   |                                   |                     |   |
| 1.4           | Heterogeneous<br>mixture of<br>silt and sand<br>with trace of<br>gravel and clay,<br>sand seams,<br>(glacial till)<br>dense to very dense |            | 2       | SS   | 57         |                              | 120             |   |    |    |    |     |                                    | 0                                   |                                   |                     | 23.2  |
|               |   |            | 3       | SS   | 45         |                              |                 |   |    |    |    |     |                                    | 0                                   |                                   |                     |   |
|               |   |            | 4       | SS   | 110        |                              | 119             |   |    |    |    |     |                                    | 0                                   |                                   |                     | 22.9  |
| 118.2         |   |            | 5       | SS   | 80/8cm     |                              |                 |   |    |    |    |     |                                    | 0                                   |                                   |                     |   |
| 4.2           | End of Borehole   |            |         |      |            |                              |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |
|               | *Borehole dry.  |            |         |      |            |                              |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |

OFFICE REPORT ON SOIL EXPLORATION

+3, x5: Numbers refer to  
Sensitivity

20  
15  
10  
5 (% STRAIN AT FAILURE

W. P. 265-87-00

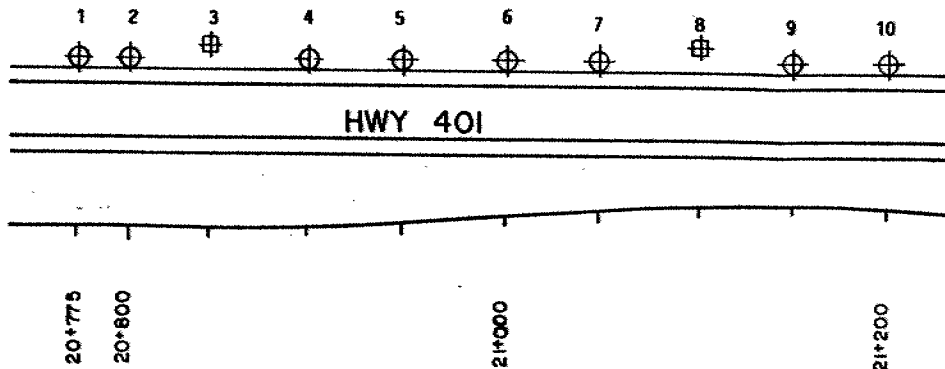
AREA I

STA 20+775 to STA 21+200

LEGEND

⊕ Bore Hole

⊞ Test Pit



NOTE: For subsoil information, refer to  
Record of Borehole Sheets.

| BH No | STATION  | ELEVATION |
|-------|----------|-----------|
| 1     | 20 + 775 | 138.7     |
| 2     | 20 + 800 | 138.7     |
| 3     | 20 + 850 | 137.2     |
| 4     | 20 + 900 | 137.6     |
| 5     | 20 + 950 | 137.3     |
| 6     | 21 + 000 | 136.7     |
| 7     | 21 + 050 | 136.4     |
| 8     | 21 + 100 | 135.1     |
| 9     | 21 + 150 | 135.3     |
| 10    | 21 + 200 | 135.0     |



MCCLYMONT & RAK ENGINEERS, INC.  
GEOTECHNICAL CONSULTANTS

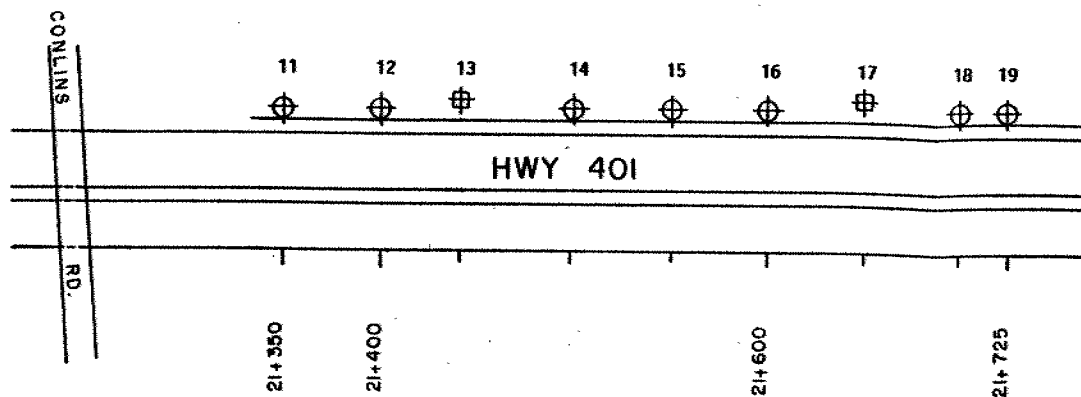
**BOREHOLE LOCATION PLAN**

|              |                   |                  |
|--------------|-------------------|------------------|
| Scale<br>NTS | Date<br>MARCH '91 | Drawing No.<br>1 |
|--------------|-------------------|------------------|

W.P. 265-87-00

AREA 2

STA 21 + 350 to 21 + 725



LEGEND

⊗ Bore Hole

⊕ Test Pit

NOTE: For subsoil information, refer to  
Record of Borehole Sheets.

| BH No | STATION  | ELEVATION |
|-------|----------|-----------|
| 11    | 21 + 350 | 133.5     |
| 12    | 21 + 400 | 133.2     |
| 13    | 21 + 450 | 132.0     |
| 14    | 21 + 500 | 132.5     |
| 15    | 21 + 550 | 132.3     |
| 16    | 21 + 600 | 131.9     |
| 17    | 21 + 650 | 130.9     |
| 18    | 21 + 700 | 131.3     |
| 19    | 21 + 725 | 131.3     |



MCCLYMONT & RAK ENGINEERS, INC.  
GEOTECHNICAL CONSULTANTS

BOREHOLE LOCATION PLAN

Scale NTS

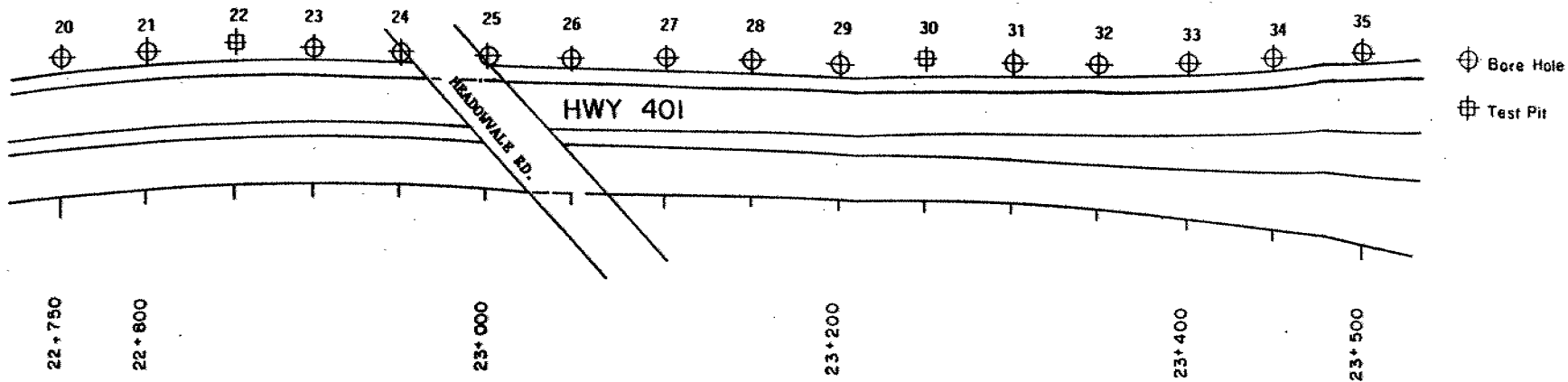
Date  
MARCH '91

Drawing No. 2

AREA 3

STA 22 + 750 to STA 23 + 500

LEGEND



| BH No | STATION  | ELEVATION |
|-------|----------|-----------|
| 20    | 22 + 750 | 125.3     |
| 21    | 22 + 800 | 124.6     |
| 22    | 22 + 850 | 123.2     |
| 23    | 22 + 900 | 124.0     |
| 24    | 22 + 950 | 123.5     |
| 25    | 23 + 000 | 122.3     |
| 26    | 23 + 050 | 123.0     |
| 27    | 23 + 100 | 123.0     |
| 28    | 23 + 150 | 122.7     |
| 29    | 23 + 200 | 122.5     |
| 30    | 23 + 250 | 122.4     |
| 31    | 23 + 300 | 121.6     |
| 32    | 23 + 350 | 122.2     |
| 33    | 23 + 400 | 122.1     |
| 34    | 23 + 450 | 121.9     |
| 35    | 23 + 500 | 121.8     |

NOTE: For subsoil information, refer to  
Record of Borehole Sheets.

W.P. 265-87-00



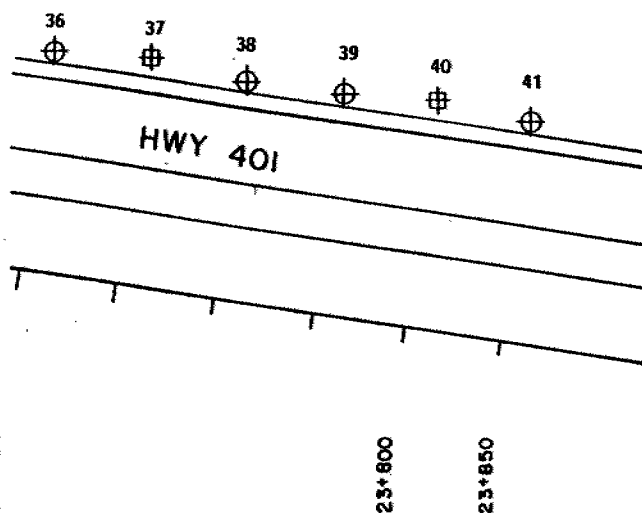
MCCLYMONT & RAK ENGINEERS, INC.  
GEOTECHNICAL CONSULTANTS

**BOREHOLE LOCATION PLAN**

Scale NTS Date MARCH '91 Drawing No. 3

AREA 4

STA 23 + 600 to STA 23 + 850



# LEGEND

⊕ Bore Hole

⊕ Test Pit

| BH No | STATION  | ELEVATION |
|-------|----------|-----------|
| 36    | 23 + 600 | 121.8     |
| 37    | 23 + 650 | 121.3     |
| 38    | 23 + 700 | 122.4     |
| 39    | 23 + 750 | 122.5     |
| 40    | 23 + 800 | 121.8     |
| 41    | 23 + 850 | 122.4     |

NOTE: For subsoil information, refer to  
Record of Borehole Sheets.

W.P. 265-87-00



MCCLYMONT & RAK ENGINEERS, INC.  
GEOTECHNICAL CONSULTANTS

## BOREHOLE LOCATION PLAN

|           |                   |                      |
|-----------|-------------------|----------------------|
| Scale NTS | Date<br>MARCH '91 | Drawing No. <b>4</b> |
|-----------|-------------------|----------------------|

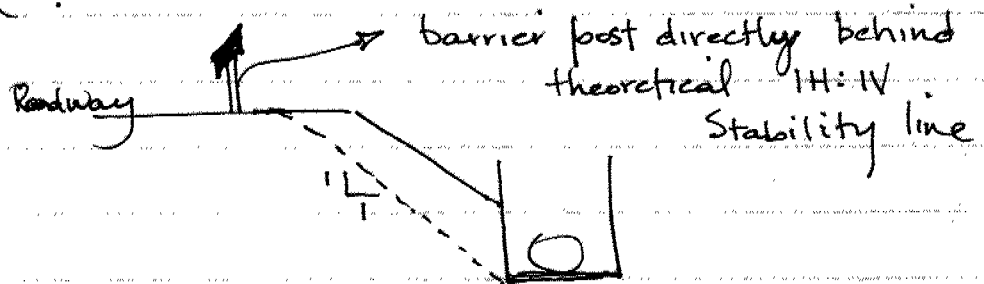
NOTE to FILE

Aug. 31

Meeting held at Central Region, Geotechnical Section  
Called by Barry Sherwood D.S. Lea Associates Ltd., who  
had some concerns regarding the road protection  
allowance along some sections of Hwy 401.

Ken Zasitko represented Geotech Section for Karan G.  
Dave Dundas & Betty Bennett attended from Fdn. Design

Report recommends 1H:1V minimum distance from roadway  
to base of excavation. Worst case scenario explained  
by B. Sherwood:



D. Dundas emphasized that safety should not be  
a concern providing the 1H:1V. min slope is from  
the edge of the roadway to the base of the excavation  
is maintained. This should be reiterated in the  
Contract.

This recommendation is satisfied for the whole length  
of the Contract.

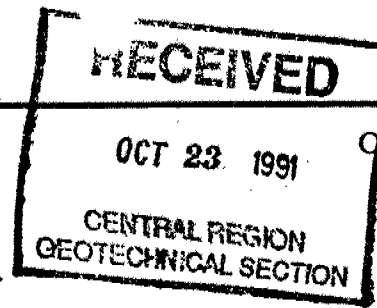
# **DS-Lea Associates Ltd.**

Consulting Engineers • Planners

1240 Ellesmere Road, 2<sup>nd</sup> Floor  
Scarborough, Ontario. M1P 2X4  
Tel: (416) 299 - 9050 - Fax: (416) 299 - 6470

21 October 1991

Mr. K. Ganesh,  
Geotechnical Section  
Ministry of Transportation Ontario  
Central Region  
1201 Wilson Avenue  
Atrium Tower, 2nd Floor  
Downsview, Ontario  
M3M 1J8



Our Ref. 1296/

Dear Mr. Ganesh:

**Re: Highway 401 - Express & EB Collector Lanes - Neilson Road  
to Highway 2A - WP 265-87-00**

Further to our 02 August 1991 letter regarding pavement protection, please find portions of the latest working plans of our staging concept where the limits of the criteria for pavement protection fall close to the travelled edge of pavement.

The offset lines are based on a 1:1 line from the bottom of excavations. If the edge of travelled lanes falls within that offset (blue line), investigation for pavement protection is required.

The Stage 1 drawing shows only local areas around proposed new manholes and catchbasins.

The Stage 2 drawing again shows only local requirements for pavement protection (Station 23 + 800±). However, sites from 21 + 100 to 22 + 200 have been identified also. Here the travelled pavement edge is clear but an existing barrier to be used falls within the limits. Our approach there is that the actual excavation is further away and would not physically impact the existing barrier, however, the stability of the barrier, if material from behind is removed, may be questioned. This would seem to be acceptable but your comments will be appreciated.

D:\1296\LET-WBS.88



21 October 1991

Mr. K. Ganesh

Our Ref. 1296/

Page 2/2

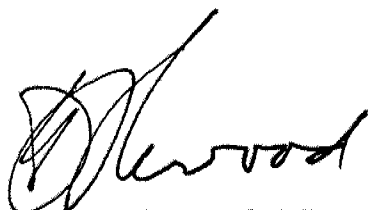
The Stage 3 drawing again shows only the local type of protection for new catchbasin/manhole installation.

In general, the requirements for roadway protection appear to be small and very localized.

Yours very truly

DS-LEA ASSOCIATES LTD.

DS-LEA ASSOCIATES LTD.



W. Barry Sherwood, P.Eng.  
Project Manager

:ecf

:attach.

cc: Mr. D.H. Smith, P.Eng., Delcan  
Mr. K. Gilchrist, MTO Construction

D:\1296\LET-WBS.88

DOCUMENT MICROFILMING IDENTIFICATION

G.I.-30 SEPT. 1976

GEOCRES No. 30414-212

DIST. 6 REGION           

W.P. No. 264-87-00 (A)

CONT. No.           

W. O. No.           

STR. SITE No.           

HWY. No. 401

LOCATION Storm Sewers

Neilson Rd to Meadowvale Rd.

No of PAGES -           

=====

OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT.           

REMARKS:

57-1

| REVISIONS | DESCRIPTION |        |     |      |      |    |        |        |           |
|-----------|-------------|--------|-----|------|------|----|--------|--------|-----------|
|           | DESIGN BH   | CHK BH | SAS | CODE | QHBC | 83 | LOAD   | DATE   | APRIL '91 |
|           | DRAWN       | GY     | CHK | BH   | SITE |    | STRUCT | SCHEME | DWG 1     |

C1229

MARCH 1991

FOUNDATION INVESTIGATION REPORT  
STORM SEWER SHORING EVALUATION  
HWY 401, NEILSON ROAD TO HWY 2  
W.P. 264-87-01 (a), SITE N\A  
DISTRICT 6, TORONTO

DISTRIBUTION;      12 COPIES - MINISTRY OF TRANSPORTATION  
   FOUNDATION DESIGN SECTION  
  
   1 COPY - MCCLYMONT AND RAK ENGINEERS INC.

PREPARED FOR:  
  
MINISTRY OF TRANSPORTATION OF ONTARIO  
1201 WILSON AVENUE  
ROOM 315, CENTRAL BUILDING  
DOWNSVIEW, ONTARIO  
M3M 1J8

*GEO # 30014-212*

FOUNDATION INVESTIGATION REPORT  
FOR  
STORM SEWER SHORING EVALUATION  
HWY 401, NEILSON ROAD TO HWY 2  
W.P. 264-87-01 (a), SITE N\A  
DISTRICT 6, TORONTO

**INTRODUCTION**

This report contains geotechnical information necessary to evaluate shoring requirements for the proposed storm sewer construction along Highway 401, between Neilson Road and Hwy 2. The investigation was carried out at the request of Foundation Design Section of the Ministry of Transportation of Ontario.

**SITE DESCRIPTION**

The proposed widening of Highway 401, between Neilson Road and Highway 2, will be to the immediate north of the existing highway. The road alignment slopes down from west to east. In certain areas, the excavations for the proposed sewers will be in close proximity to the existing west bound express lanes. The sewer segments, where excavations will encroach within 1H : 1V plane, as defined by the crest of the existing WB shoulder lane of Hwy 401 and the invert of the proposed sewer excavations, are as follows:

|        |   |              |    |          |
|--------|---|--------------|----|----------|
| Area 1 | - | St. 20 + 776 | to | 21 + 194 |
| Area 2 | - | St. 21 + 341 | to | 21 + 725 |
| Area 3 | - | St. 22 + 764 | to | 23 + 465 |
| Area 4 | - | St. 23 + 598 | to | 23 + 850 |

The existing roadway is generally constructed in fill, and the lands to the immediate north of the existing highway, have a gentle slope.

## PROCEDURE

The field investigation was carried out between the period of February 18 and 27, 1991. The fieldwork consisted of drilling thirty three boreholes, and excavating eight test-pits (two test-pits in each of the above areas). The boreholes were advanced using a track, and truck, mounted C.M.E. 55 machines equipped with solid stem augers. The test-pits were excavated with a 580 Case back-hoe.

Disturbed samples were recovered by means of a 50 mm O.D. Split Spoon Sampler driven into the soil according to the specification of the Standard Penetration Test (ASTM D 1587-8).

Standpipes were installed in selected boreholes to facilitate periodic monitoring of the groundwater elevations. For details see the enclosed Record of Borehole sheets.

The elevations and stations of the boreholes were provided by the MTO's office.

Laboratory testing, carried out on representative samples, was to identify and determine the physical properties of the overburden, including:

- o Natural moisture content
- o Grain size distribution
- o Atterberg Limit
- o Unit Weight

## SUBSURFACE CONDITIONS

The predominant subsurface deposits essentially consist of sand to silty sand, to gravelly sand; and a heterogeneous mixture of silt and sand with trace to some gravel and clay (non-cohesive glacial till). The encountered soil conditions can be summarized in two typical sections;

- o Section A; for Areas 1 and 2,
- o Section B; for Areas 3 and 4.

Section A - consists of 0.3 to 1.7 m of upper granular fill, varying from compact to very dense sand and gravel to gravelly sand to silty sand, and overlying compact to very dense native silty sand to sand, to gravelly sand. Occasional non-cohesive till layers were encountered within this section. The granular deposit extends to the depth explored, i.e. 5.0 m.

Section B - comprise 0.9 to 2.1 m of compact to very dense upper granular fill, varying from sand and gravel to silty sand to sandy silt, and overlying compact to very dense heterogeneous mixture of silt and sand, with trace to some gravel and clay (non-cohesive till). Organic stained very stiff clayey silt strata, 0.9 to 1.7 m thick, was encountered between Stations 22 + 775 and 22 + 975 m. Wet sand seams/layers were generally evident within the glacial till deposit, which extends to the maximum depth of investigation, i.e. 8.0 m at Borehole 35.

The boundaries of the different soil strata, together with the field and laboratory test results, appear on the Record of Borehole sheets appended to this report. Also refer to Drawings 1 to 4 for the locations and elevations of the boreholes. Detailed descriptions of the different soil strata encountered are provided below.

#### SECTION A - AREAS 1 AND 2

##### Upper Sand and Gravel to Gravelly Sand, to Silty Sand (Fill)

The surficial fill material was encountered in most of the boreholes. The depth of the fill varies from 0.3 to 1.7 m. Generally, the sand and gravel to gravelly sand is dominant in the upper 0.3 to 0.6 m, and below these depths the deposit becomes more silty. Organic stained silt (topsoil) seams/layers were evident within the fill, or at the bottom of the fill deposit, at some borehole locations.

This fill appears to have been placed during the construction of the existing embankments. The 'N' values vary from 16 to 60 blows, indicating a state of compaction varying from compact to very dense. The higher blows are attributed to high gravel/cobble contents. Typically, the state of compaction varies from compact to dense state. The moisture content varies from 4 to 13 percent. Typical gradation envelopes are shown in Figures 1 and 2.

##### Silty Sand to Sand to Gravelly Sand (Native)

This predominant granular native deposit was encountered in all the boreholes. The deposit generally consists of sand with variable silt and gravel content. It extends to the maximum depth of investigation, i.e. 5.0 m.

The sand is fine to medium sized, with trace of silt and gravel, and a typical gradation envelope is given in Figure 3. A typical grain size envelope for gravelly sand is shown in Figure 4. In Test-Pit 13, gravel layers were evident, and the gradation curves are given in Figure 5.

Occasional silt and sand, non-cohesive glacial till, layers were evident at Boreholes 1, 10, 13 to 15, within the depth investigated. The thickness of these layers varies from 0.4 m to 1.0 m. A typical gradation envelope is given in Figure 6.

The 'N' values vary from 13 blows, per 30 cm penetration, to 50 blows per 10 cm penetration, indicating a state of compaction varying from compact to very dense. The moisture content varies from 4 to 21 percent.

#### SECTION B - AREAS 3 AND 4

##### Sand and Gravel to Silty Sand, to Sandy Silt (Fill)

These granular deposits extend to a depth varying from 0.9 to 2.1 m. The fill appears to have been placed during the construction of the existing embankments. Generally, the deposit is more silty beyond Station 23 + 350 m. Organic stained silt (topsoil) seams/layers, varying from 40 mm to 250 mm in thickness, were evident within the fill, or at the bottom of the fill deposit, at some borehole locations.

Standard Penetration Test 'N' values range from 13 to 54 blows indicating that this strata is in a compact to very dense state of compaction. The moisture content varies from 4 to 22 percent. Typical gradation curves are given in Figure 7.

##### Clayey Silt, organic stained

This deposit was encountered between Station 22 + 775 to 22 + 975 m. The thickness of the deposit ranges from 0.9 to 1.7 m. The deposit contains some sand.

'N' values range from 12 to 18 blows, indicating it is in a very stiff state. The moisture content varies from 17 to 28 percent. The average Plastic and Liquid Limit values of 17 and 26 (based on two samples), exhibiting low plasticity, are shown in Figure 9. Grain size distribution envelope is given in Figure 8.

##### Heterogenous Mixture of Silt and Sand with trace to some Gravel and Clay (Glacial Till)

Underlying the above materials is the predominant deposit of non-cohesive glacial till with occasional wet sand seams. At Boreholes 24, 27, 28, 29 and 32, this strata is intersected with thicker layers of water bearing sandy silt to silty sand, varying from 0.5 to 1.3 m in depth. Cobbles and boulders were encountered in the glacial deposit.



The 'N' values ranging from 10 blows, per 30 cm penetration, to 100 blows per 7 cm penetration were obtained during field testing, reflecting a compact to very dense state of compaction. Generally, the deposit is in a dense to very dense state. The Atterberg test results are shown in Figure 11.

Laboratory testing yielded the following physical properties:

| Property                     | Range      |
|------------------------------|------------|
| Natural Moisture Content (%) | 5 - 12     |
| Liquid Limit (%)             | 16 - 19    |
| Plastic Limit (%)            | 11 - 13    |
| Unit Weight (kN/cu.m)        | 22.5 -24.4 |

Grain size distribution envelope is given in Figure 10.

#### GROUNDWATER CONDITIONS

Observation of the groundwater levels was carried out by measuring the water elevations in the open holes during drilling, as well as in standpipes, installed in some boreholes for a long term monitoring.

The ground water level slopes from Elevation 134.4 m at Sta. 20 + 775 m, to Elevation 118.1 m at Sta. 23 + 700 m. The ground water more or less follows the same direction as the ground surface.

In Areas 1 and 2, i.e. Sta 20 + 776 to 21 + 725, the stabilized ground water levels were established, at the time of investigation i.e. February 1991, in granular sand or gravelly sand deposits.

However, in Areas 3 and 4, i.e. Sta. 22 + 764 to 23 + 850 m, the ground water levels, in some of the boreholes, are close to the ground surface. Based on the soil examination, moisture content profile and the examination of the water conditions in the test-pit, it is noted that the water present in the boreholes is due to seepage occurring from the bottom of the fill deposit, or from sand seams/layers within the glacial till deposit.

It should be noted that the long term water levels may vary due to seasonal fluctuations and precipitation.

## MISCELLANEOUS

The fieldwork for this investigation was carried out under the supervision of S. Magdolen, Geologist and G. Semaan, Field Engineer. The equipment was owned and operated by Master Soils Investigations Limited.

The project was carried out under the supervision of S. Bandukwala, Project Engineer. The report was written by S. Bandukwala, and reviewed by L. Rak, Principal Engineer.

Submitted by

MCCLYMONT AND RAK ENGINEERS INC.



S. Bandukwala, P.Eng.



L.J. Rak, P.Eng.

## EXPLANATION OF TERMS USED IN REPORT

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

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

SOILS ARE DESCRIBED BY THEIR COMPOSITION AND CONSISTENCY OR DENSENESS.

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

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

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

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

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

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

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

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

**JOINTING AND BEDDING:**

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

## ABBREVIATIONS AND SYMBOLS

### FIELD SAMPLING

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

### STRESS AND STRAIN

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

### MECHANICAL PROPERTIES OF SOIL

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

### PHYSICAL PROPERTIES OF SOIL

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

## UNIFIED SOIL CLASSIFICATION SYSTEM

CLAY &amp; SILT

SAND

GRAVEL

Fine

Medium

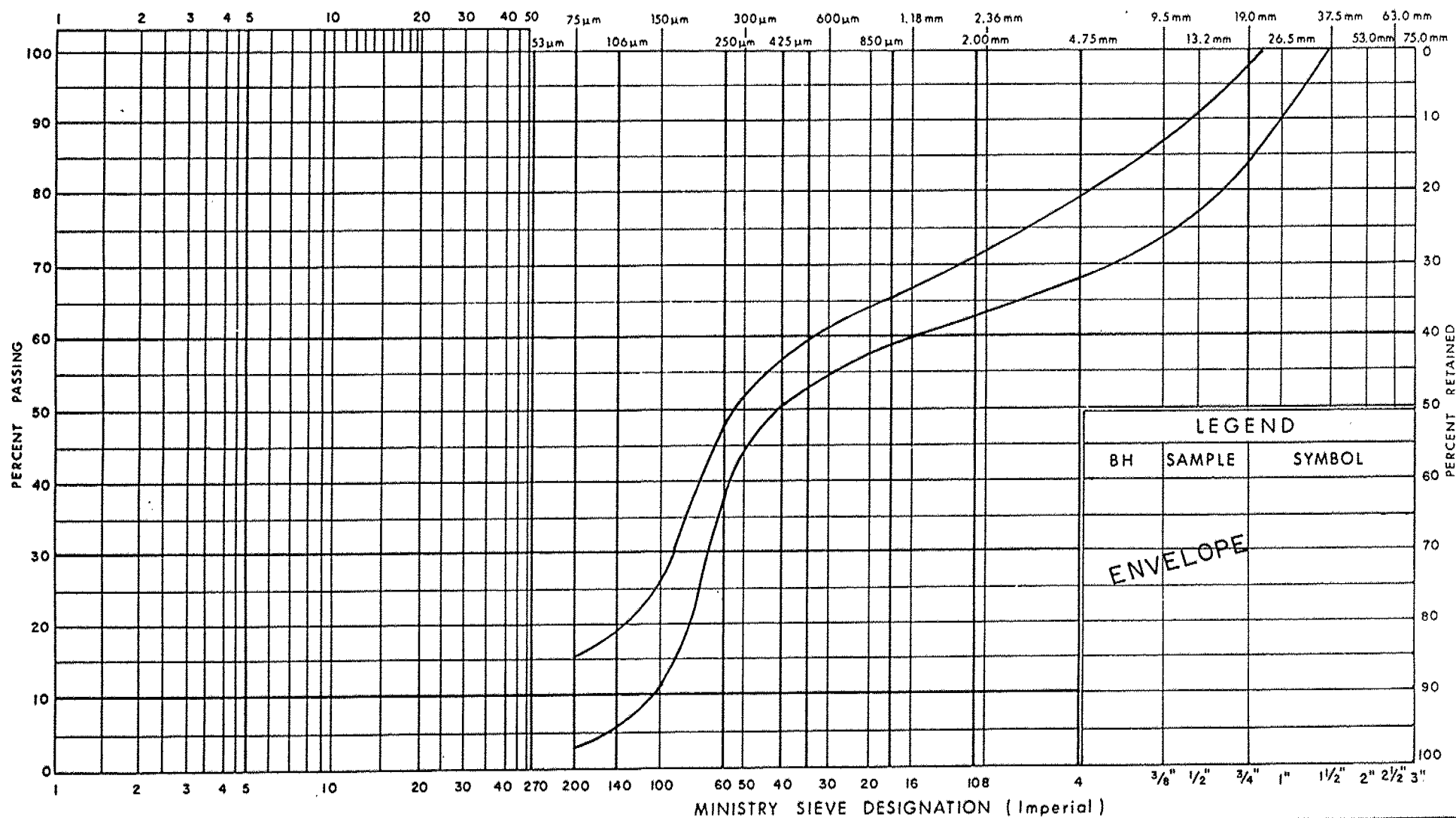
Coarse

Fine

Coarse

GRAIN SIZE IN MICROMETERS

MINISTRY SIEVE DESIGNATION (Metric)



## LEGEND

BH

SAMPLE

SYMBOL

ENVELOPE

GRAIN SIZE DISTRIBUTION  
GRAVELLY SAND (FILL)

FIG No 1

W P 264-87-00(a)



Ministry of  
Transportation

Ontario

## UNIFIED SOIL CLASSIFICATION SYSTEM

CLAY &amp; SILT

SAND

GRAVEL

Fine

Medium

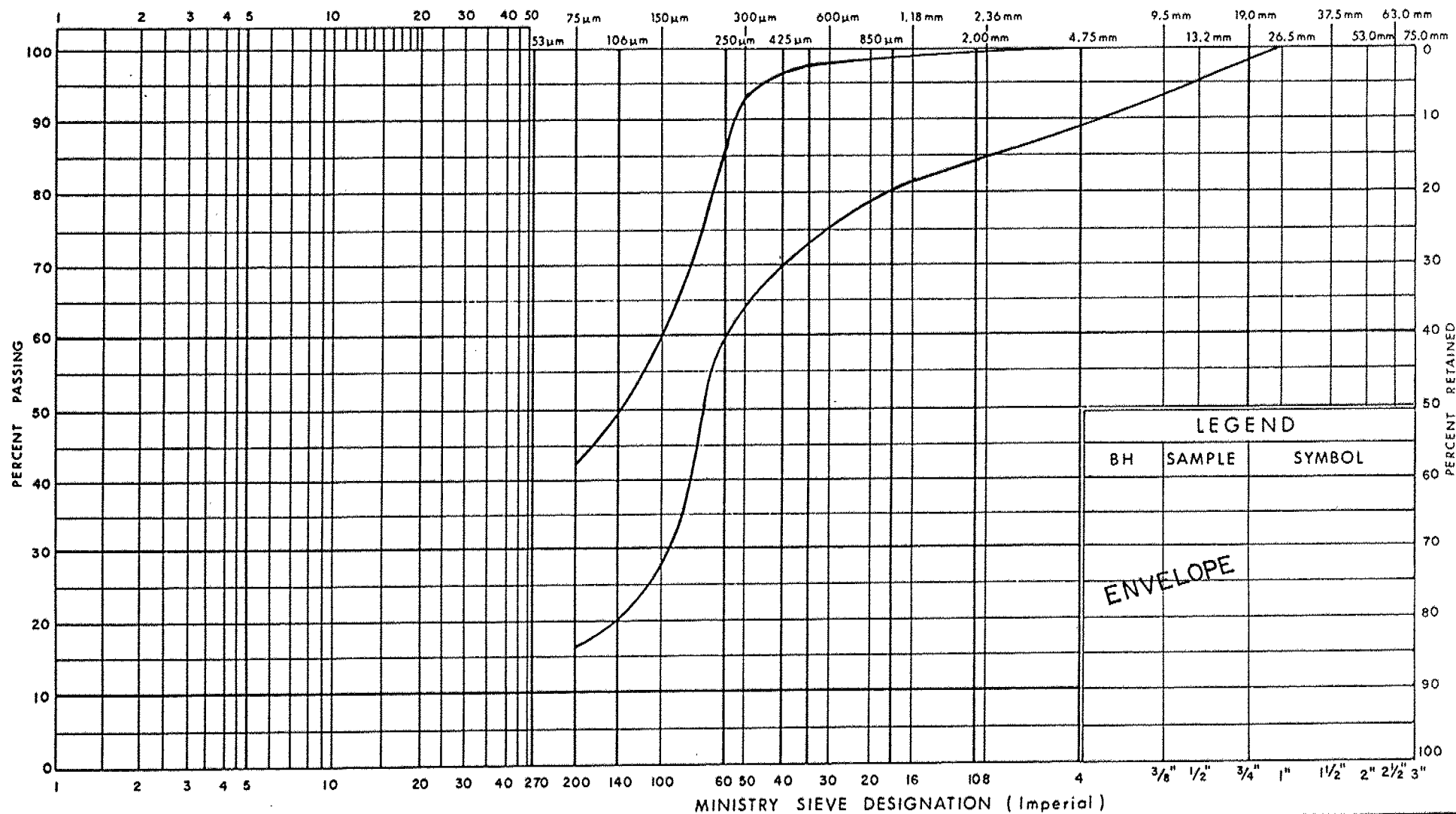
Coarse

Fine

Coarse

GRAIN SIZE IN MICROMETERS

MINISTRY SIEVE DESIGNATION (Metric)

Ministry of  
Transportation

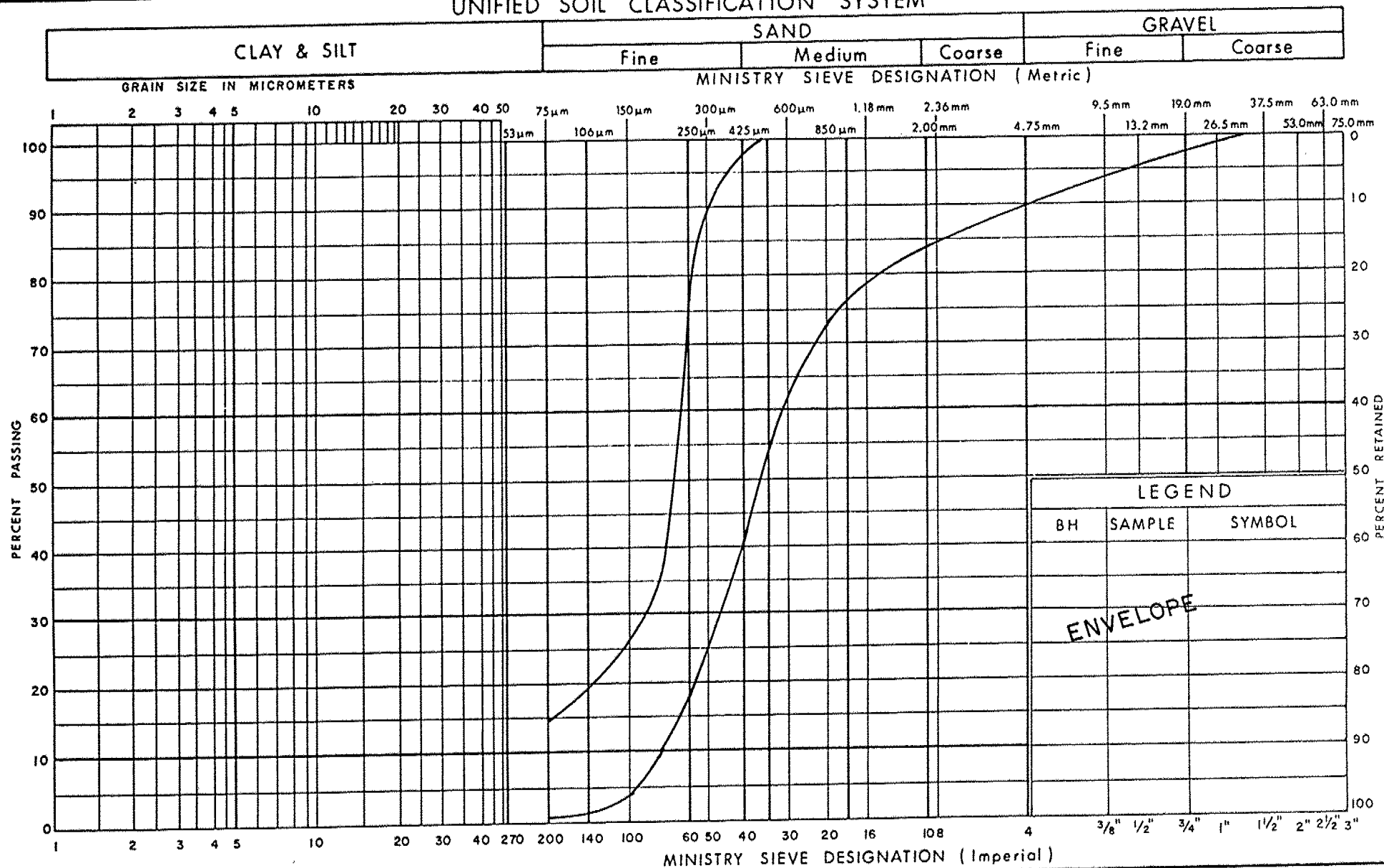
## GRAIN SIZE DISTRIBUTION

SILTY SAND TO SAND WITH SOME GRAVEL AND SILT (FILL)

FIG No 2

W P 264-87-00(a)

## UNIFIED SOIL CLASSIFICATION SYSTEM

Ministry of  
Transportation

GRAIN SIZE DISTRIBUTION  
SAND, trace of silt and gravel

FIG No 3

W P 264-87-00(a)

## UNIFIED SOIL CLASSIFICATION SYSTEM

CLAY &amp; SILT

SAND

GRAVEL

Fine

Medium

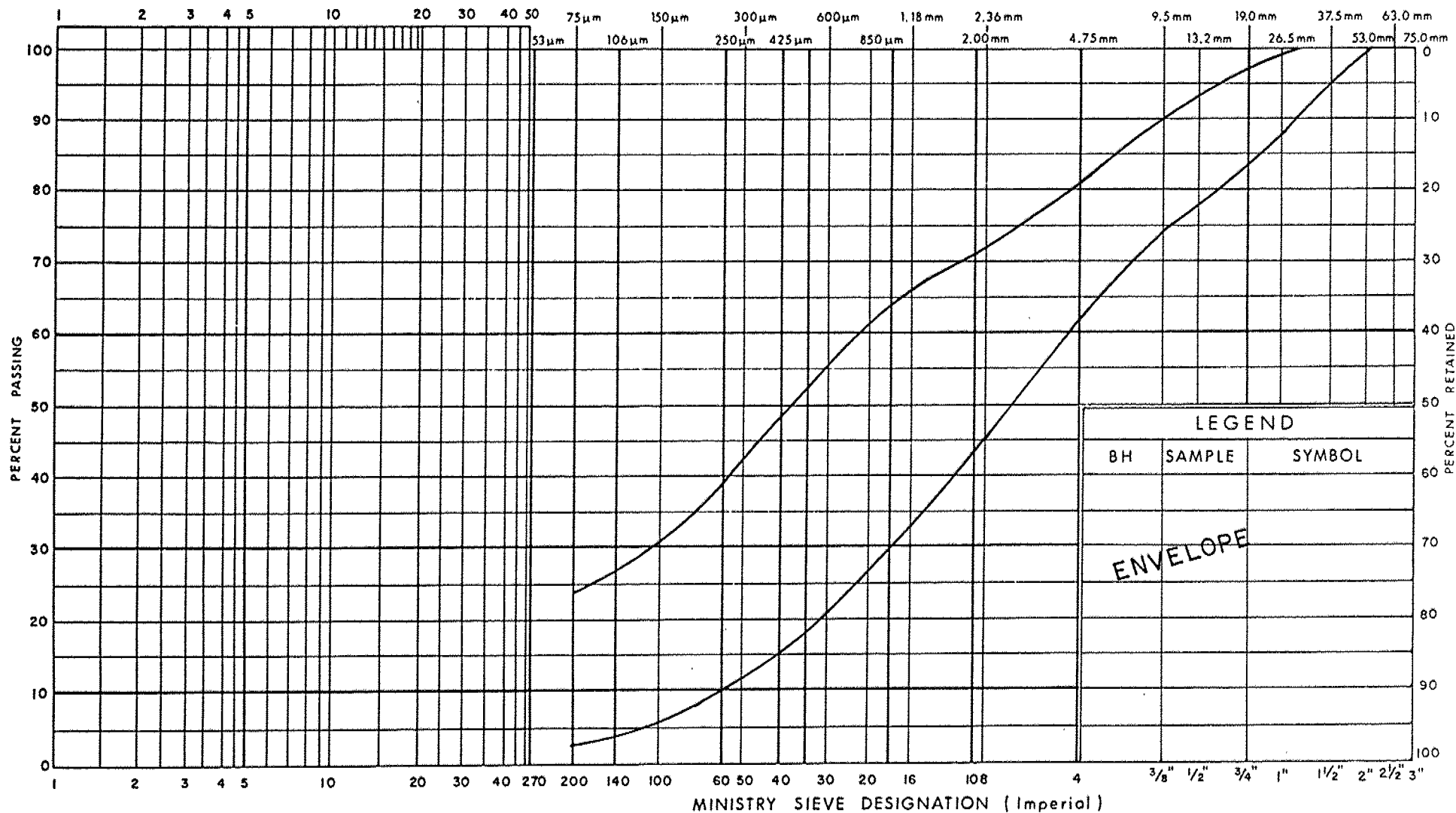
Coarse

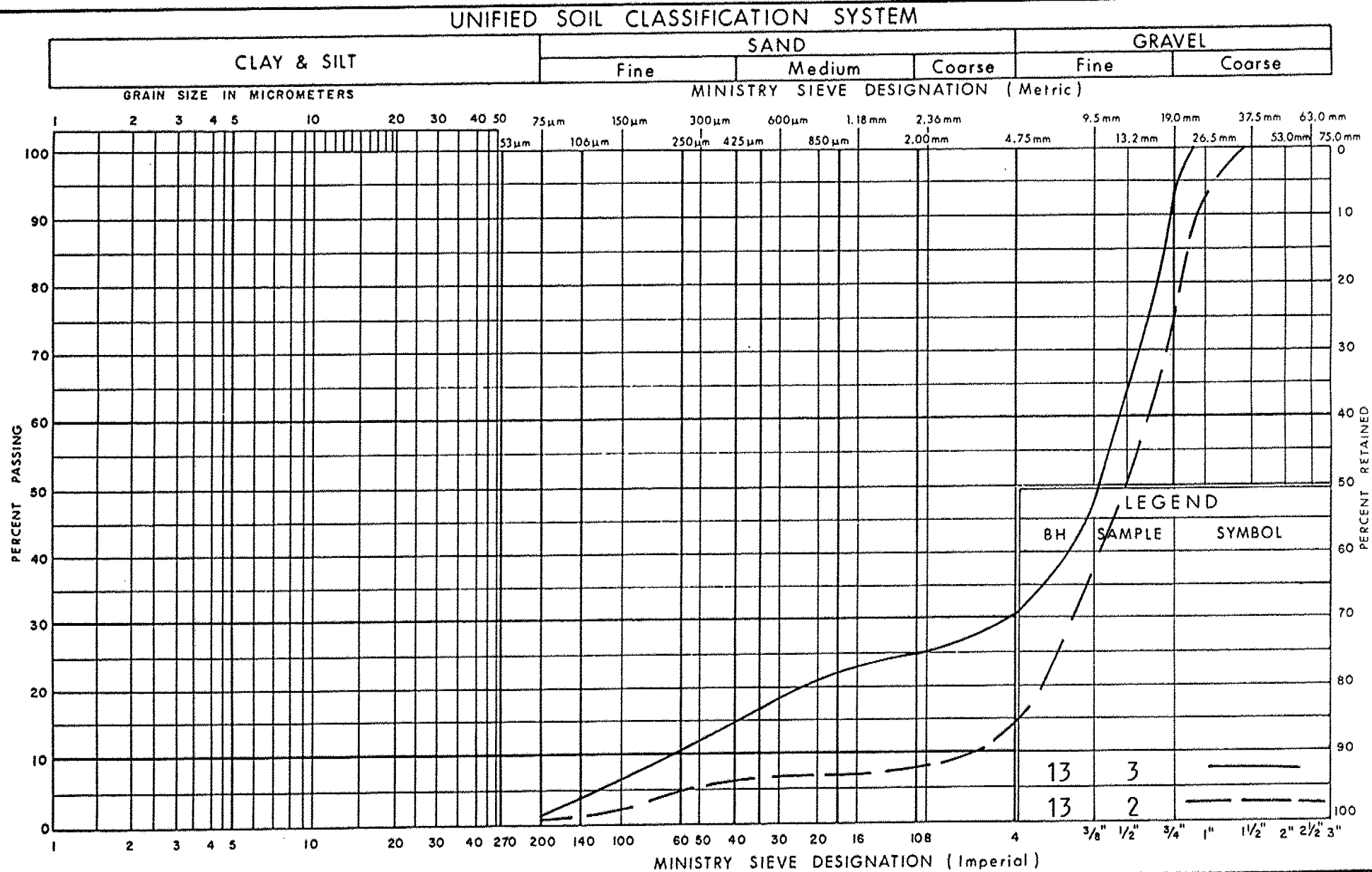
Fine

Coarse

GRAIN SIZE IN MICROMETERS

MINISTRY SIEVE DESIGNATION (Metric)



Ministry of  
Transportation

## GRAIN SIZE DISTRIBUTION

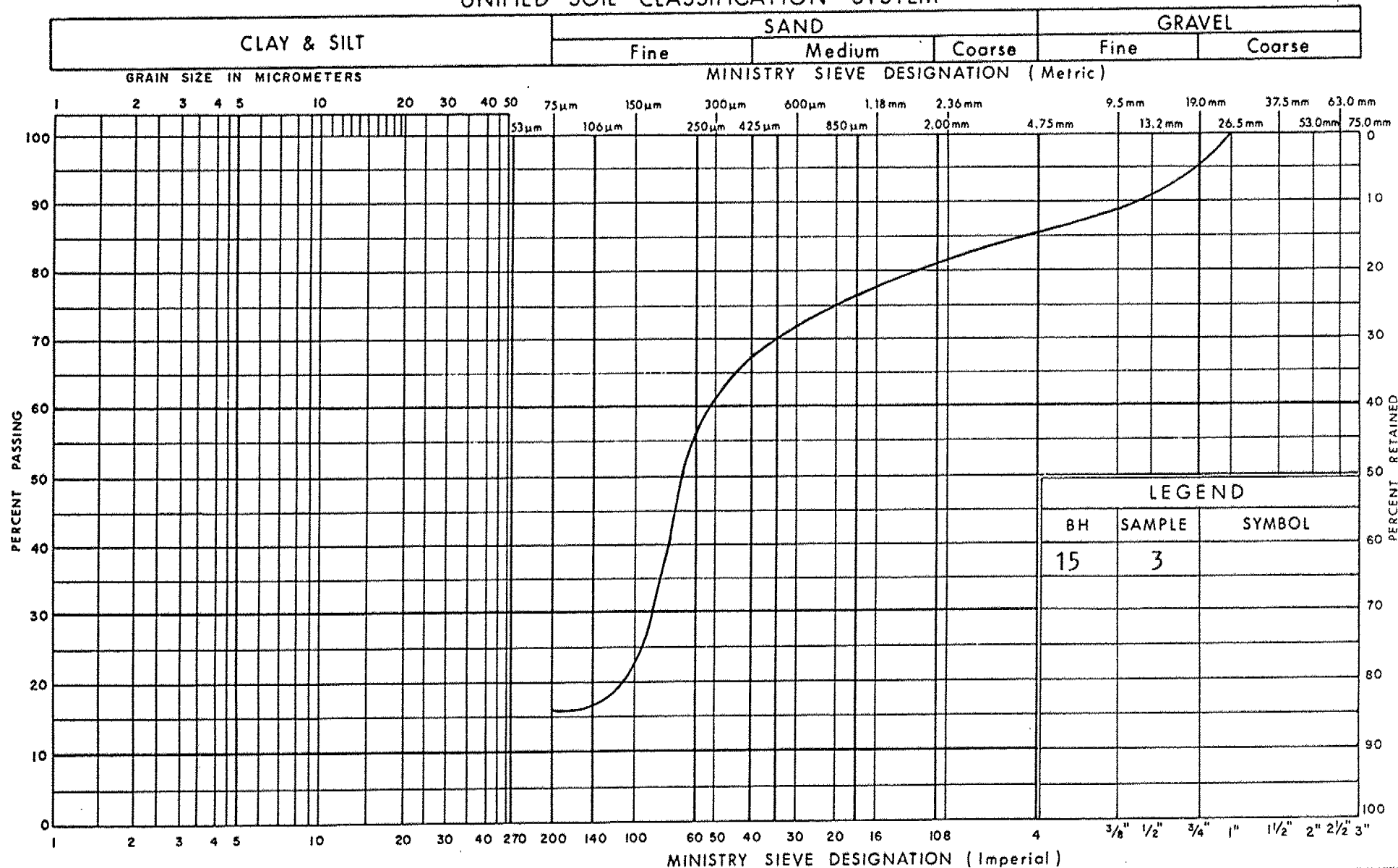
GRAVEL, some sand

FIG No 5

W P 264-87-00(a)



## UNIFIED SOIL CLASSIFICATION SYSTEM



Ministry of  
Transportation

## GRAIN SIZE DISTRIBUTION

Het. mixture of silty sand with  
some gravel (glacial till)

FIG No 6

W P 264-87-00(a)

## UNIFIED SOIL CLASSIFICATION SYSTEM

CLAY &amp; SILT

SAND

GRAVEL

Fine

Medium

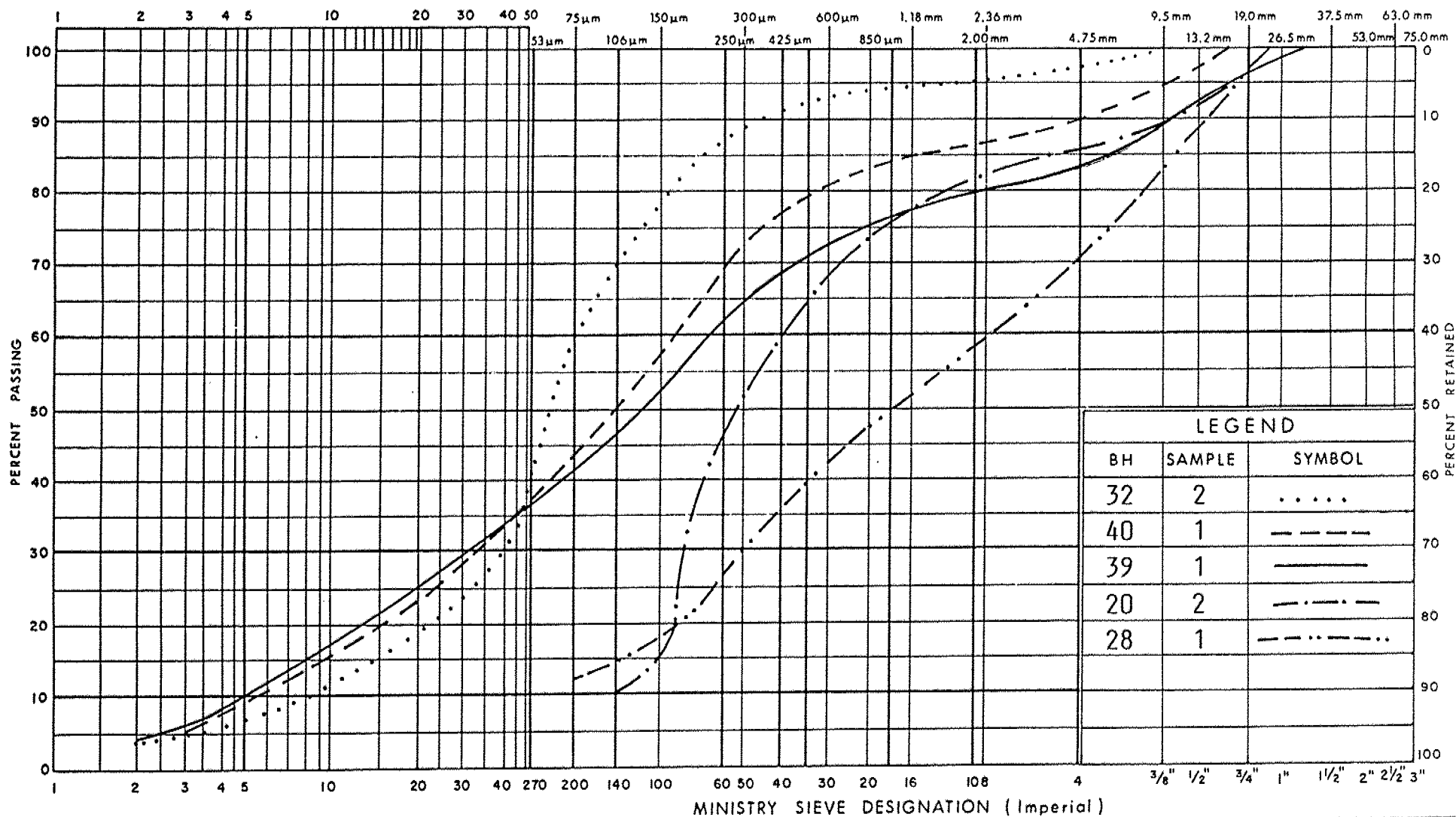
Coarse

Fine

Coarse

GRAIN SIZE IN MICROMETERS

MINISTRY SIEVE DESIGNATION (Metric)



## LEGEND

| BH | SAMPLE | SYMBOL      |
|----|--------|-------------|
| 32 | 2      | .....       |
| 40 | 1      | -----       |
| 39 | 1      | ————        |
| 20 | 2      | - . - . - . |
| 28 | 1      | - . . . - . |

Ministry of  
Transportation

GRAIN SIZE DISTRIBUTION  
SILTY SAND TO SAND WITH SOME GRAVEL (FILL)

FIG No 7

W P 264-87-00(a)

## UNIFIED SOIL CLASSIFICATION SYSTEM

CLAY &amp; SILT

SAND

GRAVEL

Fine

Medium

Coarse

Fine

Coarse

GRAIN SIZE IN MICROMETERS

MINISTRY SIEVE DESIGNATION (Metric)

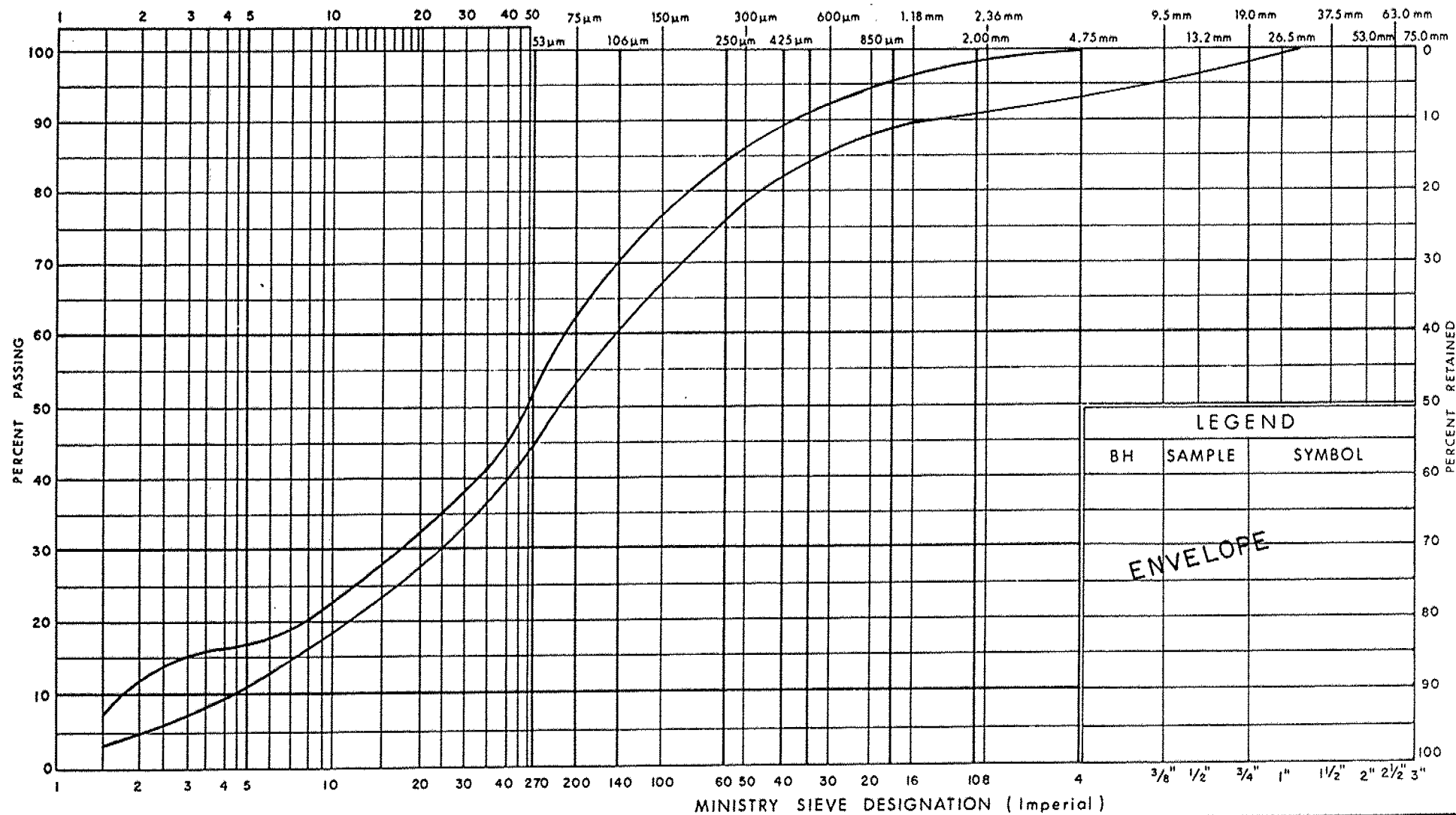
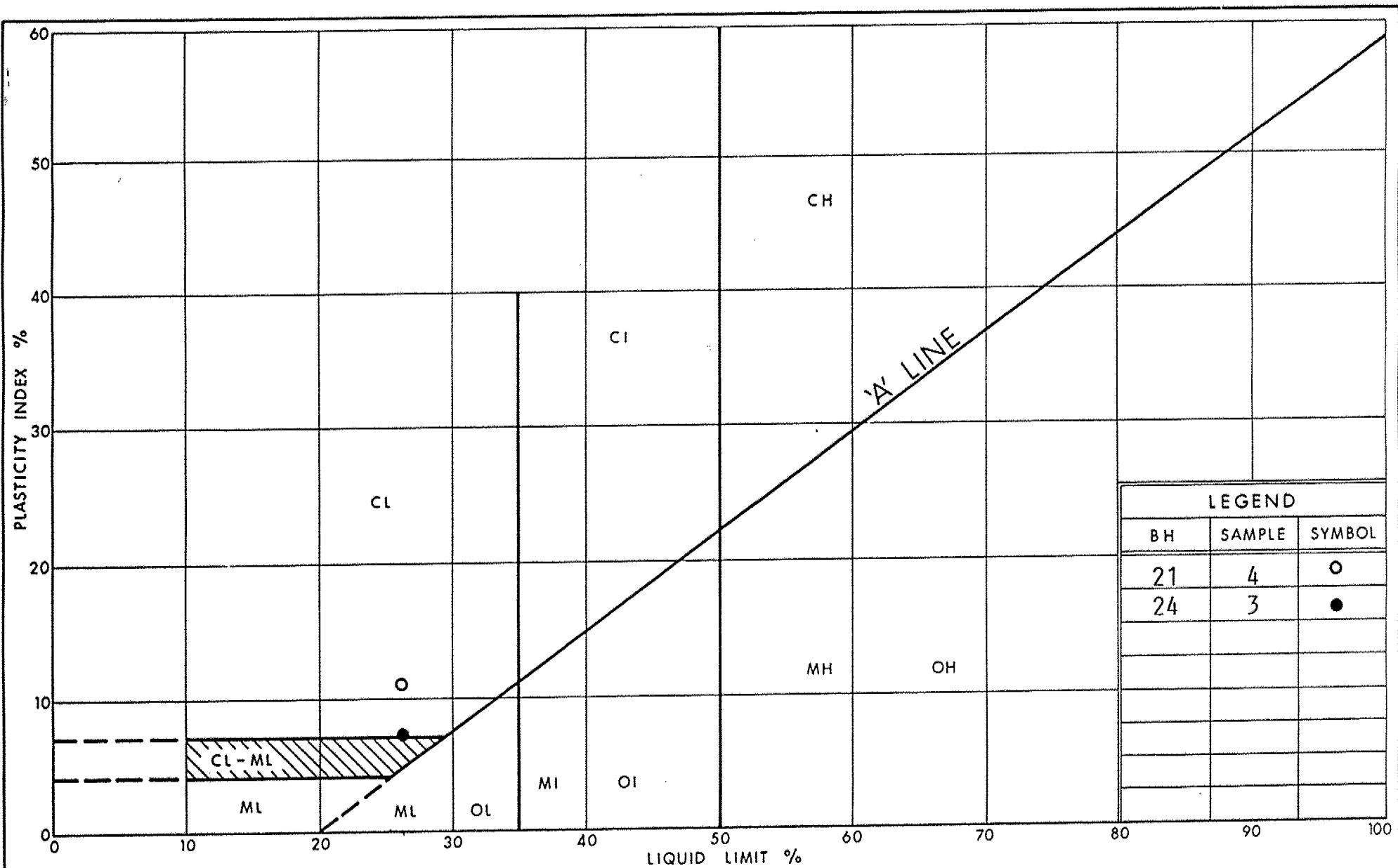
Ministry of  
TransportationGRAIN SIZE DISTRIBUTION  
CLAYEY SILT

FIG No 8

W P 264-87-00(a)



Ministry of  
Transportation

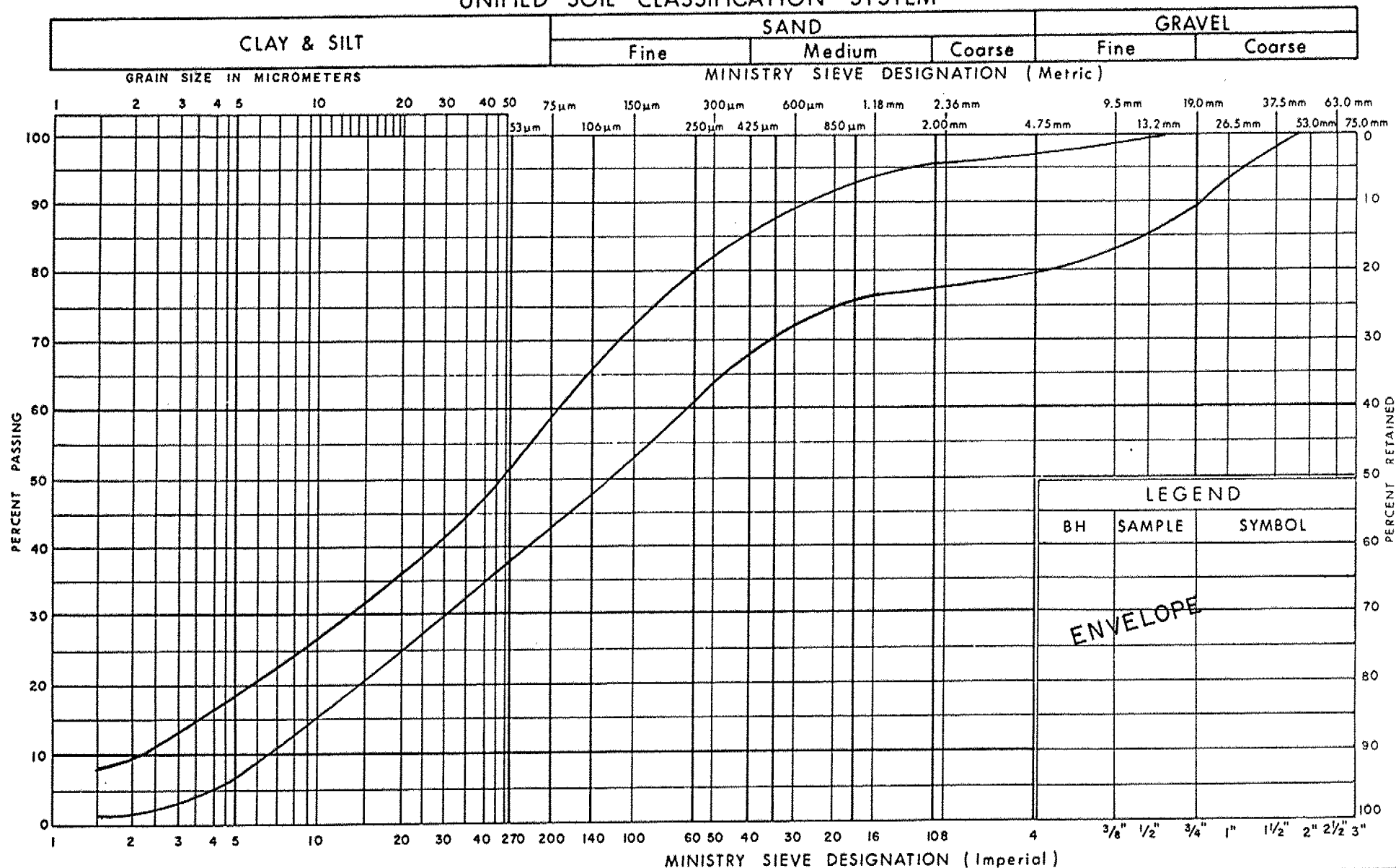
Ontario

# PLASTICITY CHART CLAYEY SILT

FIG No 9

W P 264-87-00(a)

## UNIFIED SOIL CLASSIFICATION SYSTEM

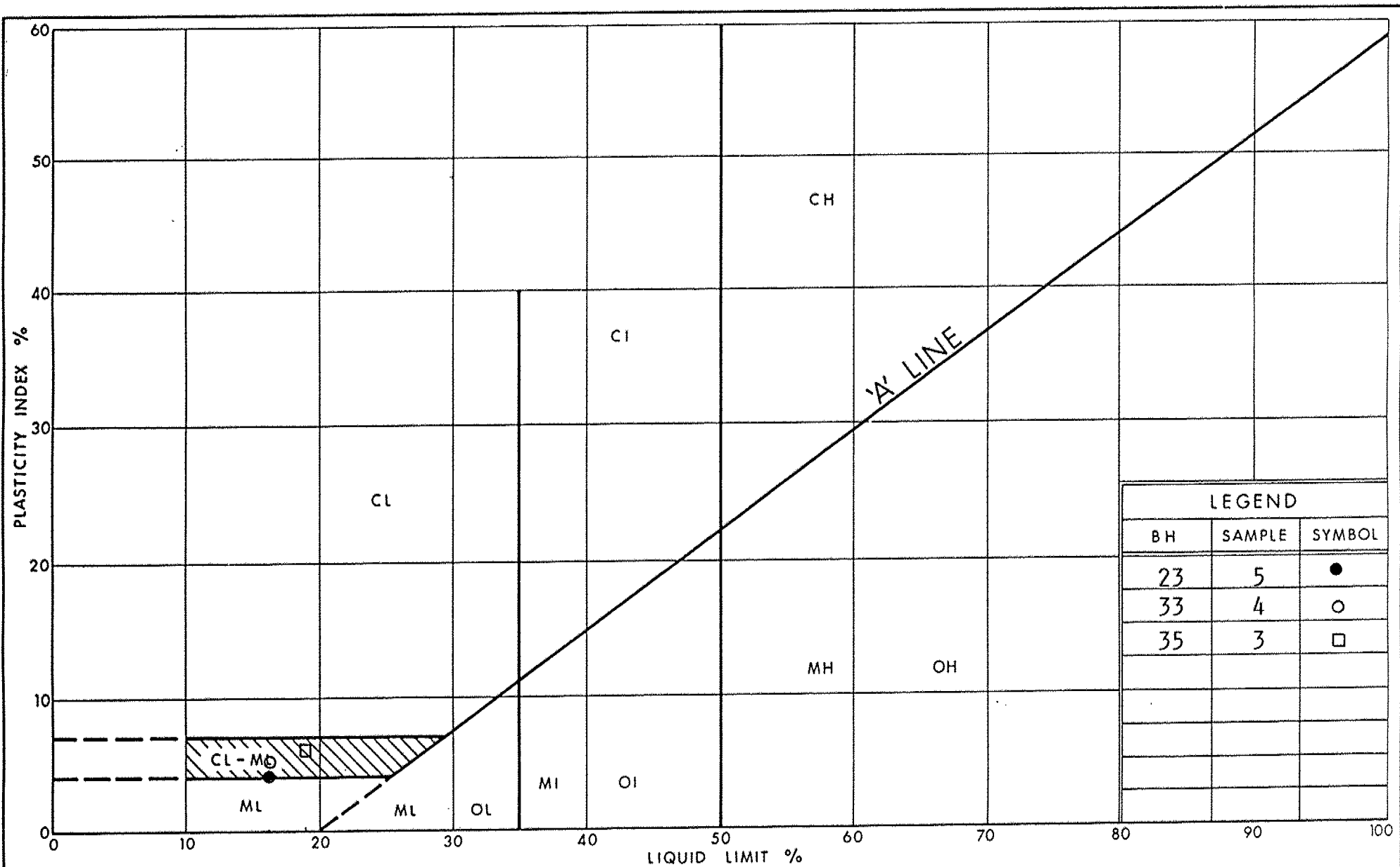


Ministry of  
Transportation

**GRAIN SIZE DISTRIBUTION**  
Het. mixture of sandy silt with  
gravel and trace of clay (TILL)

FIG No 10

W P 264-87-00(a)



Ministry of  
Transportation

Ontario

PLASTICITY CHART  
Het. mixture of sandy silt with  
gravel and trace of clay (TILL)

FIG No 11

W P 264-87-00(a)

# RECORD OF BOREHOLE No 1

METRIC

W P 264-87-00(a) LOCATION Station 20 + 775m, 1.5m N of W shoulder pavement edge ORIGINATED BY SM  
 DIST 6 HWY 401 BOREHOLE TYPE Solid stem auger COMPILED BY SB  
 DATUM Geodetic DATE February 22, 1991 CHECKED BY SB

OFFICE REPORT ON SOIL EXPLORATION

| SOIL PROFILE  |  |            | SAMPLES |      |            | GROUND WATER<br>CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT |    |    |    |     | PLASTIC<br>LIMIT<br>W <sub>p</sub> | NATURAL<br>MOISTURE<br>CONTENT<br>W | LIQUID<br>LIMIT<br>W <sub>L</sub> | UNIT<br>WEIGHT<br>γ | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%)<br>GR SA SI CL |
|---------------|--|------------|---------|------|------------|----------------------------|-----------------|---|----|----|----|-----|------------------------------------|-------------------------------------|-----------------------------------|---------------------|--|
| ELEV<br>DEPTH | DESCRIPTION  | STRAT PLOT | NUMBER  | TYPE | 'N' VALUES |                            |                 | 20  | 40 | 60 | 80 | 100 |                                    |                                     |                                   |                     |  |
| 138.7         | Ground surface   |            |         |      |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |  |
| 0.0           | Granular: 300 mm<br><br>SILTY SAND<br>compact to dense |            | 1       | SS   | 39         |                            | 138             |   |    |    |    |     |                                    | 0                                   |                                   |                     | 0 61 (39)  |
| 137.2         |  |            | 2       | SS   | 19         |                            |                 |   |    |    |    |     |                                    | 0                                   |                                   |                     |  |
| 1.5           | Het. mixture of sand<br>and silt with gravel,<br>dense |            | 3       | SS   | 44         |                            | 137             |   |    |    |    |     |                                    | 0                                   |                                   |                     |  |
| 136.6         |  |            |         |      |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |  |
| 2.1           | SAND<br>some silt and<br>gravel,<br>compact to dense   |            | 4       | SS   | 27         |                            | 136             |   |    |    |    |     |                                    | 0                                   |                                   |                     |  |
|               |  |            | 5       | SS   | 21         |                            |                 |   |    |    |    |     |                                    | 0                                   |                                   |                     |  |
|               |  |            |         |      |            |                            | 135             |   |    |    |    |     |                                    |                                     |                                   |                     |  |
|               |  |            | 6       | SS   | 32         |                            |                 |   |    |    |    |     |                                    | 0                                   |                                   |                     |  |
|               | Wet below 4.3m   |            |         |      |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |  |
| 133.7         |  |            | 7       | SS   | 16         |                            | 134             |   |    |    |    |     |                                    |                                     | 0                                 |                     |  |
| 5.0           | End of Borehole  |            |         |      |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |  |

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

20  
15 0.5 (%) STRAIN AT FAILURE  
10

# RECORD OF BOREHOLE No 2

METRIC

W P 264-87-00(a) LOCATION Station 20 + 800m, 1.4m N of W shoulder pavement edge ORIGINATED BY SM  
DIST 6 HWY 401 BOREHOLE TYPE Solid stem auger COMPILED BY SB  
DATUM Geodetic DATE February 22, 1991 CHECKED BY SB

| SOIL PROFILE  |  |            | SAMPLES |      |            | GROUND WATER<br>CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT |    |    |    |     | PLASTIC<br>LIMIT<br>W <sub>p</sub> | NATURAL<br>MOISTURE<br>CONTENT<br>W | LIQUID<br>LIMIT<br>W <sub>L</sub> | UNIT<br>WEIGHT<br>γ | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%) |
|---------------|--|------------|---------|------|------------|----------------------------|-----------------|---|----|----|----|-----|------------------------------------|-------------------------------------|-----------------------------------|---------------------|---|
| ELEV<br>DEPTH | DESCRIPTION  | STRAT PLOT | NUMBER  | TYPE | 'N' VALUES |                            |                 | 20  | 40 | 60 | 80 | 100 |                                    |                                     |                                   |                     |   |
| 138.7         | Ground surface   |            |         |      |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     | GR SA SI CL                                       |
| 0.0           | Sand and gravel,<br>some silt<br>(Granular Fill)         |            | 1       | SS   | 60         |                            | 138             |   |    |    |    |     | 0                                  |                                     |                                   |                     |   |
| 138.1         |  |            |         |      |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 0.6           | SILTY SAND<br>trace of gravel,<br>compact                |            | 2       | SS   | 24         |                            |                 |   |    |    |    |     | 0                                  |                                     |                                   |                     |   |
|               |  |            |         |      |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 136.7         |  |            | 3       | SS   | 28         |                            | 137             |   |    |    |    |     | 0                                  |                                     |                                   |                     | 3 54 (43)   |
| 2.0           |  |            |         |      |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |
|               | SAND<br>trace of silt<br>and gravel,<br>compact to dense |            | 4       | SS   | 38         |                            | 136             |   |    |    |    |     | 0                                  |                                     |                                   |                     | 4 92 (4)  |
|               |  |            | 5       | SS   | 32         |                            |                 |   |    |    |    |     | 0                                  |                                     |                                   |                     |   |
|               |  |            |         |      |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |
|               |  |            | 6       | SS   | 21         |                            | 135             |   |    |    |    |     | 0                                  |                                     |                                   |                     |   |
|               |  |            |         |      |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |
|               | Wet below 4.2m   |            |         |      |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 133.7         |  |            | 7       | SS   | 20         |                            | 134             |   |    |    |    |     | 0                                  |                                     |                                   |                     |   |
| 5.0           | End of Borehole  |            |         |      |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |

OFFICE REPORT ON SOIL EXPLORATION

+3, x5: Numbers refer to  
Sensitivity

20  
15 5 (%) STRAIN AT FAILURE  
10



# RECORD OF TEST PIT No 3

METRIC

W P 264-87-00(a) LOCATION Station 20 + 850m, 1.0m N of W shoulder pavement edge ORIGINATED BY SM  
 DIST 6 HWY 401 BOREHOLE TYPE Back-hoe COMPILED BY SB  
 DATUM Geodetic DATE February 27, 1991 CHECKED BY SB

| SOIL PROFILE  |  |            | SAMPLES |      |            | GROUND WATER<br>CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT |    |    |    |     | PLASTIC<br>LIMIT<br>W <sub>p</sub> | NATURAL<br>MOISTURE<br>CONTENT<br>W | LIQUID<br>LIMIT<br>W <sub>L</sub> | UNIT<br>WEIGHT<br>Y | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%) |
|---|--|------------|---------|------|------------|----------------------------|-----------------|---|----|----|----|-----|------------------------------------|-------------------------------------|-----------------------------------|---------------------|---|
| ELEV<br>DEPTH   | DESCRIPTION                                  | STRAT PLOT | NUMBER  | TYPE | 'N' VALUES |                            |                 | 20  | 40 | 60 | 80 | 100 |                                    |                                     |                                   |                     |   |
| 137.2   | Ground surface                               |            |         |      |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 0.0   | Topsoil: 300 mm<br>SILTY SAND<br>some gravel |            |         |      |            |                            | 137             |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 135.5   | (FILL)                                       |            |         |      |            |                            | 136             |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 1.7   | Organic stained silt,<br>roots               |            | 1       | SS   |            |                            | 135             |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 135.1   |  |            |         |      |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 2.1   | SAND<br>some silt,<br>dense                  |            | 2       | SS   |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 134.0   |  |            |         |      |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 3.2   | GRAVELLY SAND                                |            | 3       | SS   |            |                            | 134             |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 133.5   | wet  |            | 4       | SS   |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 3.7   | End of Test Pit                              |            |         |      |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| NOTES:<br>1) Water level at 3.3m after 3/4 hour from completion.<br>2) Dense to hand probing, at base of test-pit.<br>3) Side slopes excavated at 60° to horizontal,<br>were stable during the period (45 min.) the<br>test pit was open. |  |            |         |      |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |

OFFICE REPORT ON SOIL EXPLORATION

+3, x5: Numbers refer to  
Sensitivity

20  
15 5 (%) STRAIN AT FAILURE  
10

# RECORD OF BOREHOLE No 4

METRIC

W P 264-87-00(a) LOCATION Station 20 + 900m, 2.8m N of W shoulder pavement edge ORIGINATED BY SM  
 DIST 6 HWY 401 BOREHOLE TYPE Solid stem auger COMPILED BY SB  
 DATUM Geodetic DATE February 22, 1991 CHECKED BY SB

| SOIL PROFILE |   |            | SAMPLES |      |            | GROUND WATER CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION RESISTANCE PLOT |    |    |    |     | PLASTIC LIMIT<br>W <sub>p</sub> | NATURAL MOISTURE CONTENT<br>W | LIQUID LIMIT<br>W <sub>L</sub> | UNIT WEIGHT<br>γ | REMARKS & GRAIN SIZE DISTRIBUTION (%) |
|--------------|---|------------|---------|------|------------|-------------------------|-----------------|--|----|----|----|-----|---------------------------------|-------------------------------|--------------------------------|------------------|---------------------------------------|
| ELEV DEPTH   | DESCRIPTION   | STRAT PLOT | NUMBER  | TYPE | 'N' VALUES |                         |                 | 20                                       | 40 | 60 | 80 | 100 |                                 |                               |                                |                  |                                       |
| 137.6        | Ground surface  |            |         |      |            |                         |                 |  |    |    |    |     |                                 |                               |                                |                  |                                       |
| 0.0          | Granular fill: 400 mm                                     |            | 1       | SS   | 42         |                         | 137             |  |    |    |    |     |                                 |                               |                                |                  |                                       |
|              | SAND trace to some silt and gravel, compact to very dense |            | 2       | SS   | 27         |                         | 136             |  |    |    |    |     |                                 |                               |                                |                  |                                       |
|              |   |            | 3       | SS   | 13         |                         | 135             |  |    |    |    |     |                                 |                               |                                |                  |                                       |
|              |   |            | 4       | SS   | 20         |                         | 134             |  |    |    |    |     |                                 |                               |                                |                  |                                       |
|              |   |            | 5       | SS   | 46         |                         | 133             |  |    |    |    |     |                                 |                               |                                |                  |                                       |
|              | Wet below 3.8m  |            | 6       | SS   | 57         |                         |                 |  |    |    |    |     |                                 |                               |                                |                  |                                       |
|              |   |            | 7       | SS   | 24         |                         |                 |  |    |    |    |     |                                 |                               |                                |                  |                                       |
| 132.6        | End of Borehole   |            |         |      |            |                         |                 |  |    |    |    |     |                                 |                               |                                |                  |                                       |
| 5.0          |   |            |         |      |            |                         |                 |  |    |    |    |     |                                 |                               |                                |                  |                                       |

OFFICE REPORT ON SOIL EXPLORATION

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

20  
15  
10  
5 (%) STRAIN AT FAILURE

# RECORD OF BOREHOLE No 5

METRIC

W P 264-87-00(a) LOCATION Station 20 + 947m, 0.2m N of W shoulder pavement edge ORIGINATED BY SM  
 DIST 6 HWY 401 BOREHOLE TYPE Solid stem auger COMPILED BY SB  
 DATUM Geodetic DATE February 22, 1991 CHECKED BY SB

| SOIL PROFILE  |   |            | SAMPLES |      |            | GROUND WATER<br>CONDITIONS | ELEVATION<br>SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT |    |    |    |     | PLASTIC<br>LIMIT<br>W <sub>p</sub> | NATURAL<br>MOISTURE<br>CONTENT<br>W | LIQUID<br>LIMIT<br>W <sub>L</sub> | UNIT<br>WEIGHT<br>γ | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%)<br>GR SA SI CL |
|---------------|---|------------|---------|------|------------|----------------------------|--------------------|---|----|----|----|-----|------------------------------------|-------------------------------------|-----------------------------------|---------------------|--|
| ELEV<br>DEPTH | DESCRIPTION   | STRAT PLOT | NUMBER  | TYPE | 'N' VALUES |                            |                    | 20  | 40 | 60 | 80 | 100 |                                    |                                     |                                   |                     |  |
| 137.3         | Ground surface  |            |         |      |            |                            |                    |   |    |    |    |     |                                    |                                     |                                   |                     |  |
| 0.0           | Sand and gravel,<br>some silt<br>(FILL)                               |            |         |      |            |                            |                    |   |    |    |    |     |                                    |                                     |                                   |                     |  |
| 136.4         | Topsoil: 50 mm  |            |         |      |            |                            |                    |   |    |    |    |     |                                    |                                     |                                   |                     |  |
| 0.9           | SAND<br>trace to some<br>silt and gravel,<br>compact to very<br>dense |            | 1       | SS   | 41         |                            |                    |   |    |    |    |     |                                    |                                     |                                   |                     |  |
|               |   |            | 2       | SS   | 35         |                            |                    |   |    |    |    |     |                                    |                                     |                                   |                     |  |
|               |   |            | 3       | SS   | 36         |                            |                    |   |    |    |    |     |                                    |                                     |                                   |                     |  |
|               |   |            | 4       | SS   | 39         |                            |                    |   |    |    |    |     |                                    |                                     |                                   |                     |  |
|               |   |            | 5       | SS   | 21         |                            |                    |   |    |    |    |     |                                    |                                     |                                   |                     |  |
|               |   |            | 6       | SS   | 76         |                            |                    |   |    |    |    |     |                                    |                                     |                                   |                     |  |
| 132.3         | End of Borehole   |            |         |      |            |                            |                    |   |    |    |    |     |                                    |                                     |                                   |                     |  |
| 5.0           | *Stabilized ground<br>water level at<br>3.8m depth.                   |            |         |      |            |                            |                    |   |    |    |    |     |                                    |                                     |                                   |                     |  |

OFFICE REPORT ON SOIL EXPLORATION

# RECORD OF BOREHOLE No 6

METRIC

W P 264-87-00(a) LOCATION Station 21 + 000m, 0.2m N of W shoulder pavement edge ORIGINATED BY SM  
 DIST 6 HWY 401 BOREHOLE TYPE Solid stem auger COMPILED BY SB  
 DATUM Geodetic DATE February 22, 1991 CHECKED BY SB

| SOIL PROFILE  |   |            | SAMPLES |      |            | GROUND WATER<br>CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT |    |    |    |     | PLASTIC<br>LIMIT<br>W <sub>p</sub> | NATURAL<br>MOISTURE<br>CONTENT<br>W | LIQUID<br>LIMIT<br>W <sub>L</sub> | UNIT<br>WEIGHT<br>γ | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%) |
|---------------|---|------------|---------|------|------------|----------------------------|-----------------|---|----|----|----|-----|------------------------------------|-------------------------------------|-----------------------------------|---------------------|---|
| ELEV<br>DEPTH | DESCRIPTION   | STRAT PLOT | NUMBER  | TYPE | 'N' VALUES |                            |                 | 20  | 40 | 60 | 80 | 100 |                                    |                                     |                                   |                     |   |
| 136.7         | Ground surface  |            |         |      |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     | GR SA SI CL                                       |
| 0.0           | Sand and gravel<br>some silt<br>(FILL)                                |            | 1       | CS   |            |                            | 136             |   |    |    |    |     | 0                                  |                                     |                                   |                     |   |
| 135.8         |   |            | 2       | SS   | 46         |                            |                 |   |    |    |    |     | 0                                  |                                     |                                   |                     |   |
| 0.9           | SAND<br>trace to some<br>silt and gravel,<br>compact to very<br>dense |            | 3       | SS   | 26         |                            | 135             |   |    |    |    |     | 0                                  |                                     |                                   |                     | 0 95 (5)  |
|               |   |            | 4       | SS   | 50/15cm    |                            | 134             |   |    |    |    |     | 0                                  |                                     |                                   |                     |   |
|               | Wet below 3.2m  |            | 5       | SS   | 40         |                            | 133             |   |    |    |    |     | 0                                  |                                     |                                   |                     |   |
|               |   |            | 6       | SS   | 23         |                            |                 |   |    |    |    |     | 0                                  |                                     |                                   |                     | 22 65 (13)  |
| 131.7         |   |            | 7       | SS   | 15         |                            | 132             |   |    |    |    |     | 0                                  |                                     |                                   |                     |   |
| 5.0           | End of Borehole   |            |         |      |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |

OFFICE REPORT ON SOIL EXPLORATION

# RECORD OF BOREHOLE No 7

METRIC

W P 264-87-00(a) LOCATION Station 21 + 050m, 0.2m N of W shoulder pavement edge ORIGINATED BY SM  
 DIST 6 HWY 401 BOREHOLE TYPE Solid stem auger COMPILED BY SB  
 DATUM Geodetic DATE February 22, 1991 CHECKED BY SB

| SOIL PROFILE  |   |            | SAMPLES |      |            | GROUND WATER<br>CONDITIONS | ELEVATION<br>SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT |    |    |    |     | PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT |   |                | UNIT<br>WEIGHT<br>γ | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%)<br>GR SA SI CL |
|---------------|---|------------|---------|------|------------|----------------------------|--------------------|---|----|----|----|-----|---|---|----------------|---------------------|--|
| ELEV<br>DEPTH | DESCRIPTION   | STRAT PLOT | NUMBER  | TYPE | 'N' VALUES |                            |                    | 20  | 40 | 60 | 80 | 100 | W <sub>p</sub>                                      | W | W <sub>L</sub> |                     |  |
| 136.4         | Ground surface  |            |         |      |            |                            |                    |   |    |    |    |     |   |   |                |                     |  |
| 0.0           | Sand and gravel   | ⊗          | 1       | CS   |            |                            |                    |   |    |    |    |     |   |   |                |                     |  |
| 135.8         | some silt<br>(FILL)   | ⊗          |         |      |            |                            |                    |   |    |    |    |     |   |   |                |                     |  |
| 0.6           | SAND  | ⋯          | 2       | SS   | 38         |                            |                    |   |    |    |    |     |   |   |                |                     |  |
|               | trace to some<br>silt and gravel,<br>compact to very<br>dense | ⋯          | 3       | SS   | 29         |                            |                    |   |    |    |    |     |   |   |                |                     |  |
|               |   | ⋯          | 4       | SS   | 29         |                            |                    |   |    |    |    |     |   |   |                |                     |  |
|               |   | ⋯          | 5       | SS   | 23         |                            |                    |   |    |    |    |     |   |   |                |                     |  |
|               | Wet below 3.0m  | ⋯          | 6       | SS   | 31         |                            |                    |   |    |    |    |     |   |   |                |                     |  |
|               |   | ⋯          | 7       | SS   | 59         |                            |                    |   |    |    |    |     |   |   |                |                     |  |
| 131.4         | End of Borehole   |            |         |      |            |                            |                    |   |    |    |    |     |   |   |                |                     |  |

OFFICE REPORT ON SOIL EXPLORATION

+3, x5: Numbers refer to  
Sensitivity

20  
15 5 (%) STRAIN AT FAILURE  
10

# RECORD OF TEST PIT No 8

METRIC

W P 264-87-00(a) LOCATION Station 21 + 100m, 1.5m N of W shoulder pavement edge ORIGINATED BY SM  
 DIST 6 HWY 401 BOREHOLE TYPE Back-hoe COMPILED BY SB  
 DATUM Geodetic DATE February 27, 1991 CHECKED BY SB

| SOIL PROFILE  |   |            | SAMPLES |      |            | GROUND WATER CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION RESISTANCE PLOT |    |    |    |     | PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT |   |                | UNIT WEIGHT $\gamma$ | REMARKS & GRAIN SIZE DISTRIBUTION (%) |
|---|---|------------|---------|------|------------|-------------------------|-----------------|--|----|----|----|-----|---|---|----------------|----------------------|---------------------------------------|
| ELEV DEPTH  | DESCRIPTION   | STRAT PLOT | NUMBER  | TYPE | 'N' VALUES |                         |                 | 20                                       | 40 | 60 | 80 | 100 | W <sub>p</sub>                                      | W | W <sub>L</sub> |                      |                                       |
| 135.1   | Ground surface  |            |         |      |            |                         |                 |  |    |    |    |     |   |   |                |                      |                                       |
| 0.0   | Topsoil: 560 mm SAND trace to some silt and gravel, dense |            | 1       | CS   |            |                         |                 |  |    |    |    |     |   |   |                | 7 89 (4)             |                                       |
| 132.7   |   |            |         |      |            |                         |                 |  |    |    |    |     |   |   |                |                      |                                       |
| 2.4   | GRAVELLY SAND wet, dense                                  |            | 2       | CS   |            |                         |                 |  |    |    |    |     |   |   |                | 33 63 (4)            |                                       |
| 131.4   |   |            |         |      |            |                         |                 |  |    |    |    |     |   |   |                |                      |                                       |
| 3.7   | End of Test Pit   |            |         |      |            |                         |                 |  |    |    |    |     |   |   |                |                      |                                       |
| NOTES:<br>1) Water level at 2.4m after 1½ hrs. from completion.<br>2) Dense to hand probing, at base of test-pit. |   |            |         |      |            |                         |                 |  |    |    |    |     |   |   |                |                      |                                       |

OFFICE REPORT ON SOIL EXPLORATION

# RECORD OF BOREHOLE No 9

METRIC

W P 264-87-00(a) LOCATION Station 21 + 150m, 1.0m N of W shoulder pavement edge ORIGINATED BY SM  
 DIST 6 HWY 401 BOREHOLE TYPE Solid stem auger COMPILED BY SB  
 DATUM Geodetic DATE February 22, 1991 CHECKED BY SB

| SOIL PROFILE  |   |            | SAMPLES |      |            | GROUND WATER<br>CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT |                    |  |  | PLASTIC<br>LIMIT<br>W <sub>p</sub> | NATURAL<br>MOISTURE<br>CONTENT<br>W | LIQUID<br>LIMIT<br>W <sub>L</sub> | UNIT<br>WEIGHT<br>γ | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%) |
|---------------|---|------------|---------|------|------------|----------------------------|-----------------|---|--------------------|--|--|------------------------------------|-------------------------------------|-----------------------------------|---------------------|---|
| ELEV<br>DEPTH | DESCRIPTION   | STRAT PLOT | NUMBER  | TYPE | 'N' VALUES |                            |                 | 20 40 60 80 100                             | SHEAR STRENGTH kPa |  |  |                                    |                                     |                                   |                     |   |
| 135.3         | Ground surface  |            |         |      |            |                            |                 |   |                    |  |  |                                    |                                     |                                   |                     | GR SA SI CL                                       |
| 0.0           | Granular Fill: 300 mm<br>SAND<br>trace to some silt,<br>dense to very dense |            | 1       | SS   | 35         |                            | 135             |   |                    |  |  |                                    |                                     |                                   |                     | 0 93 (7)<br><br>25 69 (6)                         |
|               |   |            | 2       | SS   | 41         |                            | 134             |   |                    |  |  |                                    |                                     |                                   |                     |   |
|               |   |            | 3       | SS   | 50/15 cm   |                            |                 |   |                    |  |  |                                    |                                     |                                   |                     |   |
| 133.0         |   |            |         |      |            |                            | 133             |   |                    |  |  |                                    |                                     |                                   |                     |   |
| 2.3           | GRAVELLY SAND<br>wet,<br>dense to very dense                                |            | 4       | SS   | 74         |                            |                 |   |                    |  |  |                                    |                                     |                                   |                     |   |
|               |   |            | 5       | SS   | 36         |                            | 132             |   |                    |  |  |                                    |                                     |                                   |                     |   |
|               |   |            |         |      |            |                            |                 |   |                    |  |  |                                    |                                     |                                   |                     |   |
| 131.3         |   |            | 6       | SS   | 75         |                            | 131             |   |                    |  |  |                                    |                                     |                                   |                     |   |
| 4.0           | SAND<br>some silt and<br>gravel, wet,<br>dense to very dense                |            |         |      |            |                            |                 |   |                    |  |  |                                    |                                     |                                   |                     |   |
| 130.3         |   |            | 7       | SS   | 33         |                            |                 |   |                    |  |  |                                    |                                     |                                   |                     |   |
| 5.0           | End of Borehole   |            |         |      |            |                            |                 |   |                    |  |  |                                    |                                     |                                   |                     |   |

OFFICE REPORT ON SOIL EXPLORATION

+3, x5: Numbers refer to  
Sensitivity

20  
15 5 (%) STRAIN AT FAILURE  
10

# RECORD OF BOREHOLE No 10

METRIC

W P 264-87-00(a) LOCATION Station 21 + 200m, 0.2m N of W shoulder pavement edge ORIGINATED BY SM  
 DIST 6 HWY 401 BOREHOLE TYPE Solid stem auger COMPILED BY SB  
 DATUM Geodetic DATE February 22, 1991 CHECKED BY SB

| SOIL PROFILE  |                          |            | SAMPLES |      |            | GROUND WATER<br>CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT |    |    |    |     | PLASTIC<br>LIMIT<br>W <sub>p</sub> | NATURAL<br>MOISTURE<br>CONTENT<br>W | LIQUID<br>LIMIT<br>W <sub>L</sub> | UNIT<br>WEIGHT<br>γ | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%) |
|---------------|--------------------------|------------|---------|------|------------|----------------------------|-----------------|---|----|----|----|-----|------------------------------------|-------------------------------------|-----------------------------------|---------------------|---|
| ELEV<br>DEPTH | DESCRIPTION              | STRAT PLOT | NUMBER  | TYPE | 'N' VALUES |                            |                 | 20  | 40 | 60 | 80 | 100 |                                    |                                     |                                   |                     |   |
| 135.0         | Ground surface           |            |         |      |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 0.0           | Granular Fill: 300 mm    | ⊗          | 1       | SS   | 29         |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |
|               | SAND                     |            | 2       | SS   | 73         |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |
|               | trace to some            |            |         |      |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |
|               | silt and gravel,         |            | 3       | SS   | 53         |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |
|               | very dense               |            |         |      |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |
|               | Wet below 2.3m           |            | 4       | SS   | 46         |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |
|               |                          |            | 5       | SS   | 65         |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |
|               |                          |            | 6       | SS   | 55         |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 130.4         |                          |            |         |      |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 4.6           | Het. mixture of sand,    | ⊗          | 7       | SS   | 84         |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 130.0         | silt, gravel, very dense |            |         |      |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 5.0           | End of Borehole          |            |         |      |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |

OFFICE REPORT ON SOIL EXPLORATION

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

20  
15  
10  
5 (%) STRAIN AT FAILURE



# RECORD OF BOREHOLE No II

METRIC

W P 264-87-00(a) LOCATION Station 21 + 350m, 0.2m N of W shoulder pavement edge ORIGINATED BY SM  
 DIST 6 HWY 401 BOREHOLE TYPE Solid stem auger COMPILED BY SB  
 DATUM Geodetic DATE February 22, 1991 CHECKED BY SB

| SOIL PROFILE  |   |            | SAMPLES |      |            | GROUND WATER<br>CONDITIONS | ELEVATION<br>SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT |    |    |    |     | PLASTIC<br>LIMIT<br>W <sub>p</sub> | NATURAL<br>MOISTURE<br>CONTENT<br>W | LIQUID<br>LIMIT<br>W <sub>L</sub> | UNIT<br>WEIGHT<br>γ | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%) |
|---------------|---|------------|---------|------|------------|----------------------------|--------------------|---|----|----|----|-----|------------------------------------|-------------------------------------|-----------------------------------|---------------------|---|
| ELEV<br>DEPTH | DESCRIPTION   | STRAT PLOT | NUMBER  | TYPE | 'N' VALUES |                            |                    | 20  | 40 | 60 | 80 | 100 |                                    |                                     |                                   |                     |   |
| 133.5         | Ground surface  |            |         |      |            |                            |                    |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 0.0           | Topsoil: 150 mm<br>SILTY SAND<br>some gravel,<br>very dense |            | 1       | CS   |            |                            | 133                |   |    |    |    |     | 0                                  |                                     |                                   |                     |   |
| 132.3         |   |            | 2       | SS   | 74         |                            |                    |   |    |    |    |     | 0                                  |                                     |                                   |                     |   |
| 1.2           | GRAVELLY SAND<br>trace of silt,<br>dense to very dense      |            | 3       | SS   | 50/10cm    |                            | 132                |   |    |    |    |     | 0                                  |                                     |                                   |                     |   |
|               |   |            | 4       | SS   | 56         |                            | 131                |   |    |    |    |     | 0                                  |                                     |                                   |                     |   |
|               | Wet below 3.0m  |            | 5       | SS   | 39         |                            | 130                |   |    |    |    |     | 0                                  |                                     |                                   |                     |   |
| 129.2         |   |            | 6       | SS   | 66         |                            |                    |   |    |    |    |     | 0                                  |                                     |                                   |                     |   |
| 4.3           | End of Borehole   |            |         |      |            |                            |                    |   |    |    |    |     |                                    |                                     |                                   |                     |   |

OFFICE REPORT ON SOIL EXPLORATION

+3, x5: Numbers refer to  
Sensitivity

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

# RECORD OF BOREHOLE No 12

METRIC

W P 264-87-00(a) LOCATION Station 21 + 400, 0.2m N of W shoulder pavement edge ORIGINATED BY SM  
 DIST 6 HWY 401 BOREHOLE TYPE Solid stem auger COMPILED BY SB  
 DATUM Geodetic DATE February 22, 1991 CHECKED BY SB

OFFICE REPORT ON SOIL EXPLORATION

| SOIL PROFILE  |   |            | SAMPLES |      |            | GROUND WATER<br>CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT              |  |  | PLASTIC<br>LIMIT<br>W <sub>p</sub> | NATURAL<br>MOISTURE<br>CONTENT<br>W | LIQUID<br>LIMIT<br>W <sub>L</sub> | UNIT<br>WEIGHT<br>γ | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>{%} |                    |  |  |                   |
|---------------|---|------------|---------|------|------------|----------------------------|-----------------|--|--|--|------------------------------------|-------------------------------------|-----------------------------------|---------------------|---|--------------------|--|--|-------------------|
| ELEV<br>DEPTH | DESCRIPTION   | STRAT PLOT | NUMBER  | TYPE | 'N' VALUES |                            |                 | 20 40 60 80 100  |  |  |                                    |                                     |                                   |                     |   | SHEAR STRENGTH kPa |  |  | WATER CONTENT (%) |
|               |   |            |         |      |            |                            |                 | ○ UNCONFINED + FIELD VANE<br>● QUICK TRIAXIAL x LAB VANE |  |  |                                    |                                     |                                   |                     |   |                    |  |  |                   |
| 133.2         | Ground surface  |            |         |      |            |                            |                 |  |  |  |                                    |                                     |                                   |                     | GR SA SI CL                                       |                    |  |  |                   |
| 0.0           | Granular: 250 mm<br>SILTY SAND<br>topsoil seams,<br>compact (FILL)                | ⊗          |         |      |            |                            | 133             |  |  |  |                                    |                                     |                                   |                     | 11 72 (17)  |                    |  |  |                   |
| 132.3         |   | ⊗          |         |      |            |                            |                 |  |  |  |                                    |                                     |                                   |                     |   |                    |  |  |                   |
| 0.9           | GRAVELLY SAND<br>trace of silt,<br>compact to very<br>dense<br><br>Wet below 3.2m | ⊗          | 1       | SS   | 38         |                            | 132             |  |  |  |                                    |                                     |                                   |                     |   |                    |  |  |                   |
|               |   | ⊗          | 2       | SS   | 50         |                            |                 |  |  |  |                                    |                                     |                                   |                     |   |                    |  |  |                   |
|               |   | ⊗          | 3       | SS   | 81         |                            | 131             |  |  |  |                                    |                                     |                                   |                     |   |                    |  |  |                   |
|               |   | ⊗          | 4       | SS   | 22         |                            | 130             |  |  |  |                                    |                                     |                                   |                     |   |                    |  |  |                   |
|               |   | ⊗          | 5       | SS   | 30         |                            | 129             |  |  |  |                                    |                                     |                                   |                     |   |                    |  |  |                   |
| 128.9         |   | ⊗          |         |      |            |                            |                 |  |  |  |                                    |                                     |                                   |                     | 33 62 (5)   |                    |  |  |                   |
| 4.3           | End of Borehole   |            |         |      |            |                            |                 |  |  |  |                                    |                                     |                                   |                     |   |                    |  |  |                   |

+3, x5 : Numbers refer to  
Sensitivity

20  
15 0.5 (%) STRAIN AT FAILURE  
10

# RECORD OF TEST PIT No 13

METRIC

W P 264-87-00(a) LOCATION Station 21 + 450m, 0.9m N of W shoulder pavement edge ORIGINATED BY SM  
 DIST 6 HWY 401 BOREHOLE TYPE Back-hoe COMPILED BY SB  
 DATUM Geodetic DATE February 27, 1991 CHECKED BY SB

| SOIL PROFILE  |  |            | SAMPLES |      |            | GROUND WATER<br>CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT |    |    |    |     | PLASTIC<br>LIMIT<br>W <sub>p</sub> | NATURAL<br>MOISTURE<br>CONTENT<br>W | LIQUID<br>LIMIT<br>W <sub>L</sub> | UNIT<br>WEIGHT<br>γ | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%) |
|---|--|------------|---------|------|------------|----------------------------|-----------------|---|----|----|----|-----|------------------------------------|-------------------------------------|-----------------------------------|---------------------|---|
| ELEV<br>DEPTH   | DESCRIPTION  | STRAT PLOT | NUMBER  | TYPE | 'N' VALUES |                            |                 | 20  | 40 | 60 | 80 | 100 |                                    |                                     |                                   |                     |   |
| 132.0   | Ground surface   |            |         |      |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 0.0   | Topsoil: 250 mm  |            |         |      |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 131.5   | SANDY SILT (FILL)                                      |            |         |      |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 0.5   | Het. mixt. sand and silt                               |            | 1       | CS   |            |                            | 131             |   |    |    |    |     |                                    | 0                                   |                                   |                     |   |
| 131.1   | with gravel (till)                                     |            |         |      |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 0.9   | GRAVELLY SAND<br>gravel layers,<br>occ. cobbles, moist |            | 2       | CS   |            |                            | 130             |   |    |    |    |     |                                    | 0                                   |                                   |                     | 88 11 (1)   |
|   |  |            | 3       | CS   |            |                            |                 |   |    |    |    |     |                                    | 0                                   |                                   |                     | 70 28 (2)   |
| 129.3   |  |            |         |      |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 2.7   | End of Test Pit  |            |         |      |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| NOTES:<br>1) Water level at the base of the test-pit, i.e. 2.7m.<br>2) Side slopes excavated at 60° to horizontal, were<br>stable during the period (30 min.) the test-pit<br>was open.<br>3) Dense to hand probing, at base of test-pit. |  |            |         |      |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |

OFFICE REPORT ON SOIL EXPLORATION

# RECORD OF BOREHOLE No 14

METRIC

W P 264-87-00(a) LOCATION Station 21 + 500m, 0.2m N of W shoulder pavement edge ORIGINATED BY SM  
DIST 6 HWY 401 BOREHOLE TYPE Solid stem auger COMPILED BY SB  
DATUM Geodetic DATE February 22, 1991 CHECKED BY SB

| SOIL PROFILE  |   |            | SAMPLES |      |            | GROUND WATER<br>CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT |    |    |    |     | PLASTIC<br>LIMIT<br>W <sub>p</sub> | NATURAL<br>MOISTURE<br>CONTENT<br>W | LIQUID<br>LIMIT<br>W <sub>L</sub> | UNIT<br>WEIGHT<br>γ | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%) |
|---------------|---|------------|---------|------|------------|----------------------------|-----------------|---|----|----|----|-----|------------------------------------|-------------------------------------|-----------------------------------|---------------------|---|
| ELEV<br>DEPTH | DESCRIPTION   | STRAT PLOT | NUMBER  | TYPE | 'N' VALUES |                            |                 | 20  | 40 | 60 | 80 | 100 |                                    |                                     |                                   |                     |   |
| 132.5         | Ground surface  |            |         |      |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 0.0           | Granular fill: 400 mm<br>GRAVELLY SAND<br>some silt,<br>dense<br>(FILL) |            | 1       | SS   | 37         |                            | 132             |   |    |    |    |     | 0                                  |                                     |                                   |                     | 32 53 (15)  |
|               |   |            | 2       | SS   | 33         |                            | 131             |   |    |    |    |     | 0                                  |                                     |                                   |                     |   |
| 130.8         |   |            | 3       | SS   | 41         |                            | 130             |   |    |    |    |     | 0                                  |                                     |                                   |                     |   |
| 1.7           | Het. mixture of silty<br>sand with gravel, dense<br>to very dense       |            | 4       | SS   | 50/10cm    |                            | 129             |   |    |    |    |     | 0                                  |                                     |                                   |                     |   |
| 130.1         |   |            | 5       | SS   | 46         |                            | 128             |   |    |    |    |     | 0                                  |                                     |                                   |                     |   |
| 2.4           | GRAVELLY SAND<br>very dense   |            | 6       | SS   | 26         |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 129.3         |   |            |         |      |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 3.2           | SAND<br>some gravel,<br>wet, dense to<br>compact                        |            |         |      |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 128.2         |   |            |         |      |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 4.3           | End of Borehole   |            |         |      |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |

OFFICE REPORT ON SOIL EXPLORATION

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

20  
15 5 (%) STRAIN AT FAILURE  
10

# RECORD OF BOREHOLE No 15

METRIC

W P 264-87-00(a) LOCATION Station 21 + 550m, 0.2m N of W shoulder pavement edge ORIGINATED BY SM  
 DIST 6 HWY 401 BOREHOLE TYPE Solid stem auger COMPILED BY SB  
 DATUM Geodetic DATE February 21, 1991 CHECKED BY SB

OFFICE REPORT ON SOIL EXPLORATION

| SOIL PROFILE  |  |            | SAMPLES |      |            | GROUND WATER<br>CONDITIONS | ELEVATION<br>SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT |    |    |    |     | PLASTIC<br>LIMIT<br>W <sub>p</sub> | NATURAL<br>MOISTURE<br>CONTENT<br>W | LIQUID<br>LIMIT<br>W <sub>L</sub> | UNIT<br>WEIGHT<br>γ | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%)<br>GR SA SI CL |
|---------------|--|------------|---------|------|------------|----------------------------|--------------------|---|----|----|----|-----|------------------------------------|-------------------------------------|-----------------------------------|---------------------|--|
| ELEV<br>DEPTH | DESCRIPTION  | STRAT PLOT | NUMBER  | TYPE | 'N' VALUES |                            |                    | 20  | 40 | 60 | 80 | 100 |                                    |                                     |                                   |                     |  |
| 132.3         | Ground surface   |            |         |      |            |                            |                    |   |    |    |    |     |                                    |                                     |                                   |                     |  |
| 0.0           | Granular: 300 mm<br>GRAVELLY SAND TO<br>SILTY SAND<br>topsoil seams,<br>compact<br>(FILL)  |            | 1       | SS   | 20         |                            | 132                |   |    |    |    |     | o                                  |                                     |                                   |                     | 21 67 (12)   |
| 130.9         |  |            | 2       | SS   | 31         |                            | 131                |   |    |    |    |     |                                    | o                                   |                                   |                     | 16 68 (16)   |
| 1.4           | Het. mixture of<br>silty sand with<br>gravel, wet sand<br>seams, compact<br>(glacial till) |            | 3       | SS   | 31         |                            | 130                |   |    |    |    |     |                                    | o                                   |                                   |                     |  |
| 129.9         |  |            | 4       | SS   | 34         |                            | 129                |   |    |    |    |     |                                    | o                                   |                                   |                     |  |
| 2.4           | SAND<br>some silt and<br>gravel,<br>very moist to wet,<br>dense to very<br>dense           |            | 5       | SS   | 50/19cm    |                            | 128                |   |    |    |    |     |                                    | o                                   |                                   |                     |  |
| 127.9         |  |            | 6       | SS   | 68/22cm    |                            |                    |   |    |    |    |     |                                    | o                                   |                                   |                     |  |
| 4.4           | Het. mixture of silty<br>sand with gravel, very<br>dense (glacial till)                    |            | 7       | SS   | 50/12cm    |                            |                    |   |    |    |    |     |                                    | o                                   |                                   |                     |  |
| 127.3         |  |            |         |      |            |                            |                    |   |    |    |    |     |                                    |                                     |                                   |                     |  |
| 5.0           | End of Borehole  |            |         |      |            |                            |                    |   |    |    |    |     |                                    |                                     |                                   |                     |  |

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

20  
15 5 (%) STRAIN AT FAILURE  
10

# RECORD OF BOREHOLE No 16

METRIC

W P 264-87-00(a) LOCATION Station 21 + 600m, 0.2m N of W shoulder pavement edge ORIGINATED BY SM  
 DIST 6 HWY 401 BOREHOLE TYPE Solid stem auger COMPILED BY SB  
 DATUM Geodetic DATE February 21, 1991 CHECKED BY SB

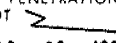
| SOIL PROFILE  |  |            | SAMPLES |      |            | GROUND WATER<br>CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT |    |    |     |  | PLASTIC<br>LIMIT<br>W <sub>p</sub> | NATURAL<br>MOISTURE<br>CONTENT<br>W | LIQUID<br>LIMIT<br>W <sub>L</sub> | UNIT<br>WEIGHT<br>γ | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%)<br>GR SA SI CL |
|---------------|--|------------|---------|------|------------|----------------------------|-----------------|---|----|----|-----|--|------------------------------------|-------------------------------------|-----------------------------------|---------------------|--|
| ELEV<br>DEPTH | DESCRIPTION  | STRAT PLOT | NUMBER  | TYPE | 'N' VALUES |                            |                 | SHEAR STRENGTH kPa                          |    |    |     |  |                                    |                                     |                                   |                     |  |
|               |  |            |         |      |            |                            | 20              | 40  | 60 | 80 | 100 |  |                                    |                                     |                                   |                     |  |
| 131.9         | Ground surface   |            | 1       | SS   | 36         |                            |                 |   |    |    |     |  |                                    |                                     |                                   |                     |  |
| 0.0           | GRANULAR SAND AND GRAVEL TO SILTY SAND topsoil seams, compact (FILL) |            | 2       | SS   | 16         |                            |                 |   |    |    |     |  |                                    |                                     |                                   |                     |  |
| 130.7         |  |            |         |      |            |                            |                 |   |    |    |     |  |                                    |                                     |                                   |                     |  |
| 1.2           | SAND some gravel and silt, compact                                   |            | 3       | SS   | 26         |                            |                 |   |    |    |     |  |                                    |                                     |                                   |                     |  |
|               |  |            | 4       | SS   | 27         |                            |                 |   |    |    |     |  |                                    |                                     |                                   |                     |  |
|               | Wet below 3.3m   |            | 5       | SS   | 33         |                            |                 |   |    |    |     |  |                                    |                                     |                                   |                     |  |
|               |  |            | 6       | SS   | 28         |                            |                 |   |    |    |     |  |                                    |                                     |                                   |                     |  |
| 127.6         |  |            |         |      |            |                            |                 |   |    |    |     |  |                                    |                                     |                                   |                     |  |
| 4.3           | End of Borehole  |            |         |      |            |                            |                 |   |    |    |     |  |                                    |                                     |                                   |                     |  |
|               | *Stabilized water table at 3.3m depth.                               |            |         |      |            |                            |                 |   |    |    |     |  |                                    |                                     |                                   |                     |  |

OFFICE REPORT ON SOIL EXPLORATION

# RECORD OF TEST PIT No 17

METRIC

W P 264-87-00(a) LOCATION Station 21 + 650m, 2.0m N of W shoulder pavement edge ORIGINATED BY SM  
 DIST 6 HWY 401 BOREHOLE TYPE Back-hoe COMPILED BY SB  
 DATUM Geodetic DATE February 27, 1991 CHECKED BY SB

| SOIL PROFILE   |   |            | SAMPLES |      |            | GROUND WATER<br>CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT  |    |    |    |     | PLASTIC<br>LIMIT<br>W <sub>p</sub> | NATURAL<br>MOISTURE<br>CONTENT<br>W | LIQUID<br>LIMIT<br>W <sub>L</sub> | UNIT<br>WEIGHT<br>Y | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%) |
|--|---|------------|---------|------|------------|----------------------------|-----------------|---|----|----|----|-----|------------------------------------|-------------------------------------|-----------------------------------|---------------------|---|
| ELEV<br>DEPTH  | DESCRIPTION   | STRAT PLOT | NUMBER  | TYPE | 'N' VALUES |                            |                 | 20  | 40 | 60 | 80 | 100 |                                    |                                     |                                   |                     |   |
| 130.9  | Ground surface  |            |         |      |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     | GR SA SI CL                                       |
| 0.0  | Organic stained<br>sandy silt   |            |         |      |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 130.1  |   |            |         |      |            |                            | 130             |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 0.8  | SAND<br>some gravel and<br>trace of silt,<br>fine to medium<br>becoming coarser<br>below 1.6m |            | 1       | CS   |            |                            |                 |   |    |    |    |     | 0                                  |                                     |                                   |                     | 2 95 (3)  |
|  |   |            | 2       | CS   |            |                            | 129             |   |    |    |    |     | 0                                  |                                     |                                   |                     |   |
| 128.2  |   |            | 3       | CS   |            |                            |                 |   |    |    |    |     | 0                                  |                                     |                                   |                     | 29 67 (4)   |
| 2.7  | End of Test Pit   |            |         |      |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| NOTES:<br>1) Test pit wet below 2.4m. Water seepage<br>significant below 2.4m depth.<br>2) Dense to hand probing. at base of test-pit. |   |            |         |      |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |

OFFICE REPORT ON SOIL EXPLORATION

# RECORD OF BOREHOLE No 18

METRIC

W P 264-87-00(a) LOCATION Station 21 + 700m, 1.4m N of W shoulder pavement edge ORIGINATED BY SM  
 DIST 6 HWY 401 BOREHOLE TYPE Solid stem auger COMPILED BY SB  
 DATUM Geodetic DATE February 21, 1991 CHECKED BY SB

| SOIL PROFILE  |  |            | SAMPLES |      |            | GROUND WATER<br>CONDITIONS | ELEVATION<br>SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT |    | PLASTIC<br>LIMIT<br>W <sub>p</sub> | NATURAL<br>MOISTURE<br>CONTENT<br>W | LIQUID<br>LIMIT<br>W <sub>L</sub> | UNIT<br>WEIGHT<br>γ | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%) |
|---------------|--|------------|---------|------|------------|----------------------------|--------------------|---|----|------------------------------------|-------------------------------------|-----------------------------------|---------------------|---|
| ELEV<br>DEPTH | DESCRIPTION  | STRAT PLOT | NUMBER  | TYPE | 'N' VALUES |                            |                    | 20  | 40 |                                    |                                     |                                   |                     |   |
| 131.3         | Ground surface   |            |         |      |            |                            |                    |   |    |                                    |                                     |                                   |                     |   |
| 0.0           | GRANULAR SAND AND<br>GRAVEL TO SILTY SAND<br>topsoil seams,<br>compact<br>(FILL) |            | 1       | SS   | 36         |                            |                    |   |    |                                    |                                     | 0                                 |                     |   |
| 130.1         |  |            | 2       | SS   | 27         |                            |                    |   |    |                                    |                                     | 0                                 |                     |   |
| 1.2           | SAND<br>some gravel and<br>silt,<br>dense to very<br>dense<br><br>Wet below 3.0m |            | 3       | SS   | 56         |                            |                    |   |    |                                    |                                     | 0                                 |                     |   |
|               |  |            | 4       | SS   | 68         |                            |                    |   |    |                                    |                                     | 0                                 |                     |   |
|               |  |            | 5       | SS   | 35         |                            |                    |   |    |                                    |                                     | 0                                 |                     |   |
| 127.0         |  |            | 6       | SS   | 35         |                            |                    |   |    |                                    |                                     | 0                                 |                     |   |
| 4.3           | End of Borehole  |            |         |      |            |                            |                    |   |    |                                    |                                     |                                   |                     |   |

OFFICE REPORT ON SOIL EXPLORATION

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

20  
15 5 (%) STRAIN AT FAILURE  
10



# RECORD OF BOREHOLE No 19

METRIC

W P 264-87-00(a) LOCATION Station 21 + 727m, 1.3m N of W shoulder pavement edge ORIGINATED BY SM  
DIST 6 HWY 401 BOREHOLE TYPE Solid stem auger COMPILED BY SB  
DATUM Geodetic DATE February 21, 1991 CHECKED BY SB

| SOIL PROFILE  |             |            | SAMPLES |      |            | GROUND WATER<br>CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT |  |  |  |  | UNIT<br>WEIGHT<br><br>γ | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%) |
|---------------|-------------|------------|---------|------|------------|----------------------------|-----------------|---|--|--|--|--|-------------------------|---|
| ELEV<br>DEPTH | DESCRIPTION | STRAT PLOT | NUMBER  | TYPE | 'N' VALUES |                            |                 | 20 40 60 80 100                             |  |  |  |  |                         |   |
|               |             |            |         |      |            |                            |                 | SHEAR STRENGTH kPa                          |  |  |  |  |                         |   |
|               |             |            |         |      |            |                            |                 |   |  |  |  |  |                         |   |
|               |             |            |         |      |            |                            |                 |   |  |  |  |  |                         |   |
|               |             |            |         |      |            |                            |                 |   |  |  |  |  |                         |   |
|               |             |            |         |      |            |                            |                 |   |  |  |  |  |                         |   |
|               |             |            |         |      |            |                            |                 |   |  |  |  |  |                         |   |
|               |             |            |         |      |            |                            |                 |   |  |  |  |  |                         |   |
|               |             |            |         |      |            |                            |                 |   |  |  |  |  |                         |   |
|               |             |            |         |      |            |                            |                 |   |  |  |  |  |                         |   |
|               |             |            |         |      |            |                            |                 |   |  |  |  |  |                         |   |
|               |             |            |         |      |            |                            |                 |   |  |  |  |  |                         |   |
|               |             |            |         |      |            |                            |                 |   |  |  |  |  |                         |   |
|               |             |            |         |      |            |                            |                 |   |  |  |  |  |                         |   |
|               |             |            |         |      |            |                            |                 |   |  |  |  |  |                         |   |
|               |             |            |         |      |            |                            |                 |   |  |  |  |  |                         |   |
|               |             |            |         |      |            |                            |                 |   |  |  |  |  |                         |   |
|               |             |            |         |      |            |                            |                 |   |  |  |  |  |                         |   |
|               |             |            |         |      |            |                            |                 |   |  |  |  |  |                         |   |
|               |             |            |         |      |            |                            |                 |   |  |  |  |  |                         |   |
|               |             |            |         |      |            |                            |                 |   |  |  |  |  |                         |   |
|               |             |            |         |      |            |                            |                 |   |  |  |  |  |                         |   |
|               |             |            |         |      |            |                            |                 |   |  |  |  |  |                         |   |
|               |             |            |         |      |            |                            |                 |   |  |  |  |  |                         |   |
|               |             |            |         |      |            |                            |                 |   |  |  |  |  |                         |   |
|               |             |            |         |      |            |                            |                 |   |  |  |  |  |                         |   |
|               |             |            |         |      |            |                            |                 |   |  |  |  |  |                         |   |
|               |             |            |         |      |            |                            |                 |   |  |  |  |  |                         |   |
|               |             |            |         |      |            |                            |                 |   |  |  |  |  |                         |   |
|               |             |            |         |      |            |                            |                 |   |  |  |  |  |                         |   |
|               |             |            |         |      |            |                            |                 |   |  |  |  |  |                         |   |
|               |             |            |         |      |            |                            |                 |   |  |  |  |  |                         |   |
|               |             |            |         |      |            |                            |                 |   |  |  |  |  |                         |   |
|               |             |            |         |      |            |                            |                 |   |  |  |  |  |                         |   |
|               |             |            |         |      |            |                            |                 |   |  |  |  |  |                         |   |
|               |             |            |         |      |            |                            |                 |   |  |  |  |  |                         |   |
|               |             |            |         |      |            |                            |                 |   |  |  |  |  |                         |   |
|               |             |            |         |      |            |                            |                 |   |  |  |  |  |                         |   |
|               |             |            |         |      |            |                            |                 |   |  |  |  |  |                         |   |
|               |             |            |         |      |            |                            |                 |   |  |  |  |  |                         |   |
|               |             |            |         |      |            |                            |                 |   |  |  |  |  |                         |   |
|               |             |            |         |      |            |                            |                 |   |  |  |  |  |                         |   |
|               |             |            |         |      |            |                            |                 |   |  |  |  |  |                         |   |
|               |             |            |         |      |            |                            |                 |   |  |  |  |  |                         |   |
|               |             |            |         |      |            |                            |                 |   |  |  |  |  |                         |   |
|               |             |            |         |      |            |                            |                 |   |  |  |  |  |                         |   |
|               |             |            |         |      |            |                            |                 |   |  |  |  |  |                         |   |
|               |             |            |         |      |            |                            |                 |   |  |  |  |  |                         |   |
|               |             |            |         |      |            |                            |                 |   |  |  |  |  |                         |   |
|               |             |            |         |      |            |                            |                 |   |  |  |  |  |                         |   |
|               |             |            |         |      |            |                            |                 |   |  |  |  |  |                         |   |
|               |             |            |         |      |            |                            |                 |   |  |  |  |  |                         |   |
|               |             |            |         |      |            |                            |                 |   |  |  |  |  |                         |   |
|               |             |            |         |      |            |                            |                 |   |  |  |  |  |                         |   |
|               |             |            |         |      |            |                            |                 |   |  |  |  |  |                         |   |
|               |             |            |         |      |            |                            |                 |   |  |  |  |  |                         |   |
|               |             |            |         |      |            |                            |                 |   |  |  |  |  |                         |   |
|               |             |            |         |      |            |                            |                 |   |  |  |  |  |                         |   |
|               |             |            |         |      |            |                            |                 |   |  |  |  |  |                         |   |
|               |             |            |         |      |            |                            |                 |   |  |  |  |  |                         |   |
|               |             |            |         |      |            |                            |                 |   |  |  |  |  |                         |   |
|               |             |            |         |      |            |                            |                 |   |  |  |  |  |                         |   |
|               |             |            |         |      |            |                            |                 |   |  |  |  |  |                         |   |
|               |             |            |         |      |            |                            |                 |   |  |  |  |  |                         |   |
|               |             |            |         |      |            |                            |                 |   |  |  |  |  |                         |   |
|               |             |            |         |      |            |                            |                 |   |  |  |  |  |                         |   |
|               |             |            |         |      |            |                            |                 |   |  |  |  |  |                         |   |
|               |             |            |         |      |            |                            |                 |   |  |  |  |  |                         |   |
|               |             |            |         |      |            |                            |                 |   |  |  |  |  |                         |   |
|               |             |            |         |      |            |                            |                 |   |  |  |  |  |                         |   |
|               |             |            |         |      |            |                            |                 |   |  |  |  |  |                         |   |
|               |             |            |         |      |            |                            |                 |   |  |  |  |  |                         |   |
|               |             |            |         |      |            |                            |                 |   |  |  |  |  |                         |   |
|               |             |            |         |      |            |                            |                 |   |  |  |  |  |                         |   |
|               |             |            |         |      |            |                            |                 |   |  |  |  |  |                         |   |
|               |             |            |         |      |            |                            |                 |   |  |  |  |  |                         |   |
|               |             |            |         |      |            |                            |                 |   |  |  |  |  |                         |   |
|               |             |            |         |      |            |                            |                 |   |  |  |  |  |                         |   |
|               |             |            |         |      |            |                            |                 |   |  |  |  |  |                         |   |
|               |             |            |         |      |            |                            |                 |   |  |  |  |  |                         |   |
|               |             |            |         |      |            |                            |                 |   |  |  |  |  |                         |   |
|               |             |            |         |      |            |                            |                 |   |  |  |  |  |                         |   |
|               |             |            |         |      |            |                            |                 |   |  |  |  |  |                         |   |
|               |             |            |         |      |            |                            |                 |   |  |  |  |  |                         |   |
|               |             |            |         |      |            |                            |                 |   |  |  |  |  |                         |   |
|               |             |            |         |      |            |                            |                 |   |  |  |  |  |                         |   |
|               |             |            |         |      |            |                            |                 |   |  |  |  |  |                         |   |
|               |             |            |         |      |            |                            |                 |   |  |  |  |  |                         |   |
|               |             |            |         |      |            |                            |                 |   |  |  |  |  |                         |   |
|               |             |            |         |      |            |                            |                 |   |  |  |  |  |                         |   |
|               |             |            |         |      |            |                            |                 |   |  |  |  |  |                         |   |
|               |             |            |         |      |            |                            |                 |   |  |  |  |  |                         |   |
|               |             |            |         |      |            |                            |                 |   |  |  |  |  |                         |   |
|               |             |            |         |      |            |                            |                 |   |  |  |  |  |                         |   |
|               |             |            |         |      |            |                            |                 |   |  |  |  |  |                         |   |
|               |             |            |         |      |            |                            |                 |   |  |  |  |  |                         |   |

OFFICE REPORT ON SOIL EXPLORATION

# RECORD OF BOREHOLE No 20

METRIC

W P 264-87-00(a) LOCATION Station 22 + 750m, 0.2m N of W shoulder pavement edge ORIGINATED BY SM  
 DIST 6 HWY 401 BOREHOLE TYPE Solid stem auger COMPILED BY SB  
 DATUM Geodetic DATE February 21, 1991 CHECKED BY SB

OFFICE REPORT ON SOIL EXPLORATION

| SOIL PROFILE |   |            | SAMPLES |      |            | GROUND WATER CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION RESISTANCE PLOT |    |    |    |     | PLASTIC NATURAL LIQUID LIMIT MOISTURE CONTENT LIMIT |   |                | UNIT WEIGHT<br>$\gamma$<br>KN/m <sup>3</sup> | REMARKS & GRAIN SIZE DISTRIBUTION (%)<br>GR SA SI CL |
|--------------|---|------------|---------|------|------------|-------------------------|-----------------|--|----|----|----|-----|---|---|----------------|--|--|
| ELEV DEPTH   | DESCRIPTION   | STRAT PLOT | NUMBER  | TYPE | 'N' VALUES |                         |                 | 20                                       | 40 | 60 | 80 | 100 | W <sub>p</sub>                                      | W | W <sub>L</sub> |  |  |
| 125.3        | Ground surface  |            |         |      |            |                         |                 |  |    |    |    |     |   |   |                |  |  |
| 0.0          | Topsoil: 150 mm<br>Granular material: 250mm   |            | 1       | SS   | 34         |                         | 125             |  |    |    |    |     | 0   |   |                |  | 14 76 (10)   |
|              | SAND trace to some silt and gravel, organic stained layers, compact to dense (FILL)   |            | 2       | SS   | 35         |                         | 124             |  |    |    |    |     | 0   |   |                |  |  |
| 123.2        |   |            | 3       | SS   | 21         |                         | 123             |  |    |    |    |     | 0   |   |                |  |  |
| 2.1          | Heterogeneous mixture of silt and sand with trace to some gravel and clay, occasional wet sand seams, very dense (glacial till) |            | 4       | SS   | 53         |                         | 122             |  |    |    |    |     | 0   |   |                | 23.3   | 23.8   |
|              |   |            | 5       | SS   | 70         |                         | 121             |  |    |    |    |     | 0   |   |                |  |  |
|              |   |            | 6       | SS   | 100/7cm    |                         | 120             |  |    |    |    |     | 0   |   |                |  |  |
| 118.9        |   |            | 7       | SS   | 50/15cm    |                         | 119             |  |    |    |    |     | 0   |   |                |  |  |
| 6.4          | End of Borehole   |            |         |      |            |                         |                 |  |    |    |    |     |   |   |                |  |  |

# RECORD OF BOREHOLE No 21

METRIC

W P 264-87-00(a) LOCATION Station 22 + 800m, 0.2m N of W shoulder pavement edge ORIGINATED BY SM  
DIST 6 HWY 401 BOREHOLE TYPE Solid stem auger COMPILED BY SB  
DATUM Geodetic DATE February 21, 1991 CHECKED BY SB

OFFICE REPORT ON SOIL EXPLORATION

| SOIL PROFILE  |   |            | SAMPLES |      |            | GROUND WATER<br>CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT |    |    |    |     | PLASTIC<br>LIMIT<br>W <sub>p</sub> | NATURAL<br>MOISTURE<br>CONTENT<br>W | LIQUID<br>LIMIT<br>W <sub>L</sub> | UNIT<br>WEIGHT<br>γ<br>KN/m <sup>3</sup> | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%)<br>GR SA SI CL |
|---------------|---|------------|---------|------|------------|----------------------------|-----------------|---|----|----|----|-----|------------------------------------|-------------------------------------|-----------------------------------|--|--|
| ELEV<br>DEPTH | DESCRIPTION   | STRAT PLOT | NUMBER  | TYPE | 'N' VALUES |                            |                 | 20  | 40 | 60 | 80 | 100 |                                    |                                     |                                   |  |  |
| 124.6         | Ground surface  |            |         |      |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |  |  |
| 0.0           | SAND AND GRAVEL<br>some silt,<br>dense to very dense<br>(FILL)  |            | 1       | SS   | 44         |                            | 124             |   |    |    |    |     |                                    | 0                                   |                                   |  |  |
| 123.4         | Topsoil: 120 mm   |            | 2       | SS   | 54         |                            |                 |   |    |    |    |     |                                    | 0                                   |                                   |  |  |
| 1.2           | CLAYEY SILT<br>organic stained,<br>some sand<br>very stiff  |            | 3       | SS   | 18         |                            | 123             |   |    |    |    |     |                                    |                                     | 0                                 |  |  |
| 121.7         |   |            | 4       | SS   | 12         |                            | 122             |   |    |    |    |     |                                    | 10                                  |                                   |  |  |
| 2.9           | Heterogeneous<br>mixture of silt<br>and sand with<br>trace to some<br>gravel and clay,<br>occasional wet<br>sand seams,<br>dense to very dense,<br>(glacial till) |            | 5       | SS   | 38         |                            | 121             |   |    |    |    |     |                                    | 0                                   |                                   |  |  |
|               |   |            | 6       | SS   | 51         |                            |                 |   |    |    |    |     |                                    | 0                                   |                                   |  |  |
|               |   |            | 7       | SS   | 41         |                            | 120             |   |    |    |    |     |                                    | 0                                   |                                   |  |  |
| 118.1         |   |            | 8       | SS   | 83         |                            | 119             |   |    |    |    |     |                                    | 0                                   |                                   |  |  |
| 6.5           | End of Borehole   |            |         |      |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |  |  |

# RECORD OF TEST PIT No 22

METRIC

W P 264-87-00(a) LOCATION Station 22 + 850m, 1.5m N of W shoulder pavement edge ORIGINATED BY SM  
DIST 6 HWY 401 BOREHOLE TYPE Back-hoe COMPILED BY SB  
DATUM Geodetic DATE February 26, 1991 CHECKED BY SB

| SOIL PROFILE  |  |            | SAMPLES |      |            | GROUND WATER<br>CONDITIONS | ELEVATION<br>SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT |    |    |    |     | PLASTIC<br>LIMIT<br>W <sub>p</sub> | NATURAL<br>MOISTURE<br>CONTENT<br>W | LIQUID<br>LIMIT<br>W <sub>L</sub> | UNIT<br>WEIGHT<br>γ | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%) |
|---|--|------------|---------|------|------------|----------------------------|--------------------|---|----|----|----|-----|------------------------------------|-------------------------------------|-----------------------------------|---------------------|---|
| ELEV<br>DEPTH   | DESCRIPTION  | STRAT PLOT | NUMBER  | TYPE | 'N' VALUES |                            |                    | 20  | 40 | 60 | 80 | 100 |                                    |                                     |                                   |                     |   |
| 123.2   | Ground surface   |            |         |      |            |                            |                    |   |    |    |    |     |                                    |                                     |                                   |                     | GR SA 51 CL                                       |
| 0.0   | Topsoil: 150 mm  |            | 1       | CS   |            |                            | 123                |   |    |    |    |     |                                    | 0                                   |                                   |                     | 3 48 41 8   |
| 122.0   | CLAYEY SILT<br>organic stained,<br>some sand   |            | 2       | CS   |            |                            | 122                |   |    |    |    |     |                                    | 0                                   |                                   |                     |   |
| 1.2   | Het. mixture of<br>silt and sand with<br>trace to some gravel<br>and clay,<br>wet sand seams<br>between 1.8m and<br>2.7m,<br>dense<br>(glacial till) |            | 3       | CS   |            |                            | 121                |   |    |    |    |     |                                    | 0                                   |                                   |                     |   |
|   |  |            | 4       | CS   |            |                            | 120                |   |    |    |    |     |                                    | 0                                   |                                   |                     |   |
| 119.5   |  |            |         |      |            |                            |                    |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 3.7   | End of Test Pit  |            |         |      |            |                            |                    |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| NOTES:<br>1) Water seepage from sand seams between 1.8m and 2.7m.<br>2) Dense to hand probing, ab base of test-pit.<br>3) The top 2.1m cut back at 45°, with the bottom 1.6m cut vertical.<br>Very small pocket of sand at 2.3m, caved. The test pit was open for about 1hr. 45min. |  |            |         |      |            |                            |                    |   |    |    |    |     |                                    |                                     |                                   |                     |   |

OFFICE REPORT ON SOIL EXPLORATION



# RECORD OF BOREHOLE No 23

METRIC

W P 264-87-00(a) LOCATION Station 22 + 890m, 0.2m N of W shoulder pavement edge ORIGINATED BY SM  
 DIST 6 HWY 40 BOREHOLE TYPE Solid stem auger COMPILED BY SB  
 DATUM Geodetic DATE February 21, 1991 CHECKED BY SB

OFFICE REPORT ON SOIL EXPLORATION

| SOIL PROFILE   |   |             | SAMPLES |      |            | GROUND WATER<br>CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT |    |    |    |     | NATURAL MOISTURE CONTENT |   |                | UNIT<br>WEIGHT<br><br>Y<br><br>KN/m³ | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%)<br>GR SA SI CL |
|----------------|---|-------------|---------|------|------------|----------------------------|-----------------|---|----|----|----|-----|--------------------------|---|----------------|--------------------------------------|--|
| ELEV.<br>DEPTH | DESCRIPTION   | STRAT. PLOT | NUMBER  | TYPE | 'N' VALUES |                            |                 | 20  | 40 | 60 | 80 | 100 | W <sub>p</sub>           | W | W <sub>L</sub> |                                      |  |
| 124.0          | Ground surface  |             |         |      |            |                            |                 |   |    |    |    |     |                          |   |                |                                      |  |
| 0.0            | SAND AND GRAVEL<br>some silt<br>(FILL)  |             |         |      |            |                            |                 |   |    |    |    |     |                          |   |                |                                      |  |
| 123.0          |   |             | 1       | SS   | 34         |                            |                 |   |    |    |    |     |                          |   |                |                                      |  |
| 1.0            | CLAYEY SILT<br>organic stained,<br>roots,<br>some sand<br>v. stiff  |             | 2       | SS   | 18         |                            |                 |   |    |    |    |     |                          |   |                |                                      |  |
| 121.7          |   |             | 3       | SS   | 44         |                            |                 |   |    |    |    |     |                          |   |                |                                      |  |
| 2.3            |   |             | 4       | SS   | 61         |                            |                 |   |    |    |    |     |                          |   |                |                                      |  |
|                | Het. mixture of<br>sandy silt with<br>gravel and clay,<br>occ. sand seams,<br>dense to very<br>dense,<br>(glacial till) |             | 5       | SS   | 33         |                            |                 |   |    |    |    |     |                          |   |                |                                      |  |
|                |   |             | 6       | SS   | 33         |                            |                 |   |    |    |    |     |                          |   |                |                                      |  |
|                |   |             |         |      |            |                            |                 |   |    |    |    |     |                          |   |                |                                      |  |
|                |   |             |         |      |            |                            |                 |   |    |    |    |     |                          |   |                |                                      |  |
| 117.6          |   |             | 7       | SS   | 50/12cm    |                            |                 |   |    |    |    |     |                          |   |                |                                      |  |
| 6.4            | End of Borehole   |             |         |      |            |                            |                 |   |    |    |    |     |                          |   |                |                                      |  |

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

20  
15 5 (%) STRAIN AT FAILURE  
10

# RECORD OF BOREHOLE No 24

METRIC

W P 264-87-00(a) LOCATION Station 22 + 956m, 7.0m N of W shoulder pavement edge ORIGINATED BY SM  
 DIST 6 HWY 401 BOREHOLE TYPE Solid stem auger COMPILED BY SB  
 DATUM Geodetic DATE February 21, 1991 CHECKED BY SB

OFFICE REPORT ON SOIL EXPLORATION



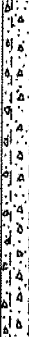

| SOIL PROFILE  |   |            | SAMPLES |      |            | GROUND WATER<br>CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT |    |    |    |     | PLASTIC<br>LIMIT<br>W <sub>p</sub> | NATURAL<br>MOISTURE<br>CONTENT<br>W | LIQUID<br>LIMIT<br>W <sub>L</sub> | UNIT<br>WEIGHT<br>γ | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%) |
|---------------|---|------------|---------|------|------------|----------------------------|-----------------|---|----|----|----|-----|------------------------------------|-------------------------------------|-----------------------------------|---------------------|---|
| ELEV<br>DEPTH | DESCRIPTION   | STRAT PLOT | NUMBER  | TYPE | 'N' VALUES |                            |                 | 20  | 40 | 60 | 80 | 100 |                                    |                                     |                                   |                     |   |
| 123.5         | Ground surface  |            |         |      |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 0.0           | Mixture of silt,<br>clay and sand,<br>organic stained,<br>compact<br>(FILL)                                   |            | 1       | SS   | 19         |                            | 123             |   |    |    |    |     |                                    |                                     | 0                                 | 20.8                |   |
| 122.0         |   |            | 2       | SS   | 15         |                            | 122             |   |    |    |    |     |                                    |                                     | 0                                 |                     |   |
| 1.5           | CLAYEY SILT<br>some sand<br>v. stiff  |            | 3       | SS   | 18         |                            | 121             |   |    |    |    |     |                                    |                                     | 0                                 |                     | 0 41 54 5   |
| 121.1         |   |            | 4       | SS   | 57         |                            | 120             |   |    |    |    |     |                                    |                                     | 0                                 | 23.2                |   |
| 2.4           | Het. mixture of<br>silt and sand with<br>gravel and clay,<br>occ. sand seams,<br>very dense<br>(glacial till) |            | 5       | SS   | 50/15cm    |                            | 119             |   |    |    |    |     |                                    |                                     | 0                                 |                     |   |
|               |   |            | 6       | SS   | 50/15cm    |                            | 118             |   |    |    |    |     |                                    |                                     | 0                                 |                     |   |
| 117.7         |   |            |         |      |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 5.8           | SILTY SAND<br>wet, very dense   |            | 7       | SS   | 50/5cm     |                            |                 |   |    |    |    |     |                                    |                                     | 0                                 |                     |   |
| 117.1         |   |            |         |      |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 6.4           | End of Borehole   |            |         |      |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |

# RECORD OF BOREHOLE No 25

METRIC

W P 264-87-00(a) LOCATION Station 23 + 006, 5.0m N of W shoulder pavement edge ORIGINATED BY SM  
 DIST 6 HWY 401 BOREHOLE TYPE Solid stem auger COMPILED BY SB  
 DATUM Geodetic DATE February 21, 1991 CHECKED BY SB

OFFICE REPORT ON SOIL EXPLORATION

| SOIL PROFILE |  | STRAT. PLOT   | SAMPLES |      |            | GROUND WATER CONDITIONS   | ELEVATION SCALE | DYNAMIC CONE PENETRATION RESISTANCE PLOT |    |    |    |     | PLASTIC LIMIT<br>W <sub>p</sub> | NATURAL MOISTURE CONTENT<br>W | LIQUID LIMIT<br>W <sub>L</sub> | UNIT WEIGHT<br>γ | REMARKS & GRAIN SIZE DISTRIBUTION (%) |
|--------------|--|---|---------|------|------------|---|-----------------|--|----|----|----|-----|---------------------------------|-------------------------------|--------------------------------|------------------|---------------------------------------|
| ELEV. DEPTH  | DESCRIPTION  |   | NUMBER  | TYPE | 'N' VALUES |   |                 | 20                                       | 40 | 60 | 80 | 100 |                                 |                               |                                |                  |                                       |
| 122.3        | Ground surface   |   |         |      |            |   |                 |  |    |    |    |     |                                 |                               |                                |                  |                                       |
| 0.0          | SAND AND GRAVEL TO SAND compact (FILL)   |  | 1       | CS   |            |   | 122             |  |    |    |    |     | 0                               |                               |                                |                  |                                       |
| 121.1        | Topsoil: 100 mm  |  | 2       | SS   | 19         |   | 121             |  |    |    |    |     | 0                               |                               |                                |                  |                                       |
| 1.2          | Het. mixture of silt and sand with gravel and clay, occ. sand seams, very dense (glacial till) |  | 3       | SS   | 67         |  | 121             |  |    |    |    |     | 0                               |                               |                                | 23.3             | 7 45 47 1                             |
|              |  |   | 4       | SS   | 100/7cm    |   | 120             |  |    |    |    |     | 0                               |                               |                                |                  |                                       |
|              |  |   | 5       | SS   | 100/10cm   |   | 119             |  |    |    |    |     | 0                               |                               |                                |                  |                                       |
|              |  |   |         |      |            |   | 118             |  |    |    |    |     |                                 |                               |                                |                  |                                       |
| 117.6        |  |   | 6       | SS   | 100/10cm   |   |                 |  |    |    |    |     | 0                               |                               |                                | 23.1             |                                       |
| 4.7          | End of Borehole  |   |         |      |            |   |                 |  |    |    |    |     |                                 |                               |                                |                  |                                       |

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

20  
15  
10  
5 (%) STRAIN AT FAILURE

# RECORD OF BOREHOLE No 26

METRIC

W P 264-87-00(a) LOCATION Station 23 + 050m, 0.2m N of W shoulder pavement edge ORIGINATED BY SM  
 DIST 6 HWY 401 BOREHOLE TYPE Solid stem auger COMPILED BY SB  
 DATUM Geodetic DATE February 21 & 22, 1991 CHECKED BY SB

OFFICE REPORT ON SOIL EXPLORATION

| SOIL PROFILE  |   |            | SAMPLES |      |            | GROUND WATER<br>CONDITIONS | ELEVATION<br>SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT |    |    |    |     | PLASTIC<br>LIMIT<br>W <sub>p</sub> | NATURAL<br>MOISTURE<br>CONTENT<br>W | LIQUID<br>LIMIT<br>W <sub>L</sub> | UNIT<br>WEIGHT<br>Y | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%) |
|---------------|---|------------|---------|------|------------|----------------------------|--------------------|---|----|----|----|-----|------------------------------------|-------------------------------------|-----------------------------------|---------------------|---|
| ELEV<br>DEPTH | DESCRIPTION   | STRAT PLOT | NUMBER  | TYPE | 'N' VALUES |                            |                    | 20  | 40 | 60 | 80 | 100 |                                    |                                     |                                   |                     |   |
| 123.0         | Ground surface  |            |         |      |            |                            |                    |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 0.0           | Topsoil: 50 mm  |            | 1       | SS   | 55         |                            | 122                |   |    |    |    |     | 0                                  |                                     |                                   |                     |   |
| 122.0         | SAND AND GRAVEL<br>dense to very dense<br>(FILL)  |            | 2       | SS   | 33         |                            |                    |   |    |    |    |     | 0                                  |                                     |                                   |                     |   |
| 1.0           |   |            | 3       | SS   | 71         |                            | 121                |   |    |    |    |     | 0                                  |                                     |                                   |                     | 6 41 (51)   |
|               | Het. mixture of<br>silt and sand with<br>gravel and clay,<br>occ. sand seams,<br>very dense<br>(glacial till) |            | 4       | SS   | 50/12cm    |                            | 120                |   |    |    |    |     | 0                                  |                                     |                                   |                     |   |
|               |   |            | 5       | SS   | 50/9cm     |                            |                    |   |    |    |    |     | 0                                  |                                     |                                   | 22.3                |   |
|               |   |            | 6       | SS   | 60/7cm     |                            | 119                |   |    |    |    |     |                                    |                                     |                                   |                     |   |
|               |   |            |         |      |            |                            | 118                |   |    |    |    |     | 0                                  |                                     |                                   |                     |   |
|               |   |            |         |      |            |                            | 117                |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 116.7         |   |            | 7       | SS   | 75/10cm    |                            |                    |   |    |    |    |     | 0                                  |                                     |                                   |                     |   |
| 6.3           | End of Borehole   |            |         |      |            |                            |                    |   |    |    |    |     |                                    |                                     |                                   |                     |   |

+3, x5: Numbers refer to  
Sensitivity

20  
15 5 (%) STRAIN AT FAILURE  
10

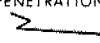








# RECORD OF BOREHOLE No 27

METRIC

W P 264-87-00(a) LOCATION Station 23 + 100m, 0.2m N of W shoulder pavement edge ORIGINATED BY SM  
DIST 6 HWY 401 BOREHOLE TYPE Solid stem auger COMPILED BY SB  
DATUM Geodetic DATE February 20, 1991 CHECKED BY SB

OFFICE REPORT ON SOIL EXPLORATION

| SOIL PROFILE  |  |   | SAMPLES |      |            | GROUND WATER<br>CONDITIONS  | ELEVATION SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT  |  |  |  |  | PLASTIC<br>LIMIT<br>W <sub>p</sub> | NATURAL<br>MOISTURE<br>CONTENT<br>W | LIQUID<br>LIMIT<br>W <sub>L</sub> | UNIT<br>WEIGHT<br>γ | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|---------------|--|---|---------|------|------------|---|-----------------|---|--|--|--|--|------------------------------------|-------------------------------------|-----------------------------------|---------------------|---|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|
| ELEV<br>DEPTH | DESCRIPTION  | STRAT PLOT  | NUMBER  | TYPE | 'N' VALUES |   |                 | SHEAR STRENGTH kPo  |  |  |  |  |                                    |                                     |                                   |                     |   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|               |  |   |         |      |            |   |                 | 20 40 60 80 100   |  |  |  |  |                                    |                                     |                                   |                     |   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|               |  |   |         |      |            |   |                 |   |  |  |  |  |                                    |                                     |                                   |                     |   | WATER CONTENT (%)  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|               |  |   |         |      |            |   |                 |   |  |  |  |  |                                    |                                     |                                   |                     |   | ○ UNCONFINED + FIELD VANE<br>● QUICK TRIAXIAL x LAB VANE |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|               |  |   |         |      |            |   |                 |   |  |  |  |  |                                    |                                     |                                   |                     |   | 10 20 30   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 123.0         | Ground surface   |   |         |      |            |   |                 |   |  |  |  |  |                                    |                                     |                                   |                     |   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 0.0           | SAND AND GRAVEL<br>TO SILTY SAND<br>some organics,<br>compact<br>(FILL)          |  | 1       | SS   | 30         |  | 122             |   |  |  |  |  |                                    | 0                                   |                                   |                     | 22.5  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 121.8         |  |  | 2       | SS   | 27         |   |                 |   |  |  |  |  |                                    |                                     | 0                                 |                     |   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 1.2           |  |   |         |      |            |   |                 |   |  |  |  |  |                                    |                                     |                                   |                     |   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|               | Het. mixture of<br>silt and sand with<br>gravel,<br>dense<br>(glacial till)      |  | 3       | SS   | 38         |   |                 | 121   |  |  |  |  |                                    | 0                                   |                                   |                     |   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|               |  |   | 4       | SS   | 45         |   |                 | 120   |  |  |  |  |                                    |                                     | 0                                 |                     |   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 120.0         |  |   |         |      |            |   |                 |   |  |  |  |  |                                    |                                     |                                   |                     |   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 3.0           | SILTY SAND<br>wet,<br>very dense   |  | 5       | SS   | 65         |   |                 | 119   |  |  |  |  |                                    |                                     | 0                                 |                     |   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 118.7         |  |   | 6       | SS   | 60         |   |                 |   |  |  |  |  |                                    |                                     |                                   |                     |   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 4.3           |  |   |         |      |            |   |                 |   |  |  |  |  |                                    |                                     |                                   |                     |   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|               | Het. mixture of<br>silt and sand with<br>gravel,<br>very dense<br>(glacial till) |  | 7       | SS   | 50/5cm     |   | 118             |   |  |  |  |  |                                    | 0                                   |                                   | 23.2                |   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|               |  |   |         |      |            |   |                 |   |  |  |  |  |                                    |                                     |                                   |                     |   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 116.7         |  |   | 8       | SS   | 50/5cm     |   | 117             |   |  |  |  |  |                                    | 0                                   |                                   |                     |   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 6.3           | End of Borehole  |   |         |      |            |   |                 |   |  |  |  |  |                                    |                                     |                                   |                     |   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |

+3, x5: Numbers refer to  
Sensitivity

20  
15 5 (%) STRAIN AT FAILURE  
10

# RECORD OF BOREHOLE No 28

METRIC

W P 264-87-00(a) LOCATION Station 23 + 150m, 0.2m N of W shoulder pavement edge ORIGINATED BY SM  
 DIST 6 HWY 401 BOREHOLE TYPE Solid stem auger COMPILED BY SB  
 DATUM Geodetic DATE February 20, 1991 CHECKED BY SB

OFFICE REPORT ON SOIL EXPLORATION

| SOIL PROFILE  |   |            | SAMPLES |      |            | GROUND WATER<br>CONDITIONS | ELEVATION<br>SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT |    |    |    |     | PLASTIC<br>LIMIT<br>W <sub>p</sub> | NATURAL<br>MOISTURE<br>CONTENT<br>W | LIQUID<br>LIMIT<br>W <sub>L</sub> | UNIT<br>WEIGHT<br>γ | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%) |
|---------------|---|------------|---------|------|------------|----------------------------|--------------------|---|----|----|----|-----|------------------------------------|-------------------------------------|-----------------------------------|---------------------|---|
| ELEV<br>DEPTH | DESCRIPTION   | STRAT PLOT | NUMBER  | TYPE | 'N' VALUES |                            |                    | 20  | 40 | 60 | 80 | 100 |                                    |                                     |                                   |                     |   |
| 122.7         | Ground surface  |            |         |      |            |                            |                    |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 0.0           | SAND AND GRAVEL<br>compact to very dense<br>(FILL)  |            | 1       | SS   | 27         |                            | 122                |   |    |    |    |     | o                                  |                                     |                                   |                     | 31 56 (13)  |
| 121.7         | Topsoil: 40 mm  |            | 2       | SS   | 92         |                            |                    |   |    |    |    |     |                                    | o                                   |                                   |                     |   |
| 1.0           | Het. mixture of<br>silt and sand with<br>gravel, dense to<br>very dense<br>(glacial till) |            | 3       | SS   | 41         |                            | 121                |   |    |    |    |     | o                                  |                                     |                                   | 22.7                |   |
| 119.8         |   |            | 4       | SS   | 92/20cm    |                            | 120                |   |    |    |    |     | o                                  |                                     |                                   | 23.1                |   |
| 2.9           | SANDY SILT<br>wet, very dense   |            | 5       | SS   | 50/10cm    |                            |                    |   |    |    |    |     |                                    | o                                   |                                   |                     | 1 34 (65)   |
| 118.9         |   |            |         |      |            |                            | 119                |   |    |    |    |     | o                                  |                                     |                                   |                     |   |
| 3.8           | Het. mixture of<br>silt and sand with<br>gravel, very<br>dense<br>(glacial till)          |            | 6       | SS   | 50/10cm    |                            |                    |   |    |    |    |     |                                    | o                                   |                                   |                     |   |
|               |   |            | 7       | SS   | 50/10cm    |                            | 118                |   |    |    |    |     | o                                  |                                     |                                   |                     |   |
| 116.4         |   |            | 8       | SS   | 50/10cm    |                            | 117                |   |    |    |    |     | o                                  |                                     |                                   |                     |   |
| 6.3           | End of Borehole   |            |         |      |            |                            |                    |   |    |    |    |     |                                    |                                     |                                   |                     |   |

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

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

# RECORD OF BOREHOLE No 29

METRIC

W P 264-87-00(a) LOCATION Station 23 + 200m, 0.2m N of W shoulder pavement edge ORIGINATED BY SM  
 DIST 6 HWY 401 BOREHOLE TYPE Solid stem auger COMPILED BY SB  
 DATUM Geodetic DATE February 20, 1991 CHECKED BY SB

OFFICE REPORT ON SOIL EXPLORATION

| SOIL PROFILE  |   |            | SAMPLES |      |            | GROUND WATER<br>CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT |    |    |    |     | PLASTIC<br>LIMIT<br>W <sub>p</sub> | NATURAL<br>MOISTURE<br>CONTENT<br>W | LIQUID<br>LIMIT<br>W <sub>L</sub> | UNIT<br>WEIGHT<br><br>γ | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%) |
|---------------|---|------------|---------|------|------------|----------------------------|-----------------|---|----|----|----|-----|------------------------------------|-------------------------------------|-----------------------------------|-------------------------|---|
| ELEV<br>DEPTH | DESCRIPTION   | STRAT PLOT | NUMBER  | TYPE | 'N' VALUES |                            |                 | SHEAR STRENGTH kPo                          |    |    |    |     |                                    |                                     |                                   |                         |   |
| 122.5         | Ground surface  |            |         |      |            |                            |                 | 20  | 40 | 60 | 80 | 100 |                                    |                                     |                                   |                         | GR SA SI CL                                       |
| 0.0           | SILTY SAND<br>compact<br>(FILL)   | ⊗          | 1       | SS   | 26         |                            | 122             |   |    |    |    |     |                                    | 0                                   |                                   |                         | 11 38 41 10                                       |
| 121.0         |   | ⊗          |         |      |            |                            | 121             |   |    |    |    |     |                                    | 0                                   |                                   |                         |   |
| 1.5           | Heterogenous<br>mixture of silt and<br>sand with gravel<br>and clay,<br>sand seams,<br>dense to<br>very dense<br>(glacial till) | ⊗          | 2       | SS   | 40         |                            | 120             |   |    |    |    |     |                                    | 0                                   |                                   |                         |   |
|               |   | ⊗          | 3       | SS   | 50/5cm     |                            | 119             |   |    |    |    |     |                                    | 0                                   |                                   |                         |   |
|               |   | ⊗          | 4       | SS   | 50/10cm    |                            | 118             |   |    |    |    |     |                                    | 0                                   |                                   |                         |   |
|               |   | ⊗          | 5       | SS   | 50/12cm    |                            | 117             |   |    |    |    |     |                                    | 0                                   |                                   |                         |   |
|               |   | ⊗          | 6       | SS   | 50/10cm    |                            |                 |   |    |    |    |     |                                    | 0                                   |                                   |                         |   |
| 116.7         |   | ⊗          |         |      |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                         |   |
| 5.8           | SILTY SAND  | ⊗          | 7       | SS   | 50/15cm    |                            |                 |   |    |    |    |     |                                    | 0                                   |                                   |                         |   |
| 116.2         | grey, wet, very dense   | ⊗          |         |      |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                         |   |
| 6.3           | End of Borehole   |            |         |      |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                         |   |

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

20  
15 5 (%) STRAIN AT FAILURE  
10

# RECORD OF BOREHOLE No 30

METRIC

W P 264-87-00(a) LOCATION Station 23 + 250m, 0.2m N of W shoulder pavement edge ORIGINATED BY SM  
DIST 6 HWY 401 BOREHOLE TYPE Solid stem auger COMPILED BY SB  
DATUM Geodetic DATE February 20, 1991 CHECKED BY SB

| SOIL PROFILE  |  |            | SAMPLES |      |            | GROUND WATER<br>CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT |                    | PLASTIC<br>LIMIT<br>W <sub>p</sub> | NATURAL<br>MOISTURE<br>CONTENT<br>W | LIQUID<br>LIMIT<br>W <sub>L</sub> | UNIT<br>WEIGHT<br>γ<br>KN/m <sup>3</sup> | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%)<br>GR SA SI CL |
|---------------|--|------------|---------|------|------------|----------------------------|-----------------|---|--------------------|------------------------------------|-------------------------------------|-----------------------------------|--|--|
| ELEV<br>DEPTH | DESCRIPTION  | STRAT PLOT | NUMBER  | TYPE | 'N' VALUES |                            |                 | 20 40 60 80 100                             | SHEAR STRENGTH kPa |                                    |                                     |                                   |  |  |
| 122.4         | Ground surface   |            |         |      |            |                            |                 |   |                    |                                    |                                     |                                   |  |  |
| 0.0           | SILTY SAND<br>organic stained<br>layers, moist to<br>very moist, compact<br>(FILL)   | X          | 1       | CS   |            |                            | 122             |   |                    |                                    |                                     |                                   |  |  |
|               |  |            | 2       | SS   | 35         |                            |                 |   |                    |                                    |                                     |                                   |  |  |
|               |  |            | 3       | SS   | 13         |                            |                 |   |                    |                                    |                                     |                                   |  |  |
| 120.6         | Heterogenous<br>mixture of<br>silt and sand<br>with gravel and<br>traces of clay,<br>sand seams,<br>very dense<br>(glacial till) | A          | 4       | SS   | 71         |                            | 120             |   |                    |                                    |                                     |                                   |  |  |
| 1.8           |  |            | 5       | SS   | 39         |                            |                 |   |                    |                                    |                                     |                                   |  |  |
|               |  |            | 6       | SS   | 50/12cm    |                            |                 |   |                    |                                    |                                     |                                   |  |  |
|               |  |            | 7       | SS   | 50/12cm    |                            |                 |   |                    |                                    |                                     |                                   |  |  |
|               |  |            |         |      |            |                            |                 |   |                    |                                    |                                     |                                   |  |  |
| 116.0         | End of Borehole  |            |         |      |            |                            |                 |   |                    |                                    |                                     |                                   |  |  |

OFFICE REPORT ON SOIL EXPLORATION

# RECORD OF TEST PIT No 31

METRIC

W P 264-87-00(a) LOCATION Station 23 + 300m, 1.0m N of W shoulder pavement edge ORIGINATED BY SM  
 DIST 6 HWY 401 BOREHOLE TYPE Back-hoe COMPILED BY SB  
 DATUM Geodetic DATE February 26, 1991 CHECKED BY SB

| SOIL PROFILE  |  |            | SAMPLES |      |            | GROUND WATER<br>CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT |    |    |    |     | PLASTIC<br>LIMIT<br>W <sub>p</sub> | NATURAL<br>MOISTURE<br>CONTENT<br>W | LIQUID<br>LIMIT<br>W <sub>L</sub> | UNIT<br>WEIGHT<br>γ | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%) |
|---|--|------------|---------|------|------------|----------------------------|-----------------|---|----|----|----|-----|------------------------------------|-------------------------------------|-----------------------------------|---------------------|---|
| ELEV<br>DEPTH   | DESCRIPTION  | STRAT PLOT | NUMBER  | TYPE | 'N' VALUES |                            |                 | 20  | 40 | 60 | 80 | 100 |                                    |                                     |                                   |                     |   |
| 121.6   | Ground surface   |            |         |      |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     | GR 5A 51 CL                                       |
| 0.0   | Topsoil: 100 mm<br>SAND AND GRAVEL<br>some silt                      |            | 1       | CS   |            |                            | 121             |   |    |    |    |     | 0                                  |                                     |                                   |                     | 8 45 40 7   |
| 120.6   | Organic stained<br>soil: 200 mm                                      |            | 2       | CS   |            |                            |                 |   |    |    |    |     |                                    | 0                                   |                                   |                     |   |
| 1.0   | Het. mixture of<br>silt and sand<br>with trace of<br>gravel and clay |            | 3       | CS   |            |                            | 120             |   |    |    |    |     |                                    | 0                                   |                                   |                     |   |
|   |  |            | 4       | CS   |            |                            |                 |   |    |    |    |     |                                    | 0                                   |                                   |                     |   |
|   | 50mm thick wet sand<br>seam at 2.4m                                  |            |         |      |            |                            | 119             |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 118.3   |  |            |         |      |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 3.3   | End of Test Pit  |            |         |      |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| NOTES:<br>1) Water seepage from 50mm thick wet sand seam at 2.4m.<br>2) Side slopes at 45°, were stable during the time (2½ hrs.) the test pit was open.<br>3) Very dense to hand probing, at base of test-pit. |  |            |         |      |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |

OFFICE REPORT ON SOIL EXPLORATION

# RECORD OF BOREHOLE No 32

METRIC

W P 264-87-00(a) LOCATION Station 23 + 350m, 0.2m N of W shoulder pavement edge ORIGINATED BY SM  
 DIST 6 HWY 401 BOREHOLE TYPE Solid stem auger COMPILED BY SB  
 DATUM Geodetic DATE February 20, 1991 CHECKED BY SB

OFFICE REPORT ON SOIL EXPLORATION

| SOIL PROFILE |  |            | SAMPLES |      |            | GROUND WATER CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION RESISTANCE PLOT |    |    |    |     | PLASTIC LIMIT<br>W <sub>p</sub> | NATURAL MOISTURE CONTENT<br>W | LIQUID LIMIT<br>W <sub>L</sub> | UNIT WEIGHT<br>Y | REMARKS & GRAIN SIZE DISTRIBUTION (%) |
|--------------|--|------------|---------|------|------------|-------------------------|-----------------|--|----|----|----|-----|---------------------------------|-------------------------------|--------------------------------|------------------|---------------------------------------|
| ELEV DEPTH   | DESCRIPTION  | STRAT PLOT | NUMBER  | TYPE | 'N' VALUES |                         |                 | 20                                       | 40 | 60 | 80 | 100 |                                 |                               |                                |                  |                                       |
| 122.2        | Ground surface   |            |         |      |            |                         |                 |  |    |    |    |     |                                 |                               |                                |                  | GR SA SI CL                           |
| 0.0          | Granular: 200 mm<br>Sandy topsoil: 120 mm  |            | 1       | SS   | 41         |                         | 122             |  |    |    |    |     | 0                               |                               |                                |                  | 2 38 56 4                             |
|              | SANDY SILT<br>grey, very moist<br>(FILL)   |            | 2       | SS   | 38         |                         | 121             |  |    |    |    |     | 0                               |                               |                                |                  |                                       |
| 120.5        |  |            | 3       | SS   | 28         |                         | 120             |  |    |    |    |     | 0                               |                               |                                |                  |                                       |
| 1.7          |  |            | 4       | SS   | 55         |                         | 119             |  |    |    |    |     | 0                               |                               |                                | 23.7             |                                       |
|              | Heterogeneous mixture of silt and sand with trace of gravel and clay, sand seams, compact to very dense (glacial till) |            | 5       | SS   | 50/15 cm   |                         | 118             |  |    |    |    |     | 0                               |                               |                                | 24.0             |                                       |
|              |  |            | 6       | SS   | 50/12 cm   |                         | 117             |  |    |    |    |     | 0                               |                               |                                |                  |                                       |
| 116.7        |  |            | 7       | SS   | 50/12 cm   |                         | 116             |  |    |    |    |     | 0                               |                               |                                |                  |                                       |
| 5.5          | SILTY SAND<br>grey, wet,<br>very dense   |            |         |      |            |                         |                 |  |    |    |    |     |                                 |                               |                                |                  |                                       |
| 115.9        |  |            |         |      |            |                         |                 |  |    |    |    |     |                                 |                               |                                |                  |                                       |
| 6.3          | End of Borehole  |            |         |      |            |                         |                 |  |    |    |    |     |                                 |                               |                                |                  |                                       |

+3, x5: Numbers refer to Sensitivity

20  
15  
10  
5 (%) STRAIN AT FAILURE

# RECORD OF BOREHOLE No 33

METRIC

W P 264-87-00(a) LOCATION Station 23 + 400m, 0.2m N of W shoulder pavement edge ORIGINATED BY SM  
 DIST 6 HWY 401 BOREHOLE TYPE Solid stem auger COMPILED BY SB  
 DATUM Geodetic DATE February 18, 1991 CHECKED BY SB

OFFICE REPORT ON SOIL EXPLORATION

| SOIL PROFILE  |   |            | SAMPLES |      |            | GROUND WATER<br>CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT |    |    |    |     | PLASTIC<br>LIMIT<br>W <sub>p</sub> | NATURAL<br>MOISTURE<br>CONTENT<br>W | LIQUID<br>LIMIT<br>W <sub>L</sub> | UNIT<br>WEIGHT<br>γ | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%) |
|---------------|---|------------|---------|------|------------|----------------------------|-----------------|---|----|----|----|-----|------------------------------------|-------------------------------------|-----------------------------------|---------------------|---|
| ELEV<br>DEPTH | DESCRIPTION   | STRAT PLOT | NUMBER  | TYPE | 'N' VALUES |                            |                 | 20  | 40 | 60 | 80 | 100 |                                    |                                     |                                   |                     |   |
| 122.1         | Ground surface  |            |         |      |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 0.0           | Granular: 300 mm  |            |         |      |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |
|               | SILTY SAND TO<br>SANDY SILT<br>some gravel,<br>very dense<br>(FILL)   |            | 1       | SS   | 57         |                            | 121             |   |    |    |    |     |                                    | 0                                   |                                   |                     |   |
| 120.6         |   |            |         |      |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 1.5           |   |            | 2       | SS   | 34         |                            | 120             |   |    |    |    |     |                                    | 0                                   |                                   | 24.0                |   |
|               | Heterogeneous<br>mixture of<br>silt, sand, gravel<br>and trace of<br>clay, sand<br>seams,<br>dense to<br>very dense<br>(glacial till) |            | 3       | SS   | 50/15cm    |                            | 119             |   |    |    |    |     |                                    | 0                                   |                                   | 23.3                |   |
|               |   |            | 4       | SS   | 50/12cm    |                            | 118             |   |    |    |    |     |                                    | 0                                   |                                   |                     | 20 33 37 10                                       |
|               |   |            |         |      |            |                            | 117             |   |    |    |    |     |                                    |                                     |                                   |                     |   |
|               |   |            | 5       | SS   | 50/8cm     |                            | 116             |   |    |    |    |     |                                    | 0                                   |                                   |                     |   |
|               | Very moist below<br>6.1m  |            | 6       | SS   | 50/5cm     |                            | 115             |   |    |    |    |     |                                    | 0                                   |                                   |                     |   |
| 114.3         |   |            |         |      |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |
|               |   |            | 7       | SS   | 50/7cm     |                            |                 |   |    |    |    |     |                                    | 0                                   |                                   |                     |   |
| 7.8           | End of Borehole   |            |         |      |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |

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

20  
15  
10  
5 (%) STRAIN AT FAILURE



# RECORD OF BOREHOLE No 34

METRIC

W P 264-87-00(a) LOCATION Station 23 + 450m, 0.2m N of W shoulder pavement edge ORIGINATED BY SM  
 DIST 6 HWY 401 BOREHOLE TYPE Solid stem auger COMPILED BY SB  
 DATUM Geodetic DATE February 20, 1991 CHECKED BY SB

| SOIL PROFILE  |  | SAMPLES       |        |      | GROUND WATER<br>CONDITIONS | ELEVATION<br>SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT |    |    |    |     | PLASTIC<br>LIMIT<br>W <sub>p</sub> | NATURAL<br>MOISTURE<br>CONTENT<br>W | LIQUID<br>LIMIT<br>W <sub>L</sub> | UNIT<br>WEIGHT<br>γ | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%)<br>GR SA SI CL |
|---------------|--|---------------|--------|------|----------------------------|--------------------|---|----|----|----|-----|------------------------------------|-------------------------------------|-----------------------------------|---------------------|--|
| ELEV<br>DEPTH | DESCRIPTION  | STRAT<br>PLOT | NUMBER | TYPE |                            |                    | 20  | 40 | 60 | 80 | 100 |                                    |                                     |                                   |                     |  |
| 121.9         | Ground surface   |               |        |      |                            |                    |   |    |    |    |     |                                    |                                     |                                   |                     |  |
| 0.0           | Topsoil: 150 mm  |               | 1      | CS   |                            | 121                |   |    |    |    |     | 0                                  |                                     |                                   |                     |  |
|               | SILTY SAND AND GRAVEL<br>compact<br>(FILL)   |               | 2      | SS   | 28                         |                    |   |    |    |    |     | 0                                  |                                     |                                   |                     |  |
| 120.2         |  |               | 3      | SS   | 20                         | 120                |   |    |    |    |     | 0                                  |                                     |                                   | 23.2                |  |
| 1.7           |  |               | 4      | SS   | 50/10cm                    | 119                |   |    |    |    |     | 0                                  |                                     |                                   |                     |  |
|               | Heterogeneous mixture of<br>silt and sand<br>with gravel and<br>trace of clay,<br>sand seams<br>(glacial till) |               | 5      | SS   | 81                         | 118                |   |    |    |    |     | 0                                  |                                     |                                   | 24.0                |  |
|               |  |               | 6      | SS   | 67                         | 117                |   |    |    |    |     | 0                                  |                                     |                                   |                     |  |
|               | Very moist below<br>4.5m   |               | 7      | SS   | 50/5cm                     | 116                |   |    |    |    |     | 0                                  |                                     |                                   |                     |  |
| 115.6         |  |               | 8      | SS   | 50/10cm                    |                    |   |    |    |    |     | 0                                  |                                     |                                   |                     |  |
| 6.3           | End of Borehole  |               |        |      |                            |                    |   |    |    |    |     |                                    |                                     |                                   |                     |  |

OFFICE REPORT ON SOIL EXPLORATION



# RECORD OF BOREHOLE No 35

METRIC

W P 264-87-00(a) LOCATION Station 23 + 500m, 0.2m N of W shoulder pavement edge ORIGINATED BY SM  
 DIST 6 HWY 401 BOREHOLE TYPE Solid stem auger COMPILED BY SB  
 DATUM Geodetic DATE February 18, 1991 CHECKED BY SB

OFFICE REPORT ON SOIL EXPLORATION

| SOIL PROFILE  |  |            | SAMPLES |      |            | GROUND WATER<br>CONDITIONS | ELEVATION<br>SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT |    |    |    |     | PLASTIC<br>LIMIT<br>W <sub>p</sub> | NATURAL<br>MOISTURE<br>CONTENT<br>W | LIQUID<br>LIMIT<br>W <sub>L</sub> | UNIT<br>WEIGHT<br>γ | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%) |
|---------------|--|------------|---------|------|------------|----------------------------|--------------------|---|----|----|----|-----|------------------------------------|-------------------------------------|-----------------------------------|---------------------|---|
| ELEV<br>DEPTH | DESCRIPTION  | STRAT PLOT | NUMBER  | TYPE | 'N' VALUES |                            |                    | 20  | 40 | 60 | 80 | 100 |                                    |                                     |                                   |                     |   |
| 121.8         | Ground surface   |            |         |      |            |                            |                    |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 0.0           | Topsoil: 125 mm  |            | 1       | SS   | 33         |                            | 121                |   |    |    |    |     | 0                                  |                                     |                                   |                     |   |
|               | SANDY SILT<br>some gravel,<br>dense<br>(FILL)  |            | 2       | SS   | 35         |                            |                    |   |    |    |    |     | 0                                  |                                     |                                   |                     |   |
| 120.1         | Topsoil: 125 mm  |            | 3       | SS   | 14         |                            | 120                |   |    |    |    |     | 0                                  |                                     |                                   |                     |   |
| 1.7           |  |            | 4       | SS   | 15         |                            | 119                |   |    |    |    |     | 0                                  |                                     |                                   |                     |   |
|               | Heterogeneous<br>mixture of<br>silt and sand,<br>with trace of<br>gravel and<br>clay,<br>wet sand seams,<br>compact to<br>very dense<br>(glacial till) |            | 5       | SS   | 120        |                            | 118                |   |    |    |    |     | 0                                  |                                     |                                   |                     |   |
|               |  |            | 6       | SS   | 75/5cm     |                            | 117                |   |    |    |    |     | 0                                  |                                     |                                   |                     |   |
|               |  |            | 7       | SS   | 50/10cm    |                            | 116                |   |    |    |    |     | 0                                  |                                     |                                   |                     |   |
|               |  |            | 8       | SS   | 50/8cm     |                            | 115                |   |    |    |    |     | 0                                  |                                     |                                   |                     |   |
|               |  |            | 9       | SS   | 50/5cm     |                            | 114                |   |    |    |    |     | 0                                  |                                     |                                   |                     |   |
|               |  |            | 10      | SS   | 107        |                            |                    |   |    |    |    |     | 0                                  |                                     |                                   |                     |   |
| 113.8         |  |            | 11      | SS   | 95/23cm    |                            |                    |   |    |    |    |     | 0                                  |                                     |                                   |                     |   |
| 8.0           | End of Borehole  |            |         |      |            |                            |                    |   |    |    |    |     |                                    |                                     |                                   |                     |   |

# RECORD OF BOREHOLE No 36

METRIC

W P 264-87-00(a) LOCATION Station 23 + 600m, 0.2m N of W shoulder pavement edge ORIGINATED BY SM  
 DIST 6 HWY 401 BOREHOLE TYPE Solid stem auger COMPILED BY SB  
 DATUM Geodetic DATE February 18, 1991 CHECKED BY SB

| SOIL PROFILE  |  |            | SAMPLES |      |            | GROUND WATER<br>CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT |    |    |    |     | PLASTIC<br>LIMIT<br>W <sub>p</sub> | NATURAL<br>MOISTURE<br>CONTENT<br>W | LIQUID<br>LIMIT<br>W <sub>L</sub> | UNIT<br>WEIGHT<br>γ | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%) |
|---------------|--|------------|---------|------|------------|----------------------------|-----------------|---|----|----|----|-----|------------------------------------|-------------------------------------|-----------------------------------|---------------------|---|
| ELEV<br>DEPTH | DESCRIPTION  | STRAT PLOT | NUMBER  | TYPE | 'N' VALUES |                            |                 | 20  | 40 | 60 | 80 | 100 |                                    |                                     |                                   |                     |   |
| 121.8         | Ground surface   |            |         |      |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |
| 0.0           | SANDY SILT<br>some gravel,<br>topsoil layers,<br>compact to<br>very dense<br>(FILL)                                    |            | 1       | SS   | 67         |                            | 121             |   |    |    |    |     |                                    | 0                                   |                                   |                     |   |
| 120.4         |  |            | 2       | SS   | 22         |                            |                 |   |    |    |    |     |                                    | 0                                   |                                   |                     |   |
| 1.4           | Heterogeneous<br>mixture of<br>silt, sand,<br>gravel and clay,<br>sand seams,<br>compact to dense<br><br>brown<br>grey |            | 3       | SS   | 19         |                            | 120             |   |    |    |    |     |                                    | 0                                   |                                   |                     |   |
|               |  |            | 4       | SS   | 35         |                            | 119             |   |    |    |    |     |                                    | 0                                   |                                   |                     |   |
|               |  |            | 5       | SS   | 27         |                            |                 |   |    |    |    |     |                                    | 0                                   |                                   | 24.4                |   |
| 117.6         |  |            | 6       | SS   | 15         |                            | 118             |   |    |    |    |     |                                    | 0                                   |                                   | 24.4                |   |
| 4.2           | End of Borehole  |            |         |      |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |

OFFICE REPORT ON SOIL EXPLORATION

# RECORD OF TEST PIT No 37

METRIC

W P 264-87-00(a) LOCATION Station 23 + 650m, 3.0m N of W shoulder pavement edge ORIGINATED BY SM  
 DIST 6 HWY 401 BOREHOLE TYPE Back-hoe COMPILED BY SB  
 DATUM Geodetic DATE February 26, 1991 CHECKED BY SB

| SOIL PROFILE   |   |            | SAMPLES |      |            | GROUND WATER CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION RESISTANCE PLOT |    |    |    |     | PLASTIC LIMIT<br>W <sub>p</sub> | NATURAL MOISTURE CONTENT<br>W | LIQUID LIMIT<br>W <sub>L</sub> | UNIT WEIGHT<br>γ | REMARKS & GRAIN SIZE DISTRIBUTION (%) |
|--|---|------------|---------|------|------------|-------------------------|-----------------|--|----|----|----|-----|---------------------------------|-------------------------------|--------------------------------|------------------|---------------------------------------|
| ELEV DEPTH   | DESCRIPTION   | STRAT PLOT | NUMBER  | TYPE | 'N' VALUES |                         |                 | 20                                       | 40 | 60 | 80 | 100 |                                 |                               |                                |                  |                                       |
| 121.3  | Ground surface  |            |         |      |            |                         |                 |  |    |    |    |     |                                 |                               |                                |                  |                                       |
| 0.0  | SANDY SILT organic stained layers (FILL)  |            | 1       | CS   |            |                         |                 |  |    |    |    | 0   |                                 |                               |                                |                  |                                       |
| 120.4  |   |            | 2       | CS   |            |                         |                 |  |    |    |    |     |                                 |                               |                                |                  |                                       |
| 0.9  | Het. mixture of silt and sand with gravel and occasional cobbles (glacial till) |            | 3       | CS   |            |                         |                 |  |    |    |    | 0   |                                 |                               |                                | 7                | 41 44 8                               |
|  |   |            | 4       | CS   |            |                         |                 |  |    |    |    | 0   |                                 |                               |                                |                  |                                       |
| 118.1  |   |            |         |      |            |                         |                 |  |    |    |    |     |                                 |                               |                                |                  |                                       |
| 3.2  | End of Test Pit   |            |         |      |            |                         |                 |  |    |    |    |     |                                 |                               |                                |                  |                                       |
| <p>NOTES:</p> <p>1) Test pit dry and no seepage from sand seams.</p> <p>2) Side slopes were excavated at 45°. No sign of slope instability during the period (3 hrs.) the test pit was open.</p> <p>3) Very dense to hand probing, below 1.0m.</p> |   |            |         |      |            |                         |                 |  |    |    |    |     |                                 |                               |                                |                  |                                       |

OFFICE REPORT ON SOIL EXPLORATION

# RECORD OF BOREHOLE No 38

METRIC

W P 264-87-00(a) LOCATION Station 23 + 700m, 0.2m N of W shoulder pavement edge ORIGINATED BY SM  
 DIST 6 HWY 401 BOREHOLE TYPE Solid stem auger COMPILED BY SB  
 DATUM Geodetic DATE February 18, 1991 CHECKED BY SB

OFFICE REPORT ON SOIL EXPLORATION

| SOIL PROFILE  |  |            | SAMPLES |      |            | GROUND WATER<br>CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT |  |  |  |  | PLASTIC<br>LIMIT<br>W <sub>p</sub> | NATURAL<br>MOISTURE<br>CONTENT<br>W | LIQUID<br>LIMIT<br>W <sub>L</sub> | UNIT<br>WEIGHT<br>γ | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%) |                   |  |  |
|---------------|--|------------|---------|------|------------|----------------------------|-----------------|---|--|--|--|--|------------------------------------|-------------------------------------|-----------------------------------|---------------------|---|-------------------|--|--|
| ELEV<br>DEPTH | DESCRIPTION  | STRAT PLOT | NUMBER  | TYPE | 'N' VALUES |                            |                 | 20 40 60 80 100                             |  |  |  |  |                                    |                                     |                                   |                     |   | WATER CONTENT (%) |  |  |
|               |  |            |         |      |            |                            |                 | SHEAR STRENGTH kPa                          |  |  |  |  |                                    |                                     |                                   |                     |   | WATER CONTENT (%) |  |  |
|               |  |            |         |      |            |                            |                 | ○ UNCONFINED + FIELD VANE                   |  |  |  |  |                                    |                                     |                                   |                     |   |                   |  |  |
|               |  |            |         |      |            |                            |                 | ● QUICK TRIAXIAL x LAB VANE                 |  |  |  |  |                                    |                                     |                                   |                     |   |                   |  |  |
| 122.4         | Ground surface   |            |         |      |            |                            |                 |   |  |  |  |  | 10 20 30                           |                                     |                                   | KN/m³               | GR SA SI CL                                       |                   |  |  |
| 0.0           | SANDY SILT<br>some gravel,<br>dense<br>(FILL)  |            |         |      |            |                            | 122             |   |  |  |  |  | 0                                  |                                     |                                   |                     |   |                   |  |  |
| 121.5         |  |            | 1       | SS   | 39         |                            |                 |   |  |  |  |  |                                    |                                     |                                   |                     |   |                   |  |  |
| 0.9           |  |            | 2       | SS   | 38         |                            | 121             |   |  |  |  |  | 0                                  |                                     |                                   |                     | 7 47 40 6   |                   |  |  |
|               | Heterogeneous<br>mixture of<br>silt and sand<br>with trace of<br>gravel and clay,<br>sand seams,<br>compact to<br>very dense |            | 3       | SS   | 49         |                            | 120             |   |  |  |  |  | 0                                  |                                     |                                   |                     |   |                   |  |  |
|               |  |            | 4       | SS   | 67         |                            | 119             |   |  |  |  |  | 0                                  |                                     |                                   |                     |   |                   |  |  |
|               |  |            | 5       | SS   | 31         |                            | 118             |   |  |  |  |  | 0                                  |                                     |                                   | 24.0                |   |                   |  |  |
|               |  |            | 6       | SS   | 16         |                            |                 |   |  |  |  |  | 0                                  |                                     |                                   | 23.1                |   |                   |  |  |
|               | More clayey below<br>5.2m<br>(very stiff to stiff)   |            | 7       | SS   | 13         |                            | 117             |   |  |  |  |  | 0                                  |                                     |                                   |                     |   |                   |  |  |
| 115.9         |  |            | 8       | SS   | 10         |                            | 116             |   |  |  |  |  | 0                                  |                                     |                                   |                     |   |                   |  |  |
| 6.5           | End of Borehole  |            |         |      |            |                            |                 |   |  |  |  |  |                                    |                                     |                                   |                     |   |                   |  |  |

+3, x5: Numbers refer to  
Sensitivity

20  
15 5 (%) STRAIN AT FAILURE  
10

# RECORD OF BOREHOLE No 39

METRIC

W P 264-87-00(a) LOCATION Station 23 + 750m, 0.2m N of W shoulder pavement edge ORIGINATED BY SM  
 DIST 6 HWY 401 BOREHOLE TYPE Solid stem auger COMPILED BY SB  
 DATUM Geodetic DATE February 18, 1991 CHECKED BY SB

| SOIL PROFILE  |  |            | SAMPLES |      |            | GROUND WATER<br>CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT |    |    |    |     | PLASTIC<br>LIMIT<br>W <sub>p</sub> | NATURAL<br>MOISTURE<br>CONTENT<br>W | LIQUID<br>LIMIT<br>W <sub>L</sub> | UNIT<br>WEIGHT<br>γ | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%) |
|---------------|--|------------|---------|------|------------|----------------------------|-----------------|---|----|----|----|-----|------------------------------------|-------------------------------------|-----------------------------------|---------------------|---|
| ELEV<br>DEPTH | DESCRIPTION  | STRAT PLOT | NUMBER  | TYPE | 'N' VALUES |                            |                 | 20  | 40 | 60 | 80 | 100 |                                    |                                     |                                   |                     |   |
| 122.5         | Ground surface   |            |         |      |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     | GR SA SI CL                                       |
| 0.0           | SAND AND SILT<br>some gravel,<br>very dense<br>(FILL)  |            | 1       | SS   | 59         |                            | 122             |   |    |    |    |     | 0                                  |                                     |                                   |                     | 17 40 39 4  |
| 120.7         | Topsoil: 250 mm  |            | 2       | SS   | 31         |                            | 121             |   |    |    |    |     |                                    | 0                                   |                                   |                     |   |
| 1.8           | Heterogeneous<br>mixture of<br>silt and sand<br>with gravel<br>and clay,<br>sand seams,<br>compact<br>to dense<br>(glacial till) |            | 3       | SS   | 22         |                            | 120             |   |    |    |    |     | 0                                  |                                     |                                   |                     |   |
|               |  |            | 4       | SS   | 38         |                            | 119             |   |    |    |    |     | 0                                  |                                     |                                   | 23.1                |   |
|               |  |            | 5       | SS   | 13         |                            | 118             |   |    |    |    |     | 0                                  |                                     |                                   |                     |   |
| 117.5         |  |            | 6       | SS   | 11         |                            |                 |   |    |    |    |     | 0                                  |                                     |                                   |                     |   |
| 5.0           | End of Borehole  |            |         |      |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |   |

OFFICE REPORT ON SOIL EXPLORATION

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

20  
15 5 (%) STRAIN AT FAILURE  
10

# RECORD OF TEST PIT : No 40

METRIC

W P 264-87-00(a) LOCATION Station 23 + 800m, 2.0m N of W shoulder pavement edge ORIGINATED BY SM  
 DIST 6 HWY 401 BOREHOLE TYPE Back-hoe COMPILED BY SB  
 DATUM Geodetic DATE February 26, 1991 CHECKED BY SB

| SOIL PROFILE   |   |            | SAMPLES |      |            | GROUND WATER<br>CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT |    |    |    |     | PLASTIC<br>LIMIT<br>W <sub>p</sub> | NATURAL<br>MOISTURE<br>CONTENT<br>W | LIQUID<br>LIMIT<br>W <sub>L</sub> | UNIT<br>WEIGHT<br>γ | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%)<br>GR SA SI CL |
|--|---|------------|---------|------|------------|----------------------------|-----------------|---|----|----|----|-----|------------------------------------|-------------------------------------|-----------------------------------|---------------------|--|
| ELEV<br>DEPTH  | DESCRIPTION   | STRAT PLOT | NUMBER  | TYPE | 'N' VALUES |                            |                 | 20  | 40 | 60 | 80 | 100 |                                    |                                     |                                   |                     |  |
| 121.8  | Ground surface  |            |         |      |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |  |
| 0.0  | Sandy silt topsoil:<br>600 mm<br>SILTY SAND<br>some gravel (FILL)   |            | 1       | CS   |            |                            | 121             |   |    |    |    |     |                                    |                                     |                                   |                     | 9 47 38 6  |
| 120.7  | Topsoil: 75 mm  |            | 2       | CS   |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |  |
| 1.1  | Het. mixture<br>of silt and sand<br>with gravel,<br>cobbles,<br>sand seams,<br>very dense<br>(glacial till) |            | 3       | CS   |            |                            | 120             |   |    |    |    |     |                                    |                                     |                                   |                     |  |
| 118.9  | (glacial till)  |            |         |      |            |                            | 119             |   |    |    |    |     |                                    |                                     |                                   |                     |  |
| 2.9  | End of Test Pit   |            |         |      |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |  |
| NOTES:<br>1) Below 1.1m, very dense to hand probing.<br>2) Minor seepage between topsoil and fill layer.<br>3) Side slopes were excavated at close to 60° to horizontal. The side slopes showed no sign of instability during the period (4 hrs.) the test pit was open. |   |            |         |      |            |                            |                 |   |    |    |    |     |                                    |                                     |                                   |                     |  |

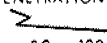

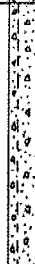
OFFICE REPORT ON SOIL EXPLORATION

# RECORD OF BOREHOLE No 41

METRIC

W P 264-87-00(a) LOCATION Station 23 + 850m, 2.0m N of W shoulder pavement edge ORIGINATED BY SM  
 DIST 6 HWY 401 BOREHOLE TYPE Solid stem auger COMPILED BY SB  
 DATUM Geodetic DATE February 18, 1991 CHECKED BY SB

OFFICE REPORT ON SOIL EXPLORATION

| SOIL PROFILE  |   |   | SAMPLES |      |            | GROUND WATER<br>* CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION<br>RESISTANCE PLOT  |  |  |  |  | PLASTIC<br>LIMIT<br>W <sub>p</sub> | NATURAL<br>MOISTURE<br>CONTENT<br>W | LIQUID<br>LIMIT<br>W <sub>L</sub> | UNIT<br>WEIGHT<br>γ | REMARKS<br>&<br>GRAIN SIZE<br>DISTRIBUTION<br>(%) |
|---------------|---|---|---------|------|------------|------------------------------|-----------------|---|--|--|--|--|------------------------------------|-------------------------------------|-----------------------------------|---------------------|---|
| ELEV<br>DEPTH | DESCRIPTION   | STRAT PLOT  | NUMBER  | TYPE | 'N' VALUES |                              |                 | SHEAR STRENGTH kPa<br>○ UNCONFINED      + FIELD VANE<br>● QUICK TRIAXIAL    x LAB VANE  |  |  |  |  | WATER CONTENT (%)                  |                                     |                                   |                     |   |
| 122.4         | Ground surface  |   |         |      |            |                              |                 |   |  |  |  |  |                                    | 10   20   30                        | KN/m <sup>3</sup>                 | GR SA SI CL         |   |
| 0.0           | SANDY SILT<br>some gravel,<br>topsoil layer,<br>very dense<br>(FILL)  |  |         |      |            |                              | 122             |   |  |  |  |  |                                    |                                     |                                   |                     |   |
| 121.0         |   |   | 1       | SS   | 73/23cm    |                              |                 |   |  |  |  |  | 0                                  |                                     |                                   |                     |   |
| 1.4           | Heterogeneous<br>mixture of<br>silt and sand<br>with trace of<br>gravel and clay,<br>sand seams,<br>(glacial till)<br>dense to very dense |  | 2       | SS   | 57         |                              | 121             |   |  |  |  |  | 0                                  |                                     |                                   | 23.2                |   |
|               |   |   | 3       | SS   | 45         |                              | 120             |   |  |  |  |  | 0                                  |                                     |                                   |                     |   |
|               |   |   | 4       | SS   | 110        |                              | 119             |   |  |  |  |  | 0                                  |                                     |                                   |                     | 22.9  |
| 118.2         |   |   | 5       | SS   | 80/8cm     |                              |                 |   |  |  |  |  | 0                                  |                                     |                                   |                     |   |
| 4.2           | End of Borehole   |   |         |      |            |                              |                 |   |  |  |  |  |                                    |                                     |                                   |                     |   |
|               | *Borehole dry.  |   |         |      |            |                              |                 |   |  |  |  |  |                                    |                                     |                                   |                     |   |

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


20  
15 5 (%) STRAIN AT FAILURE  
10

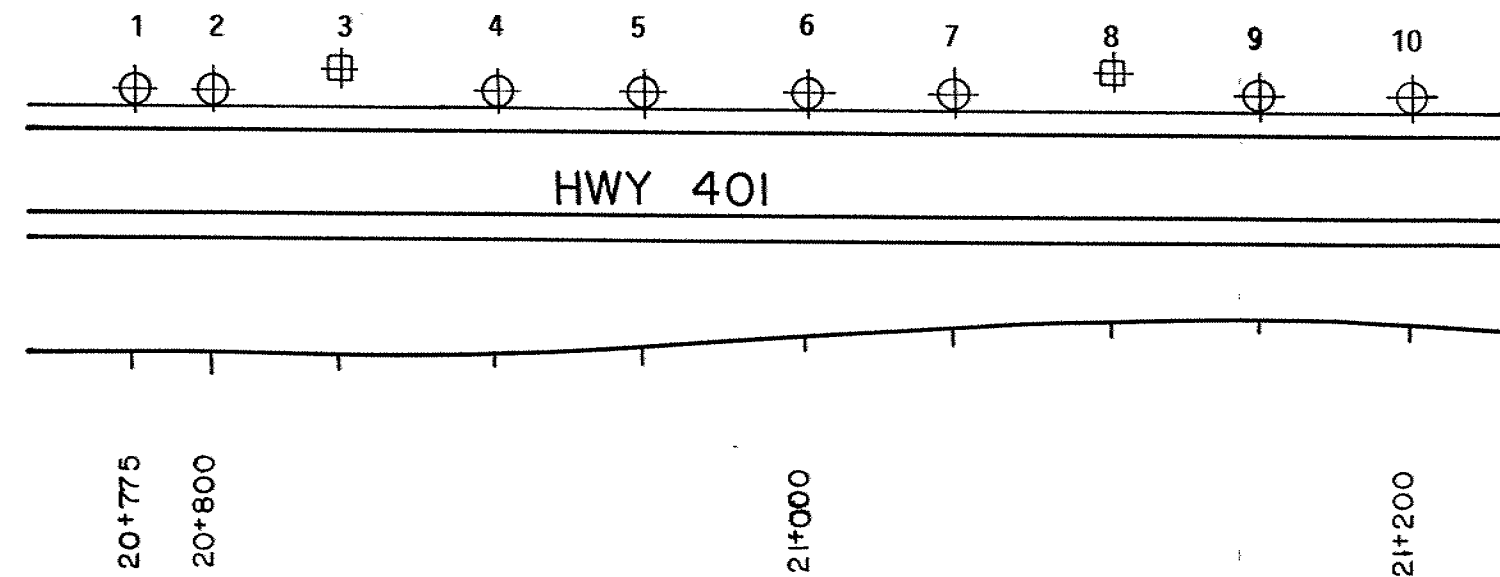
AREA I

STA 20+775 to STA 21+200

# LEGEND

 Bore Hole

 Test Pit



| BH No | STATION  | ELEVATION |
|-------|----------|-----------|
| 1     | 20 + 775 | 138.7     |
| 2     | 20 + 800 | 138.7     |
| 3     | 20 + 850 | 137.2     |
| 4     | 20 + 900 | 137.6     |
| 5     | 20 + 950 | 137.3     |
| 6     | 21 + 000 | 136.7     |
| 7     | 21 + 050 | 136.4     |
| 8     | 21 + 100 | 135.1     |
| 9     | 21 + 150 | 135.3     |
| 10    | 21 + 200 | 135.0     |

NOTE: For subsoil information, refer to  
Record of Borehole Sheets.



MCCLYMONT & RAK ENGINEERS, INC.  
GEOTECHNICAL CONSULTANTS

## BOREHOLE LOCATION PLAN



|              |                   |                  |
|--------------|-------------------|------------------|
| Scale<br>NTS | Date<br>MARCH '91 | Drawing No.<br>1 |
|--------------|-------------------|------------------|

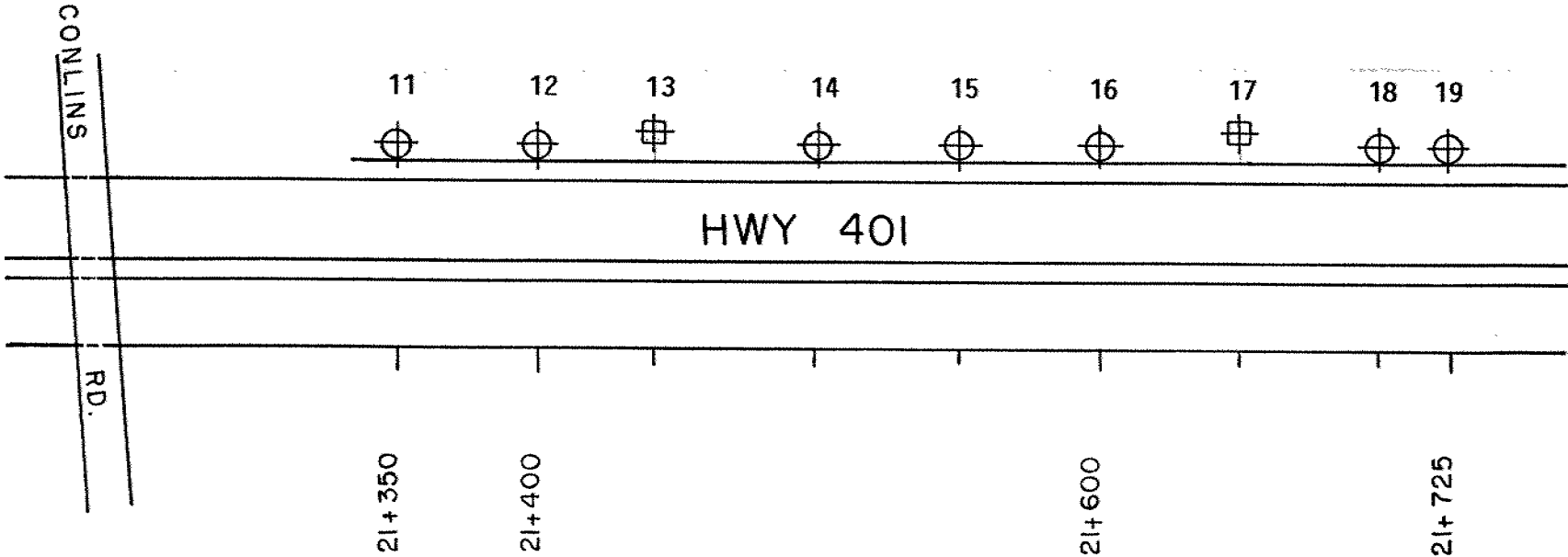


AREA 2

STA 21 + 350 to 21 + 725

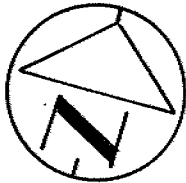
LEGEND

-  Bore Hole
-  Test Pit



| BH No | STATION  | ELEVATION |
|-------|----------|-----------|
| 11    | 21 + 350 | 133.5     |
| 12    | 21 + 400 | 133.2     |
| 13    | 21 + 450 | 132.0     |
| 14    | 21 + 500 | 132.5     |
| 15    | 21 + 550 | 132.3     |
| 16    | 21 + 600 | 131.9     |
| 17    | 21 + 650 | 130.9     |
| 18    | 21 + 700 | 131.3     |
| 19    | 21 + 725 | 131.3     |

NOTE: For subsoil information, refer to  
Record of Borehole Sheets.



MCCLYMONT & RAK ENGINEERS, INC.  
GEOTECHNICAL CONSULTANTS

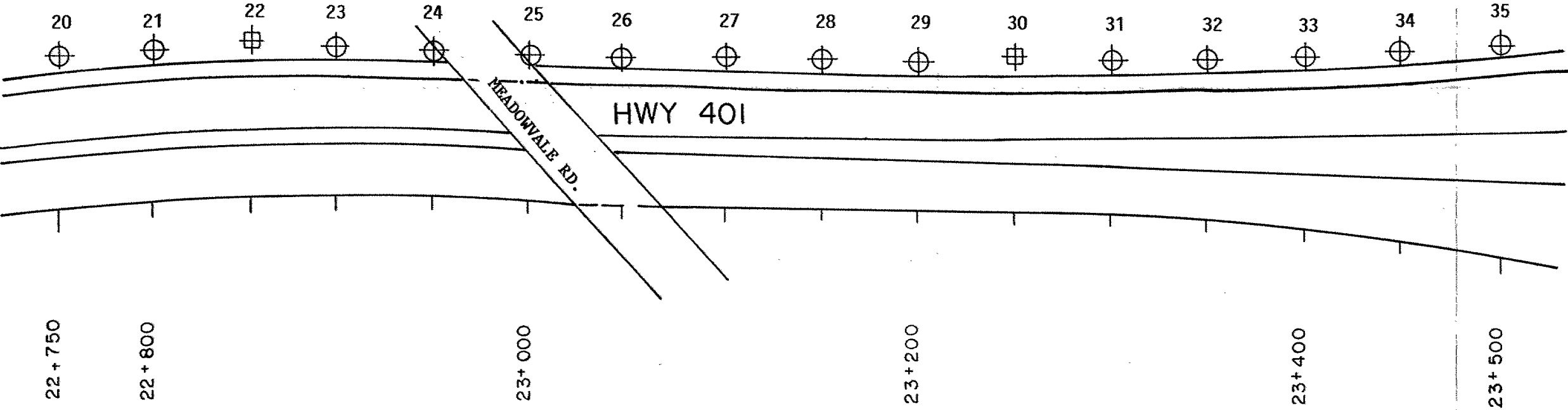
BOREHOLE LOCATION PLAN

|           |                   |               |
|-----------|-------------------|---------------|
| Scale NTS | Date<br>MARCH '91 | Drawing No. 2 |
|-----------|-------------------|---------------|

AREA 3

STA 22 + 750 to STA 23 + 500

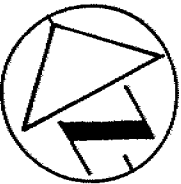
LEGEND



⊕ Bore Hole  
⊞ Test Pit

| BH No | STATION  | ELEVATION |
|-------|----------|-----------|
| 20    | 22 + 750 | 125.3     |
| 21    | 22 + 800 | 124.6     |
| 22    | 22 + 850 | 123.2     |
| 23    | 22 + 900 | 124.0     |
| 24    | 22 + 950 | 123.5     |
| 25    | 23 + 000 | 122.3     |
| 26    | 23 + 050 | 123.0     |
| 27    | 23 + 100 | 123.0     |
| 28    | 23 + 150 | 122.7     |
| 29    | 23 + 200 | 122.5     |
| 30    | 23 + 250 | 122.4     |
| 31    | 23 + 300 | 121.6     |
| 32    | 23 + 350 | 122.2     |
| 33    | 23 + 400 | 122.1     |
| 34    | 23 + 450 | 121.9     |
| 35    | 23 + 500 | 121.8     |

NOTE: For subsoil information, refer to  
Record of Borehole Sheets.

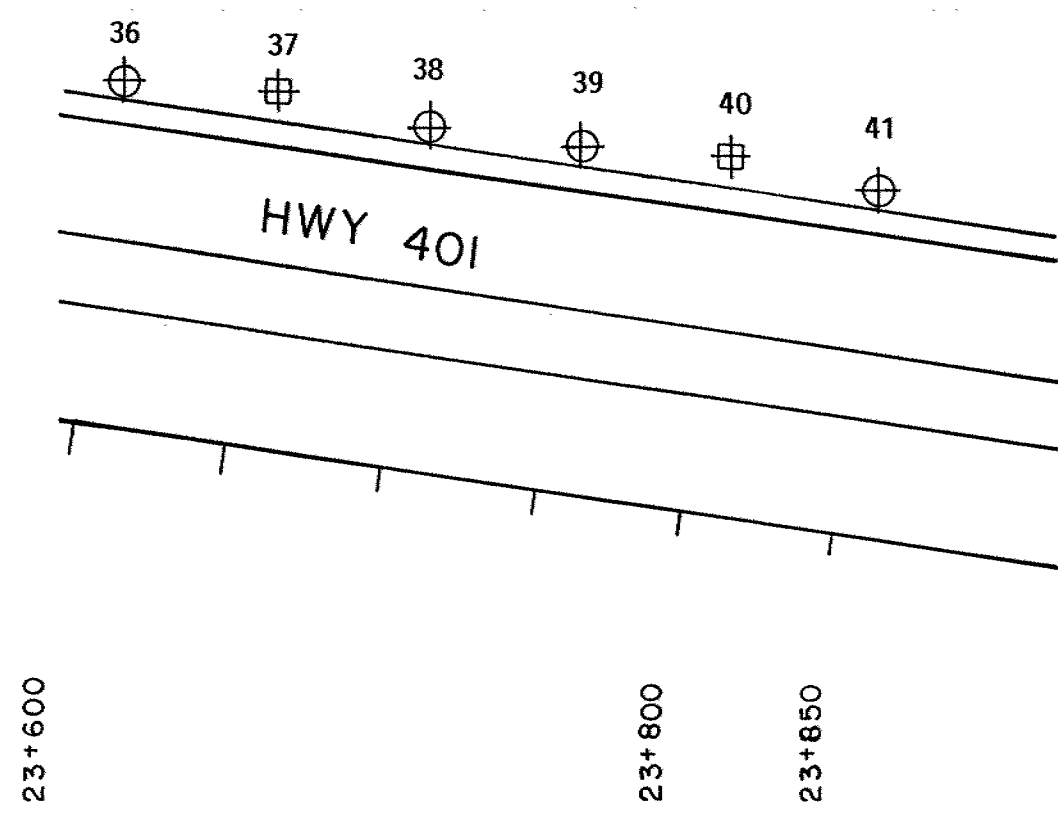


MCCLYMONT & RAK ENGINEERS, INC.  
GEOTECHNICAL CONSULTANTS

BOREHOLE LOCATION PLAN

Scale NTS Date MARCH '91 Drawing No. 3

AREA 4 STA 23 + 600 to STA 23+ 850



- LEGEND
- Bore Hole
  - Test Pit

| BH No | STATION  | ELEVATION |
|-------|----------|-----------|
| 36    | 23 + 600 | 121.8     |
| 37    | 23 + 650 | 121.3     |
| 38    | 23 + 700 | 122.4     |
| 39    | 23 + 750 | 122.5     |
| 40    | 23 + 800 | 121.8     |
| 41    | 23 + 850 | 122.4     |

NOTE: For subsoil information, refer to  
Record of Borehole Sheets.

MCCLYMONT & RAK ENGINEERS, INC.  
 GEOTECHNICAL CONSULTANTS

**BOREHOLE LOCATION PLAN**

|           |                   |                      |
|-----------|-------------------|----------------------|
| Scale NTS | Date<br>MARCH '91 | Drawing No. <b>4</b> |
|-----------|-------------------|----------------------|

# memorandum



To: **V. Boehnke, P.Eng.**  
**Head, Structural Section**  
**4th Floor, Atrium Tower**

Date: **91 09 19**

Attn: **A. Shamji, P.Eng.**  
**Structural Engineer**

From: **Foundation Design Section**  
**Room 315, Central Building**

Re: **Review of Contractor's Roadway Protection Proposal**  
**Hwy 401 W.B. Collectors**  
**Neilson Road to Meadowvale Road**  
**W.P. 264-87-00, Contract 91-28**

The contractor's proposal shown on the submitted drawings DC1 and DC2 that identifies an alternate scheme for roadway protection to facilitate the construction of the storm sewer at the above mentioned site has been reviewed by our office. The contractor's proposal consists of employing a timber strutted excavation and/or excavation slopes. The proposed method is considered an unacceptable alternative to the cantilever soldier pile lagging scheme in view of the prudence of maintaining the integrity and performance of the Hwy 401 roadway. Consequently, it is recommended that the cantilever soldier pile lagging wall be employed as previously specified.

The timber trench box can be used as a suitable replacement for steel provided that the timber members (sheathing, wales, struts, etc.) are of sufficient strength to resist the appropriate lateral earth pressures and the excavation is carried out within the trench box. The trench box method shall be employed under the conditions originally specified.

If you have any queries regarding the above comments, please do not hesitate to contact this office.

A handwritten signature in black ink, appearing to read "T. Sangiuliano".

**T. Sangiuliano, P. Eng.**  
**Foundation Engineer**

for

**D. Dundas, P. Eng.**  
**Senior Foundation Engineer**

# memorandum



Tel: 235-3731

To: Mr. P. G. Chackeris  
Sr. Project Manager  
Planning and Design Section  
Central Region

Date: 1991 03 19

From: Foundation Design Section  
Room 315, Central Building

Subject: Roadway Protection to Facilitate  
Storm Sewer Installation  
W.P. 264-87-00, Contract 91-28  
Hwy. 401 WB Collectors  
Neilson Road to Meadowvale Road

At a meeting held on December 4, 1990, it was agreed that the Foundation Design Section would carry out a further subsurface investigation at the aforementioned site. An initial investigation had been carried out by the Central Region Geotechnical Section. The additional information would allow for a more detailed review of the dewatering and shoring requirements in conjunction with the proposed storm sewer installation.

On January 8, 1991, a meeting was held to establish the areas of the work that required further investigation. It was further revealed that because the Planning and Design had not foreseen this requirement for a detailed investigation, that an Addendum to the Contract package would be required.

A formal request was provided on January 18, 1991 by the Planning and Design Section accompanied by a delineation of those areas that required investigation. Realizing the urgency of the request, the Foundation Design Section retained McClymont and Rak Engineering Inc., Geotechnical Consultants to carry out the fieldwork for the investigation and to supply the factual data. To expedite the response and to mitigate schedule impacts, it was decided that this office would provide the recommendations for the project.

This memorandum summarizes the results of a foundation investigation conducted at the aforementioned site. Discussion of the fieldwork carried out in conjunction with the project, the subsurface conditions at the site and recommendations to facilitate the storm sewer construction have been summarized

.../2

below. A report containing details of the factual information of the subsurface investigation is being prepared by McClymont & Rak Engineers Inc. who as mentioned above was retained by the Ministry to do this work. This report will be submitted as soon as it is completed.

#### Project Description

It is proposed to construct a storm sewer adjacent and parallel to the existing Highway 401 between Neilson Road and Meadowvale Road as part of the roadway drainage design in that area. The centreline of the proposed sewer ranges from upto 2.5 metres encroachment on the west shoulder to 5.2 metres offset from the edge of the shoulder. The concrete storm sewer pipe has a diameter ranging from 300 mm to 1350 mm and has an invert elevation ranging from 136.2 m to 117.9 m which corresponds to depths ranging from 1.4 to 4.0 metres below the existing ground surface.

#### Field Investigation

The fieldwork for this project was carried out by McClymont & Rak Engineers in those areas where excavations would encroach within a 1H:1V cross sectional plane, the plane defined by the crest of the existing WB edge of shoulder (south) and the base of the proposed sewer excavation. These locations are indicated in Table 1 below and illustrated on the attached plans (Dwgs. 1-4 inclusive) in the Appendix. Four designated areas (1-4 inclusive) were established.

Table 1 - Areas of Investigation

| <u>Area</u> | <u>Station</u>   |
|-------------|------------------|
| 1           | 20+775 to 21+200 |
| 2           | 21+350 to 21+725 |
| 3           | 22+750 to 23+500 |
| 4           | 23+600 to 23+850 |

The fieldwork consisted of a total of thirty three (33) sampled boreholes and eight (8) test pits distributed generally at 50 metre spacings over the four areas. Two (2) test pits were excavated per area. Conventional track mounted and truck mounted drilling units employing continuous flight solid stem augering techniques were used to advance the boreholes to depths ranging from 2.9 to 8.0 metres below the existing ground surface. Disturbed subsoil samples were generally retrieved at 0.7 metre intervals in accordance with the Standard Penetration test (ASTM D1586).

Test Pits were excavated using a 580 Case D245 backhoe to depths ranging from 0.7 metres to 3.7 metres. The test pits were excavated at slopes ranging from 45° to 60° to the horizontal and were left open for durations ranging from 45 minutes to 4 hours.

Groundwater levels were obtained by measurement in the open boreholes and also piezometers installed in the open boreholes. Observation of the groundwater conditions were also examined in the test pits.

All boreholes and test pits were backfilled upon completion of the fieldwork.

#### Subsurface Conditions

The subsurface conditions present at the four designated sections mentioned above are described below.

##### Area 1

The ground surface elevation varies from 135.0 m to 138.7 m. The subsurface stratigraphical profile consists of a surficial fill material composed of sand and gravel with traces to some silt. The thickness of this fill material ranges from 0.3 m to 1.7 m and the material has a compact state of denseness. The fill material is underlain by a native cohesionless soil consisting of a sand with some/trace silt to gravelly sand. This material ranged from a compact to a very dense denseness, but generally ranged from compact to dense ('N' values from the Standard Penetration test ranged from 13 blows/0.3 m to 50 blows/0.3 m). The deposit was explored to a maximum depth of 5.0 metres.

##### Area 2

The ground surface elevation varies from 133.5 m to 131.3 m. The subsoil stratigraphy in Area 2 was found to be similar to the stratigraphy present in Area 1. It consists of a surficial fill material composed of a silty sand with some gravel that extends up to 1.4 m in thickness. The fill material is generally in a compact state of denseness. The fill material is underlain by a cohesionless native deposit of sand with some gravel to sand and gravel with a trace silt. Interbeds of a heterogeneous mixture of silty sand and gravel are also present within this deposit in thicknesses upto a metre. The deposit was explored to a maximum thickness of 3.6 metres. The deposit generally has a dense to very dense state of denseness with 'N' values generally exceeding 30 blows/0.3 m.

##### Area 3

The ground surface elevation varies from 125.3 to 121.8 m. The subsoil stratigraphy in Area 3 consists of a surficial fill material composed of a silty sand to sand and gravel. Inclusions of organics were also randomly situated in the material. The material was generally compact to dense and extended to depths of up to 2 metres. In the subsection bounded by stations 22+775 to 22+975, the fill material is underlain by a cohesive, very stiff

clayey silt. The clayey silt has a thickness ranging from 0.9 m to 1.7 m. 'N' values as derived by the Standard Penetration test (SPT) ranged from 12 to 18 blows/0.3 m. in this material.

A heterogeneous mixture of silt, sand and gravel (Glacial Till) deposit underlies the clayey silt where the clayey silt material exists and underlies the fill material elsewhere in this area. Occasional wet sand seams ranging from 0.5 to 1.3 m in depth, exist interbedded in the deposit. Boulders and cobbles as identified and inferred during the investigation exist in the deposit. The deposit, which was explored to a maximum thickness of 6.3 m is characterized by its very dense state of denseness with 'N' values generally exceeding 50 blows/0.3 m. 'N' values in the order of 50 blows/.05 m were not uncommon in this deposit.

#### Area 4

The ground surface elevation in this area varies from 121.8 m to 122.4 m. The surficial soil in this area consists of a fill material composed of a sandy silt with some gravel. The fill material has a thickness ranging from 0.9 m to 1.8 m and has a dense to very dense denseness.

The fill material is underlain by a heterogeneous mixture of silt, sand and gravel, similar to the material in Area 3, and was explored to a maximum thickness of 5.6 metres. Boulders and cobbles as identified and inferred during the investigation exist in the deposit. This deposit of glacial origin has a compact to dense denseness and 'N' values generally range from 10 blows/0.3 m to 50 blows/0.3 m.

#### Groundwater Conditions

Observation of the groundwater levels were obtained by measurement in the open boreholes and test pits and also in sealed piezometers installed. The depths of the groundwater levels and the corresponding elevations are summarized in Table 2 below. The groundwater level generally slopes in the same direction as the ground surface.

Table 2 - Groundwater Levels

| Area | Depth Below<br>Ground Surface | Elevation   |
|------|-------------------------------|-------------|
|      | (m)                           | (m)         |
| 1    | 2.3-4.3                       | 133-134.4   |
| 2    | 2.0-3.4                       | 130.3-129.1 |
| 3    | 0.5-1.9                       | 123.4-122.0 |
| 4    | 0.7-4.3                       | 121.1-118.1 |



In general, the phreatic surface of the groundwater table is located within the native material, although in Area 3 the phreatic surface exists partially in the fill material at some locations. In addition, in Area 3 recharge of the water level into the open borehole or test pit was primarily as a result of the bleeding through the interbedded seams within the till deposit.

Groundwater levels are subject to seasonal fluctuations and hence can vary from the values hereby given.

#### DISCUSSION AND RECOMMENDATIONS

A Class B granular bedding foundation has been chosen to support the storm sewer pipe and consequently OPSD-802.03 should be referenced for the selection of pertinent design parameters, trench dimensions, bedding thickness, backfill material and placement and specified vertical and horizontal clearances.

#### CONSTRUCTION - General

The selection of the method of construction of the storm sewer is a function of two parameters:

- (1) subsoil conditions
- (2) proximity of proposed pipe to asphaltic roadway

The subsoil conditions at the site enable a temporary 1H:1V cut slope to be excavated without any short term instability provided that the groundwater is controlled in the excavation (The control of the groundwater will be discussed later in this report). Hence, bearing this criteria in mind, the selection of the construction method will be dictated by whether the proposed sewer ditch trench encroaches into a 1H:1V plane defined from a point coincident with the edge of the paved shoulder. Recommendations in general form are given below and in addition, specific recommendations pertaining to each area are also given.

(1) If the invert of the trench excavation is outside and beyond the aforementioned 1H:1V plane, then construction can proceed with a concurrent excavation/backfill operation. Excavations should not exceed 5 m in length prior to complete backfilling and no excavation should be left open for more than 8 hours.

(2) If the invert of the trench excavation is within the aforementioned 1H:1V plane and the trench section containing the pipe is beyond the outer edge of the paved shoulder, then a combination of 1H:1V slopes and a steel trench box can be employed to facilitate the excavation. The trench box sections shall be adequately braced and to maintain better control of the box, it is recommended that the box be carefully and tightly positioned

against the trench walls. The trench should be excavated ahead of the box for maximum lengths of 5 metres and the box shall be advanced in the excavated trench upon total completion of the previous pipe installations.

3(a) If the the invert of the trench excavation is within the aforementioned 1H:1V plane and the trench section containing the pipe is within the paved shoulder beyond 1.5 metres from the highway lane at a depth of less than 2.0 metres, a steel trench box as described above can be used.

3(b) If the invert of the trench excavation is within the aforementioned 1H:1V plane and at a distance of less than 1.5 metres from the highway lane or within the paved shoulder at a depth exceeding 2 metres, then a temporary shoring scheme consisting of a cantilever soldier pile-timber lagging wall is recommended. The depth of penetration of the soldier piles shall be sufficient to ensure lateral earth pressure equilibrium. Design parameters and details of the methods of installation have been given below, specific to the area in which such a system is applicable.

#### CONSTRUCTION - AREAS 1-4

A review of the proximity of the proposed storm sewer pipe to the existing west shoulder was undertaken to identify the method of construction required in each area as defined earlier. This review was executed by scaled measurement from the plans and profiles illustrating the proposed storm sewer and the results are shown in Table 1 in the Appendix. Anticipated side slopes from the edge of the paved shoulder to the invert of the trench have been computed and then compared to the 1H:1V criteria plane alluded to earlier. It is cautioned, however, that the measurements were scaled from the drawings and hence may not be the most accurate representation. Based on the observation of the proposed location of the storm sewer pipe and the subsurface conditions at the site, recommended construction methods have been given in Table 1 in the Appendix and summarized in Table 3 below.

Table 3 - Recommended Construction Method

| <u>Area</u> | <u>Station</u>   | <u>Construction Method</u> |
|-------------|------------------|----------------------------|
| 1           | 20+775 to 21+200 | Trench Box                 |
| 2           | 21+350 to 21+725 | Trench Box                 |
| 3           | 22+750 to 22+800 | Open Cut                   |
|             | 22+800 to 23+150 | Trench Box                 |
|             | 23+150 to 23+300 | Open Cut                   |
|             | 23+300 to 23+400 | Trench Box                 |
|             | 23+400 to 23+460 | Soldier Pile-Lagging Wall  |
|             | 23+460 to 23+500 | Trench Box                 |
| 4           | 23+500 to 23+600 | Trench Box                 |
|             | 23+600 to 23+850 | Soldier Pile-Lagging Wall  |

Sections depicting the worst case scenario within each area are illustrated on Drawings #5-8 inclusive in the Appendix for Areas 1-4 respectively.

Temporary Soldier Pile-Lagging Wall

To facilitate the design of the soldier pile-lagging wall, design parameters for the soil in each respective section has been tabulated in Table 4 below. Buoyant unit weights are to be applied in the earth pressure computation below the groundwater table.

Table 4 - Shoring Design Parameters

| <u>Area</u> | <u>Station</u> | <u>Soil Type</u>                  | Unfactored Angle<br>of Internal Friction<br>( $0^\circ$ ) | Bulk<br>Unit Weight<br>( $\text{kN/m}^3$ ) |
|-------------|----------------|-----------------------------------|---|--|
| 3           | 23+400         | Fill Material                     | $30^\circ$  | 20   |
|             | to             | Het. Mix. of Silt,                | $35^\circ$  | 20   |
|             | 23+460         | Sand and Gravel<br>(Glacial Till) |   |  |
| 4           | 23+600         | Fill Material                     | $30^\circ$  | 20   |
|             | to             | Het. Mix. of Silt,                | $30^\circ$  | 23   |
|             | 23+850         | Sand and Gravel<br>(Glacial Till) |   |  |

Soldier Piles can be installed in preaugered holes provided that the stability of the shaft and base of the hole is maintained throughout the installation. This is particularly prudent where the drilled shafts penetrate below the groundwater table when conditions of unbalanced hydrostatic head in the cohesionless soil can result. A nonstandard Special Provision (NSSP) shall be included in the contract documents that addresses the installation of the soldier piles under these conditions. The NSSP can read as follows.

"The native subsoil at the site is a cohesionless heterogeneous mixture of silt, sand and gravel with random seams/layers of silty sand. The groundwater table ranges from 0.5 m to 4.3 m below the ground surface and consequently, this deposit is submerged below the groundwater in most locations. The soil, is therefore, susceptible to conditions of unbalanced hydrostatic head and seepage forces that can develop into "boiling" and unstable conditions. The contractor shall maintain the stability of the shaft and base of the augered hole at all times from commencement to complete installation of soldier piles".

In addition, the Contractor shall be informed that boulders and cobbles are present within the glacial till deposit, and hence should be adequately prepared to deal with these materials during the shoring installation.

Dewatering

The elevation of the groundwater table varies in relation to the proposed pipe invert across the site. At the time of the investigation, the groundwater level was generally at or within a metre above or below the proposed pipe invert in Area 1. In Area 2, the groundwater level was at or below the proposed pipe invert. In Area 3, the pipe invert was below the groundwater level in depths ranging from approximately 0.5 m to 1.5 m. In Area 4, the groundwater table is generally at or below the proposed storm invert elevation.

Where groundwater is encountered above the invert of the trench excavation, dewatering measures will be required. A nonstandard Special Provision (NSSP) should be included in the contract documents that addresses the fact that a dewatering scheme will be required to facilitate the excavation of the cohesionless materials submerged below the prevailing groundwater table. The NSSP can be written as such.

"The storm sewer bedding and backfilling shall be placed in the dry. At the site, the trench invert may be situated below the prevailing groundwater table and in view of the cohesionless nature of the subsoil, the soil is susceptible to conditions of unbalanced hydrostatic head at the base of the excavation and soil sloughing on the sides of the excavation. Hence it is the responsibility of the Contractor to render the excavation stable throughout the construction of the storm sewer pipe by adopting an appropriate dewatering procedure to enable the proper placement of the pipe".

If you have any queries regarding the above text or require any additional information, please do not hesitate to contact this office.



T. Sangiuliano, P.Eng.  
Foundation Engineer

for

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

TS/ms

c.c.: V. Boehnke, Head, Structural Section, Central Region  
Attn: A. Shamji  
K. Bassi, Structural Office  
J. Cullen, Manager, Construction Office  
G. Green, Estimating Office  
G. Cautillo, Head, Geotechnical Section, Central Region

*APPENDIX*

TABLE 1: SUMMARY OF SUBSOIL CONDITIONS &amp; RECOMMENDATIONS

| AREA | SOIL DESCRIPTION   | BH # | ELEVATION | STATION  | PIPE SIZE | DEPTH BELOW SHOULDER | INVERT ELEVATION | GROUND WATER ELEVATION | Q OF SEWER OFFSET > EDGE W. SHOULDER | ANTICIPATED SIDE SLOPE H : V* | SEGMENT LENGTH | DE-WATERING RECOMMENDATION | CONSTRUCTION METHOD RECOMMENDED | REMARKS |
|------|--|------|-----------|----------|-----------|----------------------|------------------|------------------------|--------------------------------------|-------------------------------|----------------|----------------------------|---------------------------------|---------|
| 1    | SILTY SAND TO SAND TO GRAVELLY SAND<br>(compact to very dense) | 1    | 138.7     | 20 + 775 | 525       | 2.5                  | 136.2            | 134.4                  | 2.0                                  | 1 : 1.9                       |                |                            | TRENCH BOX IN SHORT SECTIONS    |         |
|      |  | 2    | 138.7     | 20 + 800 | 525       | 2.9                  | 135.8            | 133.9                  | 1.0                                  | 1 : 7.0                       |                |                            |                                 |         |
|      |  | 3    | 137.2     | 20 + 850 | 600       | 3.2                  | 135.0            | 134.0                  | 0.1                                  | V cut into exist. shoulder    |                |                            |                                 |         |
|      |  | 4    | 137.6     | 20 + 900 | 600       | 3.1                  | 134.5            | 133.8                  | 1.5                                  | 1 : 3.6                       |                |                            |                                 |         |
|      |  | 5    | 137.3     | 20 + 950 | 600       | 3.3                  | 134.0            | 133.5                  | 0.75                                 | Vertical cut                  |                |                            |                                 |         |
|      |  | 6    | 136.7     | 21 + 000 | 600       | 3.0                  | 133.7            | 133.5                  | 0.0                                  | Vertical cut                  |                |                            |                                 |         |
|      |  | 7    | 136.4     | 21 + 050 | 600       | 3.2                  | 133.2            | 133.4                  | 1.4                                  | 1 : 4.2                       |                |                            |                                 |         |
|      |  | 8    | 135.1     | 21 + 100 | 600       | 3.0                  | 132.7            | 132.7                  | 1.6                                  | 1 : 3.2                       |                |                            |                                 |         |
|      |  | 9    | 135.3     | 21 + 150 | 600       | 3.1                  | 132.2            | 133.0                  | 1.0                                  | 1 : 8.2                       | ~ 75m          |                            |                                 |         |
|      |  | 10   | 135.0     | 21 + 200 | 300       | 3.3                  | 131.7            | 132.7                  | 1.6                                  | 1 : 3.0                       |                |                            |                                 |         |
| 2    | SILTY SAND TO SAND TO SAND & GRAVEL<br>(compact to very dense) | 11   | 133.5     | 21 + 350 | 375       | 1.8                  | 131.7            | 130.5                  | 2.3                                  | 1 : 1.1                       |                |                            | TRENCH BOX IN SHORT SECTIONS    |         |
|      |  | 12   | 133.2     | 21 + 400 | 375       | 1.8                  | 131.4            | 130.0                  | 1.4                                  | 1 : 2.2                       |                |                            |                                 |         |
|      |  | 13   | 132.0     | 21 + 450 | 375       | 1.7                  | 131.1            | 129.3                  | 0.5                                  | Vertical cut                  |                |                            |                                 |         |
|      |  | 14   | 132.5     | 21 + 500 | 450       | 1.8                  | 130.7            | 129.1                  | 0.5                                  | Vertical                      |                |                            |                                 |         |
|      |  | 15   | 132.2     | 21 + 550 | 450       | 1.8                  | 130.4            | 130.3                  | 0.0                                  | Vertical                      |                |                            |                                 |         |
|      |  | 16   | 131.9     | 21 + 600 | 450       | 1.7                  | 130.2            | 128.6                  | 0.0                                  | Vertical                      |                |                            |                                 |         |
|      |  | 17   | 130.9     | 21 + 650 | 450       | 1.7                  | 129.9            | 128.5                  | 0.5                                  | Vertical                      |                |                            |                                 |         |
|      |  | 18   | 131.3     | 21 + 700 | 450       | 1.7                  | 129.6            | 128.0                  | 1.8                                  | 1 : 1.5                       |                |                            |                                 |         |
|      |  | 19   | 131.3     | 21 + 725 | 450       | 1.9                  | 129.4            | 128.4                  | 2.0                                  | 1 : 1.4                       |                |                            |                                 |         |
|      |  |      |           |          |           |                      |                  |                        |                                      |                               |                |                            |                                 |         |
|      |  |      |           |          |           |                      |                  |                        |                                      |                               |                |                            |                                 |         |
|      |  |      |           |          |           |                      |                  |                        |                                      |                               |                |                            |                                 |         |
|      |  |      |           |          |           |                      |                  |                        |                                      |                               |                |                            |                                 |         |

\*From North edge or westbound paved shoulder.

TABLE 1: SUMMARY OF SUBSOIL CONDITIONS &amp; RECOMMENDATIONS

| AREA | SOIL DESCRIPTION   | BH #     | ELEVATION | STATION  | PIPE SIZE (mm) | DEPTH BELOW SHOULDER | INVERT ELEVATION | GROUND WATER ELEVATION | C OF SEWER** OFFSET > EDGE W. SHOULDER | ANTICIPATED SIDE SLOPE H : V * | SEGMENT LENGTH | DE-WATERING RECOMMENDATION  | CONSTRUCTION METHOD RECOMMENDED          | REMARKS                                  |                       |
|------|--|----------|-----------|----------|----------------|----------------------|------------------|------------------------|--|--------------------------------|----------------|---|--|--|-----------------------|
| 3    | Granular Fill/<br>Organic stained clayey sandy silt<br>Het.mixt.of silt, sand gravel, clay with sand seams | 20       | 125.3     | 22 + 750 | 1350           | 4.1                  | 121.2            | 123.4                  | 5.2                                    | 1 : 1.1                        | ~ 60m          | Ground water seeping from bottom of fill or from sand seams/layers.<br>(Dewatering Scheme Required) | OPEN CUT TO TRENCH BOX IN SHORT SECTIONS |  |                       |
|      |  | 21       | 124.6     | 22 + 800 | 1350           | 3.5                  | 121.1            | 122.7                  | 4.0                                    | 1 : 1.3                        |                |   |  |  |                       |
|      |  | 22       | 123.2     | 22 + 850 | 1350           | 3.1                  | 121.0            | 121.4                  | 2.8                                    | 1 : 2.1                        |                |   |  |  |                       |
|      |  | 23       | 124.0     | 22 + 900 | 975            | 3.1                  | 120.9            | 123.9                  | 2.5                                    | 1 : 2.2                        |                |   |  |  |                       |
|      |  | 24       | 123.5     | 22 + 950 | 150            | 3.0                  | 120.5            | 121.6                  | 1.0                                    |                                |                |   |  |  |                       |
|      | Granular Fill Overlying<br>Het. mixture of silt, sand, gravel, clay (till) with wet sand seams/ layers     | 25       | 122.3     | 23 + 000 | 975            | 3.0                  | 120.2            | 120.8                  | 2.0                                    | 1 : 3.2                        |                |   |  |  |                       |
|      |  | 26       | 123.0     | 23 + 050 | 975            | 3.0                  | 120.0            | 121.2                  | 2.5                                    | 1 : 2.2                        |                |   |  |  |                       |
|      |  | 27       | 123.0     | 23 + 100 | 975            | 3.2                  | 119.8            | 122.1                  | 3.5                                    | 1 : 1.4                        |                |   |  |  |                       |
|      |  | 28       | 122.7     | 23 + 150 | 825            | 3.1                  | 119.6            | 122.4                  | 3.7                                    | 1 : 1                          |                |   |  |  |                       |
|      |  | 29       | 122.5     | 23 + 200 | 825            | 3.2                  | 119.3            | 122.0                  | 3.3                                    | 1 : 1.3                        |                |   |  |  |                       |
|      |  | 30       | 122.4     | 23 + 250 | 825            | 3.3                  | 119.1            | 121.0                  | 3.5                                    | 1 : 1.3                        |                |   |  |  |                       |
|      |  | 31       | 121.6     | 23 + 300 | 825            | 3.3                  | 118.9            | 119.2                  | 4.3                                    | 1 : 1                          |                |   |  |  |                       |
|      |  | 32       | 122.2     | 23 + 350 | 825            | 3.6                  | 118.6            | 121.7                  | 2.6                                    | 1 : 2.0                        |                |   |  |  |                       |
|      |  | 33       | 122.1     | 23 + 400 | 825            | 3.9                  | 118.2            | 121.3                  | 2.2                                    | 1 : 2.8                        |                |   |  |  |                       |
|      |  | 34       | 121.9     | 23 + 450 | 825            | 4.0                  | 117.9            | 118.1                  | 1.0                                    | Vertical                       |                |   |  |  |                       |
| 35   | 121.8  | 23 + 500 | 150       | -        | -              | 120.1                | -0.7             |                        |  |                                |                |   |  |  |                       |
| 4    | Sandy Silt Fill Overlying<br>Het.mixture of silt, sand, gravel, clay (till) with wet sand seams            | 36       | 121.8     | 23 + 600 | 375            | 0.8                  | 121.0            | 121.1                  | -0.3                                   | CUT AREA                       | ~ 200m         |   | TRENCH BOX IN SHORT SECTION              | SHORING SOLDIER PILE WITH TIMBER LAGGING | USE $\phi = 30^\circ$ |
|      |  | 37       | 121.3     | 23 + 650 | 375            | 2.2                  | 119.9            | dry to 118.1           | -0.5                                   |                                |                |   |  |  |                       |
|      |  | 38       | 122.4     | 23 + 700 | 375            | 3.0                  | 119.4            | 118.1                  | -0.7                                   | VERTICAL SHOULDER              |                |   |  |  |                       |
|      |  | 39       | 122.5     | 23 + 750 | 375            | 2.0                  | 120.5            | 120.6                  | -1.5                                   |                                |                |   |  |  |                       |
|      |  | 40       | 121.8     | 23 + 800 | 300            | 1.7                  | 121.0            | dry to 118.9           | -2.0                                   | (WITHIN SHOULDER)              |                |   |  |  |                       |
|      |  | 41       | 122.4     | 23 + 850 | 300            | 1.5                  | 121.2            | dry                    | -2.5                                   |                                |                |   |  |  |                       |

\*\*Minus sign indicates offset towards the road (on south side of W. shoulder edge).

\*From North edge of Westbound paved shoulder.

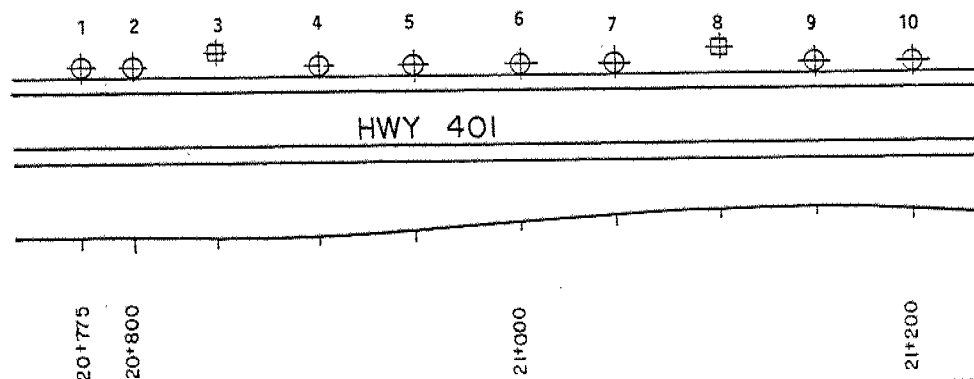
# LEGEND

⊕ Bore Hole

⊞ Test Pit

AREA I

STA 20+775 to STA 21+200



NOTE: For subsoil information, refer to  
Record of Borehole Sheets.

| BH No | STATION  | ELEVATION |
|-------|----------|-----------|
| 1     | 20 + 775 | 138.7     |
| 2     | 20 + 800 | 138.7     |
| 3     | 20 + 850 | 137.2     |
| 4     | 20 + 900 | 137.6     |
| 5     | 20 + 950 | 137.3     |
| 6     | 21 + 000 | 136.7     |
| 7     | 21 + 050 | 136.4     |
| 8     | 21 + 100 | 135.1     |
| 9     | 21 + 150 | 135.3     |
| 10    | 21 + 200 | 135.0     |



## BOREHOLE LOCATION PLAN

|              |                   |                  |
|--------------|-------------------|------------------|
| Scale<br>NTS | Date<br>MARCH '91 | Drawing No.<br>1 |
|--------------|-------------------|------------------|




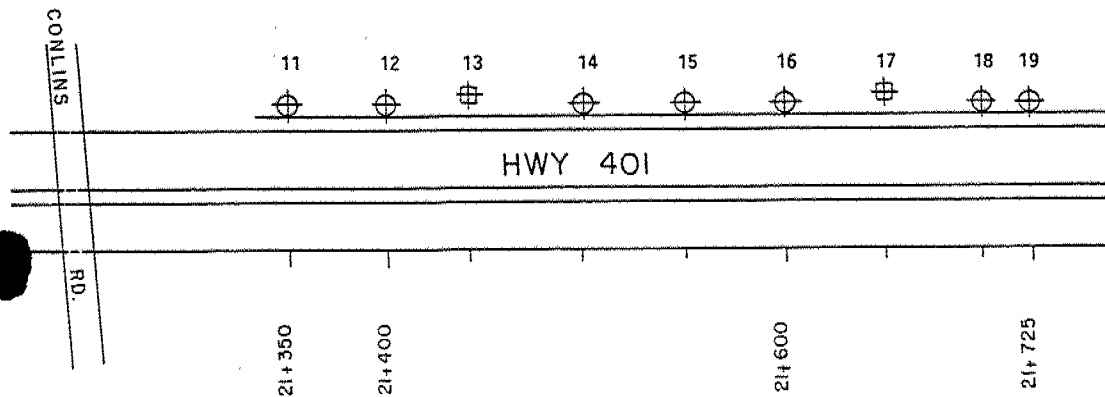
AREA 2

STA 21+350 to 21+725

# LEGEND

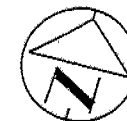
 Bore Hole

 Test Pit



NOTE: For subsoil information, refer to  
Record of Borehole Sheets.

| BH No | STATION  | ELEVATION |
|-------|----------|-----------|
| 11    | 21 + 350 | 133.5     |
| 12    | 21 + 400 | 133.2     |
| 13    | 21 + 450 | 132.0     |
| 14    | 21 + 500 | 132.5     |
| 15    | 21 + 550 | 132.3     |
| 16    | 21 + 600 | 131.9     |
| 17    | 21 + 650 | 130.9     |
| 18    | 21 + 700 | 131.3     |
| 19    | 21 + 725 | 131.3     |



## BOREHOLE LOCATION PLAN

Scale NTS Date MARCH '91 Drawing No. 2

AREA 3

STA 22 + 750 to STA 23 + 500

LEGEND

20

21

22

23

24

25

26

27

28

29

30

31

32

33

34

35

⊕ Bore Hole

⊕ Test Pit

HWY 401

MEADOWDALE RD.

22 + 750

22 + 800

23 + 000

23 + 200

23 + 400

23 + 500

| BH No | STATION  | ELEVATION |
|-------|----------|-----------|
| 20    | 22 + 750 | 125.3     |
| 21    | 22 + 800 | 124.6     |
| 22    | 22 + 850 | 123.2     |
| 23    | 22 + 900 | 124.0     |
| 24    | 22 + 950 | 123.5     |
| 25    | 23 + 000 | 122.3     |
| 26    | 23 + 050 | 123.0     |
| 27    | 23 + 100 | 123.0     |
| 28    | 23 + 150 | 122.7     |
| 29    | 23 + 200 | 122.5     |
| 30    | 23 + 250 | 122.4     |
| 31    | 23 + 300 | 121.6     |
| 32    | 23 + 350 | 122.2     |
| 33    | 23 + 400 | 122.1     |
| 34    | 23 + 450 | 121.9     |
| 35    | 23 + 500 | 121.8     |

NOTE: For subsoil information, refer to  
Record of Borehole Sheets.



BOREHOLE LOCATION PLAN

Scale NTS


Date  
MARCH '91


Drawing No. 3

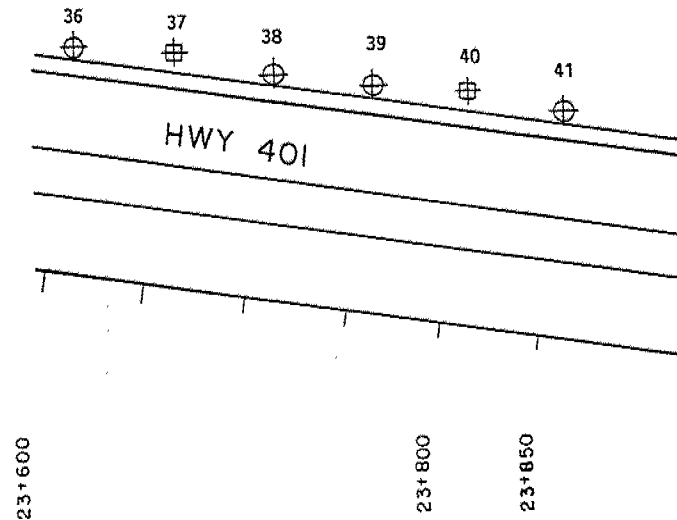
AREA 4

STA 23 + 600 to STA 23 + 850

# LEGEND

 Bore Hole

 Test Pit



| BH No | STATION  | ELEVATION |
|-------|----------|-----------|
| 36    | 23 + 600 | 121.8     |
| 37    | 23 + 650 | 121.3     |
| 38    | 23 + 700 | 122.4     |
| 39    | 23 + 750 | 122.5     |
| 40    | 23 + 800 | 121.8     |
| 41    | 23 + 850 | 122.4     |

NOTE: For subsoil information, refer to  
Record of Borehole Sheets.

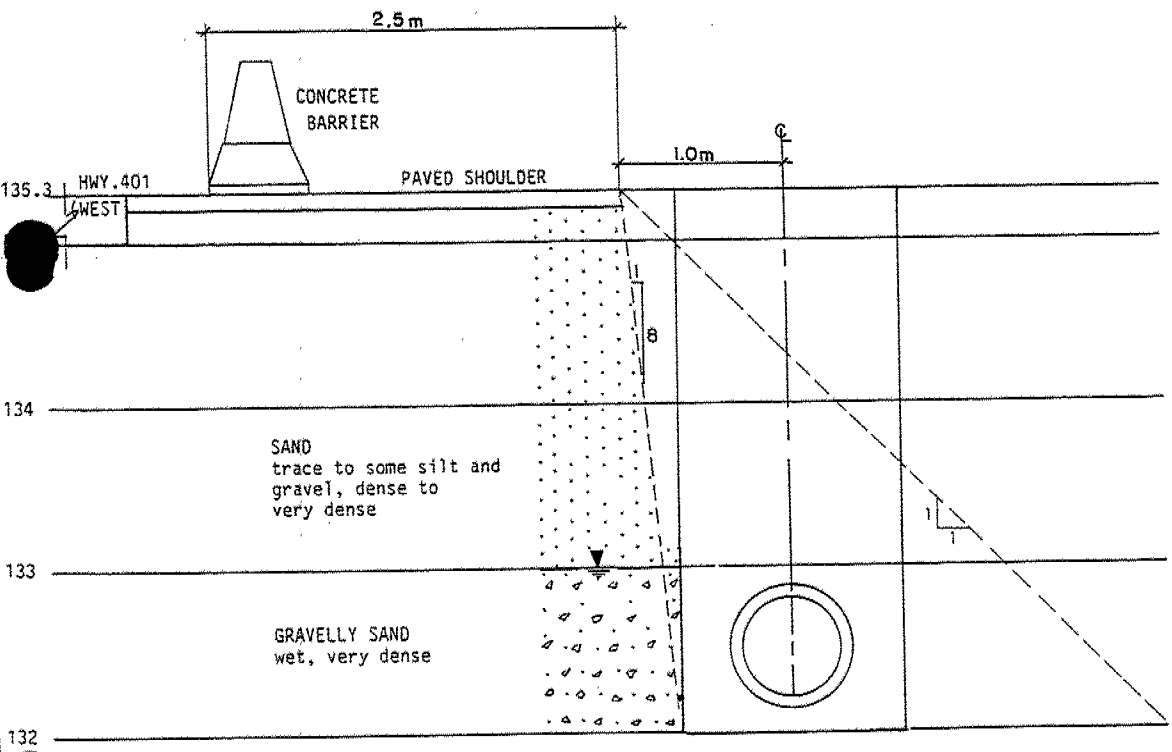
## BOREHOLE LOCATION PLAN

Scale NTS

Date  
MARCH '91

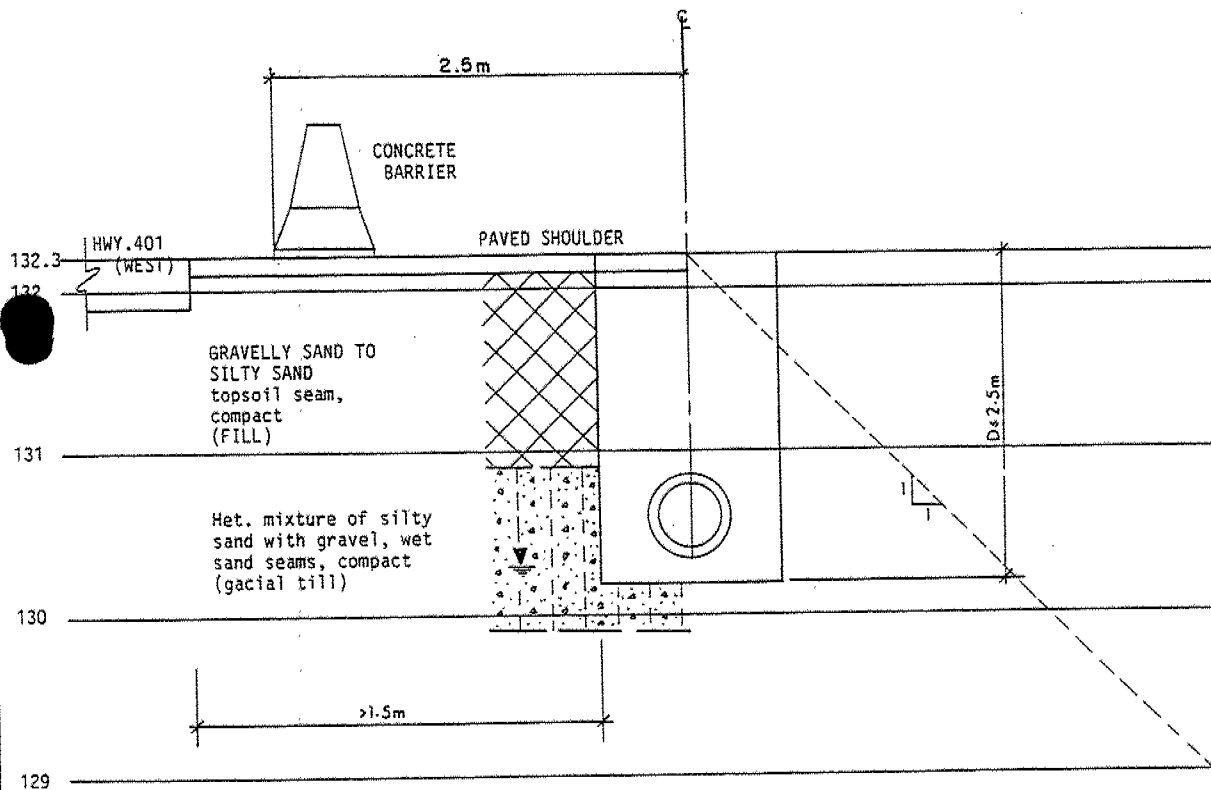
Drawing No. 4





CROSS SECTION, STATION 21 + 150 (TRENCH BOX)

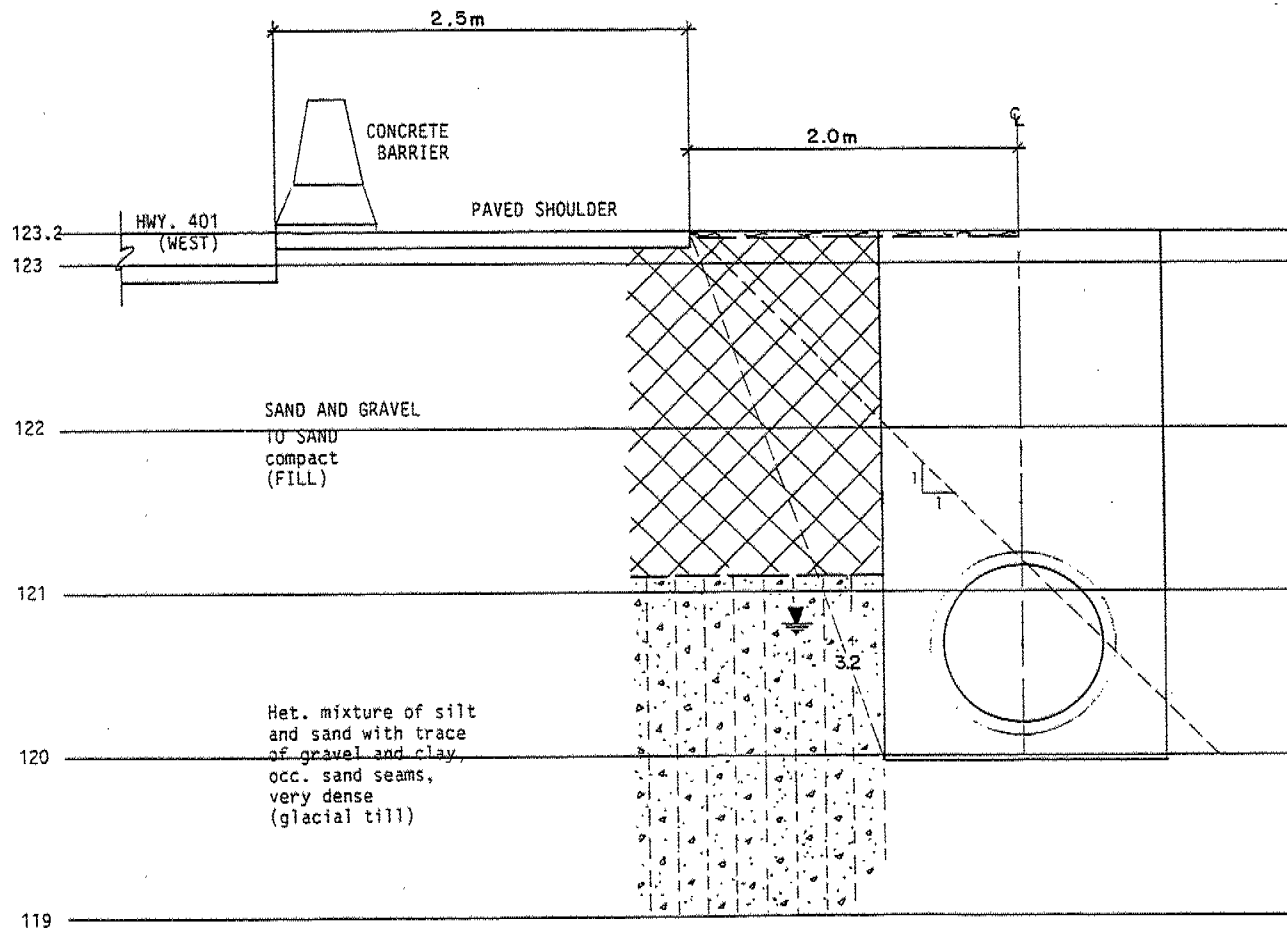
|                        |         |             |
|------------------------|---------|-------------|
| AREA 1 - CROSS SECTION |         |             |
| Scale                  | Date    | Drawing No. |
| 1:30                   | 03/1991 | 5           |



CROSS SECTION, STATION 21 + 550 (TRENCH BOX)

AREA 2 - CROSS SECTION

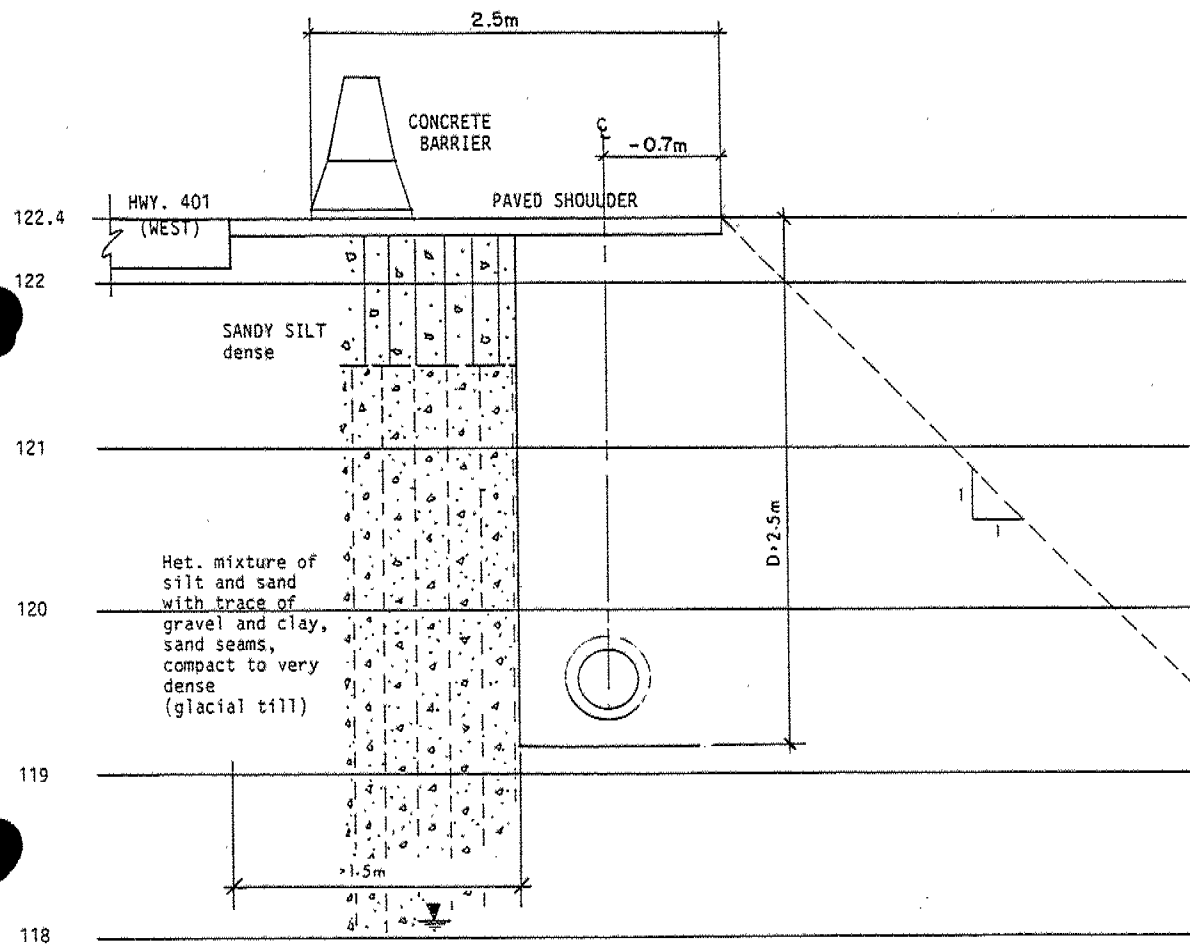
|       |         |             |
|-------|---------|-------------|
| Scale | Date    | Drawing No. |
| 1:30  | 03/1991 | 6           |



CROSS SECTION, STATION 23 + 006 (TRENCH BOX)

AREA 3 - CROSS SECTION

| Scale | Date    | Drawing No. |
|-------|---------|-------------|
| 1:30  | 03/1991 | 7           |



CROSS SECTION, STATION 23 + 700 (SOLDIER PILE LAGGING)

AREA 4 - CROSS SECTION

| Scale | Date    | Drawing No. |
|-------|---------|-------------|
| 1:30  | 03/1991 | 8           |

## MEMORANDUM

To: P. Chackeris  
Sr. Project Manager  
Planning and Design Section  
Central Region

Date: 91 02 13

From: Foundation Design Section  
Room 315, Central Building

Re: Roadway Protection  
Contract 91-28  
W.P. 264-87-00  
Hwy. 401 WB Collectors Neilson Rd. To Meadowvale Rd.

---

Further to your memo dated Jan.31/91, following are tentative recommendations for road protection for the above-noted project. As you are aware, the foundation investigation for this project has been initiated and the results of that investigation will be used to verify, or change, the tentative recommendations as required.

- Where inverts of excavations are within a 2H:1V plane, but outside a 1H:1V plane, defined by the crest of the Hwy. 401 embankment, construction can proceed with a concurrent excavation/backfill operation. Excavations should not exceed 5 m in length prior to complete backfilling, and no excavation should be left open for more than 8 hours.

- Where inverts of excavations are within a 1H:1V plane, defined by a reference 1 m outside the traffic barrier (that is, between the traffic barrier and the crest of Hwy. 401), shoring will be required. A shoring scheme should be included in the contract with provisions for consideration of alternatives proposed by the Contractor. The shoring could consist of sheet pile or soldier piles/lagging walls depending on the location of the water table and the dewatering scheme.

- Where groundwater is encountered above the invert of excavations, a dewatering scheme will be required. A dewatering SP should require that the groundwater be lowered below the invert of excavations prior to excavating. Since it is anticipated that much of the soil at this site will be noncohesive, the Contractor should be cautioned through the SP that noncohesive soils are susceptible to disturbance under conditions of unbalanced hydrostatic head. It is anticipated that sheet piling could be used to permit dewatering without disturbing the soil. In this case, the sheet piles should extend a minimum depth below excavations, equal to the hydrostatic head above the invert of excavations, prior to dewatering.



- Sheet piles should be designed to fulfil earth retaining functions assuming the following parameters:

angle of internal friction = 30 degrees

unit weight = 21 kN/m<sup>3</sup>

position of the groundwater table is half way between excavation invert and ground surface

If there are any questions, please call.

A handwritten signature in cursive script, appearing to read 'D. Dundas'.

D. Dundas, P.Eng.  
Sr. Foundation Engineer

## MEMORANDUM

To: G. Cautillo  
Head  
Geotechnical Section  
  
Attention: K Hadipour

From: Foundation Design Section  
Room 315, Central Building

Re: Storm Sewers  
Neilson Road to Meadowvale Road  
WP 264-87-00, Site N/A  
Hwy. 401, District 6, Toronto

---

Date: 90 08 29

Further to your memo of Aug. 23/90, we have reviewed the implications of high water table on the proposed sewers between Neilson Road and Meadowvale Road.

As agreed in our previous discussions, our comments are based on existing subsurface information from Geotechnical Section boreholes. The comments are intended as general guidelines rather than site-specific recommendations, which would have required foundation investigations.

From our review of the boreholes and the sewer/catch basin proposal, it is our understanding that the soil is generally non-cohesive, and at some locations excavations will be required to extend as much as 3 m below the water table. Also, there are occasional bouldery zones.

We recommend that the contractor should be advised of these conditions through SP's in the contract documents.

- The non-cohesive soil at this site is susceptible to disturbance under conditions of unbalanced hydrostatic head. Where the prevailing groundwater elevation is above excavations in non-cohesive soil, a dewatering scheme will be required. In order to permit construction of the sewer and catch basins in the dry, the dewatering scheme should lower the groundwater below any excavations, and construction should proceed without disturbing the foundation soils. The dewatering scheme will be the responsibility of the contractor but will probably consist of either sheet pile cofferdams (driven roughly to a depth below the excavation equal to the head of water) or well points. In any case the contractor should submit a proposal, signed and sealed by an engineer registered with the APEO, for review.

- The overburden at the site contains occasional bouldery zones. An alternative excavation/dewatering method may be required if boulders are encountered. The contractor should prepare a proposal in the event that this situation should arise and submit it for review.
- It is the responsibility of the contractor to ensure the safety and integrity of the roadway during construction of the sewer/catch basins. This will probably require a shoring system which the contractor should arrange to be designed, stamped and sealed, by an engineer registered with the APEO, and then submitted for review.

If there are any questions, please advise.

A handwritten signature in dark ink, appearing to read 'D. Dundas', with a stylized, cursive script.

D. Dundas, P. Eng.  
Sr. Foundation Engineer

# M E M O R A N D U M

GEOTECHNICAL SECTION, CENTRAL REGION

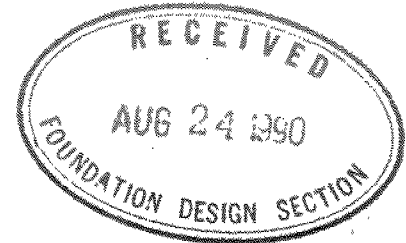
TELEPHONE: 235-5438

To: M. Devata  
Chief Foundation Engineer  
Foundation Design Section  
3rd Floor, Central Building

DATE: 90 08 23

Attention: D. Dundas

Re: Highway 401 Westbound Collectors  
Neilson Road to Meadowvale Road  
Storm Sewers  
W.P. 264-87-00



A geotechnical investigation was carried out to evaluate the soils condition at the storm sewers location for the above noted project. It was found that at few significant areas the storm sewers are well below the water table.

It has been brought to our attention by the consultant that by raising the storm sewers and by increasing the pipe sizes, it could be that the sewers may still be below water table but to a lesser extent.

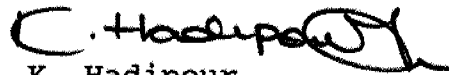
Could you please review the implications of high water table on the sewers and advise us with your recommendations.

A copy of the borehole data taken at each catchbasin location, a set of plans indicating the location and depth of storm sewers and the water table level are enclosed for your information.

Your prompt reply is greatly appreciated in order to avoid any construction delay.

Should you have any questions regarding the above matter, please contact the undersigned.

KH/GC/fd  
encl.

  
K. Hadipour  
Soils Unit Supervisor  
for:  
G. Cautillo  
Head, Geotechnical Section

cc: D. Smith (DELCAN)  
N. Sen

Disk File: c:\wp-docs\workprj\1987\264.87-00.wb

DOCUMENT MICROFILMING IDENTIFICATION

G.I.-30 SEPT. 1976

GEOCRES No. 30M14-212

DIST. 6 REGION                     

W.P. No. 264-87-00(B)

CONT. No.                     

W. O. No.                     

STR. SITE No.                     

HWY. No. 401

LOCATION Detention Ponds

Neilson Rd. to Meadowvale Rd.

No of PAGES - WB Collectors

=====

OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT.                     

REMARKS:

# MEMORANDUM

To: G. Cautillo  
Head  
Geotechnical Section  
  
Attention: K Hadipour

From: Foundation Design Section  
Room 315, Central Building

Re: Detention Ponds  
Meadowvale Road Interchange  
WP 264-87-00, Site N/A  
Hwy. 401, District 6, Toronto

---

Date: 90 08 29

Further to your memo of Aug. 24/90, we have reviewed the slope stability of the proposed detention ponds at the Meadowvale Road Interchange.

As agreed in our previous discussions, no foundation investigation was carried out and our comments are based on existing subsurface information from the Geotechnical boreholes and from the Foundation Report for the Meadowvale Road Underpass.

We have reviewed the geometry of the proposed detention ponds and it is our understanding that the highest embankment will be approximately 7 m at Ramp S-W. Also the bottoms of all the detention ponds are above elev. 120 m. We have also assumed that the embankments will not be constructed of silt and therefore instabilities triggered by rapid drawdown of water levels in the ponds will not occur. Based on these assumptions we anticipate no stability problems for 2H:1V slopes up to 8 m high provided that vegetation is established. If the embankments are constructed of materials containing a high proportion of silt, consideration should be given to blanketing the slopes, up to the HWL, with 0.6 m of free-draining granular material.

If there are any questions, please advise.



D. Dundas, P. Eng.  
Sr. Foundation Engineer

DD/mmj