cc: Foundation Section

Mr. A. M. Toye,

Bridge Engineer.

Materials & Research Section.

Attention: Mr. J. McCombie.

April 3, 1959.

Re: FOUNDATION INVESTIGATION -

Intersection of Hwy. 401 Line 'A',
and Gravel Road, Con. V, Lot A,
Aldborough & Dorchester Townships -
~~Elgin~~ Co. 93-59

Submitted herewith is our report on the subsoil conditions at the above underpass location. Field work consisting of three sampled borings and four dynamic cone penetration tests, was carried out during the period December 9 to 12, 1958.

As evidenced by the field and laboratory results presented in this report, the proposed structure can be supported on simple strip footings founded at a depth below existing ground surface of [illegible] feet (i.e., Elev. 698 or below). A footing pressure of 3 tons/sq.ft. can be applied to the subsoil at the above recommended placement depth.

No seepage problems during footing excavation are anticipated and the clayey subsoil has sufficient strength to safely support the proposed embankment loadings.

If you have any questions regarding data or recommendations contained in this report, please contact our office.

LGS/MdeF
Attach.

A. Rutka,
ACTING MAT'LS. & RESEARCH ENGR.
per:

L. G. Sederman

(L. G. Sederman,
PRINCIPAL SOILS & FOUNDATION ENGR.)

cc: Messrs. A. Toye
H. Tregaskes
D. Ramsay
W. L. Fraser
J. Roy
A. Watt
Dr. P. Barrow

Foundation Section

File

# FOUNDATION REPORT

on

Hwy. 401 & Gravel Road Crossing -
Lot A, Con. V, Twps. of Aldborough
& Oxford, 4 1/2 Miles West of Rodney.

Plan No: F-3531-4

Profile No: F-3531-2

Distribution:

| | |
|---|---|
| Mr. A. M. Toye,<br>Bridge Engineer. | (2) |
| Mr. H. A. Tregaskes,<br>Construction Engineer. | (1) |
| Mr. D. C. Ramsay,<br>Design Engineer. | (1) |
| Mr. W. L. Fraser,<br>District Engineer,<br>London, Ontario. | (1) |
| Mr. J. Roy,<br>Regional Engineer,<br>London, Ontario. | (1) |
| Mr. A. Watt,<br>Water Resources Commission. | (1) |
| Dr. P. Karrow,<br>Department of Mines. | (1) |
| Foundation Section. | (1) |
| File. | (1) |

W.P. 18-59.

W.J. F-58-46.

INTRODUCTION:

An investigation has been carried out to determine the competence of the subsoil layers for supporting the foundations of the proposed structure located some 4 1/2 miles west of Rodney where proposed Hwy. 401 Line 'A' crosses the gravel road in Lot A, Con. V, Townships of Aldborough and Oxford, (Station 8 + 60, - Profile No. F-3531-2).

The field work commenced on December 9, 1958 and was completed on December 12, 1958.

DESCRIPTION OF THE SITE & GEOLOGY:

The site and its surrounding area are generally flat farmlands, presently under cultivation.

Physiographically, the site is located on the bevelled portion of the Bothwell Sand Plain, composed basically of a deep deposit of silty clay till. At this site, the stiff clay stratum is overlain by a shallow surface veneer of organic topsoil. Because of the increase in strength with depth exhibited by the clayey till layer, boreholes were not extended to bedrock elevation.

DESCRIPTION OF FIELD & LABORATORY WORK:

Field work consisted of 3 sampled boreholes with dynamic cone penetration tests adjacent to each hole, and one separate dynamic cone penetration test. The exploration programme was carried out by means of a skid-mounted coredrill machine, adapted for soil sampling. Samples were recovered at depth intervals of five feet. Relatively undisturbed 2" I.D. thin walled Shelby tube samplers and disturbed 2" O.D. split barrelled spoon samplers were recovered from the cohesive clayey subsoil. The dimensions of the

cont'd. /2 ...

DESCRIPTION OF FIELD & LABORATORY WORK: (cont'd.) ...

split barrelled sampler, and the energy used in driving it, conform to the requirements of the Standard Penetration Test.

Upon receipt in the laboratory, samples were visually examined and identified. Routine index tests were performed on selected representative samples. Laboratory and field test results have been presented in the borehole logs and detailed in tabular form.

The Location Plan, and Subsoil Profile are shown in Drawing No. F-58-46 A.

SUBSOIL CONDITIONS:

The site is underlain by a deep deposit of stiff silty clay, the upper zone of which has been subjected to oxidation.

In each of the sampled boreholes the topsoil was found to be underlain by the stiff silty clay stratum. The upper zone of the stratum has been oxidized to its present brownish colour. Below the oxidized zone the colour is predominantly grey. The stiff condition of this stratum of clay is believed to be the result of glaciations. Borings were carried to a depth of 35 feet - (i.e., Elev. 668) below the ground surface.

In general, the stiff clay contains approximately 7% fine to medium gravel throughout. Averaged unit weight and moisture content were found to be 135 p.c.f. and 16% respectively. Laboratory shear strength tests show that the stiff clay has a minimum value of 4000 p.s.f. for the upper 20 feet of the subsoil. The stiff clay appears to be heavily preconsolidated.

Laboratory and field test results have been summarized in Table No. 1 and are included in this report under Appendix I.

cont'd. /3 ...

WATER CONDITIONS:

Due to the low permeability of the clay, it was impossible to establish the ground water table of the site during the boring programme. The water table has been assumed at ground surface. In view of the fact that no water-bearing sand seams or artesian water conditions were encountered during the time of boring, the amount of seepage inflow during excavations will be of minor quantities, only.

FOUNDATION SUPPORT:

The stiff silty clay can provide satisfactory foundation support for the proposed structure. Spread footing support can be obtained at Elev. 698 or below. At this elevation the strength and compressibility characteristics of the clayey stratum are such that bearing capacity of at least 3 T.s.f. can be used for spread footing design. This incorporates a factor of safety of 3. Settlements consequent upon application of this bearing pressure will be within tolerable limits. Footings founded at Elevation 698 (approximately 5 ft. below existing ground surface) will have sufficient protection against frost action.

No seepage problems with respect to shallow footing excavations are anticipated.

The subsoil has sufficient strength to safely support the proposed embankment loads for both the gravel road underpass approach fills.

cont/ 4 ...

CONCLUSIONS & RECOMMENDATIONS:

(1) The site is covered by a deep deposit of stiff silty clay, the very dense till state of which is believed to be the result of glaciations.

(2) Subsoil conditions are such that spread footing support can be obtained at Elev. 698 or below. At this elevation or below, an allowable bearing capacity of at least 3 T.s.f. can be provided by the stiff clay. Settlement consequent upon application of this bearing pressure will be within tolerable limits. Footings founded at Elevation 698 - (approximately 5 ft. below existing ground surface) are believed to have adequate protection against frost penetration.

(3) No seepage problems with respect to shallow footing excavations are anticipated.

(4) No approach fill stability problem is anticipated either for the proposed grade line of Hwy. 401 or the gravel road approach embankments.

A. Loh,
Foundation Engineer.

# APPENDIX I.

FEB 58

TABLE No. 1.

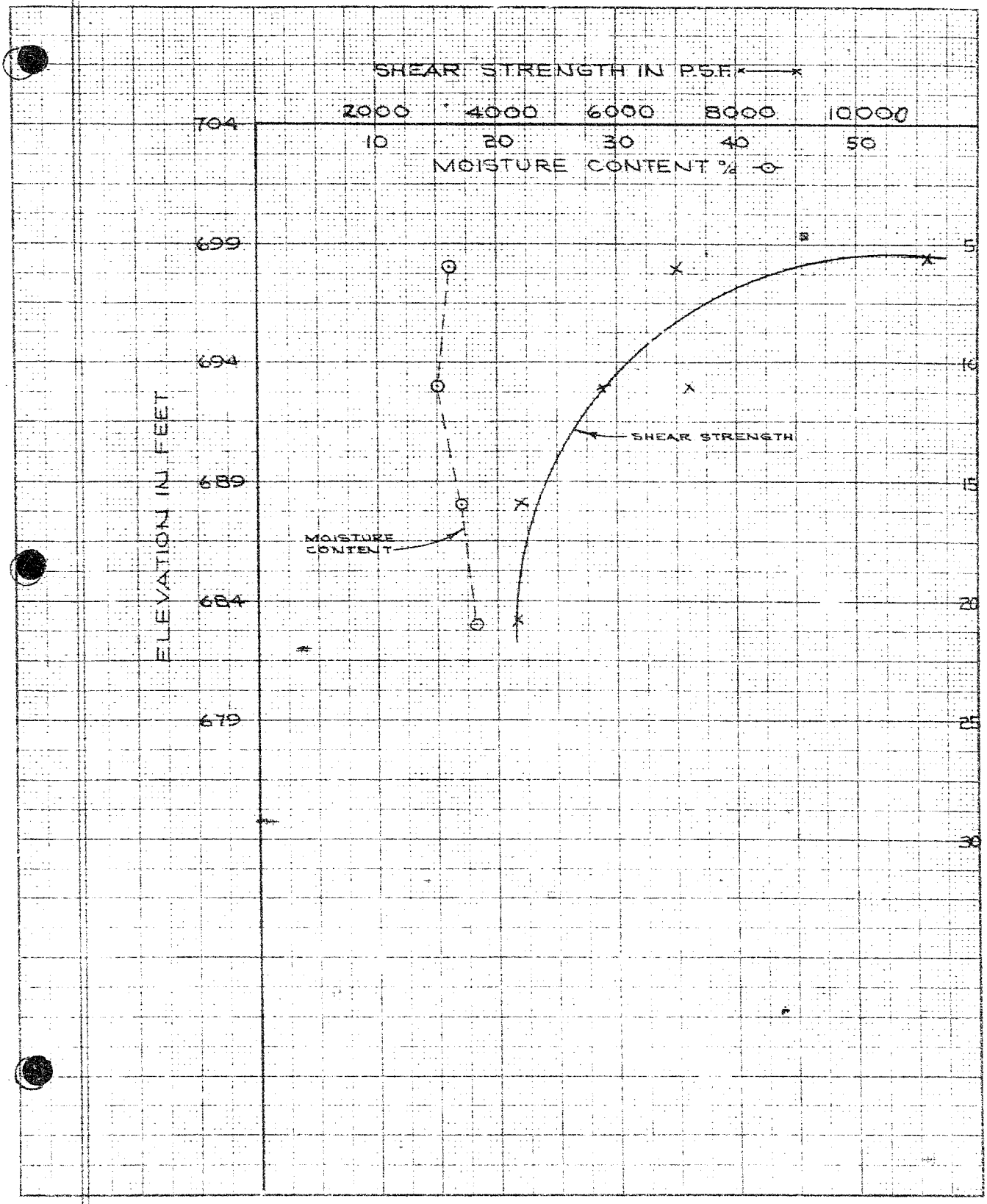
# SUMMARY OF FIELD & LABORATORY TESTS

JOB F-58-46
W.P. 18-59

| HOLE NO. | SAMP NO. | SAMPLE DEPTH (FEET) | MATERIAL DESCRIPTION | PENET'N RESIST. BLOWS/FT. | MOIST. CONT. % | PLASTIC LIMIT % | LIQUID LIMIT % | SHEAR STRENGTH p.s.f. | UNIT WEIGHT p.c.f. | REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | T1 | 5'-7' | Stiff brown silty clay. | 51 | 15.9 | 16.2 | 29.9 | 6990 | 135.5 | Approximately 7% fine to medium gravel throughout. |
| 1 | T2 | 10'-12' | Stiff grey silty clay. | 57 | 14.1 | - | - | 5760 | 137.0 | |
| 1 | T3 | 15'-17' | " " " " | 42 | 16.9 | - | - | 4320 | 133.1 | |
| 1 | T4 | 20'-22' | " " " " | 27 | - | - | - | - | - | |
| 1 | S5 | 25'-26'6" | " " " " | 27 | - | - | - | - | - | |
| 1 | S6 | 30'-31'6" | " " " " | 27 | - | - | - | - | - | |
| 1 | S7 | 34'-35'6" | " " " " | 29 | - | - | - | - | - | |
| 2 | T1 | 5'-7' | Stiff brown silty clay. | 41 | - | - | - | - | - | |
| 2 | T2 | 10'-11'6" | Stiff brown silty clay. | 61 | 16.4 | - | - | 10,300 | 133.0 | |
| 2 | T3 | 15'-17' | Stiff grey silty clay. | 53 | - | - | - | - | - | |
| 2 | T4 | 20'-22' | " " " " | 46 | 17.6 | - | - | 4030 | 135.5 | |
| 3 | T1 | 5'-6' | Stiff brown clay. | 36 | 14.6 | - | - | 11,200 | 137.3 | |
| 3 | T2 | 10'-12' | Stiff grey clay. | 51 | 15.3 | - | - | 7200 | 139.0 | |
| 3 | T3 | 15'-17' | " " " | 37 | 16.2 | - | - | 4030 | 136.2 | |
| 3 | T4 | 20'-22' | " " " | 25 | 18.4 | - | - | 2360 | 134.6 | |
| 3 | S5 | 25'-26'6" | " " " | 23 | - | - | - | - | - | |
| 3 | S6 | 30'-31'6" | " " " | 36 | - | - | - | - | - | |
| 3 | S7 | 34'-35'6" | " " " | 36 | - | - | - | - | - | |

T1 - Denotes Shelby Tube Sample.
S1 - Denotes Split Spoon Sample.

W.P. 18-59 JOB F-58-46



FORM OB-ML-126 H.O.R.

DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS & RESEARCH BRANCH - FOUNDATIONS SECTION - DOWNSVIEW

# OFFICE REPORT ON SOIL EXPLORATION

DRILL RIG 54-5 OPERATION BORE & PENET'N JOB F-58-46 W.P. 18-59 BORING 1 STA. 8+22 (35' Lt.)

CASING BX & AX (standard samplers to fit unless noted) DATUM GEODETIC DATE REPORT JAN. 1959

SAMPLER HAMMER WT. 250 LBS. DROP 19 INCHES COMPILED BY H.S. CHECKED BY A.L. DATE BORING 9 DEC. 1958

**ABBREVIATIONS**

V - INSITU VANE SHEAR TEST; M - MECHANICAL ANALYSIS; U - UNCONFINED COMPRESSION; $Q_c$ - TRIAXIAL CONSOLIDATED QUICK; Q - TRIAXIAL QUICK; S - TRIAXIAL SLOW; WL - WATER LEVEL IN CASING; WT - WATER TABLE IN SOIL; K - PERMIABILITY; C - CONSOLIDATION; CA. - CASING; $\gamma$ - UNIT WEIGHT

**SAMPLE TYPES**

C.S. - CHUNK; D.O - DRIVE OPEN; D.F. - DRIVE FOOT VALVE; T.O - THIN WALLED OPEN; S.S. - SLEEVE SAMPLE; P.S. - PISTON SAMPLE; W.S. - WASHED SAMPLE; R.C. - ROCK CORE

**SAMPLE CONDITION**

- DISTURBED
- FAIR
- GOOD
- LOST

| ELEVATION DEPTH | WATER CONDITIONS | DESCRIPTION | STRAT PLOT |
|---|---|---|---|
| 703.5' | | GROUND LEVEL | |
| 702.5' 1.0' | | TOPSOIL | |
| 3.5 | | STIFF BROWNISH GREY SILTY CLAY WITH ABOUT 7% OF FINE TO MED. GRAVEL | |
| 8.5 695.0 8.5' | | | |
| 13.5 | | STIFF GREY SILTY CLAY WITH ABOUT 7% OF FINE TO MEDIUM GRAVEL. | |
| 18.5 | | | |
| 23.5 | | | |
| 28.5 | | | |
| 33.5 668.0 35.5' | | END OF BOREHOLE | |
| 38.5 | | | |

ELEVATION SCALE: 700, 695, 690, 685, 680, 675, 670, 665, 660

SHEAR STRENGTH IN LBS PER SQ. FT. * 2000 4000 6000 8000

WATER CONTENT W % 10 20 O - NAT 30 □ - P.W 40 △ - L.W

PENETRATION TEST RESISTANCE BLOWS PER FOOT AT STANDARD ENERGY (4200 IN. LBS. PER BLOW)

D. CONE PEN. X------X------X 50 100 STAND. PEN. • 150 200

REFUSAL AT ELEV. 686.9' 113 BLOWS FOR 1"

END OF CASING AT ELEV. 668.5'

CASING BLOWS (ACTUAL) AX CASING SHOE

| CASING BLOWS (ACTUAL) | OTHER TESTS | CONDITION | TYPE | NO. | PENETRATION RESISTANCE | ELEV. RECOV. % |
|---|---|---|---|---|---|---|
| 3 | | | | | | 703.5 |
| 6 | | | | | | |
| 8 | | | | | | 3.5 |
| 11 | | | | | | 698.5' |
| 17 | | | | | | |
| 13 | $\gamma$=135.5 P.C.F. | | T.O. | 1 | 51 | 88 |
| 25 | | | | | | 8.5 |
| 41 | | | | | | 693.5' |
| 34 | | | | | | |
| 47 | | | | | | |
| 58 | $\gamma$=137.0 P.C.F. | | T.O. | 2 | 57 | 46 |
| 86 | | | | | | 13.5 |
| 125 | | | | | | |
| 153 | | | | | | 688.5' |
| 174 | | | | | | |
| 169 | $\gamma$=133.1 P.C.F. | | T.O. | 3 | 42 | 58 |
| 241 | | | | | | 18.5 |
| 345 | | | | | | |
| 275 | | | | | | 683.5' |
| 227 | | | T.O. | 4 | 27 | 67 |
| | | | | | | 23.5 |
| | | | | | | 678.5' |
| | | X | D.O. AX. | 5 | 27 | 100 |
| | | | | | | 28.5 |
| | | | | | | 673.5' |
| | | X | D.O. AX. | 6 | 27 | 100 |
| | | | | | | 33.5 |
| | | | | | | 668.5' |
| | | X | D.O. AX. | 7 | 29 | 100 |
| | | | | | | 38.5 |

FORM OB-ML-126

DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS & RESEARCH BRANCH - FOUNDATIONS SECTION - DOWNSVIEW

# OFFICE REPORT ON SOIL EXPLORATION

DRILL RIG 54-5 OPERATION BORE & PENET'N JOB F-58-46 W.P. 18-59 BORING 2 STA. 8+60 (39' Rt.)

CASING 8x (standard samplers to fit unless noted) DATUM GEODETIC DATE REPORT JAN. 1959

SAMPLER HAMMER WT. 250 LBS. DROP 19 INCHES COMPILED BY H.S. CHECKED BY A.L. DATE BORING 12 DEC. 1958

**ABBREVIATIONS**

V - INSITU VANE SHEAR TEST; Q - TRIAXIAL QUICK; K - PERMIABILITY
M - MECHANICAL ANALYSIS; S - TRIAXIAL SLOW; C - CONSOLIDATION
U - UNCONFINED COMPRESSION; WL - WATER LEVEL IN CASING; CA - CASING
$Q_c$ - TRIAXIAL CONSOLIDATED QUICK; WT - WATER TABLE IN SOIL; $\delta$ - UNIT WEIGHT

**SAMPLE TYPES**

CS - CHUNK; DO - DRIVE OPEN; DF - DRIVE FOOT VALVE; TO - THIN WALLED OPEN
SS - SLEEVE SAMPLE; PS - PISTON SAMPLE; WS - WASHED SAMPLE; RC - ROCK CORE

**SAMPLE CONDITION**

D - DISTURBED; F - FAIR; G - GOOD; L - LOST

## SOIL PROFILE

| ELEVATION / DEPTH | WATER CONDITIONS | DESCRIPTION | STRAT PLOT |
|---|---|---|---|
| 704.5' | | GROUND LEVEL | |
| 703.5' / 1.0' | | TOPSOIL | |
| 4.5 | | STIFF BROWNISH GREY SILTY CLAY WITH ABOUT 7% OF FINE TO MEDIUM GRAVEL. | |
| 9.5 | | | |
| 690.5' / 14.0' | | | |
| 14.5 | | STIFF GREY SILTY CLAY WITH ABOUT 7% OF FINE TO MEDIUM GRAVEL | |
| 19.5 | | | |
| 682.5' / 22.0' | | END OF BOREHOLE | |
| 24.5 | | | |

ELEVATION SCALE: 700, 695, 690, 685, 680

SHEAR STRENGTH IN LBS. PER SQ. FT. * — 2000, 4000, 6000, 8000

WATER CONTENT W % — 10, 20, 30, 40; ○ - NAT. □ - P.W. △ - L.W.

PENETRATION TEST RESISTANCE BLOWS PER FOOT AT STANDARD ENERGY (4200 IN. LBS. PER BLOW)

D. CONE PEN. X------X------X — 50, 100, 150; STAND. PEN. •——•——• — 200

CASING BLOWS (ACTUAL): 4, 6, 18, 48, 62, 20, 57, 114, 108, 128, 80, 115, 154, 175, 215, 175, 202, 234, 272, 308

REFUSAL AT ELEV. 683.9' 113 BLOWS FOR 7"

END OF CASING AT ELEV. 685.5'

## SAMPLES

| OTHER TESTS | CONDITION | TYPE | NO. | PENETRATION RESISTANCE | ELEV. RECOV. % |
|---|---|---|---|---|---|
| | | | | | 704.5 |
| | | | | | 699.5 / 4.5 |
| | | T.O. | 1 | 41 | 92 |
| | | | | | 694.5 / 9.5 |
| Ø=133.0 | | T.O. | 2 | 61 | 72 |
| | | | | | 689.5 / 14.5 |
| | | T.O. | 3 | 53 | 67 |
| | | | | | 685.5 / 19.5 |
| Ø=135.5 P.C.F. | | T.O. | 4 | 46 | |
| | | | | | 24.5 |

FORM OB-ML-126 H.D.R.

DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS & RESEARCH BRANCH - FOUNDATIONS SECTION - DOWNSVIEW

# OFFICE REPORT ON SOIL EXPLORATION

DRILL RIG 54-5 OPERATION BORE & PENET'N JOB F-58-46 W.P. 18-59 BORING 3 STA. 9+31 (40' Rt.)

CASING BX (standard samplers to fit unless noted) DATUM GEODETIC DATE REPORT JAN. 1959

SAMPLER HAMMER WT 250 LBS. DROP 19 INCHES COMPILED BY H.S. CHECKED BY A.L. DATE BORING 15 DEC. 1958

**ABBREVIATIONS**

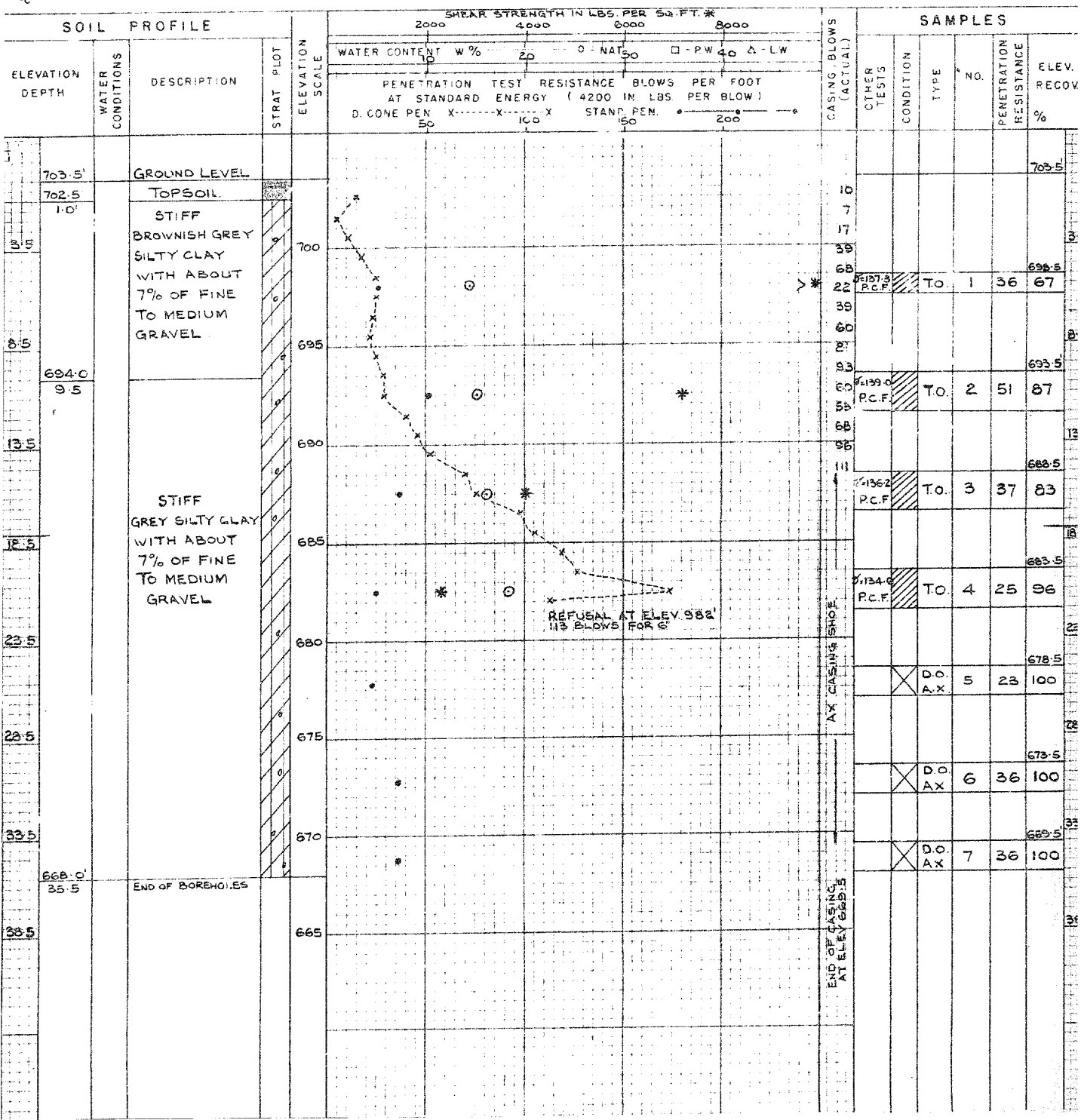
V - INSITU VANE SHEAR TEST; M - MECHANICAL ANALYSIS; U - UNCONFINED COMPRESSION; $Q_c$ - TRIAXIAL CONSOLIDATED QUICK; Q - TRIAXIAL QUICK; S - TRIAXIAL SLOW; WL - WATER LEVEL IN CASING; WT - WATER TABLE IN SOIL; K - PERMIABILITY; C - CONSOLIDATION; CA - CASING; $\gamma$ - UNIT WEIGHT

**SAMPLE TYPES**

CS - CHUNK; DO - DRIVE OPEN; DF - DRIVE FOOT VALVE; TO - THIN WALLED OPEN; SS - SLEEVE SAMPLE; PS - PISTON SAMPLE; WS - WASHED SAMPLE; RC - ROCK CORE

**SAMPLE CONDITION**

D - DISTURBED; F - FAIR; G - GOOD; L - LOST



FORM OB-ML-126

H.D.P.

DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS & RESEARCH BRANCH - FOUNDATIONS SECTION - DOWNSVIEW

# OFFICE REPORT ON SOIL EXPLORATION

DRILL R'G 54-5 OPERATION PENETRATION ONLY JOB F 58-46 W.P. 18-59 BORING 4 STA. 8+87 (39'-LT)

CASING ( standard samplers to fit unless noted ) DATUM GEODETIC DATE REPORT JAN. 1959

SAMPLER HAMMER WT. 250 LBS. DROP 19 INCHES COMPILED BY H.S. CHECKED BY A.L. DATE BORING 17. DEC. 1958

**ABBREVIATIONS**

V - INSITU VANE SHEAR TEST
M - MECHANICAL ANALYSIS
U - UNCONFINED COMPRESSION
$D_C$ - TRIAXIAL CONSOLIDATED QUICK
Q - TRIAXIAL QUICK
S - TRIAXIAL SLOW
WL - WATER LEVEL IN CASING
WT - WATER TABLE IN SOIL
K - PERMIABILITY
C - CONSOLIDATION
CA - CASING
$\gamma$ - UNIT WEIGHT

**SAMPLE TYPES**

CS - CHUNK
DO - DRIVE OPEN
DF - DRIVE FOOT VALVE
TO - THIN WALLED OPEN
SS - SLEEVE SAMPLE
PS - PISTON SAMPLE
WS - WASHED SAMPLE
RC - ROCK CORE

**SAMPLE CONDITION**

- DISTURBED
- FAIR
- GOOD
- LOST

**SOIL PROFILE**

| ELEVATION DEPTH | WATER CONDITIONS | DESCRIPTION | STRAT PLOT |
|---|---|---|---|
| 704.7' | | GROUND LEVEL | |
| 4.5 | | | |
| 9.5 | | | |
| 14.5 | | | |
| 19.5 | | | |
| 24.5 | | | |

ELEVATION SCALE: 700, 695, 690, 685, 680

WATER CONTENT W % ---------- O - NAT □ - P.W Δ - L.W

PENETRATION TEST RESISTANCE BLOWS PER FOOT AT STANDARD ENERGY ( 4200 IN. LBS. PER BLOW )

D. CONE PEN. x------x------x STAND. PEN. •——•——•

50 100 150 200

REFUSAL AT ELEV. 683.2'
113 BLOWS FOR 6"

| CASING BLOWS (ACTUAL) | SAMPLES: OTHER TESTS | CONDITION | TYPE | NO. | PENETRATION RESISTANCE | ELEV. RECOV % |
|---|---|---|---|---|---|---|
| | | | | | | |

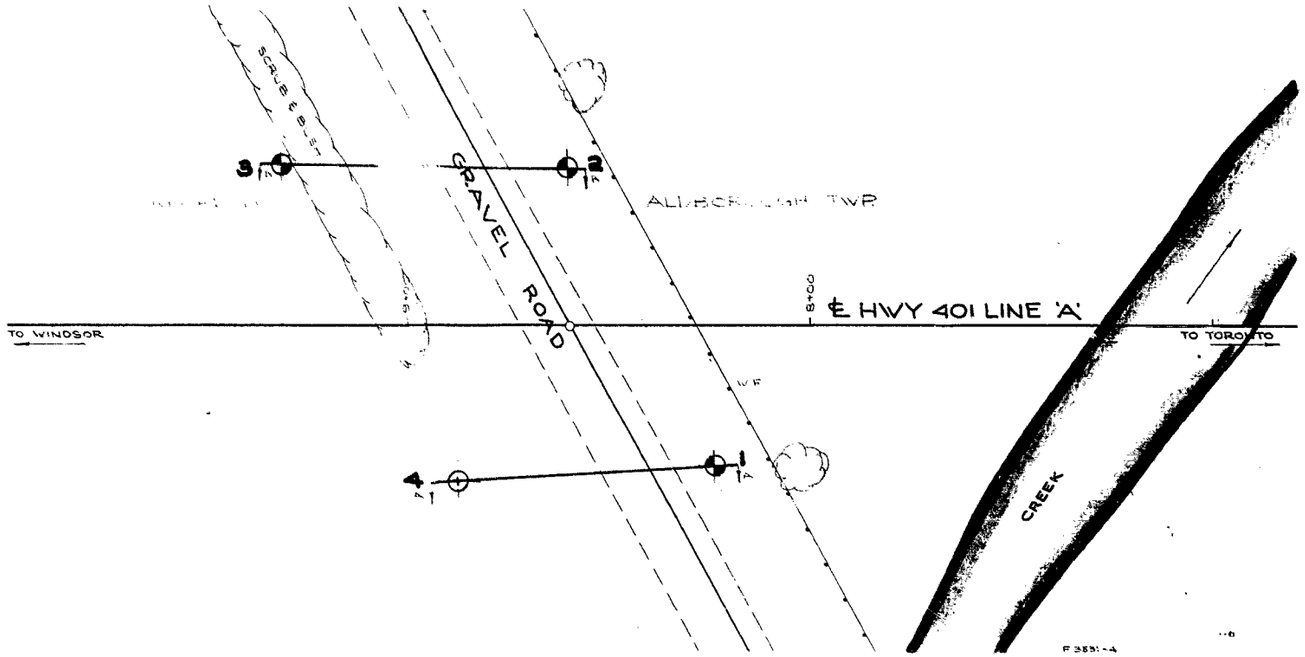
# 58-F-46

WP #93-59

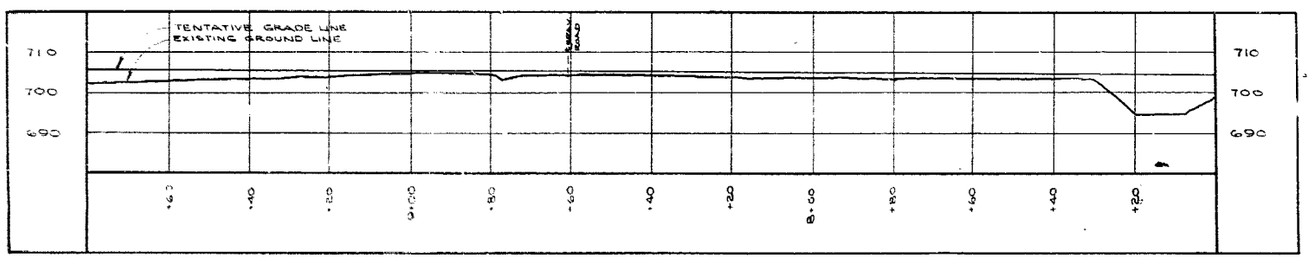
HWY #401 &

GRAVEL ROAD

CROSSING




PLAN

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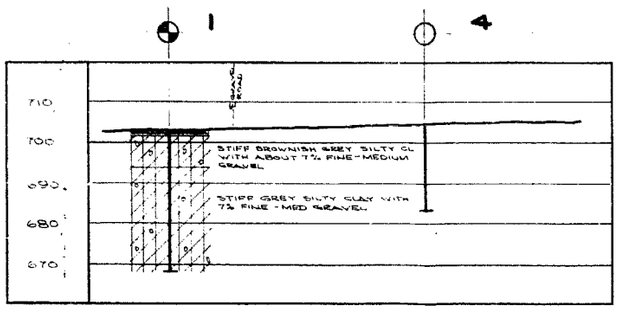
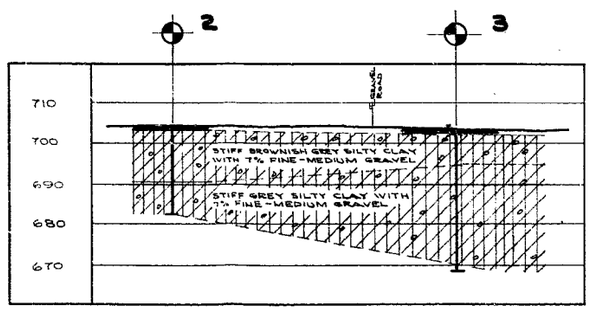
PROFILE




A-A




B-B

LEGEND

BORE HOLE

PENETRATION HOLE

BORE & PENETRATION HOLE

| HOLE NO. | ELEVATION | STATION | DISTANCE FROM ℄ |
|---|---|---|---|
| 1 | 703.5' | 8+22 | 38' LT |
| 2 | 704.5' | 8+60 | 39' RT |
| 3 | 703.5' | 9+31 | 40' RT |
| 4 | 704.7' | 8+87 | 39' LT |

— NOTE —

THE BOUNDARIES BETWEEN SOIL STRATA HAVE BEEN ESTABLISHED ONLY AT BORE HOLE LOCATIONS. BETWEEN BORE HOLES THE BOUNDARIES ARE ASSUMED FROM GEOLOGICAL EVIDENCE AND MAY BE SUBJECT TO CONSIDERABLE ERROR.

DEPARTMENT OF HIGHWAYS-ONTARIO
MATERIALS & RESEARCH SECTION

# GRAVEL ROAD PROPOSED CROSSING

SHOWING POSITIONS & ELEVATIONS OF HOLES

HWY 401 DISTRICT 2 COUNTY ELGIN & KENT
TOWNSHIP ALDBOROUGH & ORFORD LOT A CON V
LOCATION 4½ MI. W. of RODNEY

| | | |
|---|---|---|
| DRAWN BY T. MELLORS | CHECKED BY | W.P. 18-59 |
| DATE FEB 25/59 | APPROVED BY | DRAWING NO. F 58-46A |
| SCALE 1"=20' | | |