

BA 704



ONTARIO

DEPARTMENT OF HIGHWAYS

Memo to Mr. A. Toye. Date February 7th, 1958.
Bridge Engineer, Subject _____
From Materials & Research _____

Re: Foundation Report - Jerry's Creek,
Hwy. No. 3, West of Tillsonburg.
Station 330/70. W.P. 703-56.
W.J.F. 57-40.

We are forwarding herewith two copies of the above mentioned Foundation Report. The Work Project mentioned above is for the grading, granular base and hot mix paving Contract, and not specifically for the structure. To our knowledge, this crossing has never been assigned a Work Project number.

The sub-soil consists primarily of a varved clay and a maximum of 2 tons per square foot is recommended for a one inch settlement. It is evident that much higher bearing values will be required, and consequently a flexible pipe is recommended.

We would draw your attention to two culverts west of London over very similar soil conditions, which failed due to excessive settlement and which required subsequent repair by tunnelling with flexible pipe. In these two cases the fills were much less than the fill over Jerry's Creek.

F. C. Brownridge.
Materials & Research Engineer.

per;

A. RUTKA.
Principal Soils Engineer.

c.c. Mr. A. Toye.
Mr. H. Tregaskes.
Mr. D.G. Ramsay.

Mr. W.L. Fraser.
Mr. P. Karrow.
File.

Mr. A. Watt.
Foundation Section.

FOUNDATION REPORT

On

New Bridge at Highway No. 3 revision line "A"
 Crossing Jerry's Creek, one mile north of Bayham,
 Township of Bayham.

Plan No: E 3270-1

Station: 338/70

Distribution:

Mr. A. Teye
 Bridge Engineer (2)

Mr. H. Tregaskes
 Construction Engineer (1)

Mr. D. G. Ramsay
 Design Engineer (1)

Mr. W. L. Fraser
 Dist. Engr. London. (1)

Mr. A. Watt
 Water Resources Commission (1)

Mr. P. Karrow
 Department of Mines (1)

Foundation Section (1)

File (1)

W.P. 703-56

W.J. F-57-40

Introduction:

A subsoil investigation was carried out to determine the bearing capacities of layers for supporting the foundations of the proposed bridge and the stability of its approach fills.

The site is located at approximately one mile north of Bayham where Highway No. 3 Revision Line "A" crosses Jerry's Creek, concession VII, in the township of Bayham (station 338+70, profile No. C-663-4). The work started on October 21, 1957 and was completed on November 2, 1957.

Procedure:

The investigation was carried out by means of a skid mounted coredrill machine. In the course of investigations 5 boreholes, three of them with dynamic cone penetration tests, were made. Boreholes No. 1 and 2 were made in connection with the support of foundations of the structure, while boreholes No. 3, 4, and 5 were made in connection with the stability of the approach fill.

The locations of the boreholes are shown in drawing No. F-57-40A, and their elevations on log sheets under Appendix I.

Subsoil Findings and Analysis:

The site is located within the late Whittlesey lake shoreline. The terrain is basically of lacustrine material with alluvial deposit on top. The creek meanders at the site, with eroded banks and washed down boulders in and around the stream. During times of flood the water level rises some six feet above its normal elevation. The indications of continuous scouring action at the site are apparent.

The investigations revealed the following stratigraphy. In borehole No. 1, underlying some 4 ft. of alluvial sand deposit on the top, is a 3 ft. layer of gravel and sandy loam believed to be stream-bed deposit. Underlying this layer is a clay layer interbedded with silt layers in a varved state. In borehole No. 2, underlying some 4 ft. of alluvial sand deposit on the top, is an interbedded layer of silt and sand in varved state down to elevation 643 ft. This layer in turn is underlain by a layer of clay layer interbedded with silt layers in a varved state (similar to the layer in borehole No. 1). Borehole No. 1 was lowered down to elevation 619.7 ft. and, as no bedrock was encountered, it was stopped there.

From the boreholes samples were extracted and tested in the laboratory. The test results showed that the clays are of low plasticity having index properties of 23% average liquid limit, 18% average plastic limit, and that the silts are almost non-plastic. The average moisture content is about 21.5% and the average unit weight about 135 p.c.f.

The unconfined compression test results are rather erratic and misleading on account of the fact that the samples are varved. Triaxial compression tests were also run and from the results it appears that the varved layer should be treated as cohesive-frictional material. Calculations from these test results indicate that the varved layer can be credited with $C = 1750$ p.s.f. and an angle of shearing resistance of 28 degrees ($\phi = 28^\circ$).

The standard penetration tests performed during sampling in the field registered an average of 35 blows per foot penetration.

Boreholes No. 3, 4, and 5 were investigated in connection with the stability of the approach fills to the structure. The stratigraphy of the subsoil was established and soil tests performed on field samples.

From visual observations it was seen that the water table at the site is at or close to the water level of the creek (about 652.8 ft).

CONCLUSIONS AND RECOMMENDATIONS.

From the above discussion it will follow that:-

1. The site is located within the late Whittlesey lake shore line. The terrain is composed of basically lacustrine material with some alluvial deposit on top.
2. The subsoil stratigraphy, as revealed by the investigation, is composed of interbedded layers of clay and silt in varved state underlying the alluvial sand deposits on top.
3. Treating the varved layers as materials having both cohesion and angle of shearing resistance, and judging its consistency from the standard penetration resistance of about 35 blows per foot penetration, the layer can be credited with a bearing value of 2 T.s.f. against a maximum of one inch settlement, at about elevation 646 ft. This elevation is also calculated to be convenient for overcoming scouring hazards at this site.

4. It is apparent from the height of the grade line that much higher bearing values must of necessity be used, both for the structure and also for the approach fills. The ultimate bearing capacity of the subsoil is in excess of 2 tons per square foot; however, if a greater value is used, the settlement will be in excess of 1", and for this reason a rigid type structure does not seem desirable. It is therefore recommended that flexible pipe be considered. The flexible pipe should be placed on a prepared foundation, the bottom of which should extend to approximately elevation 648. It is expected that the maximum settlement will be in the neighbourhood of 4" - 6".
5. The approach fill stability will be established if 2:1 side slope and granular material or cohesive material having $C = 1400$ p.s.f. is used. It is assumed that the topsoil and all undesirable materials will be removed before the embankment is constructed. As the borrow material in the immediate vicinity will be a cohesive medium clay, to achieve the desired cohesive value to ensure stability, adequate compaction according to specifications (95%) must be obtained.

V. Korlu
Foundations Engineer.

APPENDIX I.

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

DRILL RIG 54-2 OPERATION BORE JOB F-57-40 WP 703.50 BORING 1 STA. 338+42 (28' RT)
 CASING BX (standard samplers to fit unless noted) DATUM GEODETIC DATE REPORT DEC. 1957
 SAMPLER HAMMER WT. 250 LBS. DROP 22 INCHES COMPILED BY LLS CHECKED BY AL DATE BORING 22 OCT. 1957

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

ELEVATION DEPTH
 WATER CONDITIONS
 DESCRIPTION
 STRAT. PLOT
 ELEVATION SCALE

SHEAR STRENGTH IN LBS PER SQ FT
 1000 2000 3000 4000
 WATER CONTENT W % 20 30 40 50
 O - NAT O - PW Δ - LW
 PENETRATION TEST RESISTANCE BLOWS PER FOOT
 AT STANDARD ENERGY (4200 IN LBS PER BLOW)
 O. CONE PEN. X-----X-----X STAND PEN. •-----•-----•

SAMPLES

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

656.2' GROUND LEVEL

ALLUVIAL SAND

GRAVEL SANDY LOAM

GREY CLAY INTERBEDDED WITH SILT LAYERS (VARVED CLAY)

END OF BOREHOLE

END OF CASING AT ELEV. 531.3'

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

DRILL RIG 54-2 OPERATION BORE HOLE IN JOB F 57-40 WP 703-56 BORING 2 STA. 332+10 (17' LT.)
CASING 3X (standard samplers to fit unless noted) DATUM GEODETIC DATE REPORT DEC. 1957
SAMPLER HAMMER WT. 250 LBS. DROP 22 INCHES COMPILED BY H.S. CHECKED BY AL DATE BORING 29 OCT. 1957

ABBREVIATIONS

V - INSITU VANE SHEAR TEST Q - TRIAXIAL QUICK X - 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

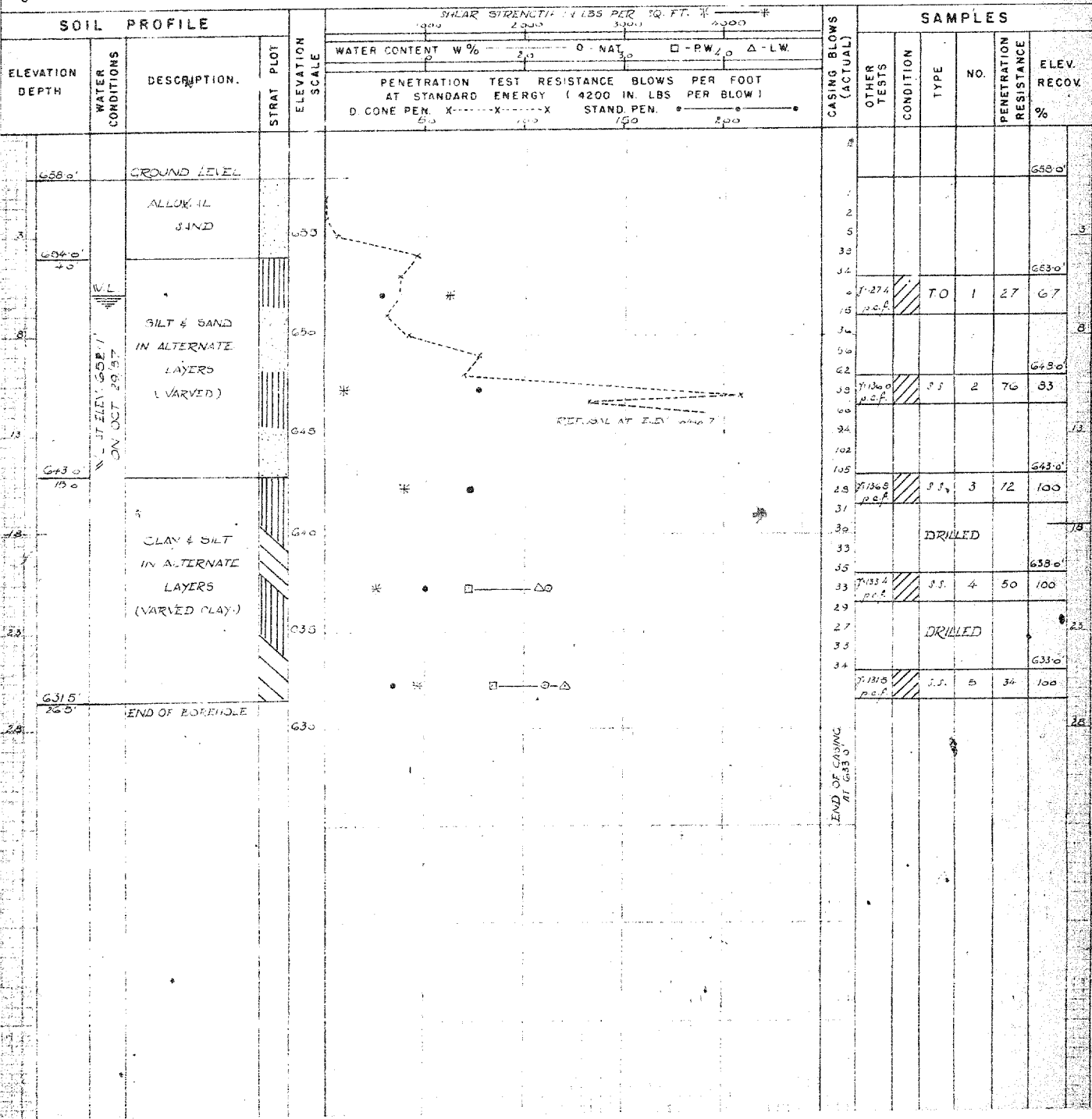
SAMPLE TYPES

SS - SLEEVE SAMPLE
PS - PISTON SAMPLE
WS - WASHED SAMPLE
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 54-2 OPERATION BORE JOB F-57-49 W.P. 703-56 BORING 3 STA. 339+66
CASING B1 (standard samplers to fit unless noted) DATUM GEODETIC DATE REPORT DEC. 1957
SAMPLER HAMMER WT. _____ LBS. DROP _____ INCHES COMPILED BY _____ CHECKED BY AL DATE BORING 30 OCT 1957

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 γ - UNIT WEIGHT

SAMPLE TYPES

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

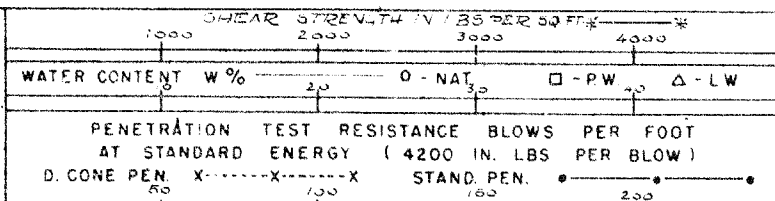
SAMPLE CONDITION



- DISTURBED
- FAIR
- GOOD
- LOST

SOIL PROFILE

ELEVATION DEPTH	WATER CONDITIONS	DESCRIPTION	STRAT PLOT	ELEVATION SCALE
653.9'		GROUND LEVEL		
653.9' 30"		MUCK		
650.9' 80"		GREY-BROWN CLAY		655
642.4' 16.5'		CLAY & SILT IN ALTERNATE LAYERS (VARVED CLAY)		650 645
		END OF BOREHOLE		



SAMPLES

CASING BLOWS (ACTUAL)	OTHER TESTS	CONDITION	TYPE	NO.	PENETRATION RESISTANCE	ELEV. RECOV. %
						653.9'
71300 p.c.f.			T.O.	1	20	63
71386 p.c.f.			S.S.	2	55	100
71343 p.c.f.			S.S.	3	73	100

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

DRILL RIG S-2 OPERATION BORING & PENETRATION JOB F-5745 W.P. 763-56 BORING 4 STA. 337+42.4
CASING BA (standard samplers to fit unless noted) DATUM GEODETIC DATE REPORT DEC 1957
SAMPLER HAMMER WT. 250 LBS. DROP 22 INCHES COMPILED BY AL CHECKED BY AL DATE BORING 31 OCT 1957

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

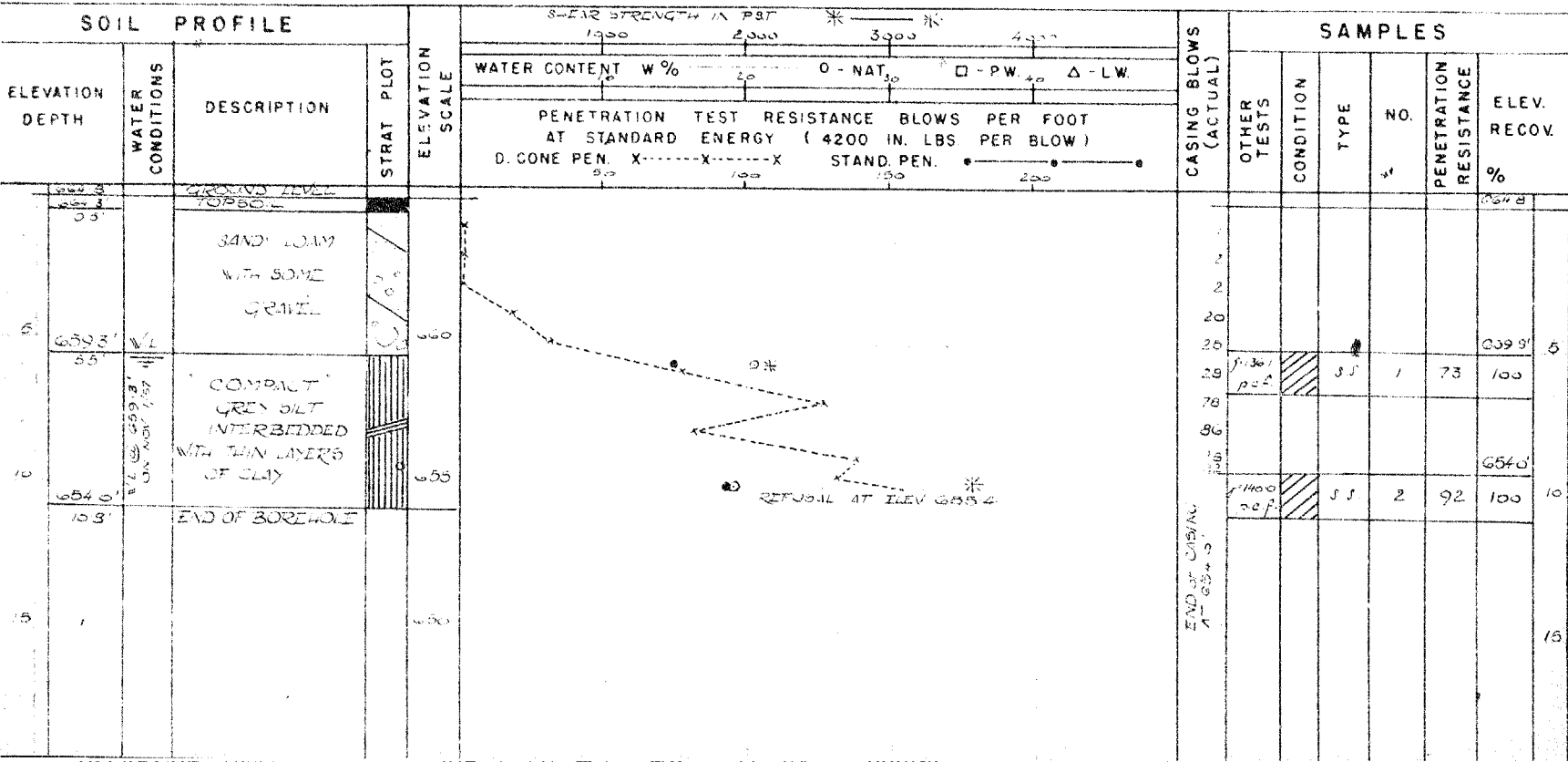
CS - CHUNK SS - SLEEVE SAMPLE
DO - DRIVE OPEN PS - PISTON SAMPLE
DF - DRIVE FOOT VALVE WS - WASHED SAMPLE
TO - THIN WALLED OPEN RC - ROCK CORE

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 54-2 OPERATION BORE & PENET JOB 7-57-49 W.P. 703-56 BORING 5 STA. 336+2.5
 CASING BA (standard samplers to fill unless noted) DATUM GEODETIC DATE REPORT DEC 1957
 SAMPLER HAMMER WT. 250 LBS. DROP 22 INCHES COMPILED BY HS CHECKED BY AL DATE BORING 1 NOV 1957

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

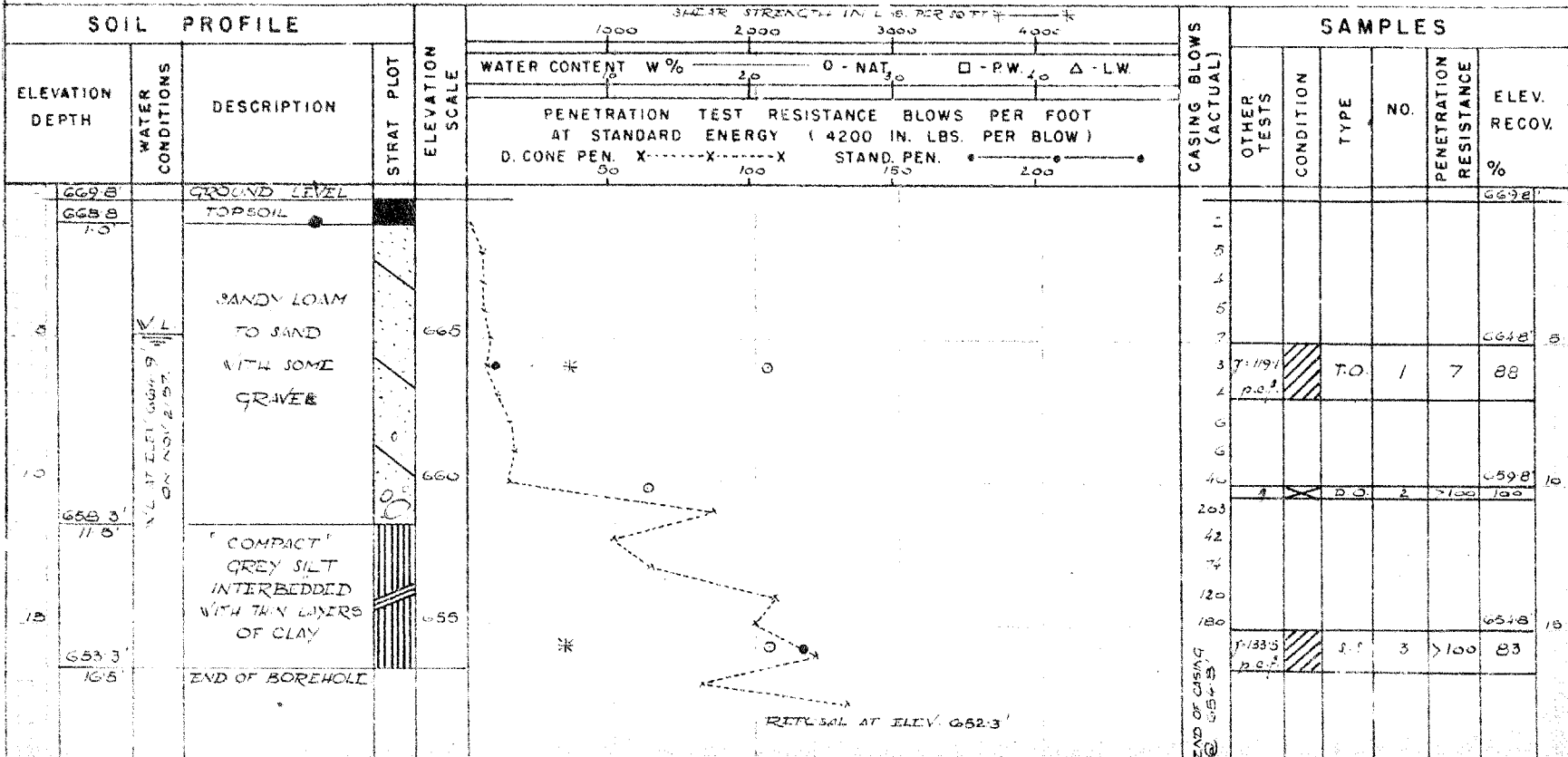
C.S - CHUNK S.S - SLEEVE SAMPLE
 DO - DRIVE OPEN P.S - PISTON SAMPLE
 DF - DRIVE FOOT VALVE W.S - WASHED SAMPLE
 T.O - THIN WALLED OPEN R.C - ROCK CORE

SAMPLE CONDITION



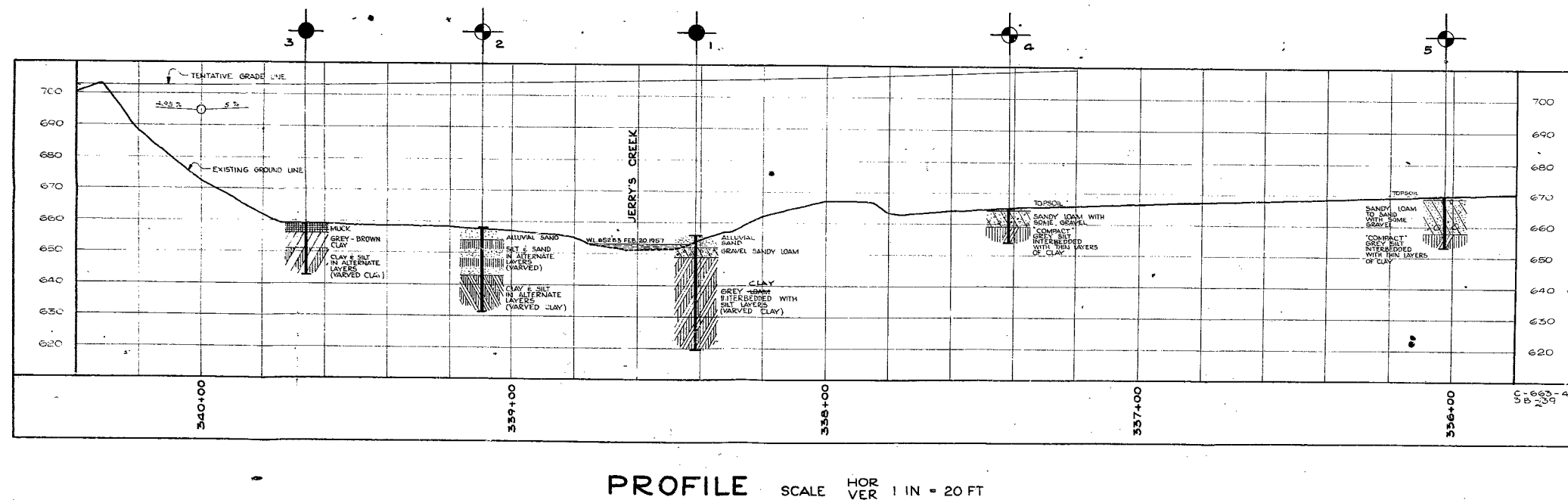
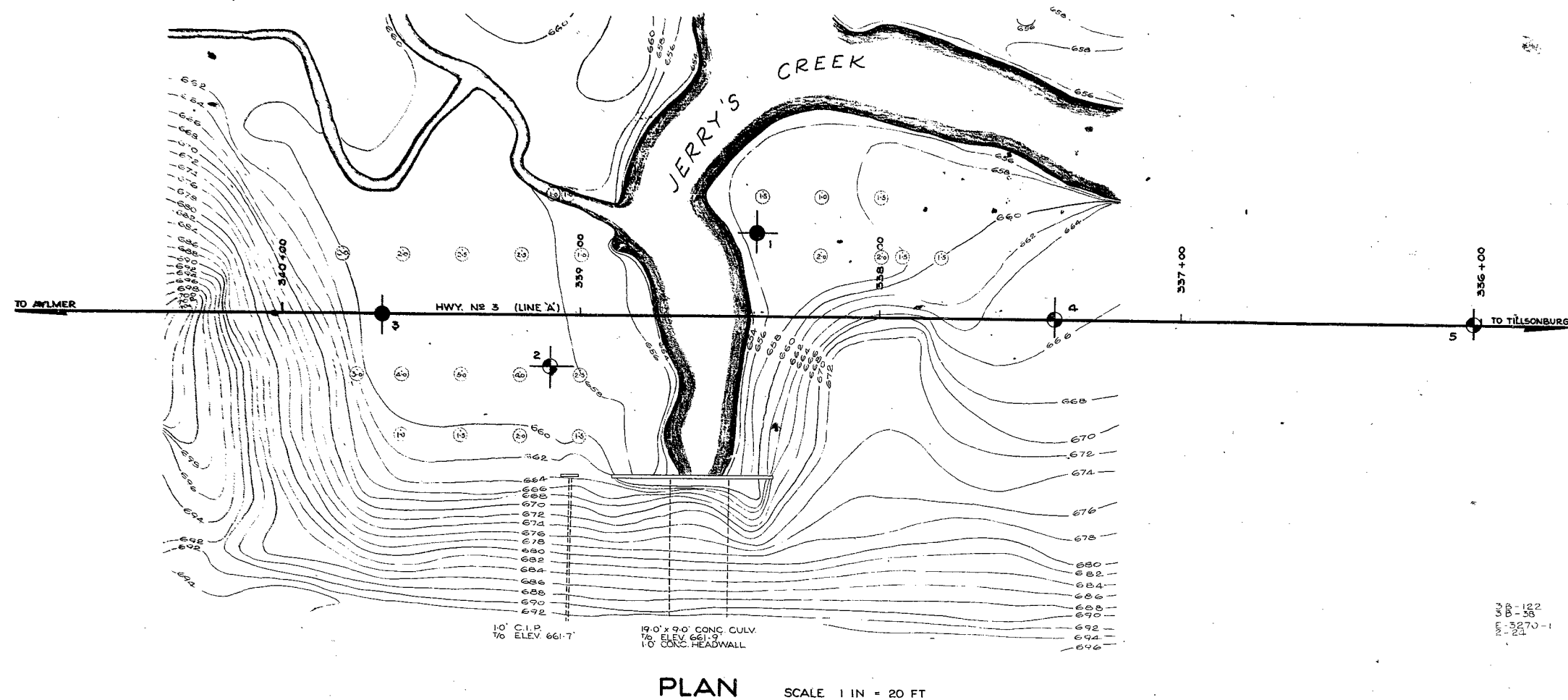
- DISTURBED
 - FAIR
 - GOOD
 - LOST

SOIL PROFILE



57-F-40
W.P. # 703-56
Hwy. # 3
CROSSING
JERRY'S CREEK
1 MILE N. OF
BAYHAM

EDITED
FOR MICROFILMING
BY *HB* DATE *1/14/52*



DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & RESEARCH SECTION - DOWNSVIEW

**JERRY'S CREEK
PROPOSED CROSSING
1 MILE N. OF BAYHAM**
SHOWING POSITION & ELEVATION OF HOLES

HWY. NO. 3	W.P. 703-56	DIV. NO. 2
CO. ELGIN	LOT 2	CON. VII
TWP. BAYHAM		
SCALE AS SHOWN	SUBMITTED BY	DATE DEC. 11 / 57
DRAWN BY R.E.F.	APPROVED BY	DRAWING NO. F-57-40A