#60-F-251C

W.P.#291-60

Hwy#401

SWITZERVILLE

RD.

ONTARIO
DEPARTMENT OF HIGHWAYS

*Memo to* Mr. A. M. Toye, *Date* July 22, 1960.

Bridge Engineer. *Subject* FOUNDATION INVESTIGATION REPORT

*From* Materials & Research Section. BY: UNIVERSAL GEOTECHNIQUE, LIMITED

Attention: Mr. S. McCombie.

Re: Proposed Crossing, Hwy. 401 and
Switzerville Rd., Twp. of Ernestown.
W.P. 291-60 -- District No. 8.

A review of the foundation report prepared by Universal Geotechnique, for the above site, has been completed by the Foundation Section. No foundation problems appear to exist at this site. The conclusions reached by the Consultant are summarized below:-

1. The site is underlain by a layer of dense, sandy till.

2. Foundations for the proposed structure should be designed as spread footings. The spread footings may be designed for a net bearing pressure of 4 tons/ft.$^2$, and founded at or below elevation 420.0'.

3. Settlements associated with the suggested loading, will be small. Maximum differential settlement should be less than 1/2 inch.

4. No problems associated with approach fill stability, exist at this site.

5. If a multi-span structure is proposed for this site, and if the abutments are supported by piles, large displacement steel piles will develop a capacity of 35 tons at approx. elevation 420.0 ± 5'. Control of fill placement in the area of piles should eliminate the need for pre-boring to facilitate placing of these piles. If pre-boring is specified through the fill material, boring should not be permitted beyond the original ground level.

If further queries arise in connection with these comments, please contact the Foundation Section.

KP/MdeF
Attach.
cc: Messrs. A. M. Toye (2)
H. A. Tregaskes
D. G. Ramsay
J. Ford
T. A. Sharpe
J. E. Gruspier
A. Watt
Fdns. Office
Gen. Files.

L. G. Soderman,
PRINCIPAL FOUNDATIONS ENGR.
Per: K Peaker
(K. Peaker,
FIELD SUPERVISING FDNS. ENGR.)

UNIVERSAL

**GEOTECHNIQUE**

LIMITED

REPORT

on

FOUNDATION INVESTIGATION

for

PROPOSED CROSSING

HIGHWAY 401 & SWITZERVILLE ROAD

TOWNSHIP OF ERNESTOWN

COUNTY OF LENNOX & ADDINGTON

for

ONTARIO DEPARTMENT OF HIGHWAYS

(W.P. 291-60)

Report N° T.440/60

100 University Avenue,
Toronto 1, Ontario.

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APPENDIX.....

# REPORT

on

# FOUNDATION INVESTIGATION

for

# PROPOSED CROSSING

# HIGHWAY 401 & SWITZERVILLE ROAD

# TOWNSHIP OF ERNESTOWN

# COUNTY OF LENNOX & ADDINGTON

for

# ONTARIO DEPARTMENT OF HIGHWAYS

(W.P. 291-60)

## INTRODUCTION

The Ontario Department of Highways are planning an Underpass at the intersection of Highway 401 and Switzerville Gravel Road in the Township of Ernestown.

In order to determine the subsurface conditions for purposes of foundation design the Materials & Research Section of DHO authorized Universal GEOTECHNIQUE Limited to proceed with an investigation at the proposed site generally in accordance with their requirements as stated in a letter of authorization dated 24th June, 1960. This Report contains the results of the subsurface exploration together with information relative to foundation design.

## AVAILABLE INFORMATION

DHO plan F 3056 [illegible] the proposed location of the Underpass of Highway 401 relative to the proposed relocation of Switzerville Gravel Road. This drawing also indicates the suggested positions for exploratory boreholes and dynamic cone penetration tests. DHO section F 3056-2 indicates that the grade elevation of proposed Highway 401 at the Underpass is to be about 419, and the new bridge will be designed to carry the minor road over Highway 401.

## THE SITE

The site of the proposed bridge is located within Lot 3, Concession VI in the Township of Ernestown in the County of Lennox & Addington.

## SUBSURFACE EXPLORATION

Subsurface exploration was carried out during the period 22nd to 28th of June, 1960, under the supervision of a Soils Engineer in charge of field operations and comprised 3 exploratory boreholes and 5 dynamic cone penetration tests located in positions as shown on drawing N° 2, the cone penetration tests being positioned within the distance of 2 to 3 feet of the boreholes except as otherwise shown on the plan.

The positions of all boreholes and penetration tests were staked and ground elevations given by the DHO Survey Crew. During the operation of exploratory boring, soil samples were obtained generally at intervals of 2-1/2 feet and where noticeable changes of strata occurred the depths of such changes were recorded.

The state of compaction of essentially cohesionless strata and the general consistency of cohesive strata were determined by standard penetration tests taken during the operation of soil sampling. (The standard penetration test, as referred to in this Report, involves the recording of the number of blows (N) of a 140 lb. hammer falling 30 inches that are required to drive a 2 inch diameter split barrel sampler 1 foot into the soil at the bottom of the borehole).

A continuous record of the general state of compaction of the soil was also obtained adjacent to all boreholes and at two additional positions by means of dynamic cone penetration tests which were carried to depths where virtually refusal conditions were encountered. The results of these tests are given graphically on drawings included in the appendix.

Visual examination and classification of all soil samples was carried out in the laboratory and the descriptions of the strata obtained from such examination together with the results of standard penetration tests are given on the borehole logs, and a summary of laboratory index property tests are given in Table N° 1.

Subsurface conditions given in this Report are those indicated by material encountered in the boreholes. The accuracy of extrapolation to obtain the soil profile should be associated directly with the geological conditions and inversely with the spacing of the boreholes.

## GEOLOGICAL FEATURES

The site is situated in the Napanee Plain which exhibits a thin mantle of glacial drift covering the underlying limestone. The glaciers that have stripped the plain of the larger part of the overburden have, in scattered locations, left somewhat thin subdued drumlins. The proposed site is located on top of one of these drumlins.

From the information obtained from the boreholes it may be concluded that the strata down to the explored depths can be classified as follows:

### TOP SOIL

About a foot of brown loam containing organic matter covers the site.

### BROWN SANDY TILL

From 15 to 18-1/2 feet of generally dense to very dense brown somewhat silty sand containing fine to coarse subangular gravel was encountered on the site: From about 1 to 2 feet below its upper surface it is loose to firm and contains traces of organic matter.

### GREY SANDY TILL

The very dense grey somewhat silty sand containing gravel that was recorded in boreholes BH.1 & 2 is the same in composition as the overlying brown till and is the unweathered parent material of the brown till.

### GROUND WATER

Free water was recorded during the period of exploration at elevation 420.5.

Water in all the boreholes was easily removed by bailing with a 2" diameter bailer.

## LABORATORY TESTS

In addition to visual examination of all soil samples, index property tests were carried out and the results are given in Table N° 1.

## DISCUSSION

The results of the subsurface exploration disclosed that the site of the proposed bridge is underlain by glacial till beneath a limited thickness of topsoil. The upper few feet of the till exists in a loose to firm state due to extensive weathering.

The glacial till has been subdivided into the upper brown till which extends to about elevation 410 in boreholes BH.1 & 2 and probably somewhat lower in borehole BH.3. Both tills with the exception of the upper part of the brown till exist in a dense to very dense state, and as the proposed pavement elevation of Highway 401 is about 419 it is suggested that normal spread footings can be supported on the brown till.

If the underside of such footings are located at elevation 414 the allowable bearing capacity may be taken as 4 tons/sq.ft.

## CONCLUSIONS

From a consideration of the soil and groundwater conditions as disclosed by the subsurface exploration the following conclusions concerning foundation design may be drawn:

1. The subsurface conditions beneath the proposed site of the bridge consist of a limited thickness of topsoil underlain by glacial till.

2. The most suitable type of foundation would be spread footings to the two abutments and central pier of the proposed bridge, such footings being supported on the brown till.

3. The allowable bearing capacity for the design of spread footings located at elevation 414 may be taken as 4 tons/sq.ft.

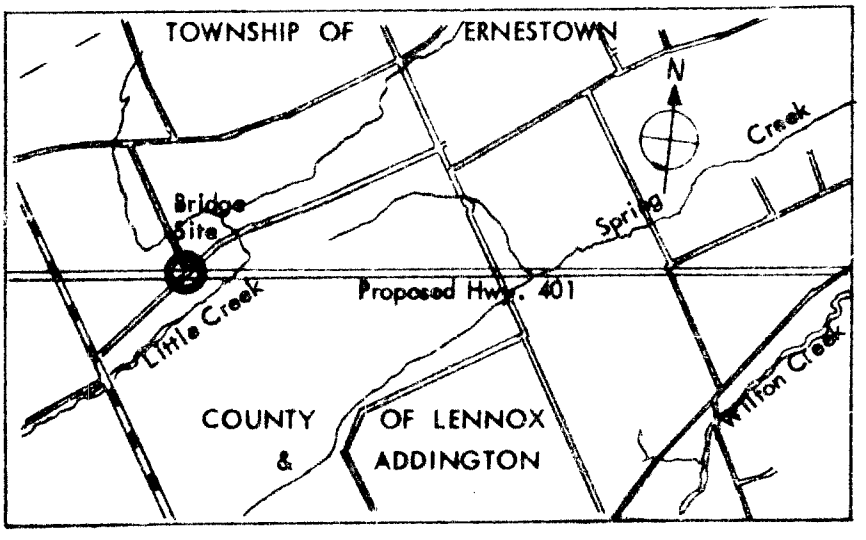
4. No difficulties need be expected in dewatering excavations for purposes of construction as the till is well graded and is generally in a very dense state.

Universal GEOTECHNIQUE Limited,

L. Baskin, P.Eng.

Report N° T.440/60

July, 1960.




KEY PLAN

Scale: 1" = 1 Mile

PROJECT Proposed Crossing Hwy. 401 & Switzerville Rd.

TITLE Key Plan

DRG NO. 1 ORDER NO T.440/60

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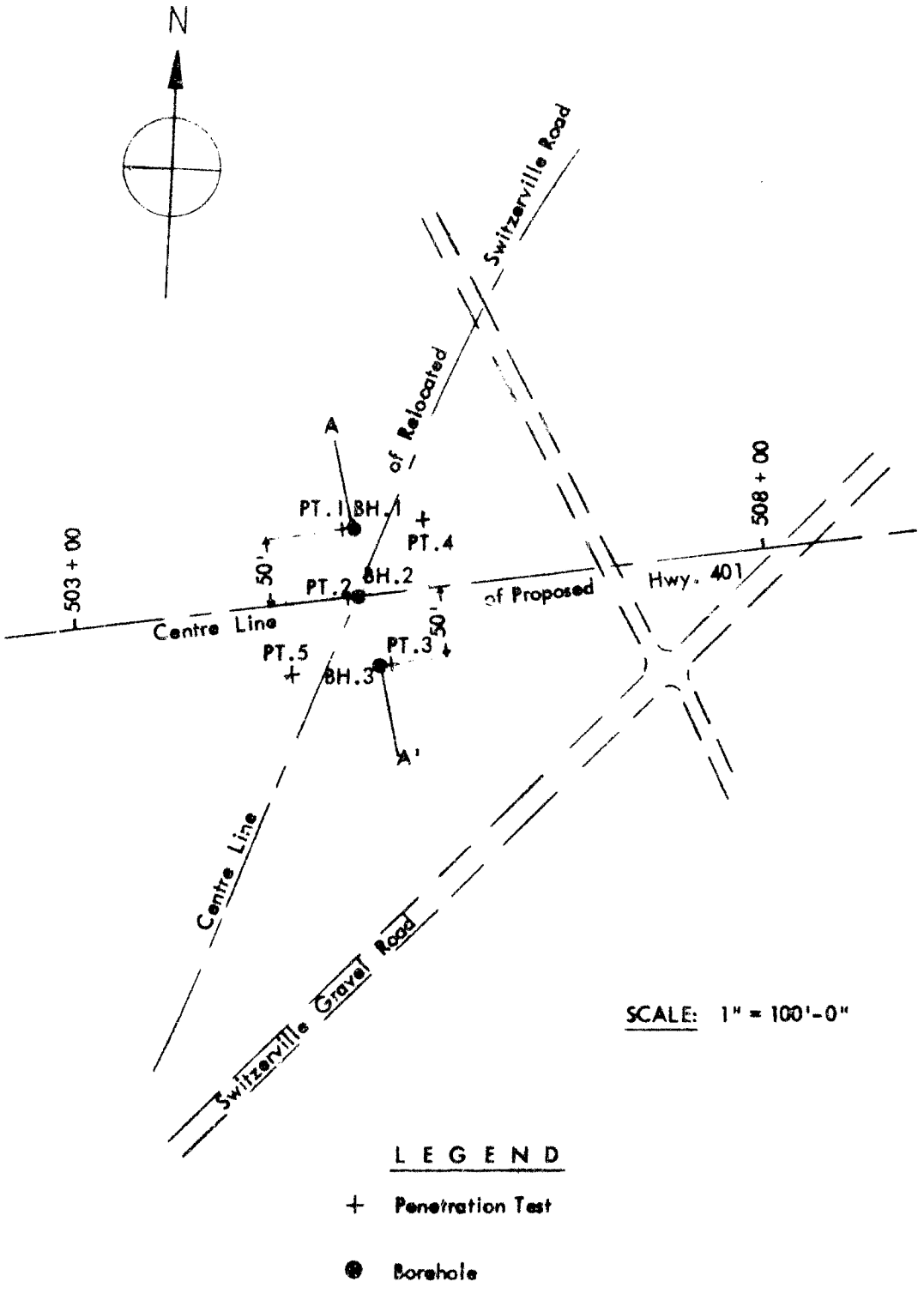


PROJECT Proposed Crossing, Hwy. 401 & Switzerville Rd.

TITLE Borehole Location Plan

DRG. NO. 2 ORDER NO. T.440/60

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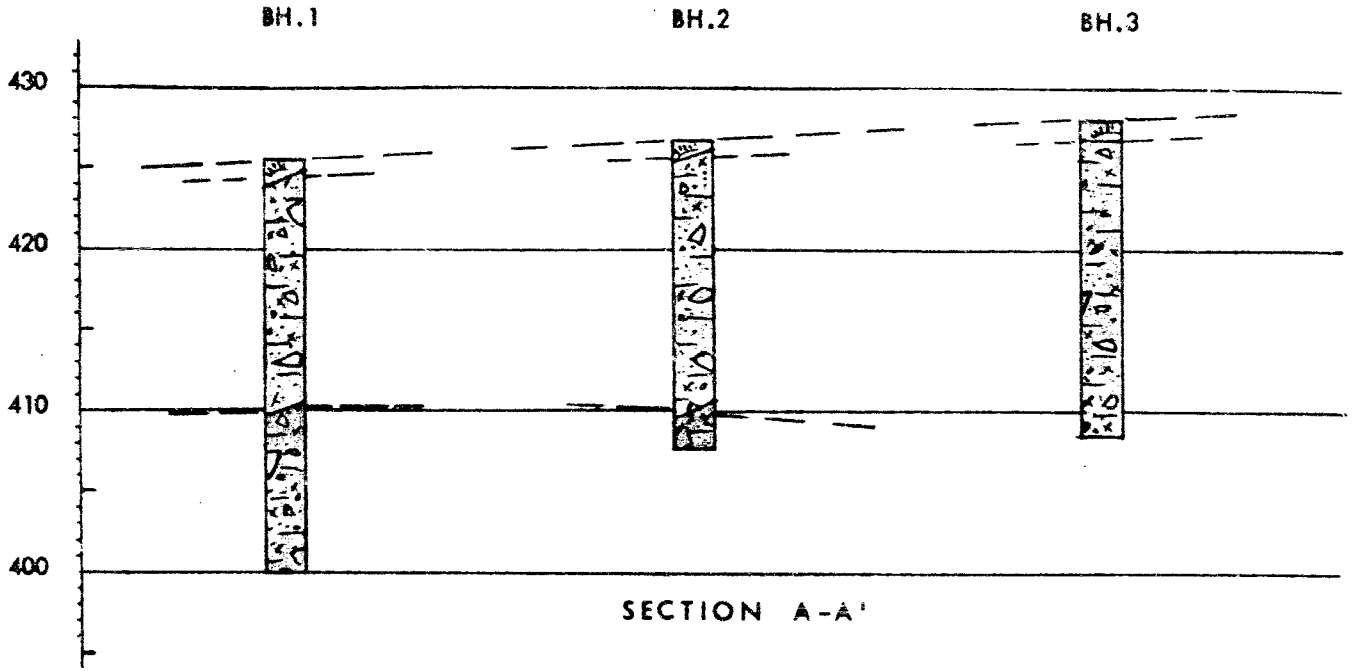
LIMITED

PROJECT Proposed Crossing Hwy. 401 & Switzerville Rd.

TITLE Geological Section

DRG. NO. 3 ORDER NO. T.440/60

UNIVERSAL GEOTECHNIQUE LIMITED




SECTION A-A'

LEGEND

TOP SOIL

BROWN SANDY TILL

GREY SANDY TILL

SCALE

Horizontal 1" = 20'-0"
Vertical 1" = 10'-0"

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SOIL MECHANICS LABORATORY

## BOREHOLE LOG

PROJECT Proposed Crossing Hwy. 401 & Switzerville Road (W.P.291-60) ORDER NO. T.440/60

CLIENT Ontario Department of Highways

BOREHOLE NO. BH.1 DIAMETER 2-1/2" CASING 2-1/2"

BOREHOLE LOCATION 505+00/50' North INCLINATION Vertical BEARING ———

| DESCRIPTION OF STRATA | ELEVATION | LEGEND | SAMPLE | DEPTH | THICKNESS | N | REMARKS |
|---|---|---|---|---|---|---|---|
| Brown loam with organic matter. | 425.5 | | | Zero | | | |
| Firm brown clayey silty SAND, occasional fine gravel & some organic matter. | | | • 1 | | | 13 | Damp. Medium to high dry strength. |
| Dense light brown silty SAND with fine to coarse subangular gravel, considerable exfoliation and some iron staining. | 420.0 | | • 2 | | | 50 | Damp. Medium dry strength. |
| Very dense do No iron staining. | | | • 3 | | | 87 | do |
| do | | | • 4 | | | - | do |
| do | | | • 5 | | | 70 ( 9") | do |
| do | 410.0 | | • 6 | | | 98 ( 9") | do |
| With some sand pockets. | | | | | | | |
| Very dense grey silty SAND with fine to coarse subangular gravel, some exfoliation. Pockets of sandy silt. | | | • 7 | | | 89 ( 7") | Damp. Medium dry strength. |
| do | | | • 8 | | | 60 ( 6") | do |
| No silt pockets | | | | | | | |
| do | | | • 9 | | | 59 ( 6") | do |
| do | 400.0 | | • 10 | 25'-6" | | 92 ( 9") | do |
| | | | End of Borehole | | | | |

SCALE : 1" = 5'-0" • DISTURBED SAMPLE ▮ UNDISTURBED SAMPLE

FORM G-1A 800 UNITED STATIONERY CO. Limited

UNIVERSAL **GEOTECHNIQUE** LIMITED

SOIL MECHANICS LABORATORY

## BOREHOLE LOG

PROJECT Proposed Crossing Hwy. 401 & Switzerville Road (W.P. 291-60) ORDER NO. T.440/60

CLIENT Ontario Department of Highways

BOREHOLE NO. BH.2 DIAMETER 2-1/2" CASING 2-1/2"

BOREHOLE LOCATION 505 + 05 INCLINATION Vertical BEARING ——

| DESCRIPTION OF STRATA | ELEVATION | LEGEND | SAMPLE | DEPTH | THICKNESS | N | REMARKS |
|---|---|---|---|---|---|---|---|
| Brown loam with organic matter. | 426.8 | | | Zero | | | |
| Loose brown silty SAND, occasional gravel, traces of organic matter. | | | • 1 | | | 9 | Damp. Medium dry strength. |
| Dense light brown silty SAND with fine to coarse subangular gravel, iron stained, some exfoliation. | | | • 2 | | | 38 | do |
| | 420.0 | | | | | | |
| do No iron staining. | | | • 3 | | | 49 | do |
| Very dense do | | | • 4 | | | 63 | do |
| do | | | • 5 | | | 139 | do |
| | 410.0 | | | | | | |
| Very dense grey silty SAND with fine to coarse subangular gravel. | | | • 6 | 19'-0" | | 113 | |
| | | | End of Borehole | | | | |

SCALE: 1" = 5'-0" • DISTURBED SAMPLE ▮ UNDISTURBED SAMPLE

FORM G-1A 800
UNITED STATIONERY CO.

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SOIL MECHANICS LABORATORY

## BOREHOLE LOG

PROJECT Proposed Crossing Hwy. 401 & Switzerville Road (W.P. 291-60) ORDER NO. T.440/60

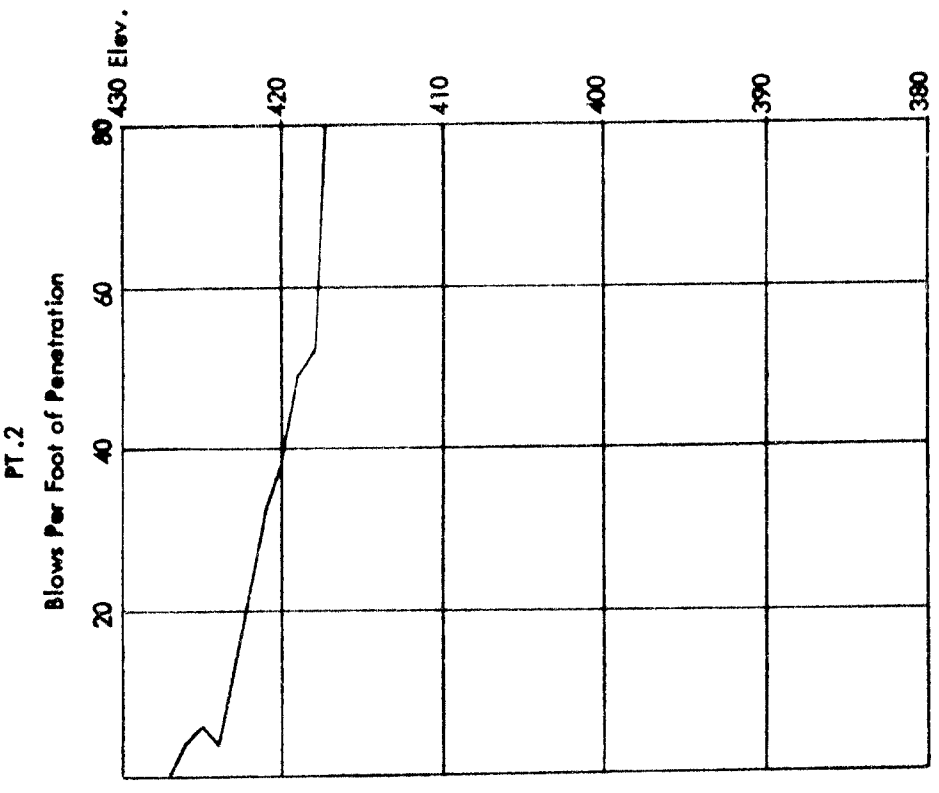
CLIENT Ontario Department of Highways

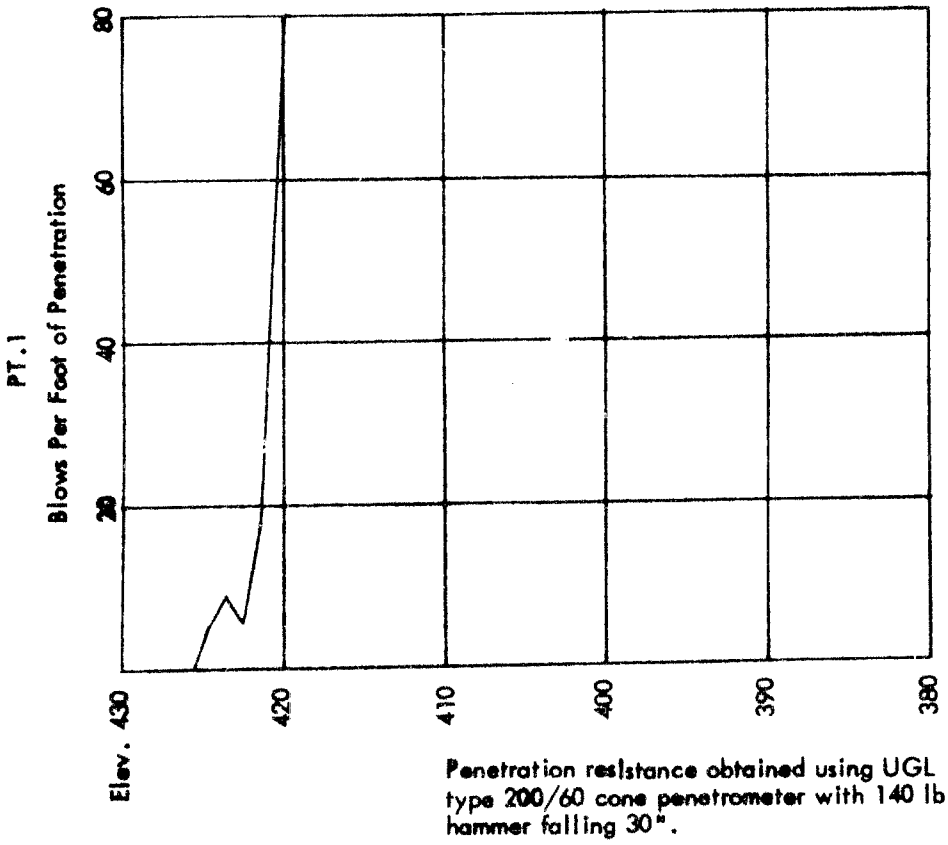
BOREHOLE NO. BH.3 DIAMETER 2-1/2" CASING 2-1/2"

BOREHOLE LOCATION 505+10/50' South INCLINATION Vertical BEARING ———

| DESCRIPTION OF STRATA | ELEVATION | LEGEND | SAMPLE | DEPTH | THICKNESS | N | REMARKS |
|---|---|---|---|---|---|---|---|
| Brown loam with organic matter. | 428.0 | | | Zero | | | |
| Loose brown silty SAND with occasional gravel and some organic matter. | | | ● 1 | 1'-3" | | 7 | Damp. Medium dry strength. |
| Dense light brown silty SAND with fine to coarse subangular gravel, some exfoliation and iron staining. | | | ● 2 | | | 54 | do |
| do | 420.0 | | ● 3 | | | 54 | do |
| Very dense do No iron staining. | | | ● 4 | | | 62 | do |
| do Includes wet sand pockets. | | | ● 5 ● 6 | | | 56 - | do |
| Very dense light brown silty SAND with fine to coarse subangular gravel. | 410.0 | | ● 7 | | | 67 (6") | do |
| do | | | ● 8 | 19'-8" | | 98 (8") | do |
| | | | End of Borehole | | | | |

SCALE: 1" = 5'-0" ● DISTURBED SAMPLE ▮ UNDISTURBED SAMPLE



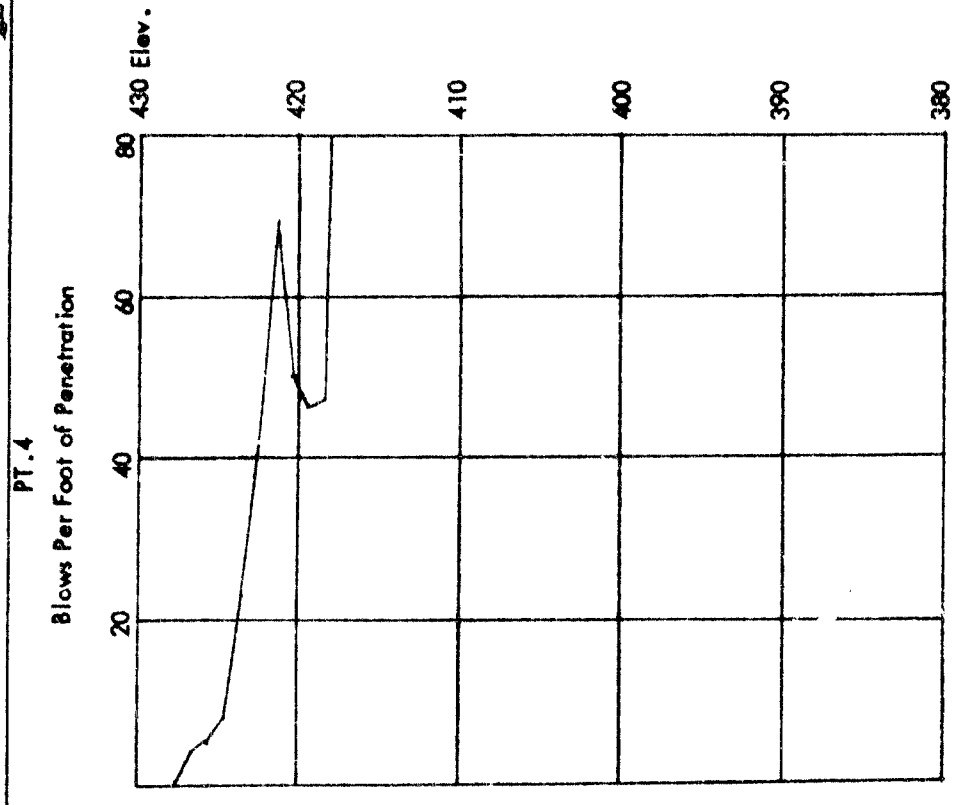

Penetration resistance obtained using UGL type 200/60 cone penetrometer with 140 lb. hammer falling 30".

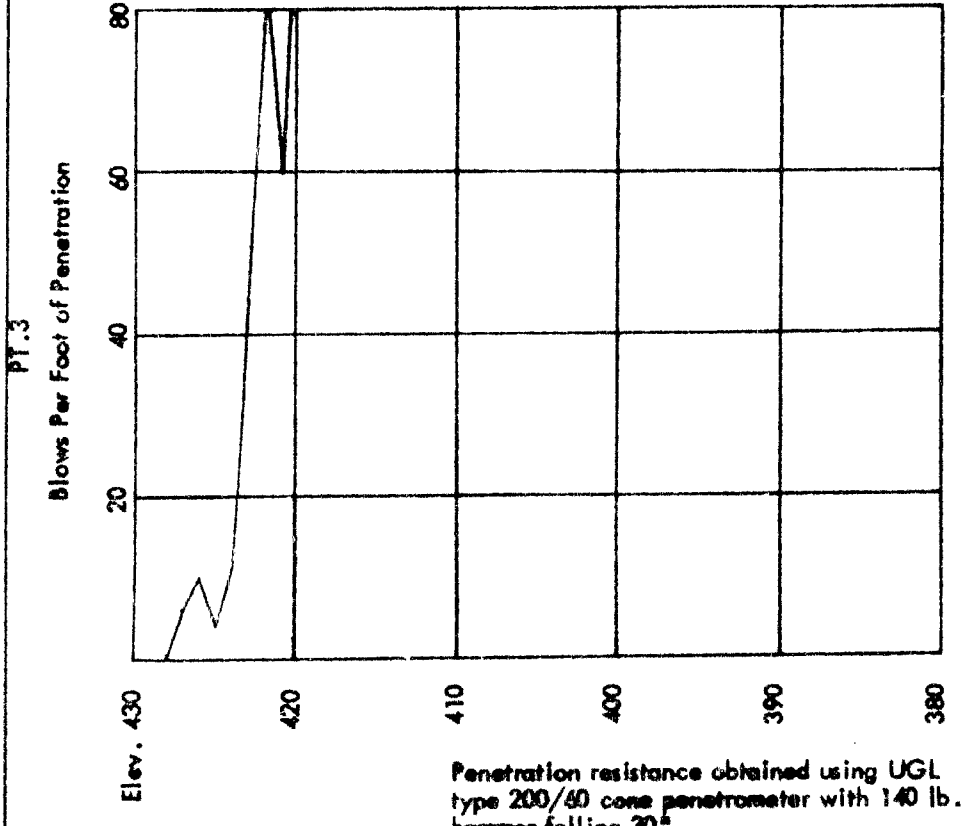
PROJECT Proposed Crossing Hwy. 401 & Switzerville Rd.

TITLE Dynamic Penetration Test Diagrams

DRG. NO. 4 ORDER NO. T.440/60

UNIVERSAL GEOTECHNIQUE LIMITED



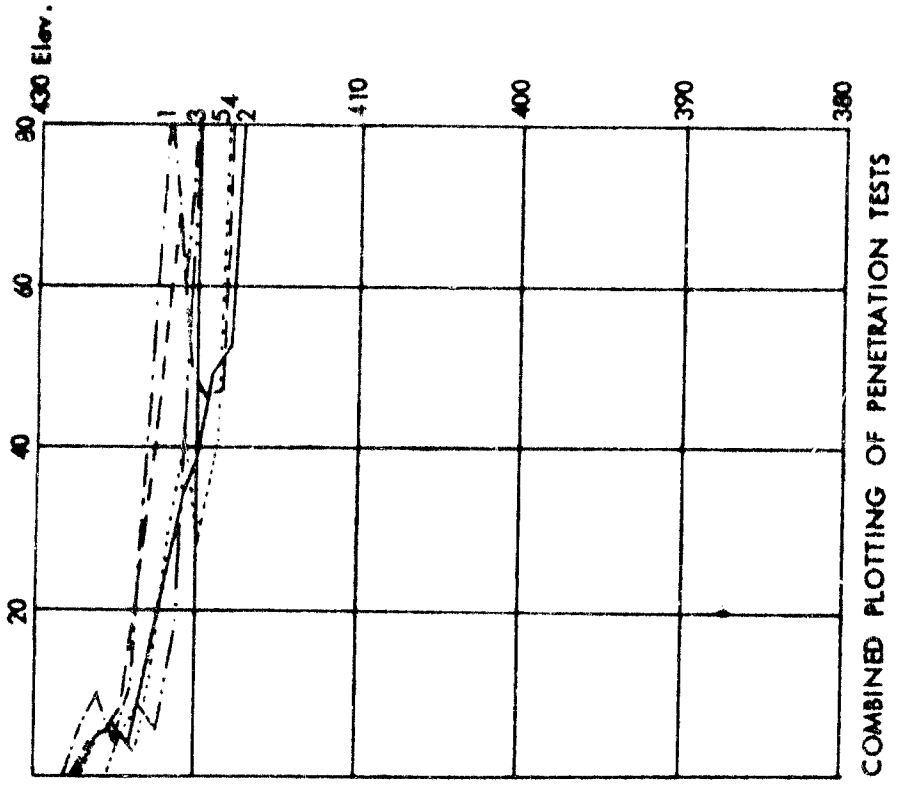

Penetration resistance obtained using UGL type 200/60 cone penetrometer with 140 lb. hammer falling 30".

PROJECT Proposed Crossing Hwy. 401 & Switzerville Rd.

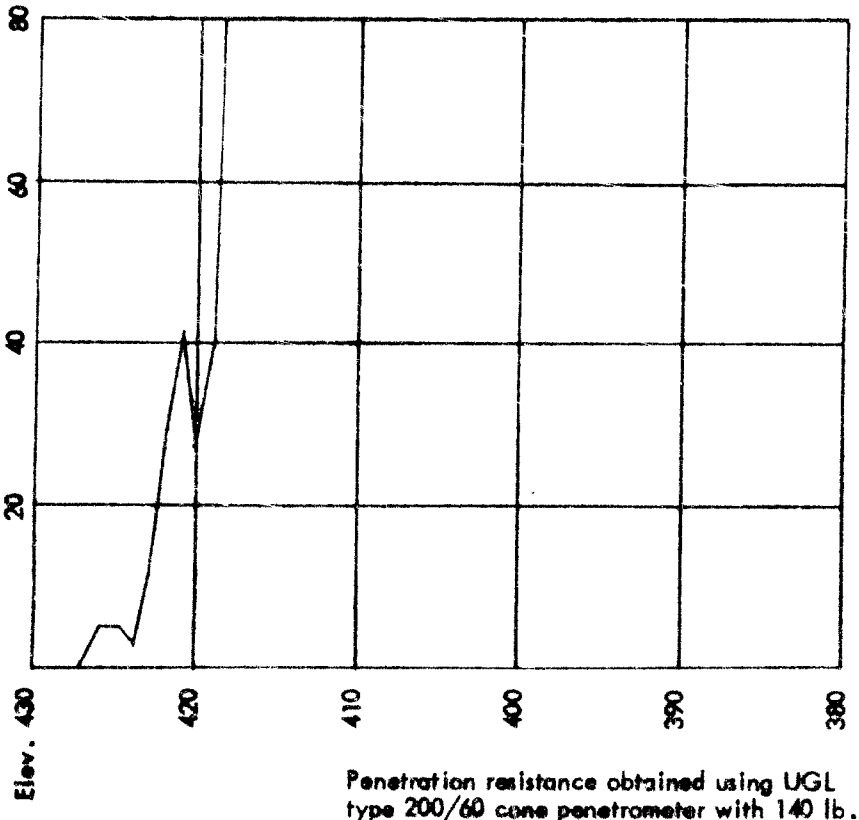
TITLE Dynamic Penetration Test Diagrams

DRG. NO. 5 ORDER NO. T.440/60

UNIVERSAL GEOTECHNIQUE LIMITED




COMBINED PLOTTING OF PENETRATION TESTS




PT.5

Blows Per Foot of Penetration

Penetration resistance obtained using UGL type 200/60 cone penetrometer with 140 lb. hammer falling 30".

PROJECT Proposed Crossing Hwy. 401 & Switzerville Rd.

TITLE Dynamic Penetration Test Diagrams

DRG. NO. 6 ORDER NO. T.440/60

UNIVERSAL GEOTECHNIQUE LIMITED

# SOIL MECHANICS LABORATORY

## INDEX PROPERTIES

REPORT NO. T.440/60 TABLE NO. 1 SHEET NO. 1

| BORE-HOLE NO | SAMPLE NO. | DEPTH FROM | DEPTH TO | NATURAL DENSITY LB/FT³ | NATURAL MOISTURE CONTENT % | LIQUID LIMIT % | PLASTIC LIMIT % | PLASTICITY INDEX | TYPE OF SAMPLE U - UNDISTURBED D - DISTURBED |
|---|---|---|---|---|---|---|---|---|---|
| BH.1 | 3 | 7'-0" | 8'-0" | 153 | 7.1 | | | | |
| | 4 | 9'-0" | 10'-0" | | 8.4 | | | | |
| | 5 | 11'-0" | 11'-9" | | 9.6 | | | | |
| | 6 | 14'-0" | 14'-9" | 150 | 8.6 | | | | |
| | 7 | 16'-10" | 17'-5" | 148 | 12.9 | | | | |
| | 8 | 18'-10" | 19'-4" | | 7.4 | | | | |
| | 9 | 22'-2" | 22'-8" | 143 | 7.7 | | | | |
| | 10 | 24'-9" | 25'-6" | | 7.3 | | | | |

PROJECT Proposed Crossing Hwy. 401 & Switzerville Rd.

TITLE Laboratory Tests

ORDER NO. T.440/60

UNIVERSAL GEOTECHNIQUE LIMITED