




#55-F-3
Hwy. #401
OVERPASS-AT
Hwy. #2



FL 129
54-90

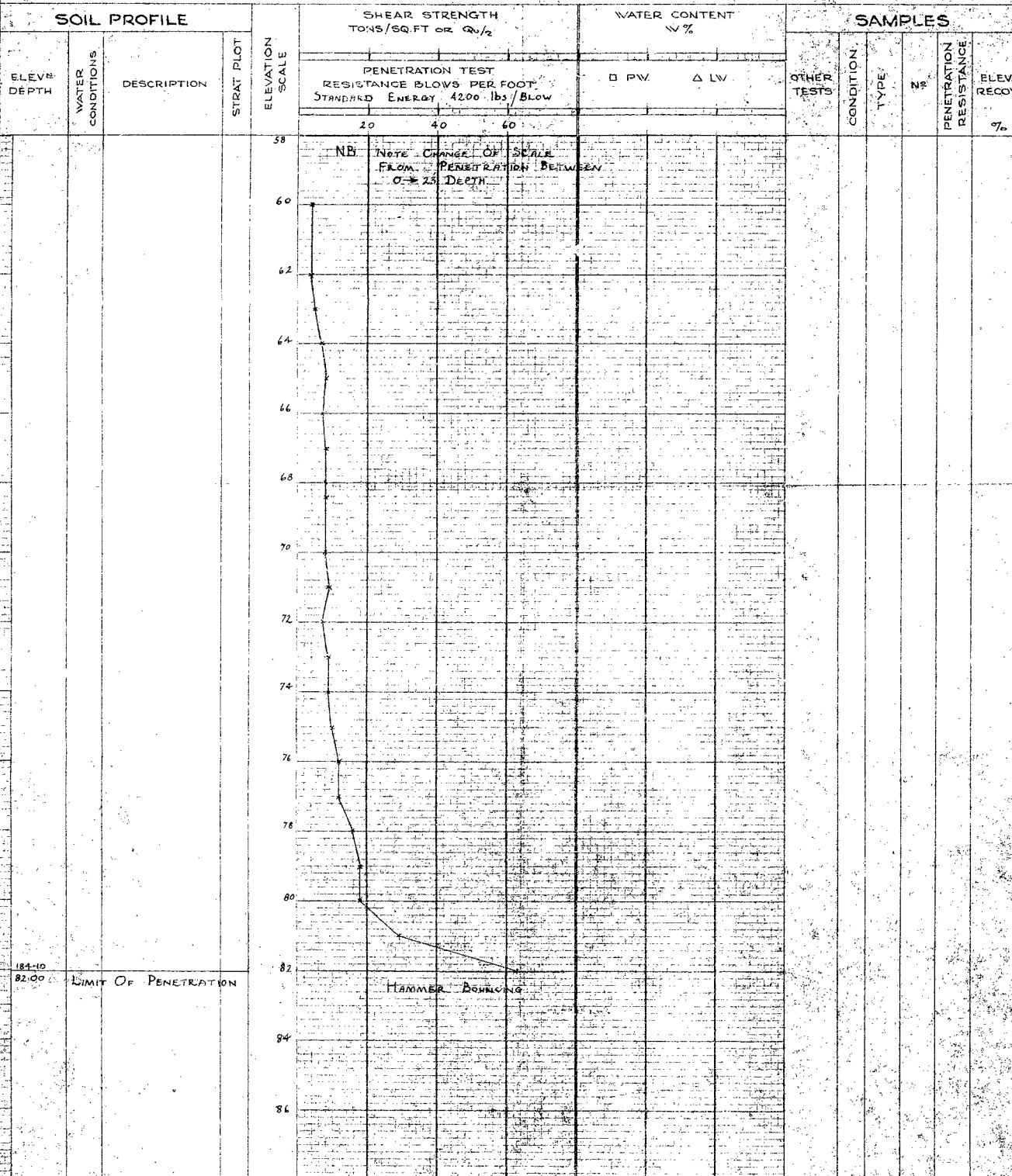
MATERIALS LABORATORY-DEPARTMENT OF HIGHWAYS - ONTARIO
OFFICE REPORT ON SOIL EXPLORATION

DRILL RIG CORE DRILL #1 JOB F-55-3 BORING NO. 1
CASING Bx (STANDARD SAMPLERS TO FIT UNLESS NOTED) DATUM 26610 STA. 257+42.26 DATE REPORT
SAMPLER HAMMER WT. 2.50 # 22 DROP 22 INCHES COMPILED BY P.B.L. CHECKED BY --- BORING DATE 22+24 APRIL 55

SAMPLE CONDITION
 DISTURBED
 GOOD
 LOST

SAMPLE TYPES
CS - CHUNK
DO - DRIVE OPEN
D.F. - DRIVE FOOT VALVE
VS - WASHED SAMPLE
TO - THIN WALLED OPEN
RC - ROCK CORE




ABBREVIATIONS
V - INSITU VANE SHEAR TEST
M - MECHANICAL ANALYSIS
U - UNCONFINED COMPRESSION
Qc - TRIAXIAL CONSOLIDATED QUICK
Q - TRIAXIAL QUICK
S - TRIAXIAL SLOW
γ - UNIT WEIGHT
K - PERMEABILITY
C - CONSOLIDATION
CA - CASING
WL - WATER LEVEL IN CASING
WT - WATER TABLE IN SOIL



FL 129
54-90

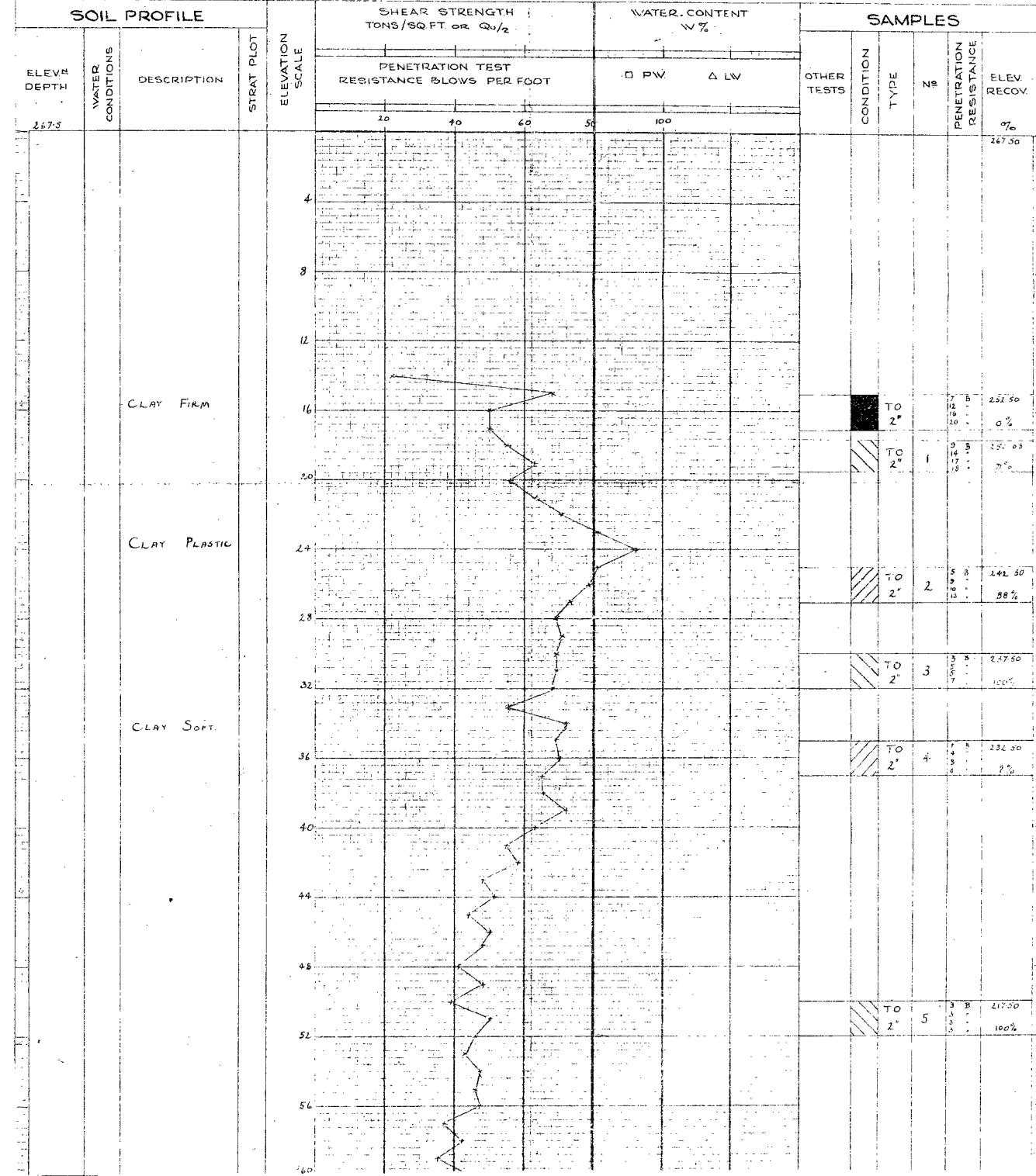
MATERIALS LABORATORY-DEPARTMENT OF HIGHWAYS - ONTARIO
OFFICE REPORT ON SOIL EXPLORATION

DRILL RIG CORE DRILL #1 JOB F-55-3 BORING NO. 2
CASING Bx (STANDARD SAMPLERS TO FIT UNLESS NOTED) DATUM 26750 STA. 257+42.26 DATE REPORT
SAMPLER HAMMER WT. 2.50 lbs # 22 DROP 22 INCHES COMPILED BY P.B.L. CHECKED BY --- BORING DATE 26 APRIL 1955

SAMPLE CONDITION
 DISTURBED
 GOOD
 LOST

SAMPLE TYPES
CS - CHUNK
DO - DRIVE OPEN
D.F. - DRIVE FOOT VALVE
VS - WASHED SAMPLE
TO - THIN WALLED OPEN
RC - ROCK CORE

ABBREVIATIONS
V - INSITU VANE SHEAR TEST
M - MECHANICAL ANALYSIS
U - UNCONFINED COMPRESSION
Qc - TRIAXIAL CONSOLIDATED QUICK
Q - TRIAXIAL QUICK
S - TRIAXIAL SLOW
γ - UNIT WEIGHT
K - PERMEABILITY
C - CONSOLIDATION
CA - CASING
WL - WATER LEVEL IN CASING
WT - WATER TABLE IN SOIL



DRILL RIG CORE DRILL JOB # 55-3
CASING 2 1/2 (STANDARD) SAMPLERS TO FIT (UNLESS NOTED) DATUM 237142.26 STA 237142.26 AT 228'
SAMPLER HAMMER WT 550 lbs. DROP 42 INCHES COMPILED BY W.B. CHECKED BY _____
BORING NO. _____ DATE REPORT _____
BORING DATE 22-12-1955

SAMPLE TYPES

ABBREVIATIONS



DISTURBED
GOOD
LOST

CS - CHUNK
DO - DRIVE OPEN
DF - DRIVE FOOT VALVE
TO - THIN WALLED OPEN

V-INSITU VANE SHEAR TEST V-UNIT WEIGHT
M-MECHANICAL ANALYSIS K-PERMEABILITY
U-UNCONFINED COMPRESSION C-CONSOLIDATION
Q-TRIAXIAL CONSOLIDATED QUICK CA-CASING
q-TRIAXIAL QUICK WL-WATER LEVEL IN CASING
T-TRIAXIAL SLOW WT-WATER TABLE IN SOIL

SOIL PROFILE

SHEAR STRENGTH

WATER CONTENT

SAMPLES

| ELEVATION DEPTH | WATER CONDITIONS | DESCRIPTION | STRAIT PLUG ELEVATION SCALE | PENETRATION TEST RESISTANCE POUNDS PER FOOT STANDARD ENGLISH PENETROMETER | D PW | A LV | OTHER TESTS | CONDITION TYPE | NB. | PENETRATION RESISTANCE | ELEV. RECOVER |
|--------------------|---------------------|---|-----------------------------------|---|------|------|----------------|-------------------|-----|---------------------------|------------------|
| 266-10 | | No Apparent Ground Water | | 80 200 300 | | | | | | | |
| | | CLAY | | | | | | | | | 262.10 |
| | | POSSIBLE FOUNDATION LEVEL BETWEEN 4' & 5' DEPTH | | | | | | X TO 3' | 1 | 15% | 56% |
| | | APPROX. DEPTH | | | | | | X TO 2' | 2 | 48% | 158% 10 |
| 255-10 | | CLAY SOFT & DAMP | | | | | | X DO 3' | 3 | 19% | 246% 10 |
| | | CLAY FIRMER | | | | | | | | | 66% |
| | | | | | | | | X TO 2' | 4 | 5' FOR 12" - 16" - 22" | 25% 10 79% |
| | | CLAY | | | | | | X TO 2' | 5 | 7' FOR 12" - 16" - 22" | 249% 10 88% |
| 243-10 | | LIMIT OF FIRST PENETRATION | | | | | | X TO 2' | 6 | 10' FOR 12" - 22" | 243% 10 94% |

DRILL RIG CORE DRILL *
CASING BX (STANDARD SAMPLERS TO FIT UNLESS NOTED)
SAMPLER HAMMER WT 290 * DROP 22 INCHES
JOB F. 552
DATUM 26750.378 257+4226.50 RI
COMPILED BY J.B.L. CHECKED BY _____
BORING NO. 2
DATE REPORT _____
BORING DATE 27th April 1965.

DRILL RIG CORE D

JOB _F_553
PAGE 14750

BORING NO.
DATE REPORT

CASING Bx (STANDARD SAMPLERS TO FIT UNLESS NOTED)
SAMPLER HAMMER WT. 250 # DROP 22 INCHES

COMPILED BY F.B.I. CHECKED BY

DATE REPORTED 27th APRIL 1955

SAMPLE CONDIT

| | |
|---|------------------|
|  | DISTURBED |
|  | GOOD |
|  | LOST |

SAMP

C.S. - CHUCK
DO. - DRIVE OPEN
D.F. - DRIVE FOOT VALVE
T.O. - THIN WALLED OPEN

TYPES

WS - WASHED SAMPLE
RC - ROCK CORE

ABBREVIATIONS

| | | |
|--------------------------------|--------------------------|---------------|
| V-INSITU VANE | SHEAR TEST | γ-UNIT WEIGHT |
| M-MECHANICAL ANALYSIS | K-PERMEABILITY | |
| U-UNCONFINED COMPRESSION | C-CONSOLIDATION | |
| Qc-TRIAxIAL CONSOLIDATED QUICK | CA-CASING | |
| S-TRIAxIAL QUICK | WL-WATER LEVEL IN CASING | |
| S-TRIAxIAL SLOW | WT-WATER TABLE IN SOIL | |




SOIL PROFILE

SHEAR STRENGTH




WATER CONTENT

SAMPLES

| SOIL PROFILE | | | | | TONS/SQ. FT. OR $Q_{u1/2}$ | | W% | | OTHER TESTS | CONDITION | TYPE | NO. | PENETRATION RESISTANCE | ELEV. RECON. |
|--------------|------------------|-------------|-------------|-----------------|----------------------------|----|----|----|-------------|-----------|------|-----|------------------------|--------------|
| ELEV. DEPTH | WATER CONDITIONS | DESCRIPTION | STRAT. PLOT | ELEVATION SCALE | PENETRATION TEST | | PW | LV | | | | | | |
| | | | | | RESISTANCE BLOWS PER FOOT | | | | | | | | | |
| | | | | | 20 | 40 | 60 | 80 | | | | | | |
| | | CLAY | | | 60 | | | | | | | | | |
| | | | | | 64 | | | | | | | | | |
| | | | | | 68 | | | | | | | | | |
| | | | | | 72 | | | | | | | | | |
| | | | | | 76 | | | | | | | | | |
| | | | | | 80 | | | | | | | | | |
| | | | | | 84 | | | | | | | | | |
| | | | | | 88 | | | | | | | | | |
| | | | | | 92 | | | | | | | | | |
| | | SAND | | | 96 | | | | | | | | | |
| | | | | | 100 | | | | | | | | | |
| | | | | | 104 | | | | | | | | | |
| | | | | | 108 | | | | | | | | | |
| | | | | | 112 | | | | | | | | | |
| | | | | | 116 | | | | | | | | | |
| | | | | | 120 | | | | | | | | | |
| | | | | | 124 | | | | | | | | | |
| | | | | | 128 | | | | | | | | | |
| | | | | | 132 | | | | | | | | | |
| | | | | | 136 | | | | | | | | | |
| | | | | | 140 | | | | | | | | | |
| | | | | | 144 | | | | | | | | | |
| | | | | | 148 | | | | | | | | | |
| | | | | | 152 | | | | | | | | | |
| | | | | | 156 | | | | | | | | | |
| | | | | | 160 | | | | | | | | | |
| | | | | | 164 | | | | | | | | | |
| | | | | | 168 | | | | | | | | | |
| | | | | | 172 | | | | | | | | | |
| | | | | | 176 | | | | | | | | | |
| | | | | | 180 | | | | | | | | | |
| | | | | | 184 | | | | | | | | | |
| | | | | | 188 | | | | | | | | | |
| | | | | | 192 | | | | | | | | | |
| | | | | | 196 | | | | | | | | | |
| | | | | | 200 | | | | | | | | | |
| | | | | | 204 | | | | | | | | | |
| | | | | | 208 | | | | | | | | | |
| | | | | | 212 | | | | | | | | | |
| | | | | | 216 | | | | | | | | | |
| | | | | | 220 | | | | | | | | | |
| | | | | | 224 | | | | | | | | | |
| | | | | | 228 | | | | | | | | | |
| | | | | | 232 | | | | | | | | | |

| SAMPLE CONDITION | | | SAMPLE TYPES | | | ABBREVIATIONS | | |
|---|------------|-----------------|-----------------------|--------------------|----------------|---------------------------------|--------------------------|----------------------------|
|  DISTURBED | CS - CHUNK | DO - DRIVE OPEN | DF - DRIVE FOOT VALVE | VS - WASHED SAMPLE | RC - ROCK CORE | V - INSITU VANE SHEAR TEST | M - MECHANICAL ANALYSIS | U - UNCONFINED COMPRESSION |
|  GOOD | | | | | | Q - TRIAXIAL CONSOLIDATED QUICK | Q - TRIAXIAL QUICK | S - TRIAXIAL SLOW |
|  LOST | | | | | | WL - WATER LEVEL IN CASING | WT - WATER TABLE IN SOIL | |

| SOIL PROFILE | | SHEAR STRENGTH | | WATER CONTENT | | SAMPLES | | | |
|--------------|------------------|----------------|-------------|-----------------|---|---------|----|-------------|-----------|
| ELEV. DEPTH | WATER CONDITIONS | DESCRIPTION | STRAT. PLOT | ELEVATION SCALE | PENETRATION TEST RESISTANCE BLOWS PER FOOT | PW | LV | OTHER TESTS | CONDITION |
| | | | | | | | | | |
| 266.10 | | CLAY FIRM | | 28 | | | | | |
| | | | | 30 | | | | | |
| | | | | 32 | | | | | |
| | | | | 34 | | | | | |
| | | CLAY SOFT | | 36 | | | | | |
| | | | | 38 | | | | | |
| | | | | 40 | | | | | |
| | | | | 42 | | | | | |
| | | | | 44 | | | | | |
| | | | | 46 | | | | | |
| | | | | 48 | | | | | |
| | | | | 50 | | | | | |
| | | CLAY VERY SOFT | | 52 | | | | | |
| | | | | 54 | | | | | |
| | | | | 56 | | | | | |
| | | | | 58 | | | | | |

| SAMPLE CONDITION | | | SAMPLE TYPES | | | ABBREVIATIONS | | |
|---|------------|-----------------|-----------------------|--------------------|----------------|---------------------------------|--------------------------|----------------------------|
|  DISTURBED | CS - CHUNK | DO - DRIVE OPEN | DF - DRIVE FOOT VALVE | VS - WASHED SAMPLE | RC - ROCK CORE | V - INSITU VANE SHEAR TEST | M - MECHANICAL ANALYSIS | U - UNCONFINED COMPRESSION |
|  GOOD | | | | | | Q - TRIAXIAL CONSOLIDATED QUICK | Q - TRIAXIAL QUICK | S - TRIAXIAL SLOW |
|  LOST | | | | | | WL - WATER LEVEL IN CASING | WT - WATER TABLE IN SOIL | |

| SOIL PROFILE | | SHEAR STRENGTH | | WATER CONTENT | | SAMPLES | | | |
|--------------|------------------|----------------|-------------|-----------------|---|---------|----|-------------|-----------|
| ELEV. DEPTH | WATER CONDITIONS | DESCRIPTION | STRAT. PLOT | ELEVATION SCALE | PENETRATION TEST RESISTANCE BLOWS PER FOOT | PW | LV | OTHER TESTS | CONDITION |
| | | | | | | | | | |
| 267.7 | | CLAY - HARD | | 2 | | | | | |
| | | | | 4 | | | | | |
| | | | | 6 | | | | | |
| | | | | 8 | | | | | |
| | | | | 12 | | | | | |
| | | | | 16 | | | | | |
| | | CLAY - PLASTIC | | 20 | | | | | |
| | | | | 24 | | | | | |
| | | | | 28 | | | | | |
| | | | | 32 | | | | | |
| | | | | 36 | | | | | |
| | | | | 40 | | | | | |
| | | CLAY - LIQUID | | 44 | | | | | |
| 222.7 | | | | 48 | | | | | |
| | | | | 52 | | | | | |
| | | | | 56 | | | | | |
| | | | | 60 | | | | | |

THE CASING WAS DRIVEN TO 450' AT WHICH DEPTH THE CLAY WAS LIQUID & ROSE INSIDE THE CASING MAKING FURTHER UNDISTURBED SAMPLING IMPOSSIBLE THE CONE PENETROMETER WAS DRIVEN FROM 450 FT TO 1125 FT

TL 100
34.90

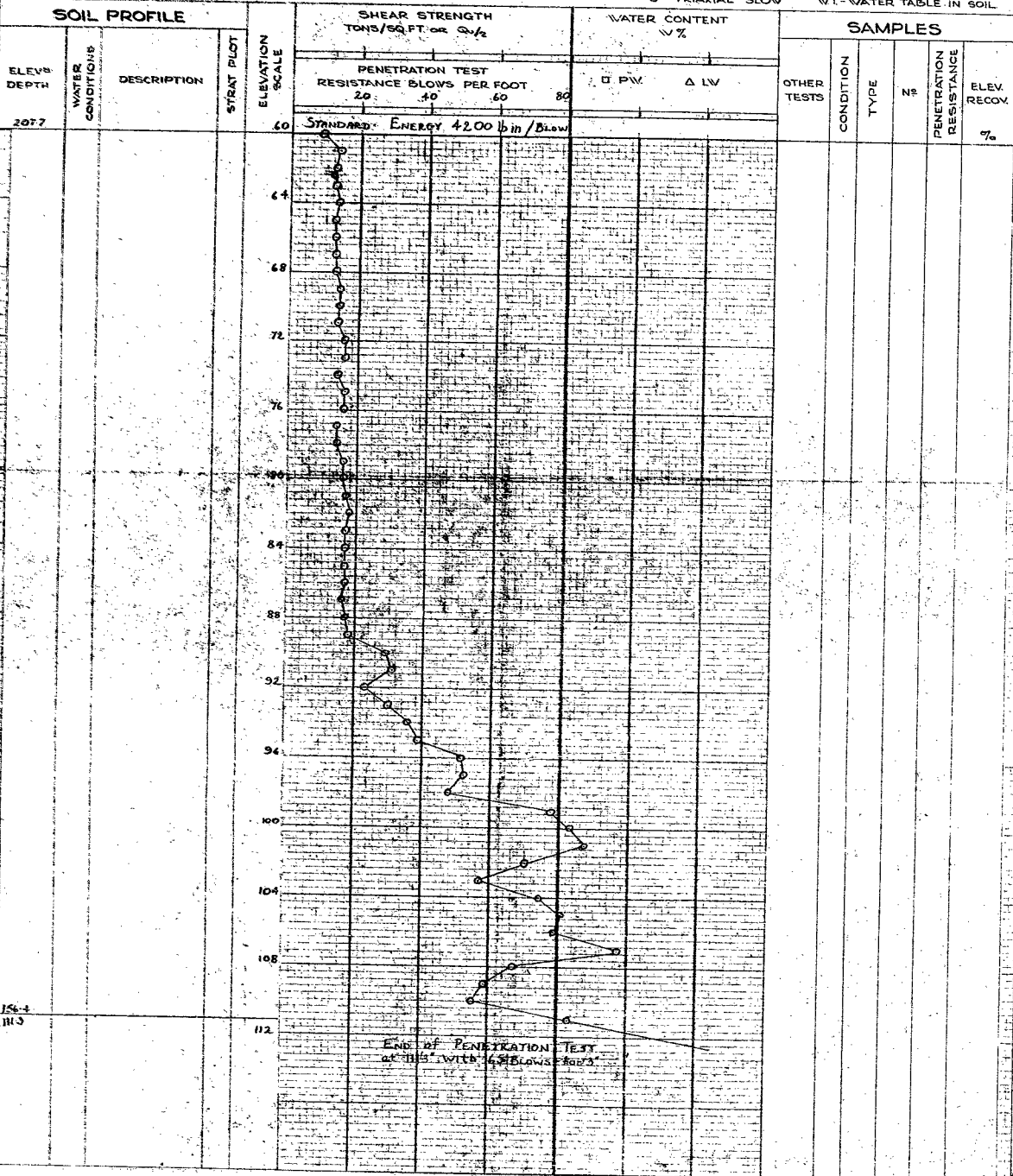
MATERIALS LABORATORY - DEPARTMENT OF HIGHWAYS - ONTARIO
OFFICE REPORT ON SOIL EXPLORATION

DRILL RIG CORE DRILL #4 JOB F-55-3 BORING NO. 3
CASING DX (STANDARD SAMPLERS TO FIT UNLESS NOTED) DATUM STR. 25.28926, 30. RT. EL. 2.77 DATE REPORT
SAMPLER HAMMER WT. 2.50 * DROP INCHES COMPILED BY DB CHECKED BY DB BORING DATE 3.4.55 MAY 1955

SAMPLE CONDITION
DISTURBED
GOOD
LOST

SAMPLE TYPES
CS - CHUNK
DO - DRIVE OPEN
DF - DRIVE FOOT VALVE
TO - THIN WALLED OPEN
VS - WASHED SAMPLE
RC - ROCK CORE

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



TL 100
34.90

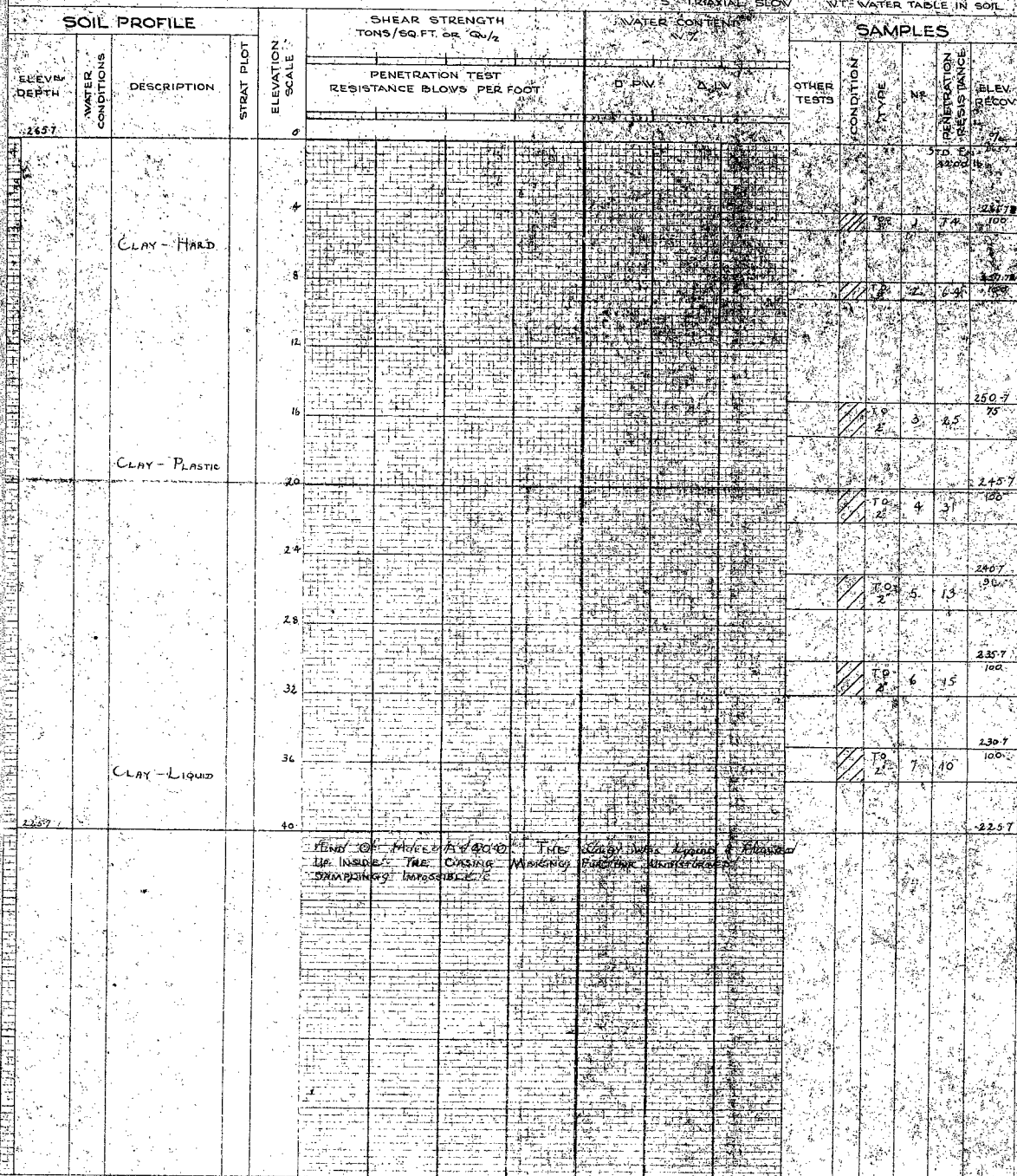
MATERIALS LABORATORY - DEPARTMENT OF HIGHWAYS - ONTARIO
OFFICE REPORT ON SOIL EXPLORATION

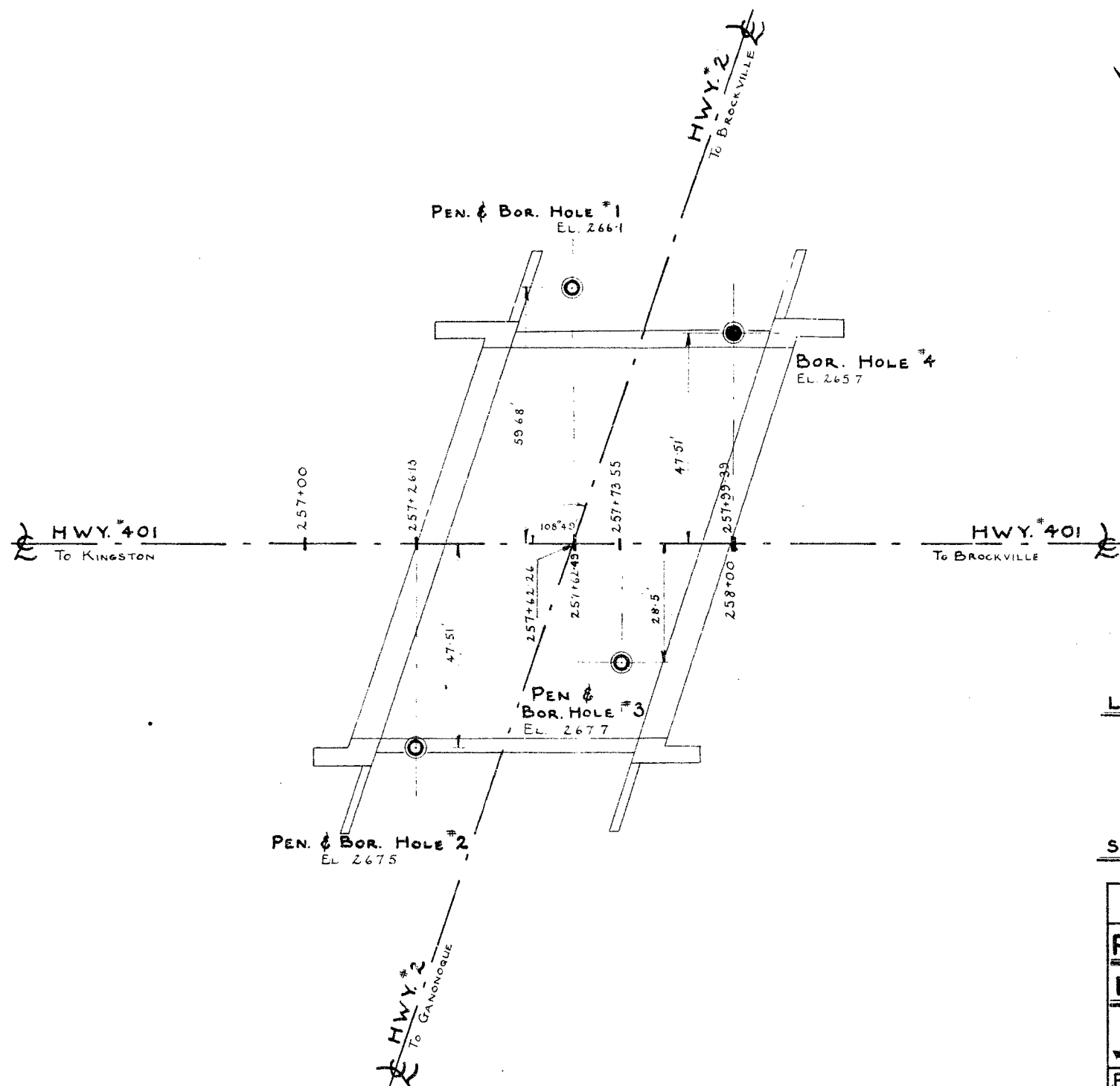
DRILL RIG CORE DRILL #4 JOB F-55-3 BORING NO. 4
CASING DX (STANDARD SAMPLERS TO FIT UNLESS NOTED) DATUM STR. 25.28926, 30. RT. EL. 2.77 DATE REPORT
SAMPLER HAMMER WT. 2.50 * DROP INCHES COMPILED BY DB CHECKED BY DB BORING DATE 3.4.55 MAY 1955

SAMPLE CONDITION
DISTURBED
GOOD
LOST

SAMPLE TYPES
CS - CHUNK
DO - DRIVE OPEN
DF - DRIVE FOOT VALVE
TO - THIN WALLED OPEN
VS - WASHED SAMPLE
RC - ROCK CORE

ABBREVIATIONS
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S - TRIAXIAL SLOW
γ - UNIT WEIGHT
K - PERMEABILITY
C - CONSOLIDATION
CA - CASING
WL - WATER LEVEL IN CASING
WT - WATER TABLE IN SOIL





LEGEND:-

- BORE HOLES
- PENETRATION & BORE HOLES

SCALE:- 1 INCH = 20 FEET.

DEPARTMENT OF HIGHWAYS:-ONTARIO-
SOILS OFFICE:-TORONTO

PROPOSED CROSSING OF HWY. 401 LINE 'A' & HWY. 2.

THE KING'S HIGHWAY NO. 401 & 2 DIV. NO. 8
CO. LEEDS
HWY. LEEDS & LANSDOWNE LOT 17 & 18 CON. I

PLAN SHOWING POSITIONS OF PEN. & BOR. HL

APPROVED

ENGINEER

CHIEF ENGINEER

| | | | |
|---------|---------------|----------|----------|
| DESIGN | CHECK | CONTRACT | NUMBERS |
| DRAWING | MLF | CHECK | PBL |
| TRACING | CHECK | LOADING | DRAWING |
| DATE | 1ST JULY 1955 | NUMBER | F-55-3A. |

REVISIONS:

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

RECORD

DATE

LOT 2-13 COM

LOT 2-13 COM

PLAN No - F3594
PROFILE No - F3594-1

LOT 13

LOT 13

316

32 1/4 skew

95.00 HQT HWY 32

0.00 HWY 32

317

LOT 12

PLAN
SCALE: 1" = 20'

123

[illegible]

BNM 318.15

[illegible]

DEPARTMENT OF HIGHWAY CONSTRUCTION

DIVISION Nº 8

PROPOSED CROSSING

THE HISTORY OF THE KING'S REVENUE

15. WILLIAMS, LILLIAN

LOT 12413 CONFIDENTIAL
PROPERTY OF THE U.S. GOVERNMENT

BRIDGE SITE

[illegible]

DATE: 10/10/68

E-2837

5-57-3

Mr. A. Tave, Bridge Engineer

October 6, 1935

Re: Foundation Investigation

F. C. Brownridge,
Mat. & Res.- Laboratory

Hy. # 401 and # 2 East Gananoque

We are forwarding herewith two copies of the report on the above investigation.

While desiccation of the clay near the surface has made it firm and capable of sustaining a spread footing, considerable settlement may be expected in the structure and approaches due to consolidation in the underlying soft clay. For this reason, a simply supported structure on spread footings is recommended rather than a rigid structure.

The clay will safely support the proposed approach fills.

F. C. Brownridge
Materials and Research Engineer

per:

(M. H. Davis)

Copies - J. Walter - Design Engineer
G. Trengaskes - Const. Engineer
L. Walker - Dist. Eng. Kingston
G. H. Parenteau
File

INDEX

| | <u>Page</u> |
|----------------------|-------------|
| Introduction | 1 |
| Procedure | 1 |
| Soil Conditions | 1 |
| Water Conditions | 2 |
| Tests & Calculations | 2 |
| Settlements | 2 |
| Bearing | 3 |
| Slope Stability | 3 |
| Recommendation | 3 |
| Conclusion | 4 |

Appendix I

Introduction:

A subsurface investigation has been completed near the junction of Hwys. # 2 and # 401 East Gananoque, on the site of the proposed Hwy. # 401 overpass.

The soil conditions have been explored in order to recommend the most suitable foundation for the overpass and examine the stability of the approach fills.

Procedure:

Four borings and three dynamic cone tests were made at the locations shown on the plan 55-F-3A, attached in appendix I, together with logs of each hole showing all the soils information obtained, locations and levels. When the clay became too soft to sample with Shelby tubes, the cone penetrometer was inserted into the borehole and hammered to refusal giving the location of firm strata and the extent of the soft material.

Soil Conditions:

Clay was found to extend to a depth of ninety five feet. The first twenty feet was very firm probably due to desiccation. After this depth it became progressively softer when at fifty feet the clay was too soft to recover with Shelby tubes. Sand was found at a depth of ninety five feet and explored for eight feet.

Water Conditions:

No evidence of ground water was found.

Tests & Calculations:

The undisturbed samples of clay have been tested for consolidation and shear strength properties in order to determine the settlement and bearing capacity of the clay.

Settlements:

Assuming a foundation pressure of 5000 lbs. per square foot, the ultimate settlement of a spread footing founded in firm clay will be about six inches; however, the rate of consolidation will be very slow and only three inches of settlement will occur in the first ten years.

The breadth of spread footings would be insufficient to induce appreciable stress in the body of the very soft clay lying beneath the upper firm clay. However, the approach fills of about twenty feet height having a base width of at least one hundred and eighty feet will influence the clay subsoil throughout its entire depth.

Using an approximate method based on liquid limits it has been estimated that the placing of twenty feet of fill will cause a settlement of eighteen inches due to consolidation of the soft clay.

Bearing:

The shear strength of the upper clay layer was found to be very high; assuming an eight foot width of footing, the effect of various bearing pressures applied at an elevation of 262.00 have been examined. For a safety factor of three a bearing pressure of two tons per square foot can be supported by the clay. However, as noted above, this will cause at least six inches settlement.

Slope Stability:

The approach fills have also been examined for slope failure, using the tested values of cohesion and the Fellenius method of analysis. It was found that for the worst condition a fill of twenty feet in height has a factor of safety of 1.6 which is adequately safe.

Recommendation:

Due to the risk of settlement a rigid frame structure will be unsuitable. A simply supported bridge is preferred with spread footing foundations using a bearing pressure of two tons per square foot at an elevation of approximately 262.00

CONCLUSIONS:

The approach fills of twenty feet height are stable but the subsoil could support up to 25 ft. of fill.

A simply supported bridge with spread footings is recommended, using a bearing pressure of 2 tons per square foot.

CAF:df

G.H. Farantatos,
Foundation Engineer,

382

Report
on
Foundation Investigation
for the Structure at the
Junction
of
Highway #401 and Highway #38
at
Gunnarogue

Copies to: Mr. D. Lamont
Bridge Engineer (2)
Mr. J. Walter
Construction Engineer (1)
Mr. Lloyd Walker
Division Engineer
Kingston, Ontario (1)

Profile No. 3594-1
Plan No. 22957-1

Introduction

Boring previously taken by this Branch indicated the possibility of bedrock close to the original ground level. Consequently this site was investigated by a power auger capable of reaching a depth of 15'0" to ascertain the general elevation of bedrock.

The site of the proposed structure appears to be located over a trough in the bedrock level into which much of the local surface water ultimately drains (a well is in use at the present time 300' west of the proposed structure). Evidence of this condition was found in one hole where the ground water appeared to be under an artesian head of some 4'0" - 6'0" of water.

The soil profile under each of the abutments and the approaches is shown on the attached drawing.

Appendix I contains a copy of the log of bore holes.

Soil Profile

The general level of the original ground on the site is 316.0 o.d. whilst that of the bedrock is 307.0 o.d. The quality of the rock was not investigated but is believed to be sound igneous rock.

There is an average of 8'0" of light brown light clay (silty) overburden. This overburden is very wet within 4'0" of the rock surface with free water level 5'0" below existing ground level.

Recommendations

The footing be brought to the bedrock the level of which is approximately an average of 3'0" below proposed G.L.C. grade level on Rwy. #401.

In the case of the west corner of the southern abutment the depth of the bedrock may be considered to be deeper than the normal economical footing depth. However this condition is local and it is suggested the excavation be taken in trench down to the rock and backfilled with a weak concrete to normal footing level.

The bedrock in this area is believed to be igneous rock.

(A. Therley)
April 22, 1955.

Hole #1

6' 9" E.

0-13"

Dark Brown Clay Loam Topsoil. Wet (Roots).

13"-8'

Light Brown Light Clay - Clay Loam (Silty) Moist-Wet 13"-8', Sat. 6'-8' (Heavy and Medium 6'-8' 55289).

8' 4'

Bedrock N.F.P. Free Water at 75".

Hole #2

8' 6" E.

0-12"

Dark Brown Clay Loam Topsoil Wet (Roots).

12"-8'

Light Brown Light Clay - Clay Loam (Silty) Wet 12"-45", Sat. 45"-5'

Free Water at 50".

6' 4'

Bedrock N.F.P.

Hole #3

2' 8" E.

0-8"

Dark Brown Clay Loam Topsoil (Moist-Wet) Roots.

8"-11'

Light Brown Light Clay - Clay Loam (Silty) Moist-Wet 8"-6' Sat. 6'-11'

Free Water at 7'.

11' 4'

Bedrock N.F.P.

Hole #4

5' E.

0-14"

Dark Brown Clay Loam Topsoil (Moist)

14"-9 1/2'

Light Brown Light Clay - Clay Loam (Silty) Moist - Wet 14"-3' Sat. 6'-9 1/2'

Free Water at 5'-7" Hole Filling.

9 1/2' 4'

Bedrock N.F.P.

Hole #5

15' E. Some Surface water.

0-12"

Dark Brown Clay Loam Topsoil (Wet).

12"-10'

Light Brown Light Clay - Clay Loam (Silty) Moist.

10'-11'

Light Brown Very Fine Sand & Silt (Moist).

11'-15'

Light Brown Light Clay - Clay Loam (Silty) Streaks of orange Brown Fine Sand (Sat.)

15' 4'

Bedrock N.F.P. Free Water at 10' (Hole Filling).

Hole #6

12' E. C/L Hwy. #32 (210' S. C/L 401)

0-7"

Dirty Gravel and Sand Mix.

7"-13"

Dark Brown Fine - Medium Sand.

13"-17"

Black Loam Topsoil.

17"-30"

Sand & Gravel Mix (Slightly Dirty).

30"-5 1/2'

Light Brown Light Clay - Clay Loam (Silty) Moist.

5 1/2' 4'

Bedrock.

Hole #7

12' E. C/L Hwy. #32 - 155' S. C/L 401

0-5"

Dirty Gravel and Sand Mix.

5"-15"

Dark Brown Fine - Medium Sand.

15"-18"

Black Loam Topsoil.

18"-23"

Sand & Gravel Mix (Slightly Dirty).

23"-9'

Light Brown Light Clay - Clay Loam (Silty) Moist to 7' Sat. 7'-9'.

9' 4"

Bedrock N.F.P.

Hole #8

12' E. C/L Hwy. #32

0-21"

Sand and Gravel Mix (Slightly Dirty).

21"-44"

Topsoil Sand and Gravel Mix.

44"-14'

Light Brown Light Clay - Clay Loam (Silty) Moist to 10', Sat. 10'-14'.

14' 4"

Bedrock N.F.P.

Hole #9

12' W. C/L Hwy. #32 - 200' N. C/L 401

0-2"

Dirty Gravel.

2"-20"

Topsoil and Gravel Mix.

20"-32"

Dirty Gravel.

32"-5'

Light Brown Light Clay - Clay Loam (Moist) (Silty).

5' 4"

Bedrock N.F.P.

Hole #10

12' W. C/L Hwy. #32

0-16"

Dirty Gravel.

16"-36"

Topsoil and Gravel Mix.

36"-10'

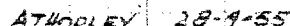
Light Brown Light Clay - Clay Loam (Silty) Moist - 7' Sat. 7'-10'.

10' 4"

Bedrock N.F.P.

SPV 75-97

PLAN E-357-1



Report
on
Foundation Investigation
for the Structure at the
Junction
of
Highway #401 and Highway #32
at
Cananogue

Copies to: Mr. H. Lemont
Bridge Engineer (2)

Mr. J. Walter
Construction Engineer (1)

Mr. Lloyd Walker
Division Engineer
Kingston, Ontario (1)

Profile No. 3564-1
Plan No. 42637-1

Introduction

Boring previously taken by this Branch indicated the possibility of bedrock close to the original ground level. Consequently this site was investigated by a power auger capable of reaching a depth of 13'0" to ascertain the general elevation of bedrock.

The site of the proposed structure appears to be located over a trough in the bedrock level into which a lot of the local surface water ultimately drains (a well is in use at the present time 300' west of the proposed structure). Evidence of this condition was found in one hole where the ground water appeared to be under an artesian head of some 4'0" - 5'0" of water.

The soil profile under each of the abutments and the approaches is shown on the attached drawing.

Appendix I contains a copy of the log of bore holes.

Soil Profile

The general level of the original ground on the site is 316.0 a.d. whilst that of the bedrock is 307.0 a.d. The quality of the rock was not investigated but is believed to be sound igneous rock.

There is an average of 8'0" of light brown light clay (silty) overburden. This overburden is very wet within 4'0" of the rock surface with free water level 5'0" below existing ground level.

Recommendations

The footing be brought to the bedrock the level of which is approximately an average of 3'0" below proposed G.S.C. grade level on Hwy. #401.

In the case of the west corner of the southern abutment the depth of the bedrock may be considered to be deeper than the normal economical footing depth. However this condition is local and it is suggested the excavation be taken in trench down to the rock and backfilled with a weak concrete to normal footing level.

The bedrock in this area is believed to be igneous rock.

(A. Thorley)
April 28, 1955.

Hole #1

6'9" E.

0-13"

Dark Brown Clay Loam Topsoil. Wet (Roots).

13"-8'

Light Brown Light Clay - Clay Loam (Silty) Moist-Wet 13"-8', Sat. 6'-8' (Heavy and Medium 6'-8' 55239).

8' 1/4

Bedrock H.F.P. Free Water at 75".

Hole #2

8'6" E.

0-12"

Dark Brown Clay Loam Topsoil Wet (Roots).

12"-6'

Light Brown Light Clay - Clay Loam (Silty) Wet 12"-45", Sat. 43"-6' Free Water at 50".

6' 1/4

Bedrock H.F.P.

Hole #3

8'8" E.

0-8"

Dark Brown Clay Loam Topsoil (Moist-Wet) Roots.

8"-11'

Light Brown Light Clay - Clay Loam (Silty) Moist-Wet 8"-6' Sat. 6'-11' Free Water at 7".

11' 1/4

Bedrock H.F.P.

Hole #4

5' E.

0-14"

Dark Brown Clay Loam Topsoil (Moist)

14"-9 1/2'

Light Brown Light Clay - Clay Loam (Silty) Moist - Wet 14"-5' Sat. 5'-9 1/2' Free Water at 5'-7" Hole Filling.

9 1/2' 1/4

Bedrock H.F.P.

Hole #5

15' E. Some Surface water.

0-12"

Dark Brown Clay Loam Topsoil (Wet).

12"-10"

Light Brown Light Clay - Clay Loam (Silty) Moist.

10"-11"

Light Brown Very Fine Sand & Silt (Moist).

11"-10"

Light Brown Light Clay - Clay Loam (Silty) Streaks of orange Brown Fine Sand (Sat.)

15' 1/4

Bedrock H.F.P. Free Water at 10' (Hole Filling).

Hole #6

12' E. C/L Hwy. #32 (210' S. C/L 401)

0-7"

Dirty Gravel and Sand Mix.

7"-13"

Dark Brown Fine - Medium Sand.

13"-17"

Black Loam Topsoil.

17"-30"

Sand & Gravel Mix (Slightly Dirty).

30"-34"

Light Brown Light Clay - Clay Loam (Silty) Moist.

34' 1/4

Bedrock.

Hole #7

12' E. C/L Hwy. #32 - 185' S. C/L 401

0-3" Dirty Gravel and Sand Mix.
3"-15" Dark Brown Fine - Medium Sand.
15"-18" Black Loam Topsoil.
18"-22" Sand & Gravel Mix (Slightly Dirty).
22"-9' Light Brown Light Clay - Clay Loam (Silty) Moist to 7' Sat. 7'-9'.
9' Bedrock N.F.P.

Hole #8

12' E. C/L Hwy. #32

0-21" Sand and Gravel Mix (Slightly Dirty).
21"-44" Topsoil Sand and Gravel Mix.
44"-14' Light Brown Light Clay - Clay Loam (Silty) Moist to 10', Sat. 10'-14'.
14' Bedrock N.F.P.

Hole #9

12' E. C/L Hwy. #32 - 200' W. C/L 401

0-2" Dirty Gravel.
2"-20" Topsoil and Gravel Mix.
20"-32" Dirty Gravel.
32"-5' Light Brown Light Clay - Clay Loam (Moist) (Silty).
5' Bedrock N.F.P.

Hole #10

12' W. C/L Hwy. #32

0-16" Dirty Gravel.
16"-36" Topsoil and Gravel Mix.
36"-10' Light Brown Light Clay - Clay Loam (Silty) Moist - 7' Sat. 7'-10'.
10' Bedrock N.F.P.

401 UNDERPASS

TWP LEEDS & LAMBTON

LOT 12 & 13 CON 2

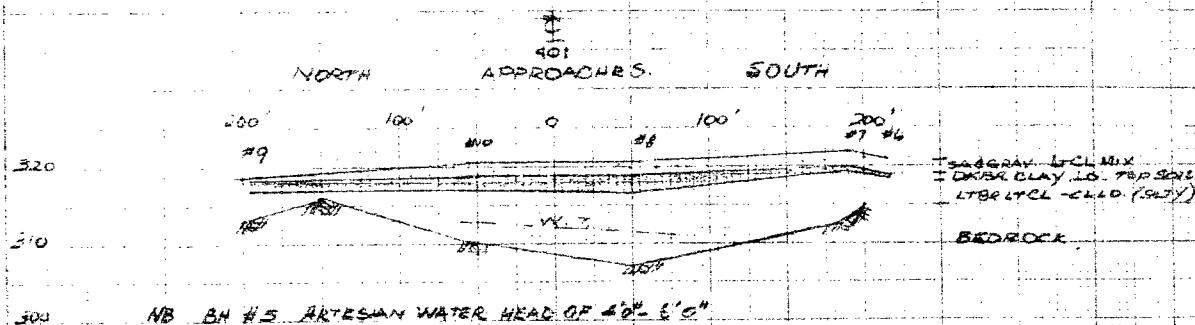
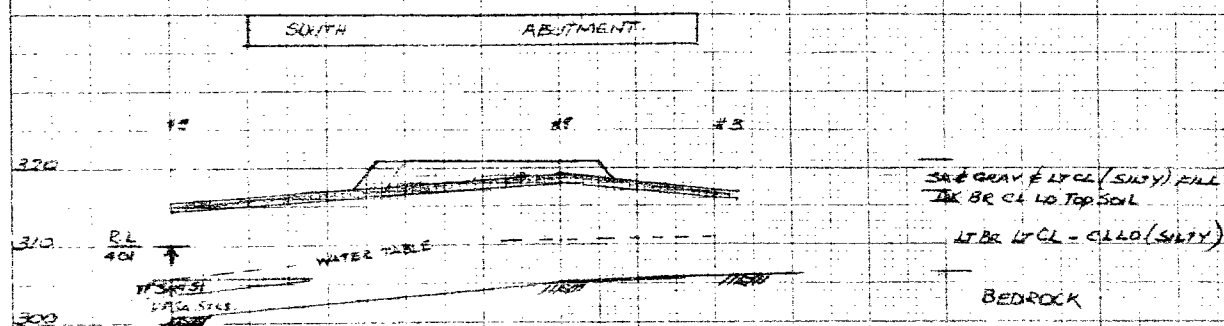
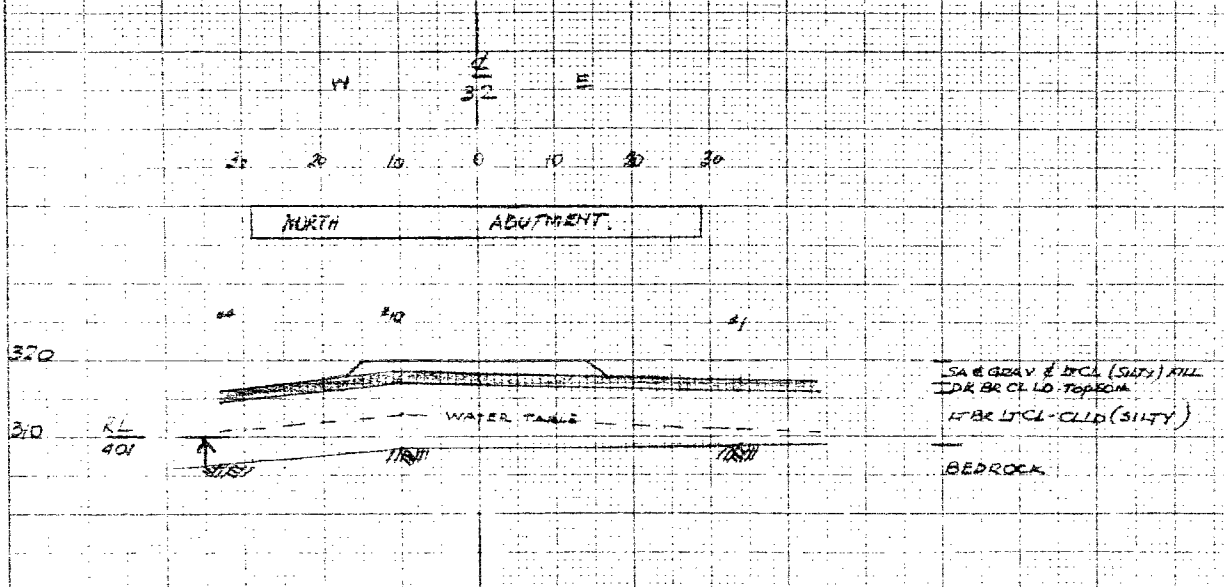
PROJ 401-H-17

SEP 1954

HWY 32

F3584-1

PLAN E357-1



NB BN #5 ARTESIAN WATER HEAD OF 40" - 5'0"

ATHORLEY 28-9-55

DATE APRIL 20/55

HOLE #1 6'9" E

0-13" Dk Br CLLo TBSL WET (ROOTS)
 13"-8' Lt Br Lt Cl-CLLo (SILTY) MOIST-WET 13'-6" SAT 6'-8" (HEM 6'-8" 55 Z 89)
 8'+ BEDROCK N.F.P. FREE WATER AT 75"

HOLE #2 8'6" E

0-12" Dk Br CLLo TBSL WET (ROOTS)
 12"-6' Lt Br Lt Cl-CLLo (SILTY) WET 12'-45" SAT 45"-6' FREE WATER AT 50"
 6'+ BEDROCK N.F.P.

HOLE #3 2'8" E

0-8" Dk Br CLLo TBSL (MOIST-WET) ROOTS
 8"-11" Lt Br Lt Cl-CLLo (SILTY) MOIST-WET 8'-6" SAT 6'-11" FREE WATER AT 7'
 11'+ BEDROCK N.F.P.

HOLE #4 S'W

0-14" Dk Br CLLo TBSL (MOIST)
 14"-9 1/2' Lt Br Lt Cl-CLLo (SILTY) MOIST-WET 14"-5' SAT 5'-9 1/2' FREE WATER AT 5'-7"
 9 1/2'+ BEDROCK N.F.P. HOLE FILLING

HOLE #5 15' W SOME SURFACE WATER

0-12" Dk Br CLLo TBSL (WET)
 12"-10' Lt Br Lt Cl-CLLo (SILTY) MOIST
 10"-11' Lt Br VF SA & GI (MOIST)
 11"-13" Lt Br Lt Cl-CLLo (SILTY) STREAKS OF OR BR FSA (SAT)
 13'+ BEDROCK N.F.P. FREE WATER AT 10' (HOLE FILLING)

HOLE #6 12' E & HWY 32 (210' S & 401)

0-7" DIRTY GRAY & SA MIX
 7"-13" Dk Br F-N SA
 13"-17" B LLo TBSL
 17"-30" SA & GRAY MIX (SL DIRTY)
 30"-5 1/2' Lt Br Lt Cl-CLLo (SILTY) MOIST
 5 1/2'+ BEDROCK

HOLE #7 12' E & HWY 32 - 185' S & 401

0-5" DIRTY GRAY & SA MIX
 5"-15" Dk Br F-N SA
 15"-18" B LLo TBSL
 18"-28" SA & GRAY MIX (SL DIRTY)
 28"-9' Lt Br Lt Cl-CLLo (SILTY) MOIST TO 2' SAT 7'-9'
 9'+ BEDROCK N.F.P.

HWY. NO 401 LOCATION 401 & 32 GANANOQUE ENGINEER BREDDIE

HOLE # 8 12' E & HWY 32

0-21" ✓ SA & GRAV MIX (SL DIRTY)
21"-44" TPCL SA & GRAV MIX
44"-14' LT BR LT CL - CLLo (SILTY) MOIST TO 10', SAT 10'-14'
14'+ BEDROCK N.F.P.

HOLE # 9 12' W & HWY 32 - 200' N & 401

0-2 DIRTY GRAV.
2-20 TPCL & GRAV MIX
20-32 DIRTY GRAV.
32-5' LT BR LT CL - CLLo (MOIST) (SILTY)
5'+ BEDROCK N.F.P.

HOLE # 10 12' W & HWY 32

0-16" DIRTY GRAV.
16"-36" TPCL & GRAV MIX
36"-10' LT BR LT CL - CLLo (SILTY) MOIST - 7' SAT 7'-10'
10'+ BEDROCK N.F.P.

A REPORT ON THE FOUNDATION

INVESTIGATION FOR THE PROPOSED HWY. # 401

OVERPASS AT HWY. # 2 EAST OF GANANOQUE

Copies to -

Mr. A. Toye, Bridge Engineer (2)

Mr. H. Tregaskes, Const. Engineer (1)

Mr. J. Walter, Design Engineer (1)

Mr. L. Water, Dist. Engineer,
Kingston, Ont. (1)

Mr. G. Farantatos (1)

File (1)

Project 55-F-3

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INTRODUCTION:

A subsurface investigation has been completed near the junction of Hwy.'s 2 and 401 east Gananoque, on the site of the proposed Hwy. # 401 overpass.

The soil conditions have been explored in order to recommend the most suitable foundation for the overpass and examine the stability of the approach fills.

PROCEDURE:

Four borings and three dynamic cone tests were made at the locations shown on the plan, 55-F-3A attached in Appendix I, together with logs of each hole showing all the soils information obtained, locations and levels. When the clay became too soft to sample with shelby tubes the cone penetrometer was inserted into the borehole and hammered to refusal giving the location of firm strata and the extent of the soft material.

SOIL CONDITIONS:

Clay was found to extend to a depth of 95 ft; the first 25 ft. was very firm probably due to desiccation. After this depth it became progressively softer when at 50 ft. the clay was too soft to recover with shelby tubes. Sand was found at a depth of 95 ft. and explored for 8 ft.

WATER CONDITIONS:

No evidence of ground water was found.

TESTS & CALCULATIONS:

The undisturbed samples of clay have been tested for consolidation and shear strength properties in order to determine the settlement and bearing capacity of the clay.

SETTLEMENTS:

Assuming a foundation pressure of 5000 lbs. per square foot, the ultimate settlement of a spread footing founded in firm clay will be about 6 inches.; however, the rate of consolidation will be very slow and only 3 inches of settlement will occur in the first 10 years.

The breadth of spread footings would be insufficient to induce appreciable stress in the body of the very soft clay lying beneath the upper firm clay. However, the approach fills of about 20 ft. height having a base width of least 180 ft. will influence the clay subsoil through out its entire depth.

Using an approximate method base on liquid limits it has been estimated that the placing of 20 ft. of fill will cause a settlement of 16 inches due to consolidation of the soft clay.

BEARING:

The shear strength of the upper clay layer was found to be very high; assuming an eight foot width of footing, the effect of various bearing pressures applied at an elevation 262.00 have been examined. For a safety factor of 3 a bearing pressure of two tons per square foot can be supported by the clay. However, as noted above, this will cause at least 6 inches of settlement.

SLOPE STABILITY:

The approach fills have also been examined for slope failure, using the tested values of cohesion and the Fellenius method of analysis. It was found that for the worst condition a fill of 20 ft. in height has factor of safety of 1.6 which is adequately safe.

RECOMMENDATIONS:

Due to the risk of settlement a rigid frame structure will be unsuitable. A simply supported bridge is preferred with spread footing foundations using a bearing pressure of 2 tons per square foot at an elevation of approximately 262.00.

CONCLUSION:

The approach fills of 20 feet height are stable but the subsoil could support up to 25 feet of fill.

A simply supported Bridge with spread footings is recommended using a bearing pressure of two tons per square foot.

G. N. Farantatos
Foundation Engineer.

APPENDIX

I