



ONTARIO

DEPARTMENT OF HIGHWAYS

139-562

Memo to Mr. A. Toye, Date December 6, 1956.
Bridge Engineer. Subject Foundation Report, Boston
Materials & Research Section, Creek Hwy. # 6, W.P. 539-56
From W.J. F-56-18, Sta. 234/40

We are submitting herewith two copies of the above mentioned report which you will find self explanatory.

The design of this structure has already been given to the consultants by your office and they have asked for our Foundation Report as soon as possible.

F. C. Brownridge
Materials & Research Engineer,

Per:

(A. Rutka)

AR/ad
Copies to: Mr. H. Tregaskes
Mr. J. Walter,
Mr. R. E. Richardson,
Foundation Section,
File.

34562A



ONTARIO
DEPARTMENT OF HIGHWAYS

Memo to Mr. J. McAllister **Date** January 7, 1959
Assistant Bridge Planning Engineer
From Materials & Research Section
Subject Re: Auger Investigations
Proposed structure site Boston
Creek, Hwy. #6 W.P. 539-56.

Enclosed herewith is the soils data obtained from a recent sub-soil investigation at this proposed structure site to determine the bedrock elevation.

A. Rutka
Acting Materials & Research Engineer

per:

P.F. Weber

PFW/sc

P. F. Weber
Soils Supervisor

c.c. H.A. Tregaskes
H.D. McMillan
R.E. Richardson
R. Schonfeld
P. Weber
File

Borehole #1

Station 230 / 00
0" - 9"
9" - 4'
4' - 9'
9' - 21½'
21½' -

30' Right
Dark gray clay loamy topsoil
Dark gray brown medium clay
Brown clay loamy till (soft, medium stony)
Gray medium clay (firm)
Bedrock (Elevation 614.5) (Water Level - 58")

Borehole #2

Station 231 / 00
0" - 6"
6" - 3'
3' - 5'
5' - 24½'
24½' - 25½'
25½' -

30' Right
Dark gray clay loamy topsoil
Dark gray brown medium clay
Brown medium - heavy clay light mottled (firm)
Gray medium clay (firm)
Gray sandy loam - loam (dense)
Bedrock (Elevation 610.5) (Water Level - 26")

Borehole #3

Station 230 / 00
0" - 8"
8" - 7'
7' - 9'

9' - 23'
23' -

30' Left
Dark gray clay loamy topsoil
Brown medium clay (firm)
Yellow brown sandy loam - sandy clay loam
till (soft)
Gray medium clay (firm)
Bedrock (Elevation 613.3) (Water Level - 50")

Borehole #4

Station 231 / 00
0" - 10"
10" - 8'
8' - 9'
9' - 28'
28' -

30' Left
Dark gray clay loamy topsoil
Brown medium clay light-medium mottled (firm)
Dark gray clay loam (soft)
Gray medium clay (Water Level - 66")
Bedrock (Elevation 608.2)

Boston Creek
Hwy. #6 Caledonia - Hagersville

W.P. 539 - 56

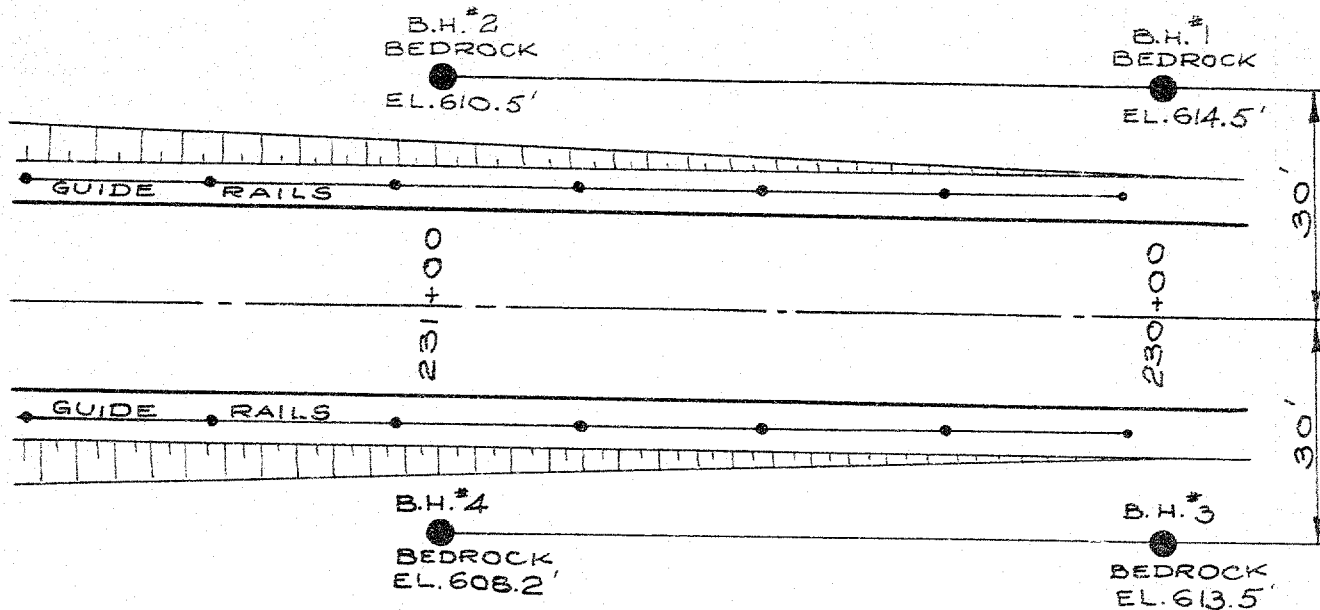
Station 230+00 - 231+00

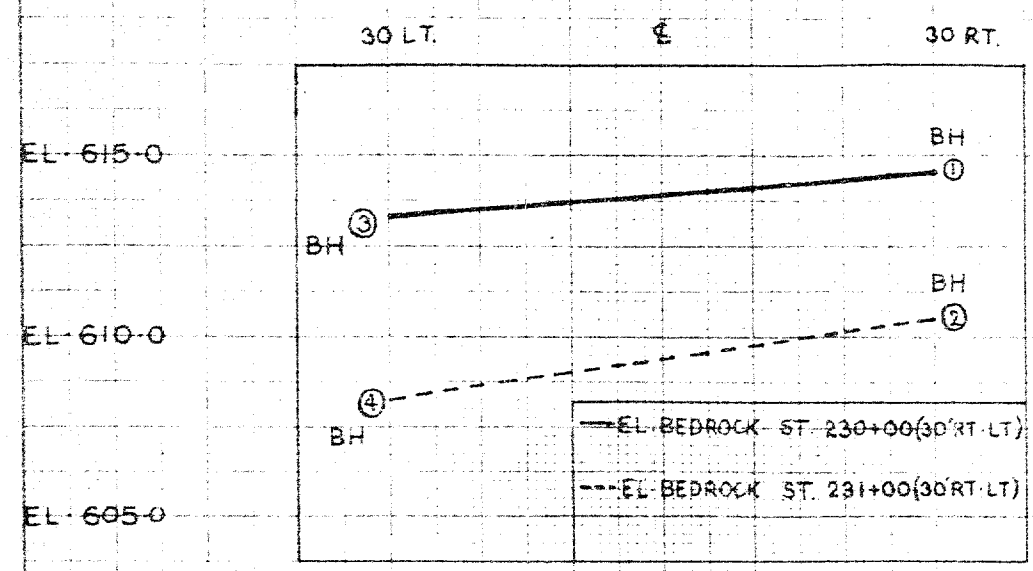
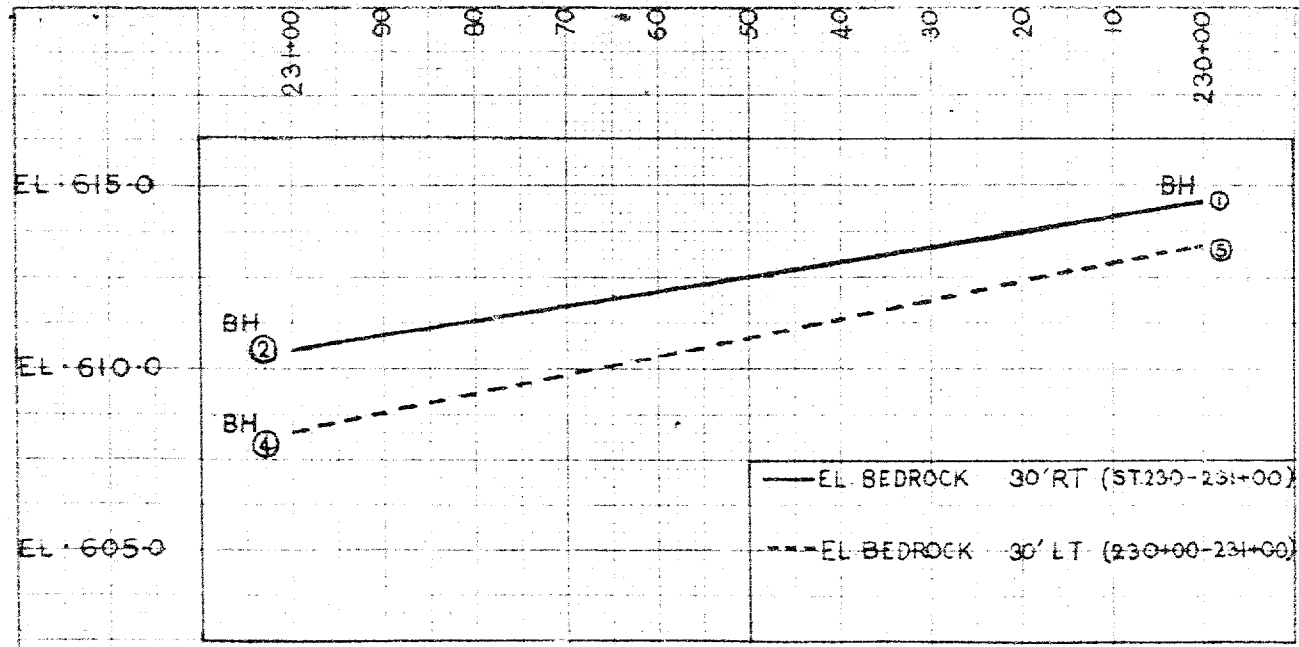
The site investigation at Boston Creek, on Highway #6 between Caledonia and Hagersville was carried out on December 23, 1958.

Four borings were carried out with a flight auger, the location of the holes being 30' left and right of \mathcal{C} at Stations 230 + 00 and 231 + 00. It was found impossible to drill any closer to the \mathcal{C} of the existing highway because of the height of the highway embankment and narrow shoulders. Also the existence of hydro wires on one side of the road and telephone wires on the other made the use of the auger closer than 30' from \mathcal{C} , a hazardous undertaking.

Attached is the required data showing elevations of bedrock and position of the boreholes.

J. McNeely
Soils Engineer





FOUNDATION REPORT

on

Boston Creek Bridge on Highway No. 6
Between Caledonia and Hagersville

Site Plan No.

Station: 234/40

Distribution:

Mr. A. Toye, Bridge Engineer	(2)
Mr. H. A. Tregaskes, Construction Engineer	(1)
Mr. J. Walter, Design Engineer	(1)
Mr. R. E. Richardson, District Engineer, Hamilton, Ontario.	(1)
Foundation Section	(1)
File	(1)

W. P. 539-56

W. J. F-56-18

I. INTRODUCTION:

A subsoil investigation was carried out to determine the kind of foundation to be used to support the proposed new bridge at this site.

The location is between Caledonia and Hagersville, where Highway No. 6 crosses the Boston Creek, (Profile No. C-1104, Station 234/40).

The work started on 9 October, 1956 and was completed on 13 October, 1956.

II. PROCEDURE:

The soil investigation was carried out by means of a core drill machine. The new proposed bridge is going to replace the existing bridge at the same site and elevation. Accordingly, two boreholes and four dynamic cone penetrations were made on both sides of the river to determine the safe bearing capacity of the subsoil.

The locations and elevations of the boreholes are shown in Drawing No. F-56-18 A, and their logs under Appendix I.

III. SUBSOIL FINDINGS AND ANALYSIS:

The physiography of the ground is lacustrine clay overlying glacial till.

The slopes are very gentle and the flow of the river slow.

The subsoil investigations revealed the terrain to be of glacial till.

III. SUBSOIL FINDINGS AND ANALYSIS: (cont'd.)

Underlying the topsoil is a layer of clay loam. This layer is 5-8 ft. deep reaching about the elevation 627 ft. The laboratory test results indicated that the soil in this layer has liquid limit 51%, plastic limit 26%, average density of 90 p.c.f., and average shearing strength of about 400 p.s.f. Also, from the field penetration tests, the average standard penetration resistance is about 6 blows per foot. Consequently, the soil in this layer is inorganic soft to medium clay of medium to high plasticity, and is capable to provide a safe bearing value of about 0.5 t.s.f. with a safety factor of 3. Below this elevation (627 ft.) right down to the bedrock, the material of the underlying layer is boulder clay till.

The laboratory test results show that the soil in this layer has liquid limit 22%, plastic limit 13%, average density of 140 p.c.f. and shearing strength of 1270 p.s.f. The average standard penetration resistance is about 10 blows per foot. Hence, these properties are comparable to inorganic stiff clay of low plasticity. This layer can provide a safe bearing value of one t.s.f. with a safety factor of 3.

Underlying these layers is the bedrock. By means of core drill, samples were extracted. The results show the bedrock being pitted, porous dolomite, interbedded with shale.

IV. CONCLUSIONS AND RECOMMENDATIONS:

From the foregoing discussion it could be concluded:

1. The upper clay layer has no competence to provide any sufficient bearing capacity to be considered for spread footing foundations.
2. The underlying layer of clay till can provide a bearing capacity of 1 t.s.f. for spread footing support. Also, excavations down to bedrock for spread footing, in this case, present a considerable economic drawback.
3. The underlying bedrock is capable to provide the required support for point bearing piles.

It will be satisfactory and economical to support the proposed bridge on point bearing piles. The piles will be supported by the bedrock at elevations as indicated.

As the new proposed bridge will replace the existing bridge at the same place and elevation, no new approach fill problem will arise.

V. Korlu
Foundation Engineer

APPENDIX I.

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

DRILL RIG # 1 OPERATION BORE & PENETRAT. JOB F-56-18 WR 539-56 BORING 2 STA 233+75 (38' RT)
 CASING BX (standard samplers to fit unless noted) DATUM GEODETIC DATE REPORT OCTOBER 1956
 SAMPLER HAMMER WT. 250 LBS. DROP 20 1/2 INCHES COMPILED BY H.S. CHECKED BY DATE BORING OCTOBER 12, 1956

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

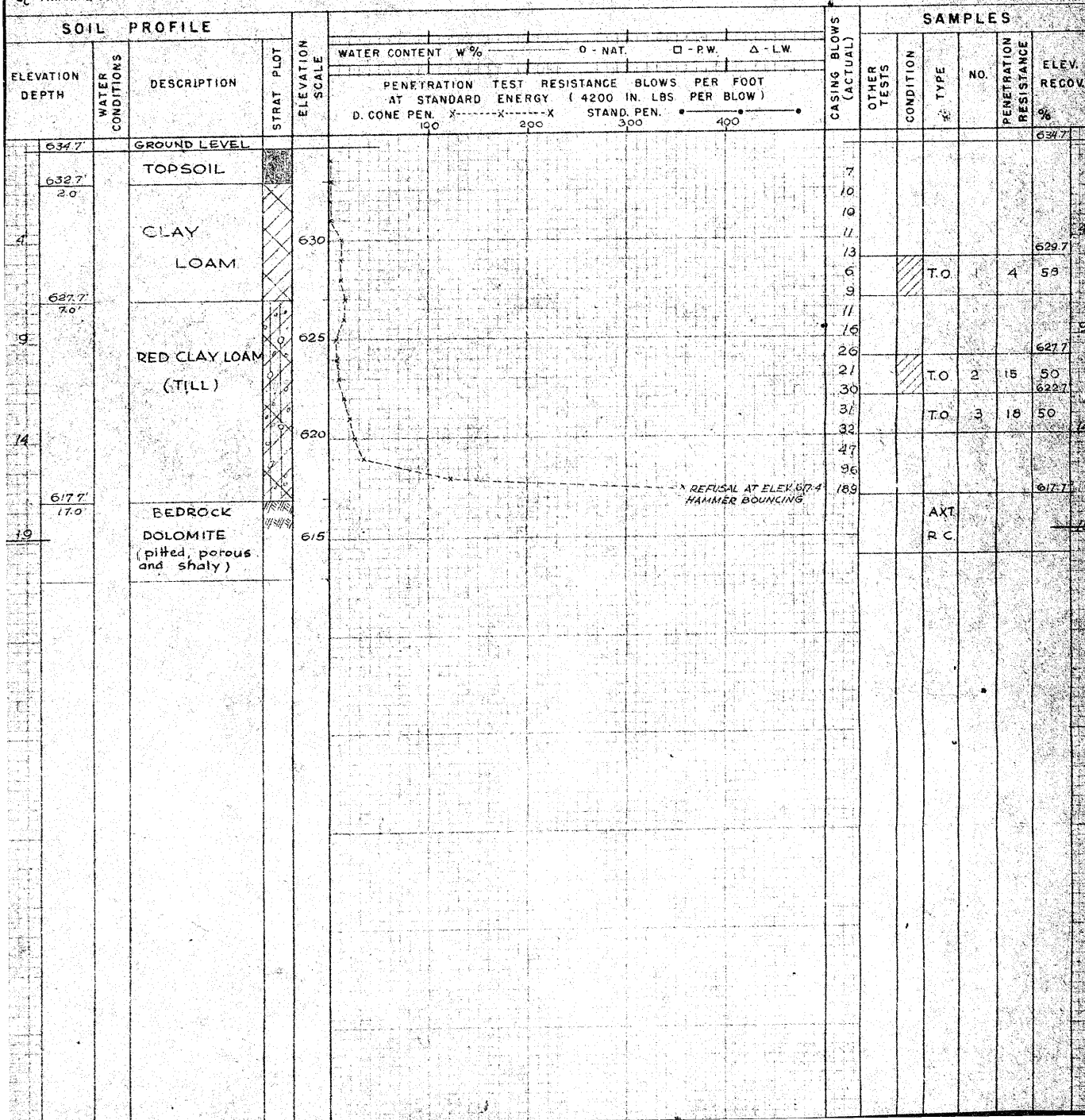
SAMPLE CONDITION



- DISTURBED
 - FAIR
 - GOOD
 - LOST

SOIL PROFILE

SAMPLES



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

DRILL RIG # 1 OPERATION PENETRATION JOB F-56-18 WP 539-56 BORING 3 STA. 234+93 (42' RT)
 CASING 3X (standard samplers to fit unless noted) DATUM GEODETIC DATE REPORT OCTOBER 1956
 SAMPLER HAMMER WT. 250 LBS. DROP 20 1/2 INCHES COMPILED BY H.S. CHECKED BY DATE BORING OCTOBER 12 1956

ABBREVIATIONS

SAMPLE TYPES

SAMPLE CONDITION



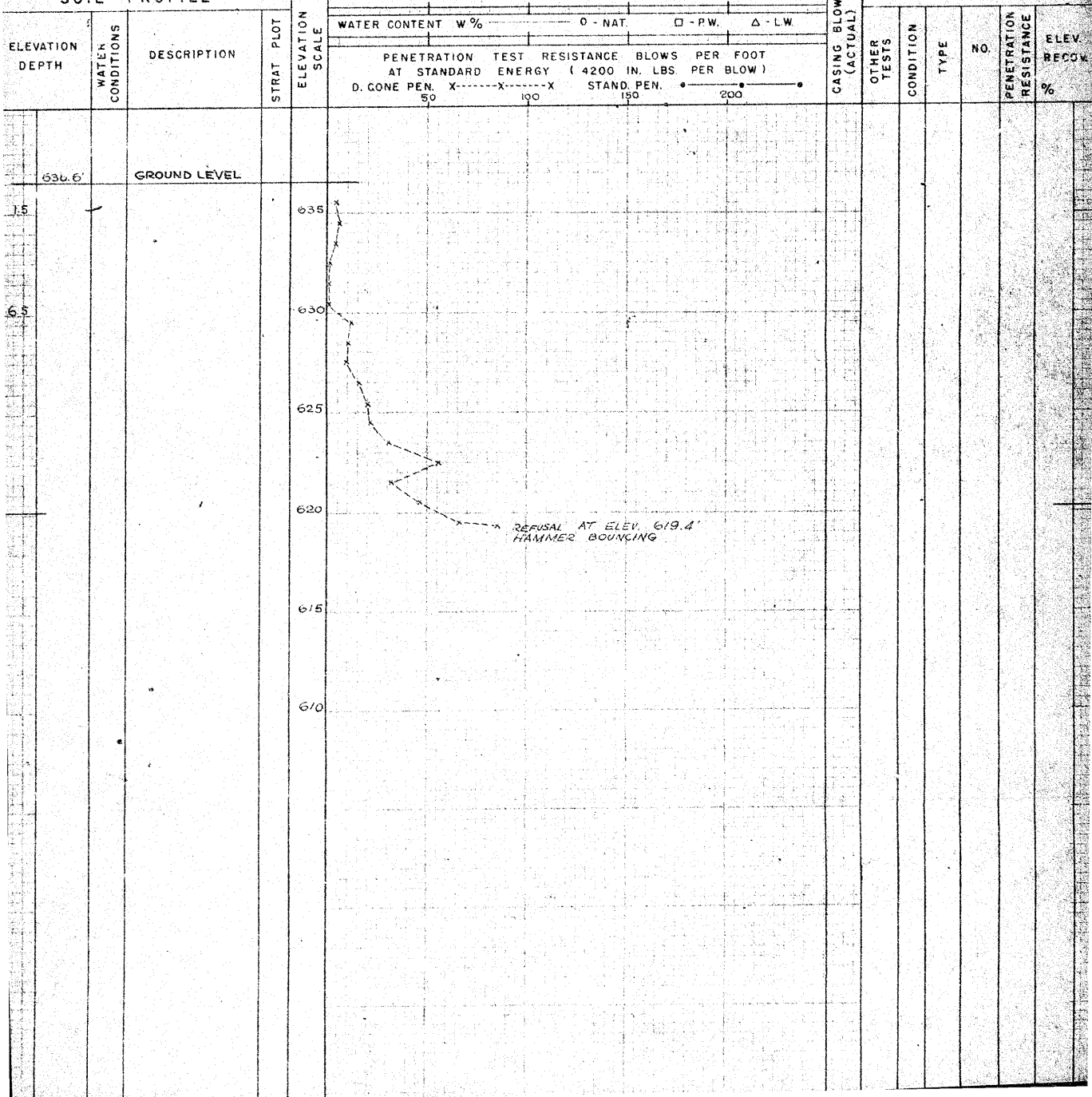
- DISTURBED
 - FAIR
 - GOOD
 - LOST

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

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

SOIL PROFILE

SAMPLES



DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS & RESEARCH BRANCH - FOUNDATIONS SECTION - DOWNSVIEW

OFFICE REPORT ON SOIL EXPLORATION

DRILL RIG # 1 OPERATION PENETRATION JOB F-56-18 WP 539-56 BORING 4 STA 235+06 (30.4')
 CASING BX (standard samplers to fit unless noted) DATUM GEODETIC DATE REPORT OCTOBER 1956
 SAMPLER HAMMER WT. 250 LBS. DROP 20 1/2 INCHES COMPILED BY H. S. CHECKED BY _____ DATE BORING OCTOBER 13, 1956

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

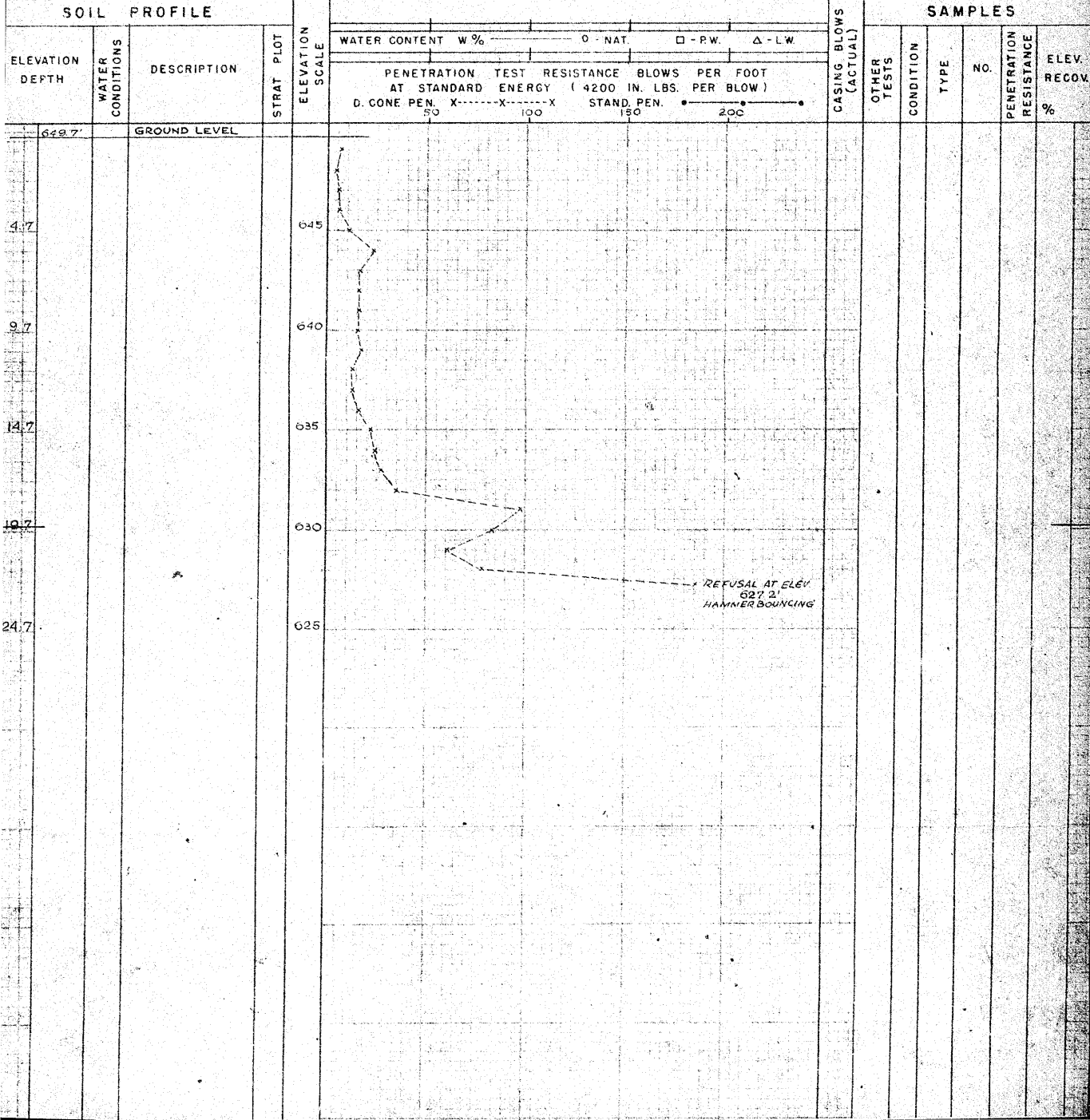
CS - CHUNK SS - SLEEVE SAMPLE
 DO - DRIVE OPEN PS - PISTON SAMPLE
 DF - DRIVE FOOT VALVE WS - WASHED SAMPLE
 TO - THIN WALLED OPEN RC - ROCK CORE

SAMPLE CONDITION



- DISTURBED
 - FAIR
 - GOOD
 - LOST

SOIL PROFILE



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

DRILL RIG # 1 OPERATION PENETRATION JOB F-56-18 WP 539-56 BORING 3 STA. 234.93 (42' RT.)
 CASING BX (standard samplers to fit unless noted) DATUM GEODETIC DATE REPORT OCTOBER 1956
 SAMPLER HAMMER WT. 250 LBS. DROP 20 1/2 INCHES COMPILED BY H.S. CHECKED BY DATE BORING OCTOBER 12 1956

ABBREVIATIONS

V - INSITU VANE SHEAR TEST Q - TRIAXIAL QUICK K - PERMIABILITY
 M - MECHANICAL ANALYSIS S - TRIAXIAL SLOW C - CONSOLIDATION
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SAMPLE TYPES

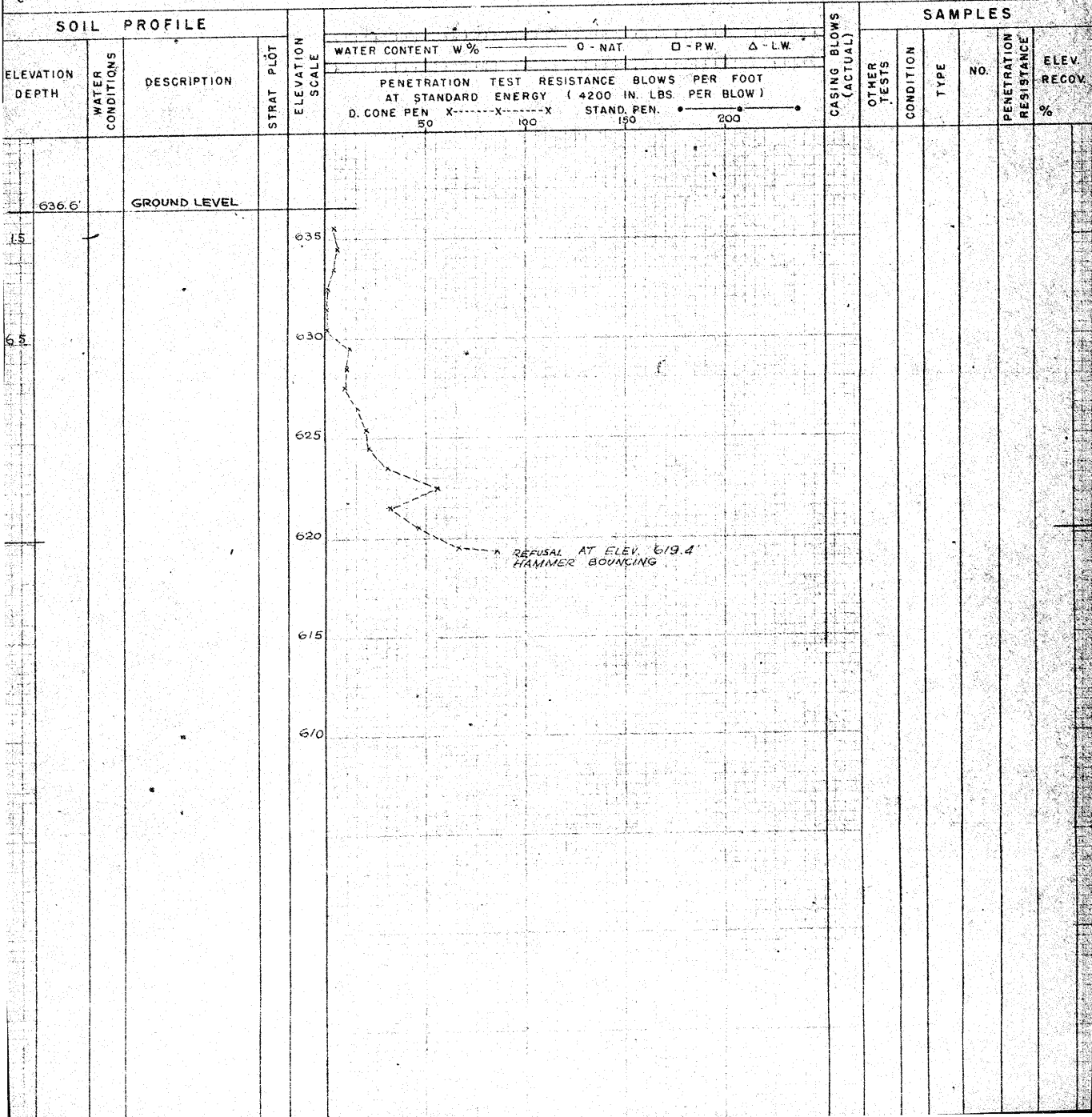
CS - CHUNK SS - SLEEVE SAMPLE
 DO - DRIVE OPEN PS - PISTON SAMPLE
 DF - DRIVE FOOT VALVE WS - WASHED SAMPLE
 TO - THIN WALLED OPEN RC - ROCK CORE

SAMPLE CONDITION



- DISTURBED
 - FAIR
 - GOOD
 - LOST

SOIL PROFILE



DRILL RIG # 1 OPERATION BORE & PENETRAT. JOB # 56-18 WP 539-56 BORING 2 STA. 233+75 (38' RT)
CASING BX (standard samplers to fit unless noted) DATUM GEODETIC DATE REPORT OCTOBER 1956
SAMPLER HAMMER WT. 250 LBS. DROP 20 1/2 INCHES COMPILED BY H.S. CHECKED BY _____ DATE BORING OCTOBER 12, 1956

SAMPLE TYPES

SAMPLE CONDITION

ADDRESS		CITY		STATE		COUNTRY	
V - INSITU VANE SHEAR TEST	Q - TRIAXIAL QUICK	K - PERMIABILITY	C.S. - CHUNK	SS. - SLEEVE SAMPLE		- DISTURBED - FAIR - GOOD - LOST	
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			
D - TRIAXIAL CONSOLIDATED QUICK	WT - WATER TABLE IN SOIL	U - UNIT WEIGHT	T.O. - THIN WALLED OPEN	RC - ROCK CORE			



- DISTURBED
- FAIR
- GOOD
- LOST

SOIL PROFILE

SAMPLES

ELEVATION DEPTH	WATER CONDITIONS	DESCRIPTION	STRAT. PLOT ELEVATION SCALE	WATER CONTENT W%		0 - NAT.		□ - P.W.		Δ - L.W.		CASING BLOW (ACTUAL)	OTHER TESTS	CONDITION	TYPE	NO.	PENETRATION RESISTANCE	ELEV. RECOVER
				PENETRATION TEST RESISTANCE BLOWS PER FOOT AT STANDARD ENERGY (4200 IN. LBS. PER BLOW) D. CONE PEN. X-----X-----X STAND. PEN. •-----•-----•														
634.7'		GROUND LEVEL																634.7'
632.7' 2.0'		TOPSOIL										7						
		CLAY LOAM										10						
													11					
													13					629.7'
													16					
627.7' 7.0'													17					
													19					
													26					627.7'
													21					
		RED CLAY LOAM (TILL)										30						622.7'
													31					
													32					
													47					
													56					
617.7' 17.0'													189					617.7'
		BEDROCK																
		DOLOMITE (pitted, porous and shaly)													AXT R.C.			

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

DRILL RIG # 1 OPERATION BORE & PENET'N JOB F-50-18 WP 539-56 BORING 1 STA 233+48 (37' LT)
CASING BX (standard samplers to fit unless noted) DATUM GEODETIC DATE REPORT OCTOBER 1956
SAMPLER HAMMER WT. 250 LBS. DROP 23 INCHES COMPILED BY H.S. CHECKED BY DATE BORING OCTOBER 11 1956

ABBREVIATIONS

SAMPLE TYPES

SAMPLE CONDITION

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

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T.O. - THIN WALLED OPEN R.C. - ROCK CORE



- DISTURBED
- FAIR
- GOOD
- LOST

SOIL PROFILE					SAMPLES									
ELEVATION DEPTH	WATER CONDITIONS	DESCRIPTION	STRAT PLOT	ELEVATION SCALE	WATER CONTENT W %			CASING BLOWS (ACTUAL)	OTHER TESTS	CONDITION	TYPE	NO.	PENETRATION RESISTANCE	ELEV RECOV
					0 - NAT.	□ - PW	Δ - LW.							
					PENETRATION TEST RESISTANCE BLOWS PER FOOT AT STANDARD ENERGY (4200 IN. LBS. PER BLOW) D. CONE PEN. X-----X-----X STAND. PEN. •-----•-----•									
					100	200	300							
		GROUND LEVEL												637.3'
2	635.3' 2.0	TOPSOIL		635				4						
								6						
								12						
								13						
								15					632.3	
7		MED. CLAY		630				4			T.O.	1	6	62
								6						
								18						
								48						
	627.3' 10.0							20					627.3	
12		CLAY LOAM (TILL)		625				22			D.O.	2	13	54
								28						
								44						
								52						
								72						
								104						
17	619.8' 17.5	BEDROCK DOLOMITE (pitted, porous and SHALEY)		620				177						619.8'
								97			AXT R.C.	3		57
22	616.3' 21.0	END OF BOREHOLE												
			</											

REFUSAL AT ELEV 613.8' HAMMER BOUNCING

#56-F-18

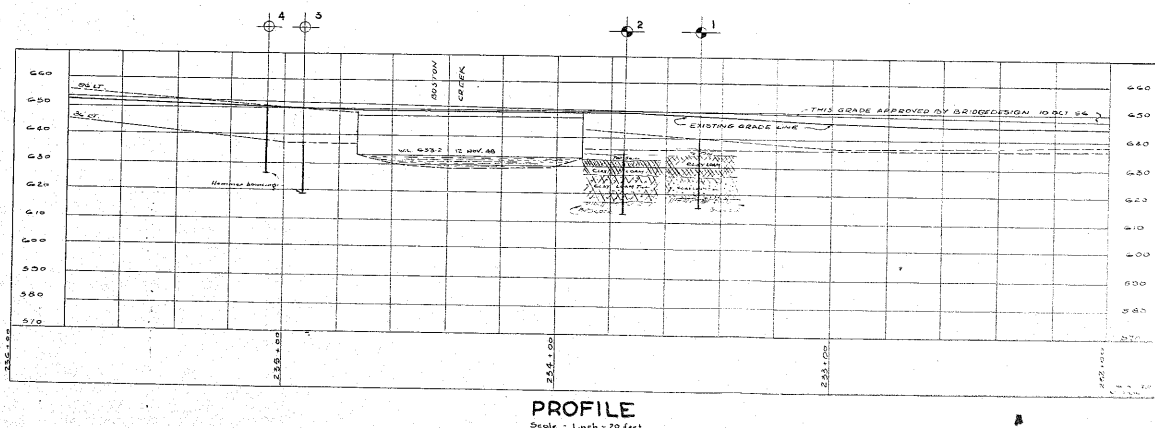
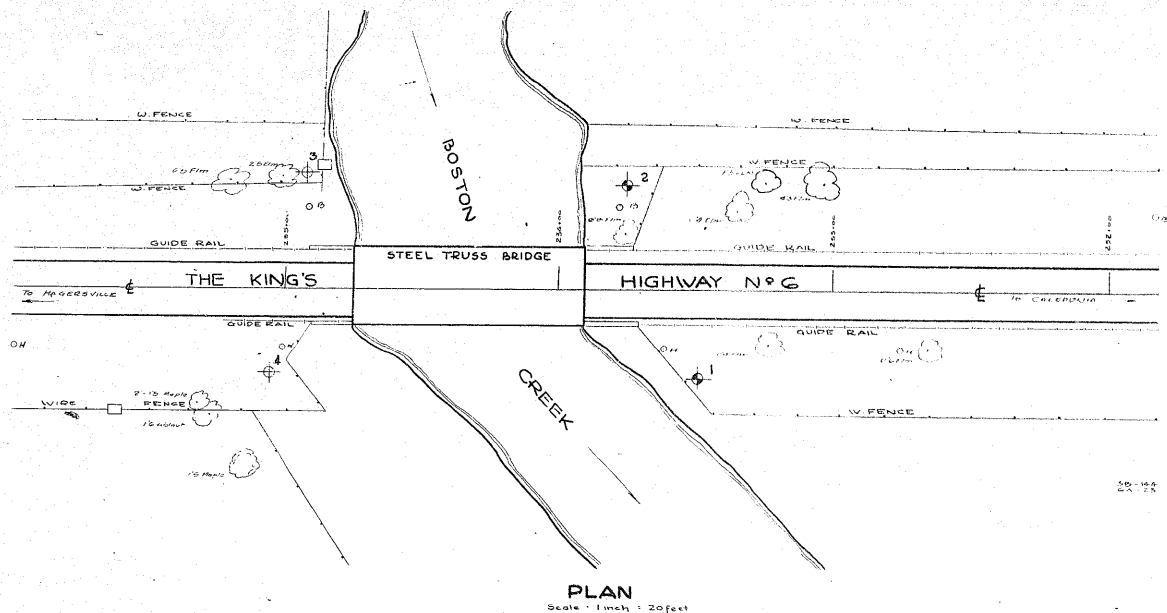
WP #539-56

Hwy #6

BETWEEN

CALEDONIA &
HAGERSVILLE





LEGEND			
Bore Hole			
Penetration Hole			
Bore & Penetration Hole			
Power Auger Hole			
HOLE NO	ELEVATION	STATION	DISTANCE FROM 1
1	457.5	252+40	57' LT
2	234.7	252+75	58' RT
3	449.7	255+00	30' LT
4	450.6	256+00	42' RT

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

DEPARTMENT OF HIGHWAYS, ONTARIO			
MATERIALS & RESEARCH SECTION - DOWNSVIEW			
BOSTON CREEK CROSSING			
THE KING'S HIGHWAY No 6		DIV No 4	
HALDIMAND ONEIDA		SHT 12 & 13 CON IV	
POSITION & ELEVATION OF HOLES			
APPROVED			
DESIGNED BY		CHECKED BY	
W. G.		W. G.	
22 NOV 54		390-54	
		F-56-18-A	