

DOCUMENT MICROFILMING IDENTIFICATION

GEOCRES No. 30M12-135

DIST 6 REGION Central

W.P. No. 103-69-13

CONT. No. 79-27

W. C. No. _____

STR. SITE No. 24-441

HWY. No. 410

LOCATION Industrial Access Rd.

U'pass, 1.2 miles north of

Hwy. 401/410

OVERLAY DRAWINGS TO BE INCLUDED WITH THIS REPORT. 3

REMARKS: documents to be unfolded
before microfilming

9-20 1415 20-10

FOUNDATION INVESTIGATION REPORT

For

Industrial Access Road Underpass
1.2 Miles North of Hwy. 401/410
W.P. 103-69-13, Site 24-41
Hwy. 410, District 6, Toronto

INTRODUCTION

This report contains the results of a foundation investigation done at the site of the above mentioned project. The fieldwork was carried out during the period of October 11 to October 13, 1978, consisting of six sampled boreholes. The borings were advanced by means of hollow stem continuous flight augers to depths ranging from 30 to 45 feet below the ground surface.

SITE AND GEOLOGY

The site is located between First Line East and Second Line East about 0.8 miles south of Derry Road in the City of Mississauga, Regional Municipality of Peel.

The terrain surrounding the site is relatively flat and the land nearby is primarily used for farming purposes. A new highway (Hwy. #410) was being constructed in this area. On either side of the new Hwy. 410 in the vicinity of the site, rockfill embankments consisting of shale have been placed to a height of about 18 feet.

The site is located in the physiographic region known as the Peel Plain. The characteristic deposit in this area is a cohesive glacial till. The overburden is underlain by shale bedrock of the Dundas-Meaford formation.

SUBSURFACE CONDITIONS

The investigation revealed that the site is underlain by a deposit of cohesive glacial till, the thickness of which was found to be in the order of 45 feet. The cohesive overburden is underlain by shale bedrock.

Factual data on the subsurface conditions is contained on the Record of Borehole Sheets. Three subsoil stratigraphical sections based on this information are shown, together with the locations and elevations of the borings, on Dwg. #1036913-A. A description of the subsoil conditions encountered is given below.

Heterogeneous Mixture of Clayey Silt, Sand and Gravel (Glacial Till)

This is the predominant deposit at the site. It extends beneath the ground surface to bedrock for a thickness of about 45 feet. The glacial till is composed of a heterogeneous mixture of clayey silt, sand and gravel. Grain size distribution curves for the glacial till as determined in the laboratory are given on Figure 1. Geotechnical identity indices of the glacial till are tabulated below.

| | | <u>Range</u> |
|--------------------------|---------------------|--------------|
| Natural Moisture Content | (W) % | 10-20 |
| Liquid Limit | (W _L) % | 18-30 |
| Plastic Limit | (W _p) % | 12-17 |

The results of the Atterberg Limit testings are also plotted on the Plasticity Chart, Figure 2, which indicates that the glacial till is cohesive with a low plasticity.

The upper 8 to 10 feet of the glacial till stratum is brown and desiccated. Below that depth, the glacial till is grey. The consistency of the glacial till is estimated to be very stiff to hard, being generally hard (N values of 27 blows/foot to over 100 blows/foot). However, a 4 to 10 foot thick zone of somewhat weaker material with a consistency of stiff to very stiff (N values of 8 to 30 blows/foot) was encountered at a depth of approximately 14 feet (elev. 597 to 602) below the ground surface.

Bedrock Conditions

According to available information, bedrock is a shale which exists at an elevation between 566 and 570.

Groundwater Conditions

Observation of the groundwater level was carried out by measuring the water level in the open boreholes. The groundwater level was found to vary between elevation 604 and elevation 601 corresponding to a depth of 8 to 12 feet below the ground surface.

DISCUSSION AND RECOMMENDATIONS

A two span structure (119 feet - 119 feet) consisting of two closed abutments and a center pier, is to be constructed at this site to carry Industrial Access Road over Hwy. 410. The profile grade of the underpass structure has been set at elevation 637.5 and that of Hwy. 410 at the crossing at elevation 615. This will require approach fills in the order of 21 feet high. Our recommendations for the structure foundations and approaches are as follows.

Structure Foundations

The glacial till at the site is a competent subsoil and the proposed two span structure can be supported on spread footings founded within the glacial till stratum. Because of the presence of a somewhat softer zone at a shallow depth, the allowable bearing capacity should not exceed $2\frac{1}{2}$ tons for the abutment footings and 3 tsf for the pier footings. As the cohesive deposit has been heavily preconsolidated, these bearing pressures would induce a settlement of a recompression nature which would complete almost immediately after the load is applied. The magnitude of the settlement would be less than 1 inch. The lateral force on the spread footings can be assumed to be resisted by the frictional force between the underside of the footing and the glacial till. To estimate the frictional resistance an adhesion of 2000 psf can be assumed.

To prevent frost action on the footing formation surface the underside of the footings should have a minimum of 4 feet of earth cover.

Since the footings will be situated in a relatively impervious cohesive subsoil, no major dewatering problems are anticipated for the footing excavation and construction. Any minor seepage from runoff into the excavation can be removed by pumping.

Approaches

The approaches have been constructed almost to the full height, consisting of shaley material. Construction of the approaches is

in accordance with the recommendations contained in the Foundation Report submitted previously for feasibility study under W.P. 103-69-00. The fills appeared to be in a very good condition.

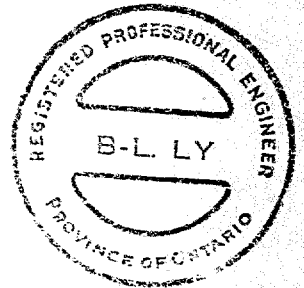
Related Considerations

In order to relieve the buildup of hydrostatic pressure behind the abutment wall, free draining granular material should be used as backfill and suitable drainage measures consisting of weep holes and perforated pipes should be provided.

To estimate the lateral earth pressure induced on the abutment wall by the granular backfill, a coefficient of earth pressure of 0.5 should be used if the wall is rigid. If some movement at the top of the wall is permitted, a coefficient of earth pressure of 0.33 can be used.

Ly BL

B. Ly, P. Eng.
Senior Engineer



M. Devata

M. Devata, P. Eng.
Supervising Engineer

October, 1978

RECORD OF BOREHOLE No 1

W P 103-69-13 LOCATION Coords. N 861 060; E 952 835 ORIGINATED BY B.L.
 DIST 6 HWY 410 BOREHOLE TYPE 3 1/2" Hollow Stem Augers COMPILED BY B.L.
 DATUM Geodetic DATE October 12, 1978 CHECKED BY W.J.

| SOIL PROFILE | | | SAMPLES | | | GROUND WATER CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION RESISTANCE PLOT | | | | PLASTIC LIMIT W _p | NATURAL MOISTURE CONTENT W | LIQUID LIMIT W _L | UNIT WEIGHT Y | REMARKS & GRAIN SIZE DISTRIBUTION (%) |
|--------------|--|------------|---------|------|------------|-------------------------|-----------------|--|----|----|----|---------------------------------|-------------------------------|--------------------------------|------------------|---------------------------------------|
| ELEV DEPTH | DESCRIPTION | STRAT PLOT | NUMBER | TYPE | 'N' VALUES | | | 20 | 40 | 60 | 80 | 100 | | | | |
| 615.1 | Ground Surface | | | | | | | | | | | | | | | GR SA SI CL |
| 0.0 | Heterogeneous Mixture of Clayey Silt, Sand and Gravel (Glacial Till) | | 1 | SS | 49 | | 610 | | | | | | | | | |
| | Brown Very Stiff to Hard | | 2 | SS | 32 | | | | | | | | | | | 0 11 47 42 |
| | Stiff to Very Stiff | | 3 | SS | 13 | | 600 | | | | | | | | | |
| | | | 4 | SS | 9 | | | | | | | | | | | 0 31 47 22 |
| | | | 5 | SS | 86 | | 590 | | | | | | | | | |
| | Hard | | 6 | SS | 47 | | | | | | | | | | | |
| | | | 7 | SS | 102 | | 580 | | | | | | | | | |
| 570.1 | Probable Bedrock | | | | | | | | | | | | | | | |
| 45.0 | End of Borehole | | | | | | | | | | | | | | | |
| | Note: Refusal to Augering at About 45 Feet | | | | | | | | | | | | | | | |



RECOPD OF BOREHOLE No 2

W P 103-69-13 LOCATION Coords. N 861 022; E 952 879 ORIGINATED BY B.L.
DIST 6 HWY 410 BOREHOLE TYPE 3 1/2" Hollow Stem Augers COMPILED BY B.L.
DATUM Geodetic DATE October 13, 1978 CHECKED BY R.J.

| SOIL PROFILE | | | SAMPLES | | | GROUND WATER CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION RESISTANCE PLOT | | PLASTIC LIMIT W _p | NATURAL MOISTURE CONTENT W | LIQUID LIMIT W _L | UNIT WEIGHT γ | REMARKS & GRAIN SIZE DISTRIBUTION [%] GR SA SI CL | | | |
|---------------|---|------------|---------|------|------------|----------------------------|--------------------|---|----|------------------------------------|-------------------------------------|-----------------------------------|---------------------|--|----|----|-----|
| ELEV DEPTH | DESCRIPTION | STRAT PLOT | NUMBER | TYPE | 'N' VALUES | | | 20 | 40 | | | | | | 60 | 80 | 100 |
| | | | | | | | | SHEAR STRENGTH | | | | | | | | | |
| 615.0 | Ground Surface | | | | | | | | | | | | | | | | |
| 0.0 | Heterogeneous Mixture of Clayey Silt, Sand and Gravel (Glacial Till) | | 1 | SS | 37 | | | | | | | | | | | | |
| | Brown Clay | | 2 | SS | 31 | | | | | | | | | | | | |
| | Very Stiff to Hard | | 3 | SS | 12 | | | | | | | | | | | | |
| | Stiff to Very Stiff | | 4 | SS | 9 | | | | | | | | | | | | |
| | | | 5 | SS | 85 | | | | | | | | | | | | |
| | Hard | | 6 | SS | 30 | | | | | | | | | | | | |
| 584.5 | | | | | | | | | | | | | | | | | |
| 30.5 | End of Borehole | | | | | | | | | | | | | | | | |
| | Note: Groundwater Level Not Established | | | | | | | | | | | | | | | | |

+3, x5: Numbers refer to
Sensitivity

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

OFFICE REPORT ON SOIL EXPLORATION

RECORD OF BOREHOLE No 3

W P 103-69-13 LOCATION Coords. N 861 122; E 952 943 ORIGINATED BY B.L.
 DIST 6 HWY 410 BOREHOLE TYPE 3 1/2" Hollow Stem Augers COMPILED BY B.L.
 DATUM Geodetic DATE October 12, 1978 CHECKED BY *sl*

| SOIL PROFILE | | | SAMPLES | | | GROUND WATER CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION RESISTANCE PLOT | | | | | PLASTIC LIMIT W _p | NATURAL MOISTURE CONTENT W | LIQUID LIMIT W _L | UNIT WEIGHT γ | REMARKS & GRAIN SIZE DISTRIBUTION (%) |
|---------------|---|------------|---------|------|--------|----------------------------|--------------------|---|----|----|----|-----|------------------------------------|-------------------------------------|-----------------------------------|---------------------|---|
| ELEV DEPTH | DESCRIPTION | STRAT PLOT | NUMBER | TYPE | VALUES | | | 20 | 40 | 60 | 80 | 100 | | | | | |
| 611.5 | Ground Surface | | | | | | | | | | | | | | | | |
| 0.0 | Heterogeneous Mixture of Clayey Silt, Sand and Gravel (Glacial Till) | | 1 | SS | 40 | | 610 | | | | | | | | | | |
| | Brown Very Stiff Grey to Hard | | 2 | SS | 35 | | 600 | | | | | | | | | | |
| | Stiff to Very Stiff | | 3 | SS | 25 | | | | | | | | | | | | |
| | Hard | | 4 | SS | 94 | | 590 | | | | | | | | | | |
| | | | 5 | SS | 97 | | | | | | | | | | | | |
| | | | 6 | SS | 60 | | 580 | | | | | | | | | | |
| | | | | | | | 570 | | | | | | | | | | |
| 567.0 | (Probable Bedrock) Shale Fragments | | 7 | SS | 90/ 3" | | | | | | | | | | | | |
| 44.5 | End of Borehole | | | | | | | | | | | | | | | | |

RECORD OF BOREHOLE No 4

W P 103-69-13 LOCATION Coords. N 861 102; E 952 962 ORIGINATED BY B.L.
 DIST 6 HWY 410 BOREHOLE TYPE 3 1/2" Hollow Stem Augers COMPILED BY B.L.
 DATUM Geodetic DATE October 12, 1978 CHECKED BY *W.J.*

| SOIL PROFILE | | | SAMPLES | | | GROUND WATER CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION RESISTANCE PLOT | | | | | PLASTIC LIMIT W _p | NATURAL MOISTURE CONTENT W | LIQUID LIMIT W _L | UNIT WEIGHT Y | REMARKS & GRAIN SIZE DISTRIBUTION (%) |
|---------------|---|------------|---------|------|------------|----------------------------|-----------------|---|----|----|----|-----|------------------------------------|-------------------------------------|-----------------------------------|---------------------|---|
| ELEV DEPTH | DESCRIPTION | STRAT PLOT | NUMBER | TYPE | 'N' VALUES | | | 20 | 40 | 60 | 80 | 100 | | | | | |
| 611.5 | Ground Surface | | | | | | | | | | | | | | | | |
| 0.0 | Heterogeneous Mixture of Clayey Silt, Sand and Gravel (Glacial Till) | | 1 | SS | 56 | | 610 | | | | | | | | | | |
| | Brown --- Grey --- | | 2 | SS | 27 | | 600 | | | | | | | | | | |
| | Hard | | 3 | SS | 31 | | | | | | | | | | | | |
| | Stiff to Very Stiff | | 4 | SS | 70 | | 590 | | | | | | | | | | |
| | Hard | | 5 | SS | 47 | | | | | | | | | | | | |
| 581.0 | | | 6 | SS | 94 | | | | | | | | | | | | |
| 30.5 | End of Borehole | | | | | | | | | | | | | | | | |



RECORD OF BOREHOLE No 5

W P 103-69-13 LOCATION Coords. N 861 199; E 953 030 ORIGINATED BY B.L.
DIST 6 HWY 410 BOREHOLE TYPE 3 1/2" Hollow Stem Augers COMPILED BY B.L.
DATUM Geodetic DATE October 11, 1978 CHECKED BY *[Signature]*

| SOIL PROFILE | | | SAMPLES | | | GROUND WATER CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION RESISTANCE PLOT | | PLASTIC LIMIT W _p | NATURAL MOISTURE CONTENT W | LIQUID LIMIT W _L | UNIT WEIGHT γ | REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL | | | |
|---------------|---|------------|---------|------|------------|----------------------------|--------------------|---|----|------------------------------------|-------------------------------------|-----------------------------------|---------------------|--|----|----|-----|
| ELEV DEPTH | DESCRIPTION | STRAT PLOT | NUMBER | TYPE | 'N' VALUES | | | 20 | 40 | | | | | | 60 | 80 | 100 |
| | | | | | | | | SHEAR STRENGTH | | | | | | | | | |
| 610.4 | Ground Surface | | | | | | | | | | | | | | | | |
| 0.0 | Heterogeneous Mixture of Clayey Silt, Sand and Gravel (Glacial Till) | | 1 | SS | 39 | | | | | | | | | | | | |
| | Brown | | 2 | SS | 28 | | | | | | | | | | | | |
| | Very Stiff to Hard | | 3 | SS | 20 | | | | | | | | | | | | |
| | Grey | | 4 | SS | 51 | | | | | | | | | | | | |
| | Stiff to Very Stiff | | 5 | SS | 91 | | | | | | | | | | | | |
| | Hard | | 6 | SS | 60 | 3" | | | | | | | | | | | |
| 579.9 | | | | | | | | | | | | | | | | | |
| 30.5 | End of Borehole | | | | | | | | | | | | | | | | |

*3, *5: Numbers refer to
Sensitivity

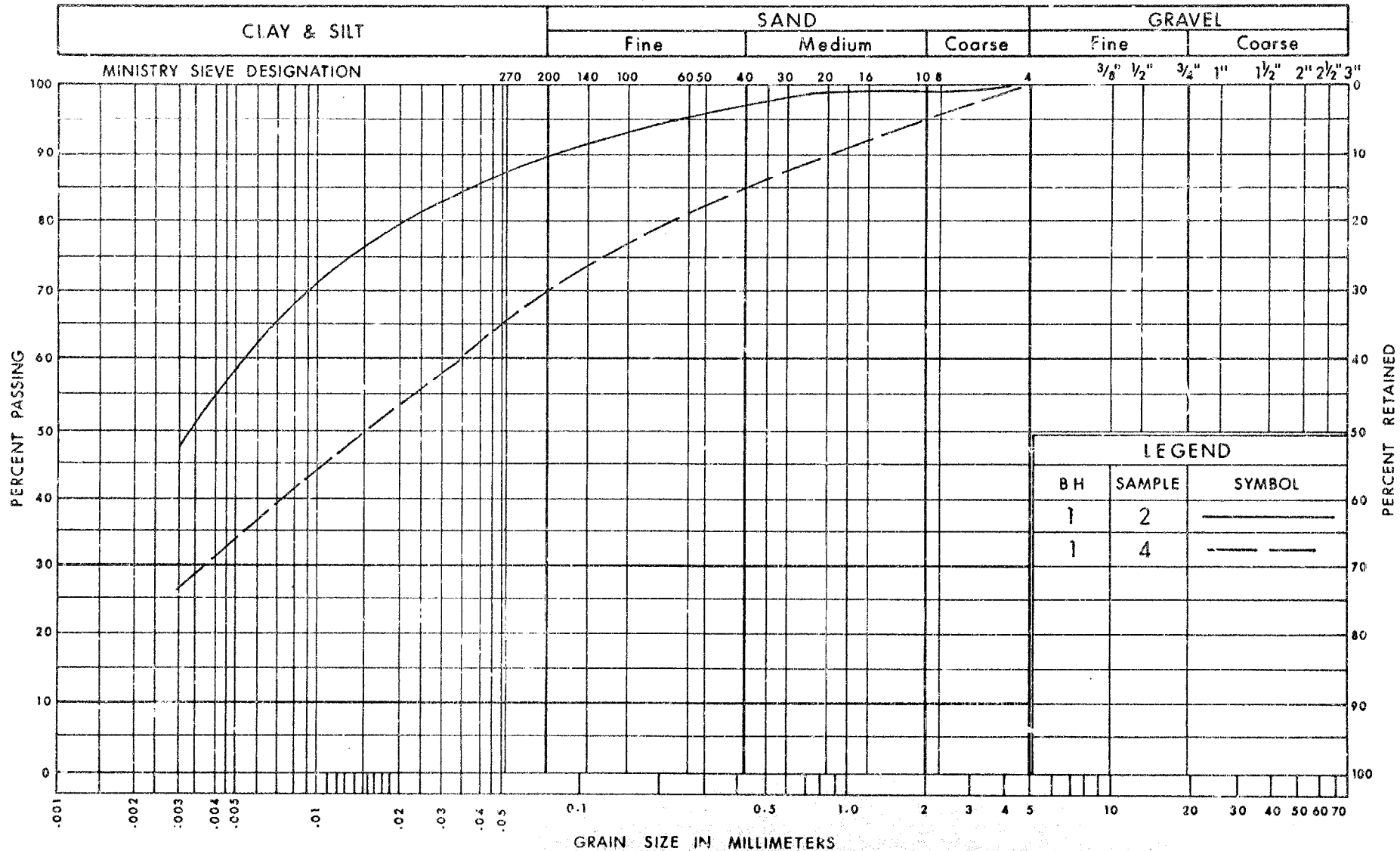
20
5-10 5 (%) STRAIN AT FAILURE
10

RECORD OF BOREHOLE No 6

W P 103-69-13 LOCATION Coords. N 861 158; E 953 076 ORIGINATED BY B.L.
 DIST 6 HWY 410 BOREHOLE TYPE 3 1/2" Hollow Stem Augers COMPILED BY B.L.
 DATUM Geodetic DATE October 11, 1978 CHECKED BY *[Signature]*

| SOIL PROFILE | | | SAMPLES | | | GROUND WATER CONDITIONS | ELEVATION SCALE | DYNAMIC CONE PENETRATION RESISTANCE PLOT | | | | PLASTIC LIMIT W _p | NATURAL MOISTURE CONTENT W | LIQUID LIMIT W _L | UNIT WEIGHT γ | REMARKS & GRAIN SIZE DISTRIBUTION (%) |
|---------------|---|------------|---------|------|------------|----------------------------|-----------------|---|----|----|----|------------------------------------|-------------------------------------|-----------------------------------|---------------------|---|
| ELEV DEPTH | DESCRIPTION | STRAT PLOT | NUMBER | TYPE | 'N' VALUES | | | 20 | 40 | 60 | 80 | 100 | | | | |
| 609.9 | Ground Surface | | | | | | | | | | | | | | | |
| 0.0 | Heterogeneous Mixture of Clayey Silt, Sand and Gravel (Glacial Till) | | 1 | SS | 32 | | | | | | | | | | | |
| | Brown - Very Stiff to Hard | | 2 | SS | 27 | | 600 | | | | | | | | | |
| | Grey Stiff to Very Stiff | | 3 | SS | 8 | | | | | | | | | | | |
| | | | 4 | SS | 14 | | 590 | | | | | | | | | |
| | | | 5 | SS | 73/ | 6" | | | | | | | | | | |
| | Hard | | 6 | SS | 100/ | 5" | 380 | | | | | | | | | |
| | | | 7 | SS | 90/ | 5" | | | | | | | | | | |
| 565.9 | Sampler Bouncing | | 8 | SS | Bouncing | | 570 | | | | | | | | | |
| 44.0 | (Probable Bedrock) End of Borehole | | | | | | | | | | | | | | | |
| | Note: Refusal to Augering at 44 Feet. | | | | | | | | | | | | | | | |

UNIFIED SOIL CLASSIFICATION SYSTEM



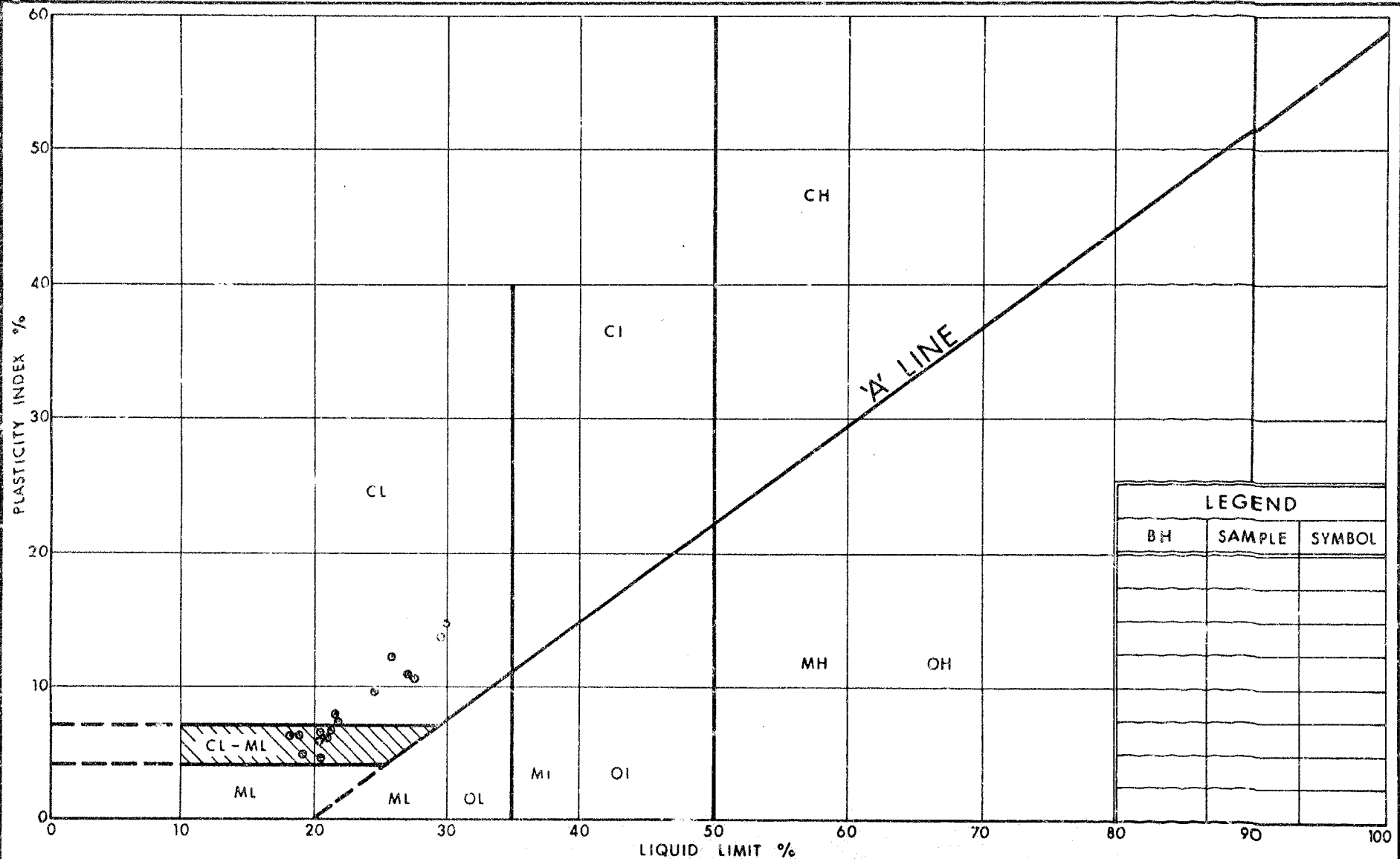
Ontario

Ministry of
Transportation and
Communications

GRAIN SIZE DISTRIBUTION
GLACIAL TILL
HET MIXTURE OF CLAYEY SILT SAND & GRAVEL

FIG No 1

W P 103-69-13



Ontario

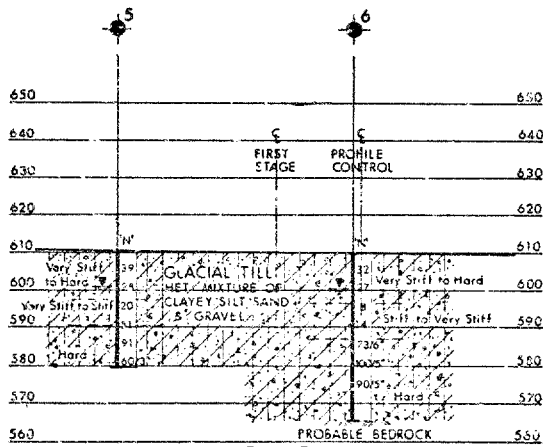
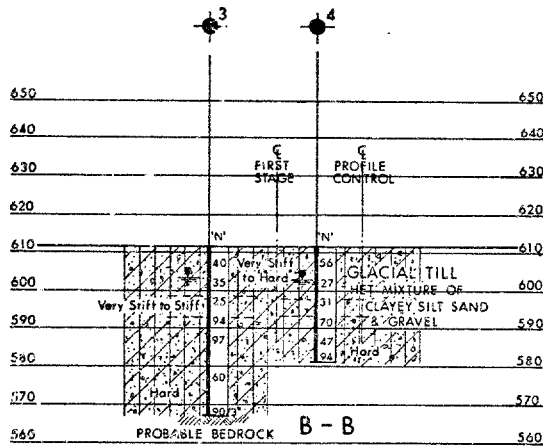
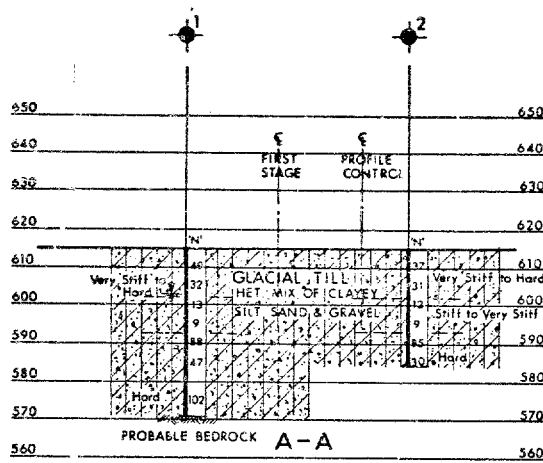
 Ministry of
Transportation and
Communications

ENGINEERING SERVICES BRANCH

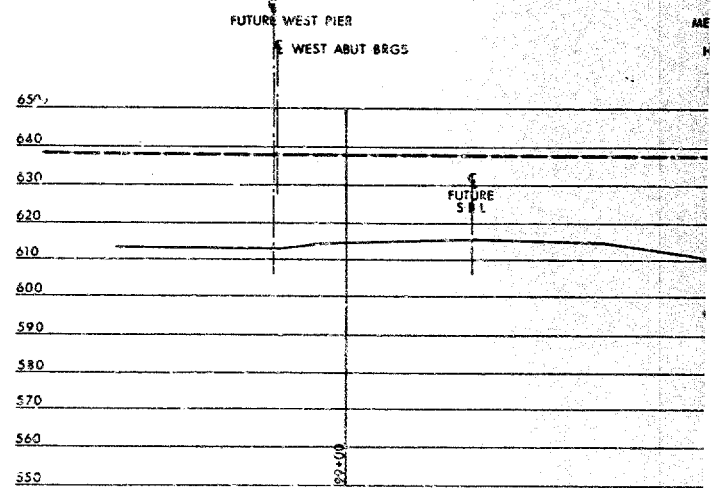
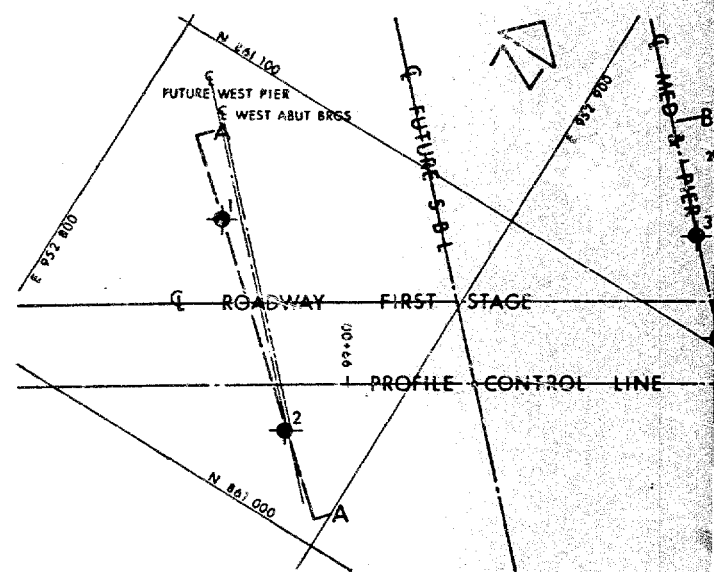
PLASTICITY CHART GLACIAL TILL HET MIXTURE OF CLAYEY SILT SAND & GRAVEL

FIG No 2

W P 103-69-13



C - C SECTIONS
 SCALE
 20 10 0 20 FT



PROFILE OF INDUS

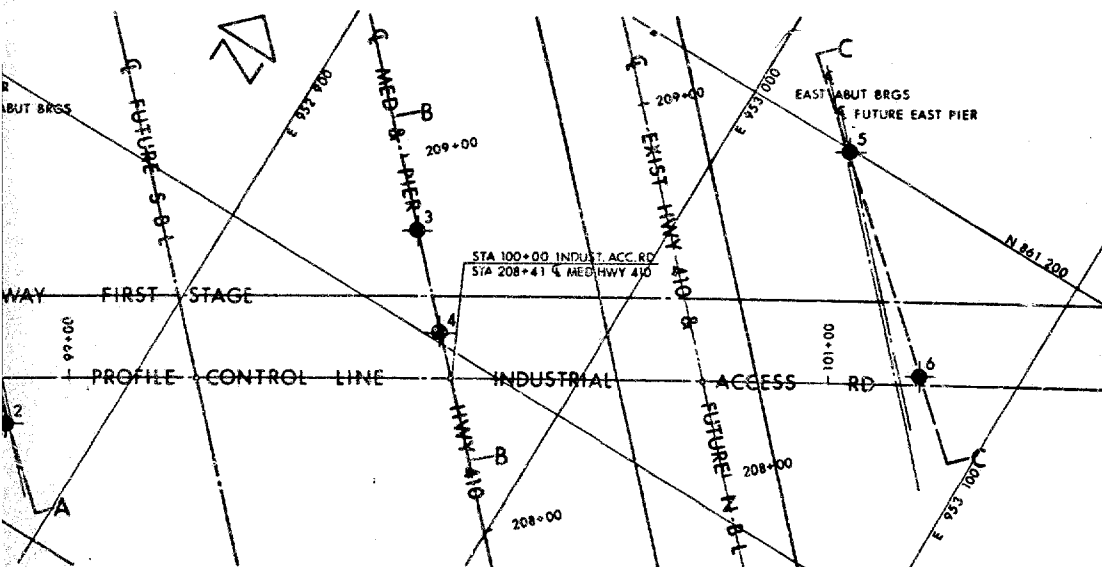
SCALE
 20 10 0

CONT No
WP No 103-69-13



INDUSTRIAL ACCESS ROAD
UNDERPASS
BORE HOLE LOCATIONS & SOIL STRATA

SHEET

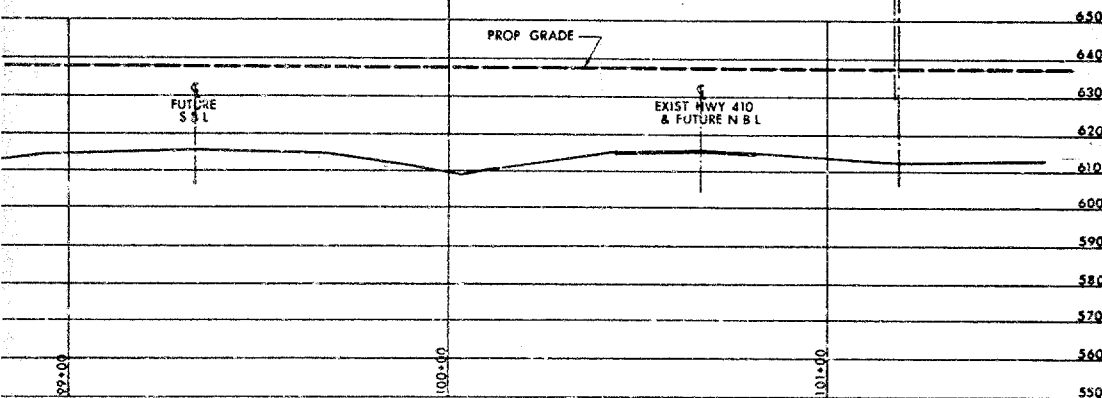


PLAN

SCALE

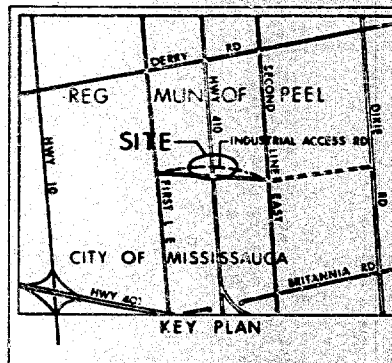
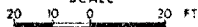


WEST PIER
WEST ABUT BRGS
MED. PIER
HWY 410
FUTURE EAST PIER
EAST ABUT BRGS



PROFILE OF INDUSTRIAL ACCESS RD

SCALE



LEGEND

- ◆ Bore Hole
- ⊕ Dynamic Cone Penetration Test (Cone)
- ⊕ Bore Hole & Cone
- W Blows/ft (Std Pen Test 350 ft lbs energy)
- CONE Blows/ft (60° Cone, 350 ft lbs energy)
- ↓ WL at time of investigation OCT 1978
NO WL observed BH No 2

| No | ELEVATION | CO-ORDINATES | |
|----|-----------|--------------|---------|
| | | NORTH | EAST |
| 1 | 615.1 | 861 060 | 952 835 |
| 2 | 615.0 | 861 022 | 952 879 |
| 3 | 611.5 | 861 122 | 952 943 |
| 4 | 611.5 | 861 102 | 952 962 |
| 5 | 610.4 | 861 199 | 953 030 |
| 6 | 609.9 | 861 158 | 953 076 |

-NOTE-

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

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

HWY No 410 DIST 6
S.S.L. CHECKED DATE 28 11 08 SITE 24-241
DRAWN BY CHECKED DATE 28 11 08 DWG 1036913-1A

Mr. G.C.E. Burkhardt
Head, Structural Section
Central Region
3501 Dufferin Street

Soil Mechanics Section
Engineering Materials Office
Room 315, Central Building

78 11 17

Re: Industrial Access Road Underpass
1.2 Miles North of Hwy. 401/410
W.P. 103-69-13, Site 24-~~4~~41
Hwy. 410, District 6, Toronto

A foundation investigation report for the feasibility study of Hwy. 410 was submitted by this Office in July, 1975 under W.P. 103-69-00. It is understood that the proposed underpass structure has been designed according to the preliminary recommendations contained in the feasibility study foundation report. After the footing locations had been finalized, a detailed investigation was carried out by this Section to determine the subsurface conditions at the proposed footing locations. The recent investigation revealed that the site is underlain by a deposit of cohesive glacial till which in turn is followed by shale bedrock. The glacial till was found to be generally competent, however, a 4 to 10 foot thick zone of somewhat weaker material was encountered in the upper portion of the overburden, with 'N' values from the Standard Penetration Test as low as 8 blows per foot. The presence of this softer zone requires a reduction in the bearing capacity originally recommended. In the light of the new subsurface data, we recommend that the allowable bearing capacity should not exceed 2½ tons for the abutment footings and 3 tsf for the pier footings. The revised bearing capacities are contained in our foundation report W.P. 103-69-13.

We trust that these bearing capacities will be used in the design.

B. Ly
B. Ly
Senior Engineer

For: M. Davata
Supervising Engineer

EL/MD/gs

cc: C.S. Grebski
W. Lin
Files /

DOCUMENT MICROFILM IDENTIFICATION

GEOCRES No. 30H 12-135

DIST 6 REGION CENTRAL

W.P. No. 10S-69-13

CONT. No. 79-27

W.O. No. _____

STR. SITE No. 24-441

HWY. No. 410

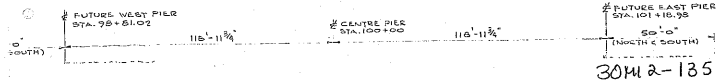
LOCATION INDUSTRIAL ACCESS RD.

U' PASS 1.2 MILES NORTH OF HWY 40/410

ENTRANCE DRAWINGS TO BE INCLUDED WITH THIS REPORT 2

REMARKS _____

WP 103-69-13 (Industrial Area P.d)



304/2-135

