

#58-F-12

WP#56-58

HWY#401 &

GRAVEL RD.

CROSSING 1 MI.

N.W. OF COBOURG



Mr. A. Toye

July 28, 1958

Bridge Engineer

Materials & Research Section

Re: Foundation Report Hwy. 401
& gravel road (between lots 20&21)
crossing, one mile N W of Cobourg,
Twp. of Hamilton

W.P. 56-58

W.J. F-58-12

Attached please find two copies of the above mentioned report.

It will be seen that at elevation 328 ft. the layer can provide 2.5 T.s.f. bearing value to support spread footing type foundations. If it is desired to place the footings at lower elevation than 328 ft., then, the use of pile support will be safer. Because it will overcome the hazards due to more than one inch settlement, anticipated in the soft clay layer between elevations 311 ft. and 295 ft.

A. Rutka

Acting Materials & Research Engineer

c.c. Mr. A. Toye
Mr. H. Tregaskes
Mr. D.G. Ramsay
Mr. H.D. Duff
Mr. A. Watt
Dr. P. Karrow
Foundation Section
File

per:


V. Korlu

VK/sc

Foundation Report

on

New bridge at Highway No. 401 and
gravel road (between lots 20 and 21)
crossing. One mile north west of
Cobourg, Township of Hamilton.

Station: 684 + 48.39

Plan No: F-3132

Distribution

Mr. A. Toye
Bridge Engineer (2)

Mr. H. Tregaskes
Construction Engineer (1)

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

Mr. H.D. Duff
Dist. Eng. Port Hope (1)

Mr. A. Watt
Water Resources Commission (1)

Dr. P. Karrow
Department of Mines (1)

Foundation Section (1)

File (1)

W.P. 56-58

W.J. F-58-12

Introduction:

A subsoil investigation was carried out to determine the bearing values of the layers for supporting the foundations of the proposed bridge. The site is located about one mile north west of Cobourg where the new Highway 401 underpasses the existing gravel road between lots 20 and 21 (Con. 1) Township of Hamilton, (station 684 + 48.39, profile no. F-3132-2)

The work started on April 22, 1958 and was completed on May 15, 1958.

Description of site and Field Work:

The location of the site is within the shorelines of late Iroquois Lake. The country is characterized by drumlins and clay plains. At this particular site the topography is rather flat with cultivated fields around. The Dye Works creek some 200 yards to the east drains the waters of this area.

The subsoil explorations were carried out by means of skid mounted core drill machine. In the course of investigations four boreholes were made, two on the south, and two on the north side of the Highway 401 center line. The borings were made by wash and drive method. By driving 2 in. diameter cone from ground level down to refusal dynamic cone penetration profile of the site was established. During the boring operation undisturbed samples were extracted and tested in the laboratory.

The locations of the boreholes is shown on drawing F-58-12A and their elevations on log sheets under Appendix I.

Field and Laboratory finding:

The investigations in the field revealed the following subsoil stratigraphy:

Under the topsoil there is a layer of light to medium clay. On the north side of the Hwy. 401 center line (boreholes no. 3 & 1) the clay is brown colour and about five feet deep. While on the south side of the center line the layer is light grey colour and about eight feet deep. Underlying this clay layer is a layer of sandy clay loam with varying amount of gravel and boulders and reaching down to elevation about 311 ft. In borehole no. 1 the amount of clay in this layer was found to be about 60% and gravel 5%. While in other three boreholes (nos. 2,3,4) the amount of clay is about 30% and gravel up to 30%. From elevation 311 ft. down to elevation 295 ft. a grey clay (65%) layer was detected in boreholes 1,2, and 3. This soil is of soft consistency and its present natural moisture content and liquid limit were measured to be both about 23%. Below elevation 295 ft. the layer changes to hard sandy clay loam till. After exploring some 15 ft. into this layer the boreholes were ended in this till layer.

The undisturbed samples extracted from the boreholes were tested in the laboratory. From these results the soils were classified and bearing values assessed in the layers. The soil in the clay loam layer, extending from elevation 332 ft. down to elevation 311 ft., is inorganic and of low plasticity. Its average moisture content was measured to be about 13% and its density about 145 p.c.f. The unconfined compression tests indicated an average of 2700 p.s.f. The average per foot penetration resistance was registered to be 25 blows in

borehole no. 1 and 45 blows in boreholes 2,3,4.

Samples extracted from the soft clay layer (between elevations 311 ft. and 295 ft.) were tested for consolidation in order to measure the probable settlement in this soft layer due to the vertical load that will be exerted by the foundations. The measured compression index (C_c) for the layer was found to be 0.093 and its average coefficient of consolidation (C_v) was found to be 1.975×10^{-3} .

Support of foundations:

The new highway 401 is underpassing the gravel road at this crossing. The new grade line indicates a cut down to elevation about 334 ft. Assuming the new structure will be supported on 7 ft. wide continuous footings. These footings could be placed at about elevation 328 ft. At this elevation the gravelly sandy clay loam layer, calculated from Meyerhof's Formula, can provide a bearing value about 3 T.s.f. with a safety factor of 3. This load will cause some settlement due to consolidation in the underlying grey clay layer. Calculating in terms of the Compression index 0.093 found from the laboratory consolidation tests and an assumed design load of 3 T.s.f. for the footings, the total maximum settlement was found to be one inch and the differential settlement less than one inch.

The shear values provided by the layer at different elevations are sufficient to overcome the affects of the lateral forces due to the vertical load on the layer transferred from the footings.

It will be noted that the placing of the footings lower than 328 ft. will lower the bulb distribution of the effective pressure down into the soft clay layer and may cause more

settlement than calculated above. In this case it will be convenient to resort to use of pile support. It can be assumed that piles when driven will find refusal in the till layer below elevation 295 ft.

Conclusions and Recommendations:

From the above discussion it will follow that:

1. The terrain is alluvial clay loam varying in gravel content and overlying a basically till layer from 295 ft. up. In between elevations 311 and 295 ft. there is a grey clay layer which has a soft consistency. Samples from this layer were tested for consolidation.
2. The new Highway no. 401 is underpassing the gravel road with a cut. So that the elevation of the new grade line is at about 324 ft. The new bridge can be supported on spread footing type foundations. These footings if placed at elevation about 328 ft. the layer can provide a bearing value of 2.5 T.s.f. with a safety factor of 3.
3. From the laboratory consolidation test results the total settlement in the underlying soft clay layer is calculated to be about one inch and the differential settlement less than one inch.
4. It will be inconvenient to place the footings lower than elevation 328 ft. For it will lower the bulb distribution of the effective pressure into the underlying soft clay layer thus

4. increasing the amount of settlement. If it is desired to place the footing lower, then, it will be convenient to use pile support for the footings. The piles driven are expected to meet refusal in the lower till layer, below elevation 295 ft.
5. The approach fills to the new structure do not present any stability problem.

APPENDIX I

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

DRILL RIG 54-6 OPERATION BORE & PENET. JOB F-58-12 WP 56-58 BORING 1 STA. 684+80 (45' LT)
CASING BX (standard samplers to fit unless noted) DATUM GEODETIC DATE REPORT JUNE 1958
SAMPLER HAMMER WT. 250 LBS. DROP 18 INCHES COMPILED BY H.S. CHECKED BY A.L. DATE BORING 22 APRIL 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
γ - 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



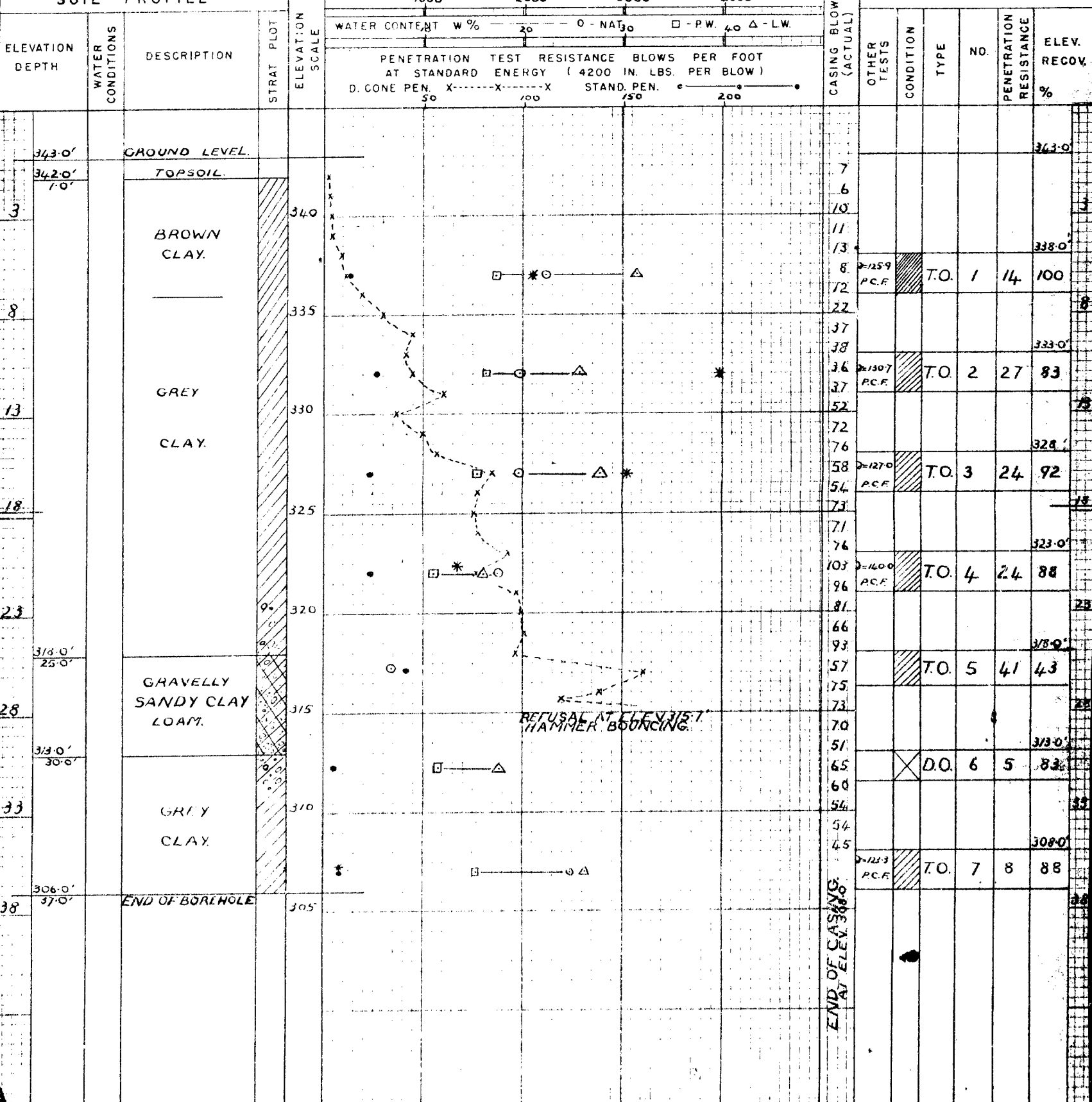
- DISTURBED
- FAIR
- GOOD
- LOST

SOIL PROFILE

SHEAR STRENGTH IN LBS. PER SQ. FT. *

WATER CONTENT W % — 20 — 30 — 40 — 50
PENETRATION TEST RESISTANCE BLOWS PER FOOT
AT STANDARD ENERGY (4200 IN. LBS. PER BLOW)
D. CONE PEN. X — 50 — 100 — 150 — 200
STAND. PEN. — 50 — 100 — 150 — 200

SAMPLES



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

DRILL RIG 54-6 OPERATION BORE PENET'N JOB F-58-12 W.P. 56-58 BORING 2 STA. 684+90(45' R)
CASING BX (standard samplers to fit unless noted) DATUM GEODLTIC DATE REPORT JUNE 1958
SAMPLER HAMMER WT. 230 LBS. DROP 19 INCHES COMPILED BY H.S. CHECKED BY A.L. DATE BORING 30 APRIL 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

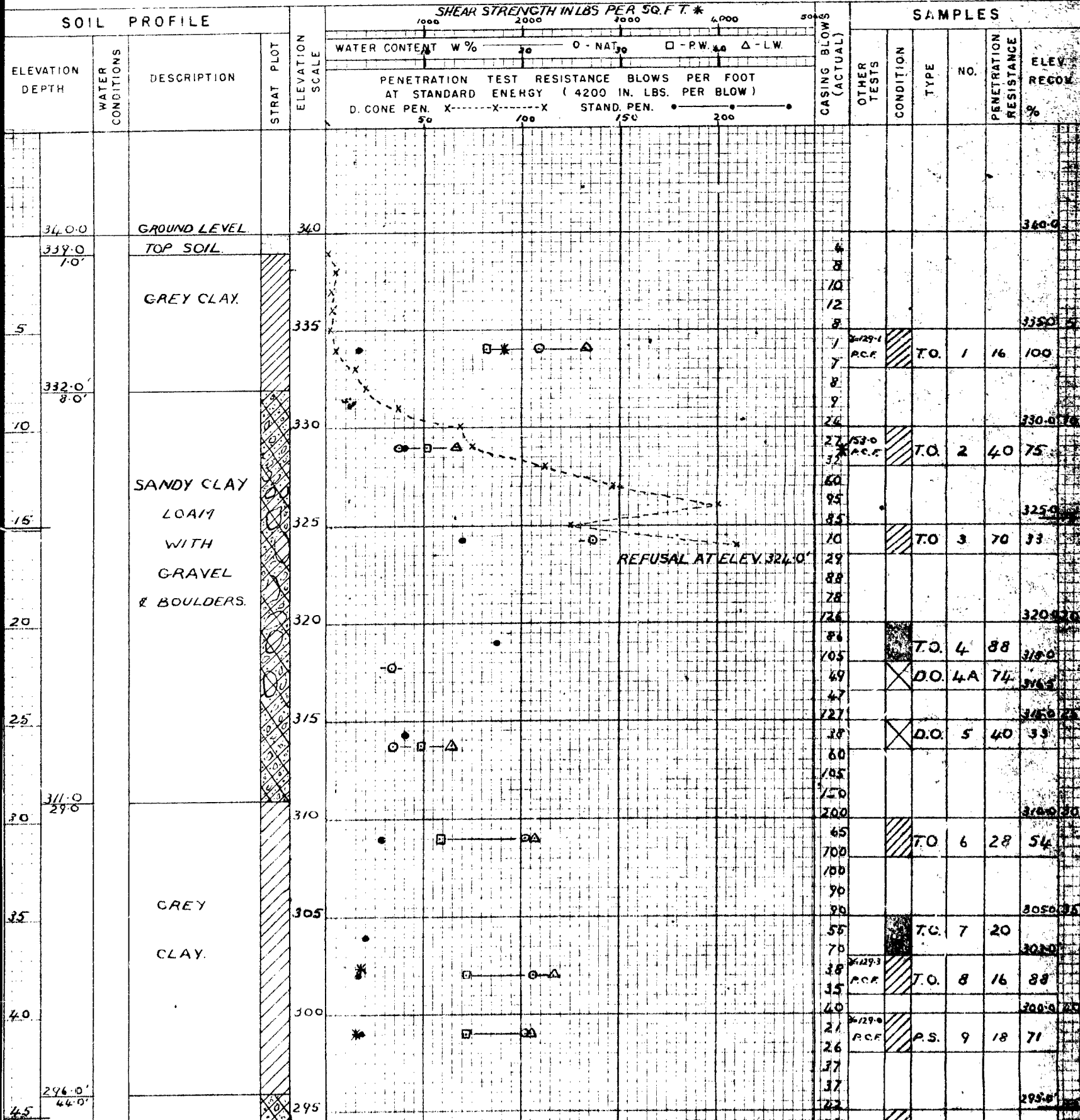
SAMPLE TYPES

C.S. - CHUNK SS. - 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



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

DRILL RIG 54-6 OPERATION BORE PENET'N JOB F-58-12 WP 56-58 BORING 3 STA. 684+28(45' L)
CASING BX (standard samplers to fit unless noted) DATUM GEODETIC DATE REPORT JUNE 1958
SAMPLER HAMMER WT. 250 LBS. DROP 19 INCHES COMPILED BY H.S. CHECKED BY A.L. DATE BORING 12 MAY 1958

ABBREVIATIONS

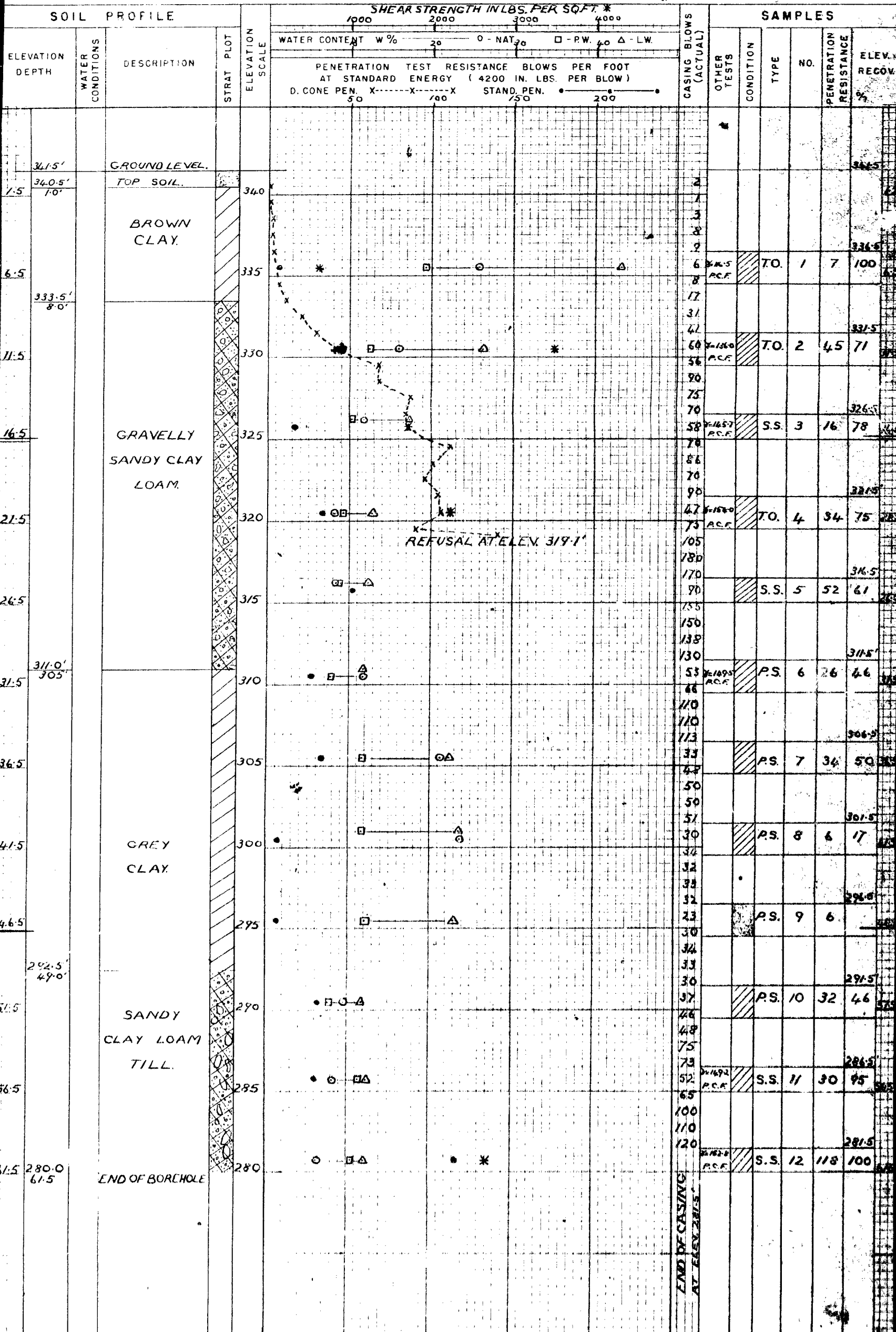
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M - MECHANICAL ANALYSIS S - TRIAXIAL SLOW C - CONSOLIDATION
U - UNCONFINED COMPRESSION WL - WATER LEVEL IN CASING CA - CASING
QC - TRIAXIAL CONSOLIDATED QUICK WT - WATER TABLE IN SOIL γ - UNIT WEIGHT

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



DRILL RIG 54-6 OPERATION BORE JOB F 58-12 WP 56-58 BORING 4 STA 684+1543.42
CASING BX (standard samplers to fit unless noted) DATUM GEODETIC DATE REPORT JUNE 1958
SAMPLER HAMMER WT. 250 LBS. DROP 19 INCHES COMPILED BY H.S. CHECKED BY A.L. DATE BORING 14 MAY 1958

V - INSITU VANE SHEAR TEST
M - MECHANICAL ANALYSIS
U - UNCONFINED COMPRESSION
QC - TRIAXIAL CONSOLIDATED QUICK

Q - TRIAXIAL QUICK

S - TRIAXIAL SLOW¹

W.L. - WATER LEVEL IN CASING

W.T. - WATER TABLE IN SOIL

K - PERMIABILITY

C - CONSOLIDATION

NG CA.- CASING

γ - UNIT WEIGHT

C.S. - CHUNK

D.O. - DRIVE OPEN

D.F. - DRIVE FOOT VALVE

T.O. - THIN WALLED OPEN

SAMPLE TYPES

S.S. - SLEEVE SAMPLE

P.S. - PISTON SAMPLE

W.S. - WASHED SAMPLE

R.C. - ROCK CORE

SAMPLE CONDITION



- DISTURBED
- FAIR
- GOOD
- LOST

