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DIST. 6 REGION

W.P. No.

CONT. No.

W. O. No. 77-11001

STR. SITE No.

HWY. No.

LOCATION EGLINTON
GO STATION SCAR.

No of PAGES -

OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT.

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# foundation investigation and design report

# ENGINEERING MATERIALS OFFICE
## SOIL MECHANICS SECTION

WO 77-11001 DIST 6

HWY STR SITE

Eglinton GO Station
Scarborough

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GEOCRES 30M 11-175

DATE JUN 30 1977

# FOUNDATION INVESTIGATION REPORT
For
Eglinton GO Station
Scarborough
W.O. 77-11001, District 6, Toronto

## INTRODUCTION

The Toronto Area Transit Operating Authority (TATOA) proposed to construct a canopy shelter at the Eglinton GO Station, Scarborough. The Soil Mechanics Section was requested to conduct a foundation investigation and to provide recommendations for the proposed project. A field investigation was, therefore, carried out by this Section to determine the subsoil and goundwater conditions at the site. This report contains the results of the investigation, together with the recommendations pertaining to the design and construction of the foundations of the proposed canopy shelter.

## SITE DESCRIPTION AND GEOLOGY

The Eglintion GO Station is located just west of the CNR overhead at Eglinton Avenue East in Scarborough. At this location, three tracks are located on an embankment one to five feet above the surrounding ground. A parking lot is presently located on the south side of the tracks and a ticket booth is situated on the north side of the tracks. The passenger platforms on either side of the tracks are asphalt covered and are connected by a pedestrian tunnel underneath the tracks.

The canopy shelter is to be incorporated as part of a new station complex to be constructed at the station. Excavation for the complex was already in progress at the time of our field investigation.

Geologically, the site is located in the Iroquois Sand Plain. This plain is covered with sand deposited by Lake Iroquois in the late Wisconsinan period. The sand overlies pleistocene deposits of till, varved clay and interglacial sands of various ages.

## FIELD AND LABORATORY WORK

The fieldwork was carried out during the period of May 12-13, 1977. It consisted of four sampled boreholes advanced by wash-boring techniques with the use of BX casing. The overburden was investigated to depths ranging from 16 to 25 feet below the ground surface. Locations and elevations of the boreholes were determined by personnel from this Section and are shown in Dwg. No. 7711001-A.

All samples were visually examined and identified. In addition, laboratory tests were done to determine the following properties:

Atterberg Limits
Natural Moisture Content
Grain Size Distribution

The results of the laboratory tests are presented in the Record of Borehole sheets.

## SUBSURFACE CONDITIONS

### General

As mentioned previously, the CNR tracks and platforms were constructed on an embankment. At the location of the proposed canopy shelter, subsoil consists of 9 to 13 feet of fill followed by parent glacial till. A description of the subsoil types is given in the following paragraphs.

### Fill Material

Fill was placed to construct the embankment. In the area investigated, a 1 ft. thick asphaltic layer (old roadbed) was intercepted some 5 to 7 feet below the existing surface. The fill material encountered above the old roadbed (upper layer) differs somewhat from the fill material underlying the old roadbed (lower layer) in composition, and the degree of compaction.

The upper fill material has a thickness of about 5 to 7 feet, and appears to have been subsequently placed on the old asphaltic roadbed to support the railway tracks. This upper fill material is composed of silty sand with gravel, and a trace of clay. Based on its grain size composition, this fill material may be classified as well graded. Standard Penetration Tests gave typical 'N' values ranging from 9 blows per foot to 24 blows per foot. It is inferred from this that this material was moderately compacted,but occasionally in localized zones poorly compacted.

The lower fill material has a thickness of about 3 to 7 feet. It is composed mainly of silty fine sand, with some clay and a trace of gravel. Typical 'N' values of the lower fill material vary from 4 blows per foot to 18 blows per foot, typically about 7 or 8 blows per foot. It is inferred from this that this lower fill material was poorly compacted. In one isolated location a pocket of silty clay is sandwiched between the till material and the glacial till stratum.

### Glacial Till (Heterogeneous Mixture of Silt, Sand and a Trace of Gravel and Clay)

Underlying the above mentioned fill material is a glacial deposit which is composed of a heterogeneous mixture of silt, sand, and a trace of gravel and clay. Typical natural moisture content is approximately 10%. Typical 'N' values vary from 30 blows per foot to 90 blows per foot, indicating that the relative density of this material is dense to very dense, being generally very dense.

### Groundwater Conditions

Groundwater level observations were made in the open boreholes shortly after the completion of the boreholes. The results indicated that the groundwater level existed at elevations between 525 feet and 529 feet, corresponding to 7 to 11 feet below the platform surface.

Because the underlying glacial till is relatively impervious compared to the sandy fill material, perched water conditions in the embankment can be anticipated after a period of rainfall.

## DISCUSSION AND RECOMMENDATIONS

The canopy shelter is proposed to be constructed on the westbound platform, supported on 30 inch diameter concrete filled augered caissons. These caissons, as understood, will be subjected to horizontal forces caused by wind loads and a vertical load imposed by the dead weight of the canopy, as well as an uplift force due to wind blast. Our recommendations pertaining to the design and construction of these caissons are given in the following paragraphs. These recommendations are made based on the assumption that the caissons will be entirely embedded in the embankment fill. Precautions to prevent cave-in and "boiling" of material during construction will be discussed in the section which follows the design recommendations.

### Vertical Bearing Capacity

The allowable bearing capacity of the caissons founded in the fill material for vertical loads can be estimated from

$$Q_{safe} = \left(\frac{\pi D^2}{4} p_s + \frac{K\pi D L^2}{2} \gamma \tan \delta\right) \times \frac{1}{F} + \gamma L$$

where $p_s$ = 2 tsf (end bearing capacity)

$K$ = 0.5 (earth pressure coefficient)

$\gamma$ = 115 pcf (soil bulk unit weight)

$\delta$ = 28° (angle of friction on the shaft)

$D$ = 30 inches (caisson diameter)

$F$ = 2.0 (factor of safety)

$L$ = embedded length in feet

By substituting the above parameters into the equation, the relationship between the safe vertical load $Q_{safe}$ and the embedded length L can be expressed as

$$Q_{safe} \text{ (tons)} = 4.91 + 0.0\ 75L + 0.0359L^2$$

### Resistance Against Lateral Load and Overturning Moment

The caissons can be designed to withstand the lateral load and the overturning moment by using either the modulus of subgrade reaction in the horizontal direction ($K_h$) or the passive resistance of the soil.

In the approach using the modulus of subgrade reaction, the deflection $\Delta$ of the caisson at the ground surface and the angle of rotation $\theta$ of the caisson due to a horizontal load and an overturning moment can be evaluated from

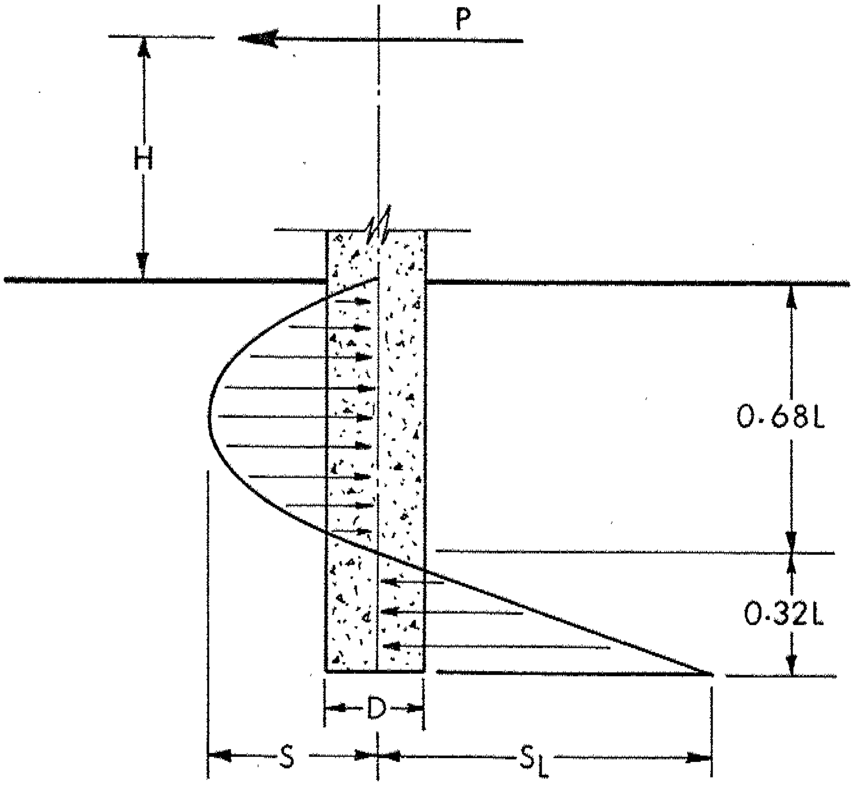
$$\Delta \text{ (in)} = \frac{24}{K_h D L^2} (2PL + 3M)$$

(P in tons
M in ton-ft
D and L in ft)

$$\theta \text{ (rad)} = \tan^{-1}\left[\frac{2}{K_h D L^2} \left(3P + \frac{6M}{L}\right)\right]$$

In the present case, a $K_h = 25 \text{ tons}/_{ft^2}/ft$ is recommended for design.

Alternatively, the caisson can be designed according to the passive resistance of the soil mass. If this approach is adopted, the distribution of the lateral pressure on the caisson, following Prof. Rutledge, can be assumed as shown below



The depth of the embedment L, from equilibrium requirements is given by the following equation

$$L = \frac{1.18P}{DS_1} + \sqrt{\left(\frac{1.18P}{DS_1}\right)^2 + \frac{PH \times 2.63}{DS_1}}$$

where $S_1 = \frac{2}{3} S.$

The induced stresses, S and $S_L$ should not exceed the allowable passive resistance given by Rankin's theory; that is

$$S \leq \frac{0.34\gamma L N_{\phi}}{2000F} \qquad (\text{tons/ft}^2)$$

at a depth of 0.34L, and

$$S_L \leq \frac{\gamma L N_{\phi}}{2000F} \qquad (\text{tons/ft}^2)$$

at a depth equal to L. In the above two equations, we suggest that the following values should be used.

factor of safety $F = 2.0$

soil bulk unit weight $\gamma = 115$ pcf

bearing capacity factor $N_{\phi} = \tan^2 (45^\circ + \frac{\phi}{2})$

$= 2.77$ (For $\phi$ equal to 28°)

This design will result in a deflection at the ground surface less than ½".

## Uplift Resistance

The allowable resistance to uplift force can be estimated from

$$Q \text{ (tons)} = 0.368L + 0.02\,L^2 \qquad (L \text{ in feet})$$

The first term in the above equation is the dead weight of the 30 inch diameter concrete caissons, and the second term is the allowable contribution from shaft friction.

## Construction Considerations

Because of the presence of groundwater in the granular fill, a temporary liner to prevent cave-ins will be required for the installation of the caissons. Unwatering by pumping water from the caissons is not advisable as this will result in an unbalanced hydrostatic head, thereby causing the sandy fill material to 'boil'. To place concrete under water, it may be necessary to use the method of tremie concrete. To ensure that any voids formed due to augering can be filled with concrete, it is suggested the concrete be placed to the cut-off elevation prior to removal of the liner and the concrete be vibrated while the liner is being withdrawn. It is also suggested in this regard that a 5 to 7 inch slump concrete should be used.

## Alternative Design Considerations

If the use of tremie concrete is uneconomical, as an alternative it may be necessary to extend the caissons into the very dense glacial till stratum for a distance of at least 2 feet, so that any inflow of water into the caissons and 'boiling' of material can be prevented. If this approach is adopted, seepage can be removed by pumping. A temporary liner, however, is still required to prevent cave-ins.

## MISCELLANEOUS

The fieldwork was carried out under the supervision of Mr. J. White. This report was prepared by Mr. B. Ly, with the assistance of Mr. J. White

James R White

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PROVINCE OF ONTARIO

BL/JW/kr/gs
June, 1977

# APPENDIX

OFFICE REPORT ON SOIL EXPLORATION

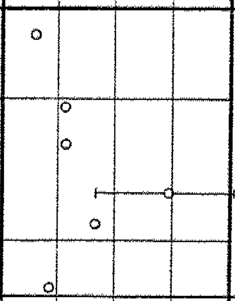
MINISTRY OF TRANSPORTATION AND COMMUNICATIONS-ONTARIO

HIGHWAY ENGINEERING DIVISION - ENGINEERING MATERIALS OFFICE - SOIL MECHANICS SECTION

# RECORD OF BOREHOLE Nº 1

WO 77-11001
DIST 6 HWY Eglinton Go Station
DATUM Geodetic
LOCATION Sta. 105+50 o/s 14.5' Rt. of R.E. of N.R. CNR
BORING DATE May 12, 1977
BOREHOLE TYPE Washboring - BX Casing
ORIGINATED BY JRW
COMPILED BY BL
CHECKED BY

| SOIL PROFILE | | | SAMPLES | | | | DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100<br>SHEAR STRENGTH ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE | LIQUID LIMIT —W_L<br>PLASTIC LIMIT —W_P<br>WATER CONTENT —W<br>WATER CONTENT % 10 20 30 | UNIT WEIGHT γ | REMARKS % GR SA SI CL |
|---|---|---|---|---|---|---|---|---|---|---|
| ELEV / DEPTH | DESCRIPTION | STRAT. PLOT | NUMBER | TYPE | 'N' VALUES | GROUND WATER ELEV | | | | |
| 536.0 | Ground Level | | | | | | | | | |
| 0.0 | Fill: Silty sand with gravel & trace of clay Moderately compacted | | 1 | SS | 16 | | | | | 21 55 16 8 |
| | | | 2 | SS | 24 | 530 | | | | |
| | Asphaltic Material<br>Silty fine sand, some clay Poorly compacted | | 3 | SS | 9 | | | | | 4 42 43 11 |
| | | | 4 | SS | 8 | ▼ | | | | |
| 524.5 | | | | | | | | | | |
| 523.0 | Clay | | | | | | | | | |
| 13.0 | Glacial Till: Het. Mixture of silt, sand & trace of gravel & clay. Very Dense | | 5 | SS | 18 | | | | | 19 29 33 19 |
| | | | 6 | SS | 48 | 520 | | | | |
| 516.0 | | | 7 | SS | 98 | | | | | 4 47 33 16 |
| 20.0 | End of Borehole | | | | | | | | | |



20
15 ◇ 5 % STRAIN AT FAILURE
10

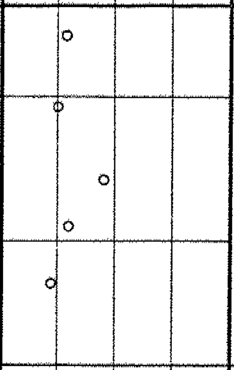
MINISTRY OF TRANSPORTATION AND COMMUNICATIONS–ONTARIO

HIGHWAY ENGINEERING DIVISION - ENGINEERING MATERIALS OFFICE - SOIL MECHANICS SECTION

# RECORD OF BOREHOLE Nº 2

WO 77-11001
DIST 6 HWY Eglinton Go Station
DATUM Geodetic
LOCATION Sta. 106+12 o/s 13.5' Rt. of R.E. of N.R. CNR
BORING DATE May 13, 1977
BOREHOLE TYPE Washboring - BX Casing
ORIGINATED BY JRW
COMPILED BY BL
CHECKED BY

| SOIL PROFILE | | | SAMPLES | | | GROUND WATER | DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100<br>SHEAR STRENGTH<br>○ UNCONFINED + FIELD VANE<br>● QUICK TRIAXIAL × LAB VANE | LIQUID LIMIT —W_L<br>PLASTIC LIMIT —W_P<br>WATER CONTENT —W<br>WATER CONTENT %<br>10 20 30 | UNIT WEIGHT γ | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|
| ELEV / DEPTH | DESCRIPTION | STRAT. PLOT | NUMBER | TYPE | 'N' VALUES | ELEV | | | | % GR SA SI CL |
| 536.1 | Ground Level | | | | | | | | | |
| 0.0 | Fill: Silty sand Trace of gravel & clay. Moderately compacted | | 1 | SS | 18 | | | | | 7 42 41 10 |
| | | | 2 | SS | 21 | | | | | |
| | Asphaltic Material | | | | | 530 | | | | |
| | Silty fine sand, some clay | | 3 | SS | 7 | | | | | |
| | | | 4 | SS | 7 | ▼ | | | | |
| | Poorly Compacted | | | | | | | | | |
| 522.6 | | | 5 | SS | 7 | | | | | 4 36 42 18 |
| 13.5 | Glacial Till: Het. mixture of silt, sand & trace of gravel & clay | | 6 | SS | 40 | 520 | | | | 2 54 34 10 |
| | | | 7 | SS | 67 | | | | | 3 50 33 14 |
| | Very Dense | | | | | | | | | |
| 511.1 | | | 8 | SS | 42 | | | | | |
| 25.0 | End of Borehole<br>Note: Water level established 2 hours after hole completed. | | | | | | | | | |



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15 ○ 5 % STRAIN AT FAILURE
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OFFICE REPORT ON SOIL EXPLORATION

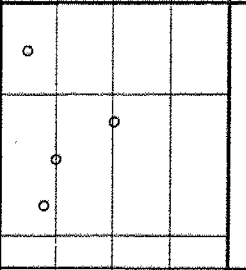
MINISTRY OF TRANSPORTATION AND COMMUNICATIONS–ONTARIO

HIGHWAY ENGINEERING DIVISION - ENGINEERING MATERIALS OFFICE - SOIL MECHANICS SECTION

# RECORD OF BOREHOLE Nº 3

WO 77-11001
DIST 6 HWY Eglinton Go Station
DATUM Geodetic
LOCATION Sta. 106+82 o/s 12' Rt. of R.E. of N.R. CNR
BORING DATE May 12, 13, 1977
BOREHOLE TYPE Washboring - BX Casing
ORIGINATED BY CJ
COMPILED BY BL
CHECKED BY

| SOIL PROFILE | | | SAMPLES | | | GROUND WATER | DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100<br>SHEAR STRENGTH ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE | LIQUID LIMIT — $W_L$<br>PLASTIC LIMIT — $W_P$<br>WATER CONTENT — W<br>WATER CONTENT % 10 20 30 | UNIT WEIGHT γ | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|
| ELEV / DEPTH | DESCRIPTION | STRAT. PLOT | NUMBER | TYPE | 'N' VALUES | ELEV | | | | % GR SA SI CL |
| 536.2 | Ground Level | | | | | | | | | |
| 0.0 | Fill: Silty sand with gravel | | | | | | | | | |
| | Moderately compacted | | 1 | SS | 20 | | | | | 31 52 (17) |
| | Asphaltic Material | | 2 | SS | 15 | 530 | | | | |
| 525.7 | Silty fine sand, some clay. Poorly compacted | | 3 | SS | 4 | ▼ | | | | 1 49 35 15 |
| 10.5 | Glacial Till: Het. mixture of silt, sand & some gravel & clay. | | 4 | SS | 29 | | | | | 12 44 30 14 |
| | | | 5 | SS | 39 | | | | | |
| | | | 6 | SS | 87 | 520 | | | | 13 43 32 12 |
| 517.7 | Very Dense | | 7 | SS | 29 | | | | | |
| 18.5 | End of Borehole | | | | | | | | | |



20
15 ○ 5 % STRAIN AT FAILURE
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OFFICE REPORT ON SOIL EXPLORATION

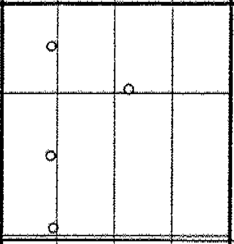
MINISTRY OF TRANSPORTATION AND COMMUNICATIONS-ONTARIO

HIGHWAY ENGINEERING DIVISION - ENGINEERING MATERIALS OFFICE - SOIL MECHANICS SECTION

# RECORD OF BOREHOLE Nº 4

WO 77-11001
DIST 6 HWY Eglinton Go Station
DATUM Geodetic
LOCATION Sta. 107+77 o/s 11.7' Rt. of R.E. of N.R. CNR
BORING DATE May 13, 1977
BOREHOLE TYPE Washboring - BX Casing
ORIGINATED BY CJ
COMPILED BY BL
CHECKED BY CP.

| SOIL PROFILE | | | SAMPLES | | | GROUND WATER | DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE | LIQUID LIMIT —— $w_L$ PLASTIC LIMIT —— $w_P$ WATER CONTENT —— $w$ / WATER CONTENT % 10 20 30 | UNIT WEIGHT $\gamma$ | REMARKS % | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ELEV / DEPTH | DESCRIPTION | STRAT. PLOT | NUMBER | TYPE | 'N' VALUES | ELEV | | | | GR | SA | SI | CL |
| 536.3 | Ground Level | | | | | | | | | | | | |
| 0.0 | Fill: Silty sand, some gravel, poorly compacted | | 1 | SS | 9 | | | | | 17 | 56 | 21 | 6 |
| | Asphaltic Material | | 2 | SS | 8 | 530 ▼ | | | | 17 | 65 | 15 | 3 |
| 526.8 | Silty fine sand, some clay Poorly compacted | | 3 | SS | 18 | | | | | | | | |
| 9.5 | Glacial Till: Het. mixture of silt, sand & trace of gravel & clay | | 4 | SS | 53 | | | | | 2 | 50 | 36 | 12 |
| | | | 5 | SS | 88 | | | | | | | | |
| 519.8 | Very Dense | | 6 | SS | 70 | 520 | | | | 2 | 50 | 34 | 14 |
| 16.5 | End of Borehole<br>Note: Water level established immediately after hole completed. | | | | | | | | | | | | |



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15 ◇ 5 % STRAIN AT FAILURE
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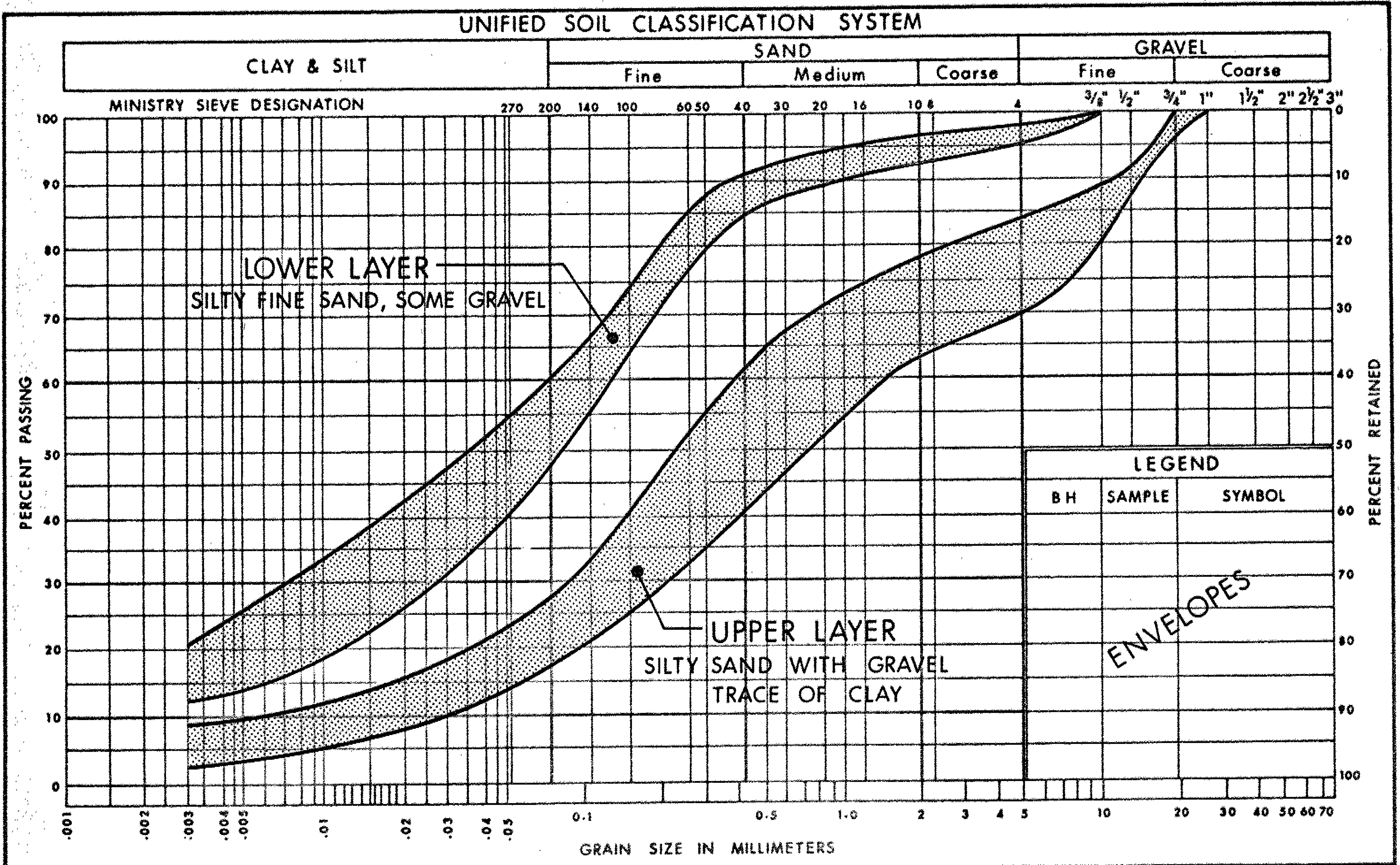
OFFICE REPORT ON SOIL EXPLORATION

Oct 75, FF-5-22



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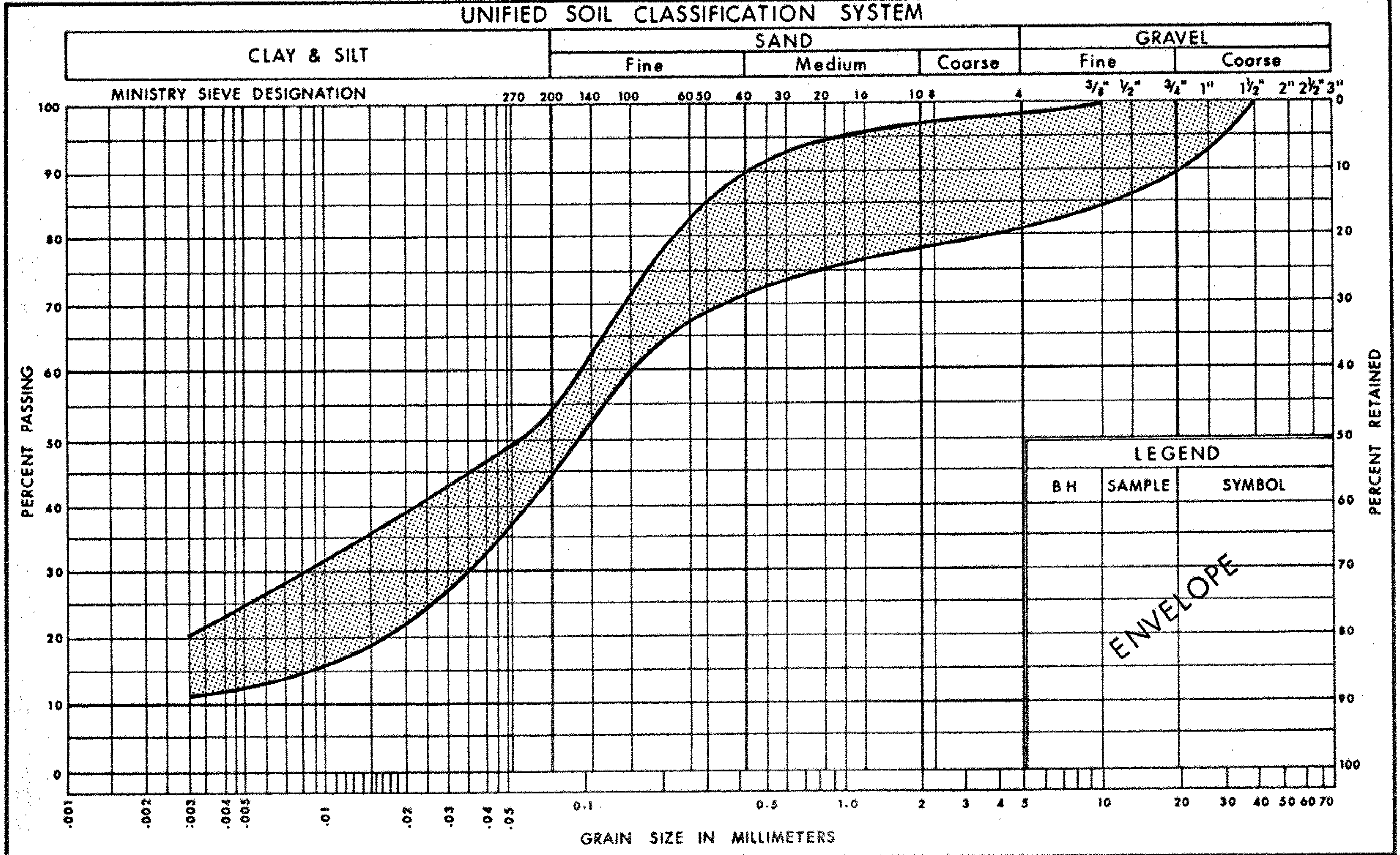
# GRAIN SIZE DISTRIBUTION
FILL MATERIAL
(UPPER & LOWER LAYER)

FIG No 1

WO 77-11001

Oct 75, FF-S-22



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## GRAIN SIZE DISTRIBUTION
## GLACIAL TILL

HET MIXTURE OF SILT, SAND, & TRACE OF GRAVEL & CLAY

FIG No 2

WO 77-11001

# ABBREVIATIONS & SYMBOLS USED IN THIS REPORT

## PENETRATION RESISTANCE

'N'- STANDARD PENETRATION RESISTANCE : - THE NUMBER OF BLOWS REQUIRED TO ADVANCE A STANDARD SPLIT SPOON SAMPLER 12 INCHES INTO THE SUBSOIL, DRIVEN BY MEANS OF A 140 POUND HAMMER FALLING FREELY A DISTANCE OF 30 INCHES.

DYNAMIC PENETRATION RESISTANCE :- THE NUMBER OF BLOWS REQUIRED TO ADVANCE A 2 INCH, 60 DEGREE CONE, FITTED TO THE END OF DRILL RODS, 12 INCHES INTO THE SUBSOIL, THE DRIVING ENERGY BEING 350 FOOT POUNDS PER BLOW

## DESCRIPTION OF SOIL

THE CONSISTENCY OF COHESIVE SOILS AND THE RELATIVE DENSITY OR DENSENESS OF COHESIONLESS SOILS ARE DESCRIBED IN THE FOLLOWING TERMS :-

| CONSISTENCY | c LB./SQ FT |
|---|---|
| VERY SOFT | 0 - 250 |
| SOFT | 250 - 500 |
| FIRM | 500 - 1000 |
| STIFF | 1000 - 2000 |
| VERY STIFF | 2000 - 4000 |
| HARD | > 4000 |

| DENSENESS | 'N' BLOWS / FT. |
|---|---|
| VERY LOOSE | 0 - 4 |
| LOOSE | 4 - 10 |
| COMPACT | 10 - 30 |
| DENSE | 30 - 50 |
| VERY DENSE | > 50 |

TERMS TO BE USED IN DESCRIBING SOILS :-

TRACE < 10% , SOME 10–25% , WITH 25–40% , > 40% SILTY, SANDY, GRAVELLY, CLAYEY ETC

## TYPE OF SAMPLE

| | | | |
|---|---|---|---|
| S.S | SPLIT SPOON | T.W. | THINWALL OPEN |
| W.S. | WASHED SAMPLE | T.P. | THINWALL PISTON |
| S.T. | SLOTTED TUBE SAMPLE | O.S | OESTERBERG SAMPLE |
| A.S. | AUGER SAMPLE | F.S. | FOIL SAMPLE |
| C.S | CHUNK SAMPLE | R.C. | ROCK CORE |

| | |
|---|---|
| P.H. | SAMPLE ADVANCED HYDRAULICALLY |
| P.M | SAMPLE ADVANCED MANUALLY |

## SOIL TESTS

| | | | |
|---|---|---|---|
| U | UNCONFINED COMPRESSION | L.V | LABORATORY VANE |
| UU | UNCONSOLIDATED UNDRAINED TRIAXIAL | F.V. | FIELD VANE |
| CIU | CONSOLIDATED ISOTROPIC UNDRAINED TRIAXIAL | C | CONSOLIDATION |
| CID | " " DRAINED " | S | SENSITIVITY |
| CAU | " ANISOTROPIC UNDRAINED " | | |
| CAD | " " DRAINED " | | |

# ABBREVIATIONS & SYMBOLS USED IN THIS REPORT

## SOIL PROPERTIES

| | | |
|---|---|---|
| $\gamma$ | UNIT WEIGHT OF SOIL (BULK DENSITY) | |
| $\gamma_s$ | UNIT WEIGHT OF SOLID PARTICLES | |
| $\gamma_w$ | UNIT WEIGHT OF WATER | |
| $\gamma_d$ | UNIT DRY WEIGHT OF SOIL (DRY DENSITY) | |
| $\gamma'$ | UNIT WEIGHT OF SUBMERGED SOIL | |
| G | SPECIFIC GRAVITY OF SOLID PARTICLES $G = \frac{\gamma_s}{\gamma_w}$ | |
| e | VOID RATIO | |
| n | POROSITY | |
| w | WATER CONTENT | |
| $S_r$ | DEGREE OF SATURATION | |
| $w_L$ | LIQUID LIMIT | |
| $w_P$ | PLASTIC LIMIT | |
| $I_P$ | PLASTICITY INDEX | |
| $w_S$ | SHRINKAGE LIMIT | |
| $I_L$ | LIQUIDITY INDEX $= \frac{w - w_P}{I_P}$ | |
| $I_C$ | CONSISTENCY INDEX $= \frac{w_L - w}{I_P}$ | |
| $e_{max}$ | VOID RATIO IN LOOSEST STATE | |
| $e_{min}$ | VOID RATIO IN DENSEST STATE | |
| $I_D$ | DENSITY INDEX $= \frac{e_{max} - e}{e_{max} - e_{min}}$ | |
| | RELATIVE DENSITY $D_r$ IS ALSO USED | |
| h | HYDRAULIC HEAD OR POTENTIAL | |
| q | RATE OF DISCHARGE | |
| v | VELOCITY OF FLOW | |
| i | HYDRAULIC GRADIENT | |
| k | COEFFICIENT OF PERMEABILITY | |
| j | SEEPAGE FORCE PER UNIT VOLUME | |
| $m_v$ | COEFFICIENT OF VOLUME CHANGE $= \frac{-\Delta e}{(1+e)\Delta\sigma'}$ | |
| $c_v$ | COEFFICIENT OF CONSOLIDATION | |
| $C_c$ | COMPRESSION INDEX $= \frac{\Delta e}{\Delta \log_{10} \sigma'}$ | |
| $T_v$ | TIME FACTOR $= \frac{c_v t}{d^2}$ (d, DRAINAGE PATH) | |
| U | DEGREE OF CONSOLIDATION | |
| $\tau_f$ | SHEAR STRENGTH | |
| $c'$ | EFFECTIVE COHESION INTERCEPT | IN TERMS OF EFFECTIVE STRESS $\tau_f = c' + \sigma' \tan \phi'$ |
| $\phi'$ | EFFECTIVE ANGLE OF SHEARING RESISTANCE, OR FRICTION | |
| $c_u$ | APPARENT COHESION | IN TERMS OF TOTAL STRESS $\tau_f = c_u + \sigma \tan \phi$ |
| $\phi_u$ | APPARENT ANGLE OF SHEARING RESISTANCE, OR FRICTION | |
| $\mu$ | COEFFICIENT OF FRICTION | |
| $S_t$ | SENSITIVITY | |

## GENERAL

| | |
|---|---|
| $\pi$ | = 3 1416 |
| e | BASE OF NATURAL LOGARITHMS 2·7183 |
| $\log_e a$ OR $\ln a$ | NATURAL LOGARITHM OF $a$ |
| $\log_{10} a$ OR $\log a$ | LOGARITHM OF $a$ TO BASE 10 |
| t | TIME |
| g | ACCELERATION DUE TO GRAVITY |
| V | VOLUME |
| W | WEIGHT |
| M | MOMENT |
| F | FACTOR OF SAFETY |

## STRESS AND STRAIN

| | |
|---|---|
| u | PORE PRESSURE |
| $\sigma$ | NORMAL STRESS |
| $\sigma'$ | NORMAL EFFECTIVE STRESS ($\bar{\sigma}$ IS ALSO USED) |
| $\tau$ | SHEAR STRESS |
| $\varepsilon$ | LINEAR STRAIN |
| $\gamma$ | SHEAR STRAIN |
| $\nu$ | POISSON'S RATIO ($\mu$ IS ALSO USED) |
| E | MODULUS OF LINEAR DEFORMATION (YOUNGS MODULUS) |
| G | MODULUS OF SHEAR DEFORMATION |
| K | MODULUS OF COMPRESSIBILITY |
| $\eta$ | COEFFICIENT OF VISCOSITY |

## EARTH PRESSURE

| | |
|---|---|
| d | DISTANCE FROM TOP OF WALL TO POINT OF APPLICATION OF PRESSURE |
| $\delta$ | ANGLE OF WALL FRICTION |
| K | DIMENSIONLESS COEFFICIENT TO BE USED WITH VARIOUS SUFFIXES IN EXPRESSIONS REFERRING TO NORMAL STRESS ON WALLS |
| $K_o$ | COEFFICIENT OF EARTH PRESSURE AT REST |

## FOUNDATIONS

| | |
|---|---|
| B | BREADTH OF FOUNDATION |
| L | LENGTH OF FOUNDATION |
| D | DEPTH OF FOUNDATION BENEATH GROUND |
| N | DIMENSIONLESS COEFFICIENT USED WITH A SUFFIX APPLYING TO SPECIFIC GRAVITY, DEPTH AND COHESION ETC IN THE FORMULA FOR BEARING CAPACITY |
| $k_s$ | MODULUS OF SUBGRADE REACTION |

## SLOPES

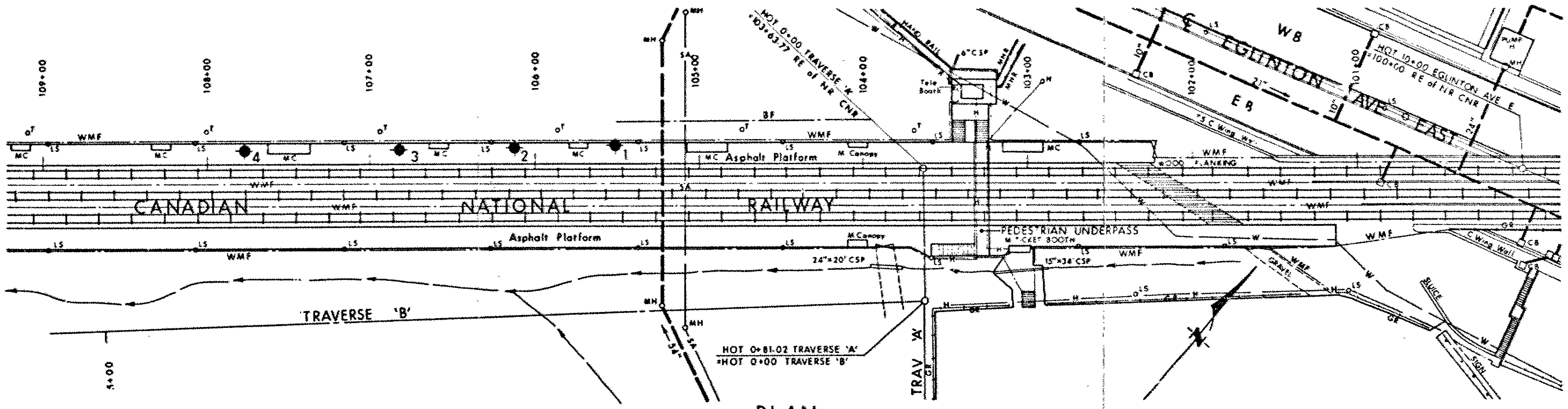
| | |
|---|---|
| H | VERTICAL HEIGHT OF SLOPE |
| D | DEPTH BELOW TOE OF SLOPE TO HARD STRATUM |
| $\beta$ | ANGLE OF SLOPE TO HORIZONTAL |

CONT No
W O No 77-11001

EGLINTON 'GO' STATION

BORE HOLE LOCATIONS & SOIL STRATA

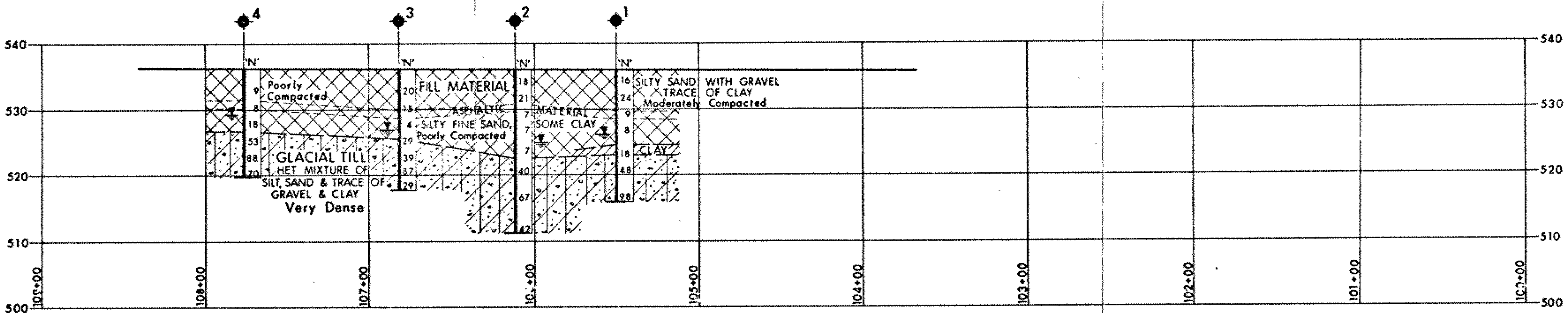
SHEET



## PLAN

SCALE

40 20 0 40 80FT

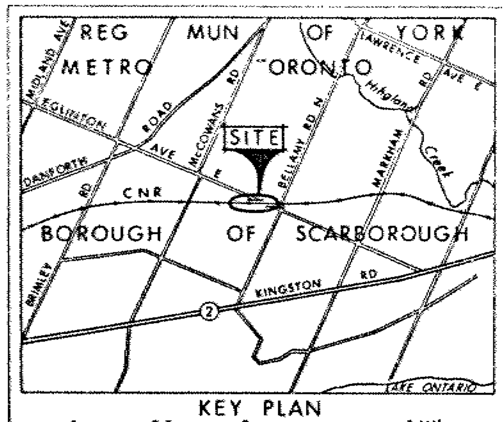


## PROFILE ALONG PLATFORM

SCALE

HOR 40 20 0 40 80FT

VERT 10 5 0 10 20FT



KEY PLAN

1 0.5 0 1 Mile

LEGEND

| | |
|---|---|
| ● | Bore Hole |
| ⊕ | Dynamic Cone Penetration Test (Cone) |
| ◐ | Bore Hole & Cone |
| 'N' | Blows/ft (Std Pen Test 350 ft lbs energy) |
| CONE | Blows/ft (60° Cone, 350 ft lbs energy) |
| ▼ | W L at time of investigation May 1977 |

| No | ELEVATION | STATION | OFFSET RE of NR CNR |
|---|---|---|---|
| 1 | 536·0 | 105+50 | 14·5' RT |
| 2 | 536·1 | 106+12 | 13·5' RT |
| 3 | 536·2 | 105+82 | 11·9' RT |
| 4 | 536·3 | 107+77 | 11·7' RT |

-NOTE-

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

| REVISIONS | | |
|---|---|---|
| DATE | BY | DESCRIPTION |

| | | |
|---|---|---|
| No EGLINTON 'GO' STATION | DIST 6 | |
| JRW CHECKED | DATE June 23 1977 | SITE |
| DRAWN CHECKED | APPROVED | DWG 7711001-A |

**Toronto Area Transit Operating Authority**

3625 Dufferin Street
Downsview, Ontario
M3K 1Z2
Telex 06-524145
MTC Toronto

File under WO 77-11001
Eglinton GO Station

May 5th, 1978.

Ministry of Transportation
& Communications,
1201 Wilson Avenue,
Downsview, Ontario.
M3M 1J8.

Attention: Mr. M. Devata,
Soils Mechanics Section

Dear Sir:

Re: Bore Hole Investigation at GO Stations

As you know over the past two years in order to provide sub-surface data for the design of the redevelopment projects at the different GO Stations it has been necessary to request the M.T.C.'s assistance. Upon each occasion both the Soils Mechanics Section and the Geotechnical Section have responded immediately and forwarded a concise report with the required sub-surface data.

However, in the process of obtaining the information during the site investigation it would be appreciated if more attention could be given to completely filling in the bore holes. Due to the nature of TATOA's service, including a substantial amount of pedestrian traffic, it is essential that holes such as these which could pose as a hazard be eliminated.

Thank you for your co-operation in the past and please review this matter with your staff.

Yours truly,

J.G. Pavelka

J.G. Pavelka, P.Eng.,
Project Engineer,
Plant Division.

JGP/jh

cc: Mr. C. Stradling

Murty : This problem occurred only in the Eglington GO parking lot done by the Region & to a less extent in the platform done by SM.
No such problems [illegible] other GO stations.

RECEIVED
MAY 08 1978
SOIL MECHANICS
MINISTRY OF TRANSPORTATION & COMMUNICATIONS

[illegible]

Discussed with J.G. Pavelka on 78 05 [illegible] and he agrees that the problem is with Reg GO office and no further action is needed.