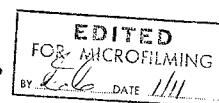


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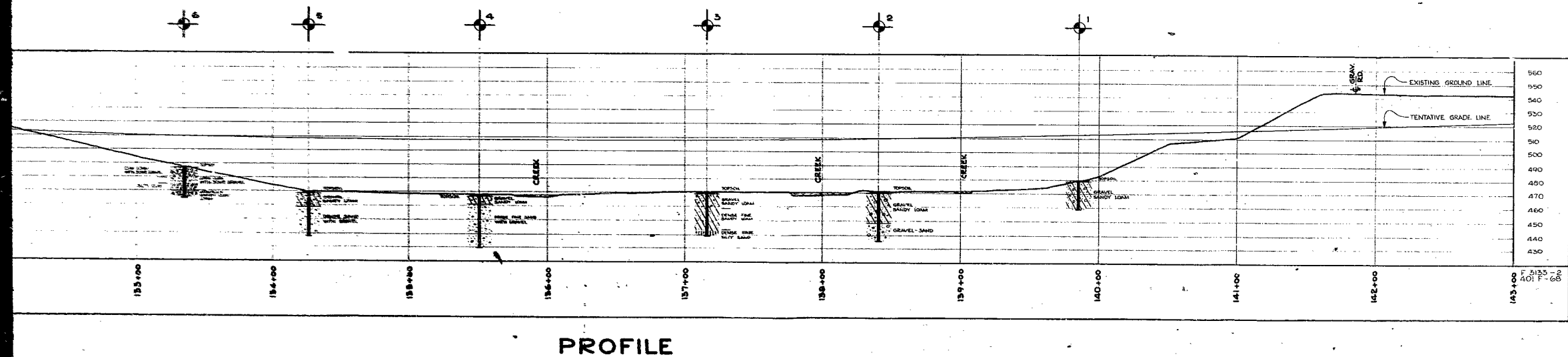
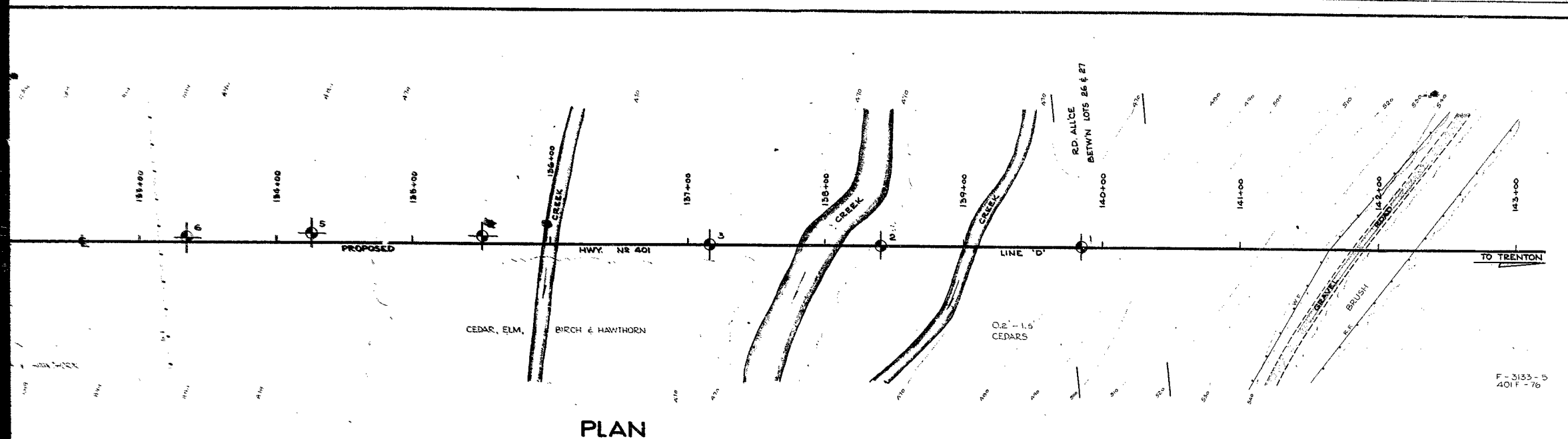


W.P. #118-57

HWY #401

CROSSING RAVINE

8 CREEK IN LOTS
#26 & #27



LEGEND			
AUGER HOLE			
BORE HOLE			
PENETRATION HOLE			
BORE & PENETRATION HOLE			
HOLE NO.	ELEVATION	STATION	DISTANCE FROM E.
1	460.0	139+85'	2
2	471.8	138+40'	4
3	471.0	137+16'	4
4	468.5	135+51'	5' LT
5	470.0	134+26'	6' LT
6	487.5	133+35'	3' 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 - DOWNSVIEW		
RAVINE & CREEK PROPOSED CROSSING 1 MILE W. OF GRAFTON		
SHOWING POSITION & ELEVATION OF HOLES		
HWY. NO. 401	W.P. 118 - 57	DIV. NO. 7
CO. NORTHUMBERLAND		
TWP. HALDIMAND	LOTS 26 & 27	CON. 1
SCALE 1 IN. = 40 FT.	SUBMITTED BY	DATE 16 MAY 1958
DRAWN BY R.E.F.	DESIGNED BY	DRAWING NO. F-58-6A

Mr. A. Toye,

June 24, 1958.

Bridge Engineer

Materials & Research Section.

Foundation Report -
New Bridge and Fill at Hwy. #401
crossing Ravine and Creek in
Lots 26 & 27, Conc. I, one mile
west of Grafton.

Plan No. F 3133-5 - W.P. 118-57
Station: 138+00 - W.J. F 58-6

We are forwarding herewith two copies of the
above mentioned Foundation Report.

It is noted that the subsoil along centre line
consists of very dense sand and gravel. As the foundation
excavation will extend a considerable distance left and
right of centre line, it is suggested that an inspection
be made during the excavation to ensure that no soft spots
are encountered. Soft spots may be treated during the course
of construction.

AN/ideF

Attach.

cc: Messrs. A. Toye
H. Tregaskes
D. G. Ramsay
H. D. Duff
A. Watt
C. Karrow

F. C. Browaridge,
MATERIALS & RESEARCH ENGR.

Per:


(A. Rutka,
Principal Soils Engr.)

Foundation Section ✓
File

FOUNDATION REPORT

on

New Bridge and Fill at Highway
No. 401 crossing Ravine and Creek in lots 26 & 27
(Con. I), one mile west of Grafton

Plan No. F-3133-5
Station: 138 + 00

Distribution:

Mr. A. Teye Bridge Engineer	(2)
Mr. H. Tregaskes Construction Engineer	(1)
Mr. D. J. Massey Design Engineer	(1)
Mr. H. D. Duff District Engineer, Port Hope	(1)
Mr. A. Watt Water Resources Commission	(1)
Dr. H. Karrow Department of Mines	(1)
Foundation Section	(1)
File	(1)

W. P. 114-67
W. J. F-33-6

INTRODUCTION:

This report covers the soil investigations carried out in order to determine the bearing values of subsoil layers for supporting the foundations of proposed structures and approach fills.

The location of the site is one mile west of Grafton where the new highway no. 401 crosses the ravine and creek in lots 26 and 27 (Sec. 1), Township of Maldimand (station 136 + 00, profile F-3133-2).

The field work started on Feb. 25, 1968 and was completed on March 19, 1968

DESCRIPTION OF SITE AND FIELD WORK:

The area is within the shoreline of late Iroquois Lake. It is characterized by large drumlins and offshore terrace formed by wave action. At intervals this terrace is cut by deep stream valleys. At this particular crossing the ravine is about 800 ft. wide across and some 70 ft. deep. The collected water in the ravine is mainly drained by means of the little creek at station 136 + 00. There is a small branch separated from this main channel which is seen at station 136 + 00. The water seen at station 136 + 00 springs from underground about 300 ft. to north of the center line. The explorations were made by means of a skid mounted coredrill machine. In the course of investigations six boreholes were made along the center line. From these boreholes the cross section of the subsoil stratigraphy was established.

The location of the boreholes is shown on the drawing no. F-32-a and their elevations on log sheets under Appendix I.

FIELD AND LABORATORY FINDINGS:

The explorations of the site revealed the following subsoil stratigraphy:

Under the topsoil the layer, down to the end of the boreholes, is

made up of gravel and sand loam. In borehole no. 6, which is situated on the western slope of the ravine, a layer of clay loam and silt clay was encountered at the top down to elevation 470 ft. Below this elevation the layer is gravely sandy clay till.

From the borehole samples were extracted and tested in the laboratory. The textural analysis revealed the soil composition as 10% binder material, 55% fine aggregate and 35% coarse aggregate. No plastic or liquid limit could be determined. The natural moisture content was measured to be about 10% and density varying 135-150 p.c.f.

The undrained triaxial tests were performed in the laboratory. The results of these tests indicate an internal friction angle of $\phi=30^\circ$ and cohesion varying from 800 p.s.f to 2500 p.s.f. This is attributed to the presence of some cohesive material in the soil varying at different elevations. However, the soil is mainly granular material and will be assessed on the basis of $C=0$ and $\phi=30^\circ$. The subsoil is in a very dense state. The Standard penetration tests registered about 100 blows per foot penetration below elevation 462 ft. The water level in the boreholes no. 2 & 3 was encountered at about elevation 455 ft.

THE SUPPORT OF CULVERT FOOTINGS:

The structure over the creek at station 138 + 00 is understood to be one arched culvert supported on continuous spread footings. The existing situation of the creek is indicative of scouring in the ravine. This factor was calculated and a depth of 4-5 ft. below the bottom of the creek was found to be safe for any scouring hazards. With this consideration it will be convenient to place the foundations some 5 ft. below the existing bottom of the creek elevation (i.e. not higher than 462 ft. at center line). At this elevation and below the average standard penetration is about 60 blows per foot (after making the necessary allowances for the saturated state of the layer). This accredits the

layer with a bearing value of 6.5 T.s.f. for 7 ft. wide footing, and more for 5 ft. wide footing.

ANALYSIS OF UNDRAINMENT STABILITY:

At this crossing there is a fill of about 40 ft. The very dense state of the subsoil is capable to support the anticipated fill overburden.

The stability of the fill material itself (40') requires the following considerations:

- (a) In case the fill will be of granular material, then for a 2 to 1 slope ($i=26.6^\circ$), fill material with an internal friction angle of $\phi=32^\circ$ will provide a safety factor of 1.2.
- (b) In case the fill will be of cohesive type material, for the same side slope as above ($i=26.6^\circ$) a $C=1000$ p.s.f. will provide a safety factor of 2.

CONCLUSIONS AND RECOMMENDATIONS:

From the above discussion it will follow that:

- 1. The subsoil, as explored in the borsholes, mainly consists of very dense fine sand and gravel with some cohesive material at different elevations.
- 2. The existing situation in the ravine is indicative of scour. From calculations it was found that lowering the footings some 5 ft. below the bottom of the existing creek would overcome any scouring hazards.
- 3. It will be convenient to support the structure on spread footings placed not higher than elevation 462 ft. At this elevation and below the layer can provide a bearing value of 6.5 T.s.f. for 7 ft. wide footings and more for 5 ft. footings.
- 4. The subsoil is dense enough to support the anticipated 40' fill at this crossing. The stability of the fill itself can be provided by using granular material of $\phi=32^\circ$ and side slope of 2.1 ($i=26.6^\circ$). This gives a safety factor of 1.2. Or cohesive material of $C=1000$

p.s.f. could be used as fill material and with a side slope of $1:26.6^\circ$ it will provide stability with a safety factor of 2.

5. The above calculations are based on findings in the borings which were made along the center line of the proposed highway 401 line "B". As the excavations and construction will extend some 140 ft. to the north and south of the center line care should be taken to watch for the possible spots of weakness that may exist beyond the limits of these explorations.

V. Korlu

Foundation Engineer

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & RESEARCH BRANCH - FOUNDATIONS SECTION - DOWNSVIEW
OFFICE REPORT ON SOIL EXPLORATION

DRILL RIG 54-1 OPERATION BORE PENET'N JOB F-58-6 WP 118-57 BORING 1 STA. 139+65.3
CASING BX (standard samplers to fit unless noted.) DATUM GEODETIC DATE REPORT MARCH 1958
SAMPLER HAMMER WT. 250 LBS. DROP 19 INCHES COMPILED BY H.S. CHECKED BY A.L. DATE BORING 26 FEB 1958

ABBREVIATIONS

V - INSITU VANE SHEAR TEST
M - MECHANICAL ANALYSIS
U - UNCONFINED COMPRESSION
QC - 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
γ - 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

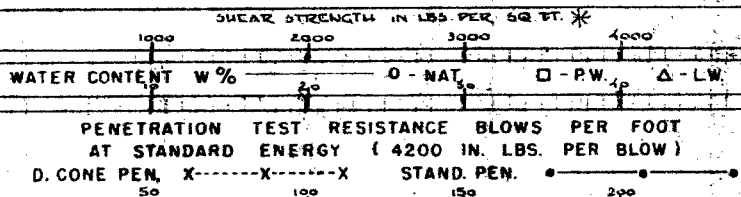
SAMPLE CONDITION



- DISTURBED
- FAIR
- GOOD
- LOST

SOIL PROFILE

ELEVATION DEPTH	WATER CONDITIONS	DESCRIPTION	STRAT PLOT	ELEVATION SCALE
480		GROUND LEVEL		480
479.0' 1'0"		TOPSOIL		
		GRAVEL SANDY LOAM		475 470 465 460
459.5' 20'5"		END OF BOREHOLE		435



SAMPLES

CASING BLOWS (ACTUAL)	OTHER TESTS	CONDITION	TYPE	NO.	PENETRATION RESISTANCE %	ELEV. RECOR.
15						4800
10						
15						
25						
14						479.3
47	1150 p.f.	5.5	1	42	100	
49						
147						
	11500 p.f.	5.5	2	>100	100	4700
	11500 p.f.	5.5	3	>100	100	4600
	11500 p.f.	5.5	4	>100	100	4500

NOTE: UNCONFINED COMPRESSION TEST RESULTS ARE UNRELIABLE
DUE TO PRESENCE OF GRAVEL & PEBBLES

END OF CASING
AT ELEV 460

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & RESEARCH BRANCH - FOUNDATIONS SECTION - DOWNSVIEW
OFFICE REPORT ON SOIL EXPLORATION

DRILL RIG 34-1 OPERATION BORE & PENET'N JOB F-58-6 WP 118-57 BORING 2 STA. 138+40.4
CASING BX (standard samplers to fit unless noted) DATUM GEODETIC DATE REPORT MARCH 1958
SAMPLER HAMMER WT. 250 LBS. DROP 12 INCHES COMPILED BY 4-5 CHECKED BY DATE BORING 5 MARCH 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
QC - TRIAXIAL CONSOLIDATED QUICK WT - WATER TABLE IN SOIL γ - UNIT WEIGHT

SAMPLE TYPES

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

SAMPLE CONDITION

 - DISTURBED
 - FAIR
 - GOOD
 - LOST

SOIL PROFILE

UNDRAINED TRIAXIAL TEST Q_u

WATER CONTENT W% — 2p — 0 - 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. — — — — —

SAMPLES

CASING BLOW (ACTUAL)	OTHER TESTS	CONDITION	TYPE	NO.	PENETRATION RESISTANCE	ELEV. RECOVER %
						471.8'
4						
54						
36						
29						466.8'
38		5.5	1	31	100	
59						
60						
29						
58						461.8'
19	7-1545 p.e.f.	5.5	2	84	100	
62						
106						
167						
166						456.8'
26		5.5	3	>100	46	
44						
89						
196						
183						451.8'
118						
47						
122						
48						
207						446.8'
16		5.5	5			
134						
116						
8						
96						441.8'
40	7-1486 p.e.f.	5.5	6	>100	100	
119						
126						
138						
201	7-1486 p.e.f.	5.5	7	>100	100	436.8'
END OF CASING LAT. ELEV. 936.8'						

**MATERIALS & RESEARCH BRANCH - FOUNDATIONS SECTION - DOWNSVIEW
OFFICE REPORT ON SOIL EXPLORATION**

DRILL RIG 54-1 OPERATION BORE & PENET'N JOB F-58-6 WP 118-57 BORING 3 STA. 137+16 1/2
CASING BX (standard samplers to fit unless noted) DATUM GEODETIC DATE REPORT APRIL 1958
SAMPLER HAMMER WT. 250 LBS. DROP 19 INCHES COMPILED BY 4.5 CHECKED BY AL DATE BORING 10 MARCH 1958

ABBREVIATIONS

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
D - TRIAXIAL CONSOLIDATED QUICK	WT - WATER TABLE IN SOIL	γ - UNIT WEIGHT

SAMPLE TYPES

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

SAMPLE CONDITION



- DISTURBED
- FAIR
- GOOD
- LOST

SOIL PROFILE

SOIL PROFILE				UNDRAINED TRIAXIAL TEST Q_c				SAMPLES							
ELEVATION DEPTH	WATER CONDITIONS	DESCRIPTION	STRAT PLOT	ELEVATION SCALE	WATER CONTENT $W\%$	0 - NAT	□ - P.W.	△ - L.W.	CASING BLOWS (ACTUAL)	OTHER TESTS	CONDITION	TYPE	NO.	PENETRATION RESISTANCE	ELEV. RECOV
					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							
471'		GROUND LEVEL		470											471'
469'5" 1.5'		TOPSOIL													
	V.L. @ 466' MARCH 11, 1958.	GRAVEL - SANDY LOAM		465											466'
				460											
459' 12'				455											461'
				450											100
		DENSE FINE SANDY LOAM		445											
444' 27'				440											446'
				435											
		DENSE FINE SILTY SAND		430											441'
439'6" 31.4'		END OF BOREHOLE		425											
				420											
				415											
				410											
				405											
				400											
				395											
				390											
				385											
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				15											
				10											
				5											
				0											

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & RESEARCH BRANCH - FOUNDATIONS SECTION - DOWNSVIEW
OFFICE REPORT ON SOIL EXPLORATION

DRILL RIG 54-1 OPERATION BORE & PENIT'N JOB F-58-6 WP 118-57 BORING 4 STA 135+51 (5' LT.)
CASING BX (standard samplers to fit, unless noted) DATUM CEODETIC DATE REPORT APRIL 1958
SAMPLER HAMMER WT. 250 LBS. DROP 12 INCHES COMPILED BY H.S. CHECKED BY DATE BORING 1 MARCH 1958

ABBREVIATIONS

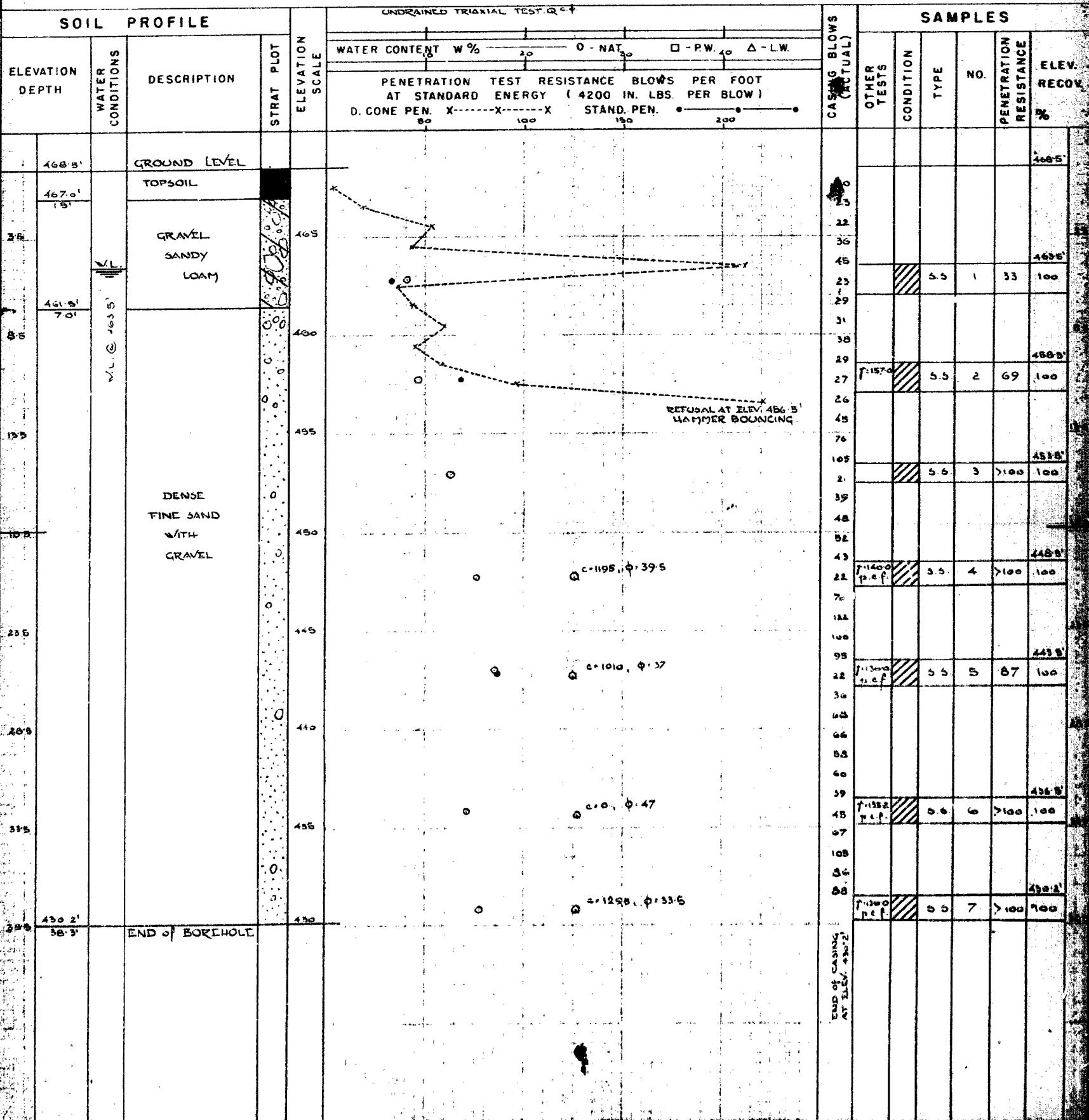
SAMPLE TYPES

SAMPLE CONDITION

V - INSITU VANE SHEAR TEST Q - TRIAXIAL QUICK K - PERMIABILITY C.S. - CHUNK S.S. - SLEEVE SAMPLE
M - MECHANICAL ANALYSIS S - TRIAXIAL SLOW C - CONSOLIDATION D.O. - DRIVE OPEN PS - PISTON SAMPLE
U - UNCONFINED COMPRESSION WL - WATER LEVEL IN CASING CA - CASING D.F. - DRIVE FOOT VALVE WS - WASHED SAMPLE
Q_c - TRIAXIAL CONSOLIDATED QUICK WT - WATER TABLE IN SOIL γ - UNIT WEIGHT T.O. - THIN WALLED OPEN RC - ROCK CORE



- DISTURBED
- FAIR
- GOOD
- LOST



DEPARTMENT OF HIGHWAYS - ONTARIO
 MATERIALS & RESEARCH BRANCH - FOUNDATIONS SECTION - DOWNSVIEW
OFFICE REPORT ON SOIL EXPLORATION

DRILL RIG 54-1 OPERATION BORE & PENET'N JOB T-58-6 WP 118-57 BORING 5 STA. 134+26 (G'LT.)
 CASING BX (standard samplers to fit unless noted) DATUM CEODITIC DATE REPORT APRIL 1958
 SAMPLER HAMMER WT. 250 LBS. DROP 12 INCHES COMPILED BY H.S. CHECKED BY --- DATE BORING 13 MARCH 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
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SAMPLE TYPES

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

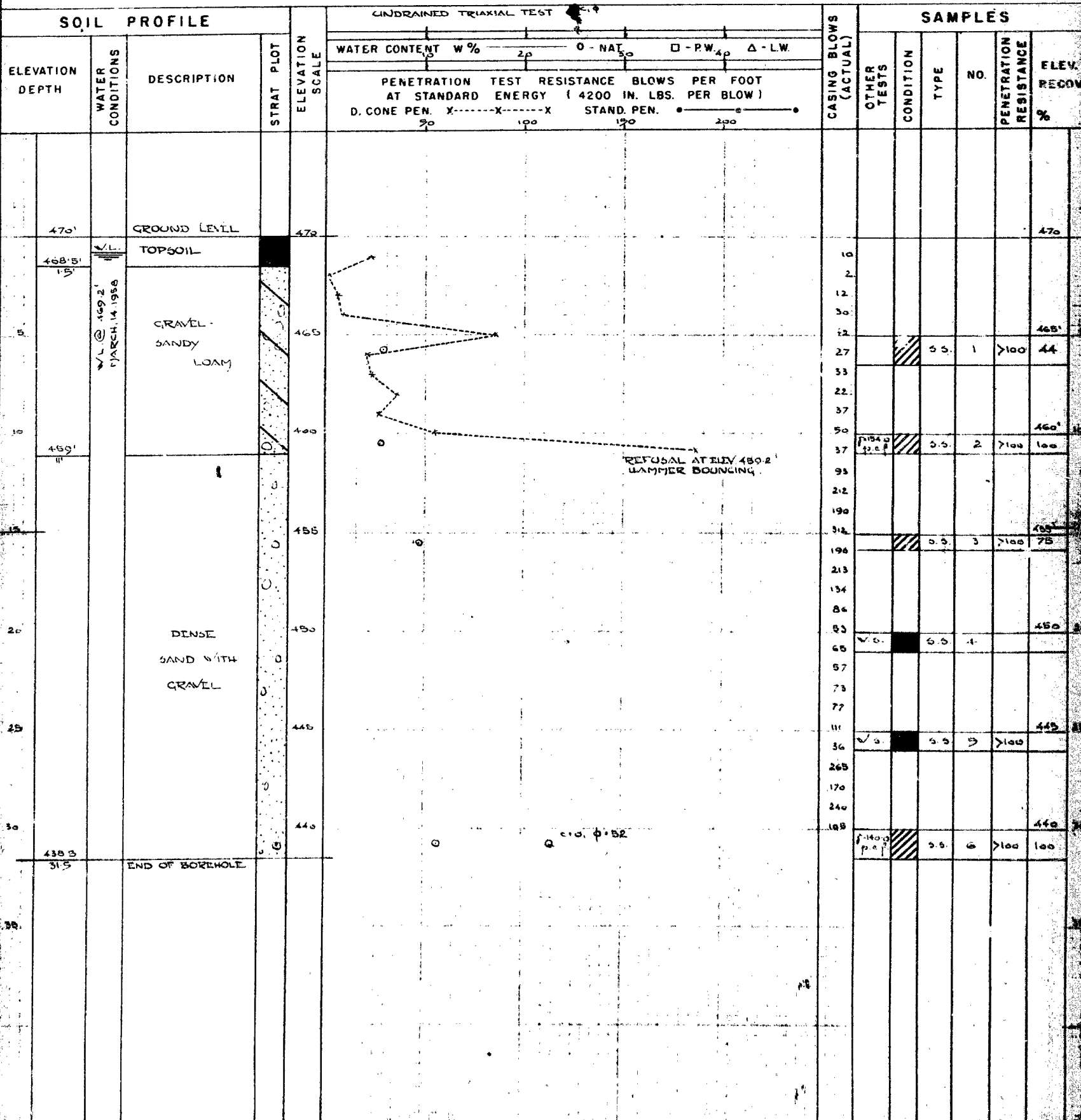
SAMPLE CONDITION

 - DISTURBED
 - FAIR
 - GOOD
 - LOST

SOIL PROFILE

UNDRAINED TRIAXIAL TEST

SAMPLES



DEPARTMENT OF HIGHWAYS - ONTARIO
 MATERIALS & RESEARCH BRANCH - FOUNDATIONS SECTION - DOWNSVIEW
OFFICE REPORT ON SOIL EXPLORATION

DRILL RIG 54-1 OPERATION SOIL & PENET. JOB F-58-6 WP. 118-57 BORING G STA. 133+35 (3' LT.)
 CASING 3X (standard samplers to fit unless noted) DATUM GEODETIC DATE REPORT APRIL 1958
 SAMPLER HAMMER WT. 250 LBS. DROP 12 INCHES COMPILED BY H.S. CHECKED BY A.L. DATE BORING 18 MARCH 1958

ABBREVIATIONS

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

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

SAMPLE CONDITION



- DISTURBED
 - FAIR
 - GOOD
 - LOST

SOIL PROFILE

