

Mr. A. M. Toye,
Bridge Engineer.

July 12, 1960.

FOUNDATION INVESTIGATION REPORT

Materials & Research Section. by: Racey, MacCallum & Associates,
Ltd.

Attention: Mr. S. McCorbie.

Re: Proposed Crossing of Hwy. No. 401 and
Westley Creek, Glengarry County, Ont.
W.P. 115-59 -- District No.9.

Attached, we are forwarding to you, the above mentioned report submitted by Racey, MacCallum and Associates, Ltd. We have reviewed the factual data presented in the report and agree with the conclusions, which we believe to be adequate for your future design work.

As for the piles for the bridge structure, the approximate elevation to which they should be driven, is between 110' and 115'. At this elevation, the number of blows should exceed 80. Such piles can be safely loaded with 35 - 40 tons per pile, provided the last five feet were driven with an excess of 50 blows per foot penetration.

Because of the very sensitive nature of the clay layer, displacement piles should not be considered.

Should there be any other questions you would like to discuss with respect to this site, please contact our Section.

AS/MdeF
Attach.

cc: Messrs. A. M. Toye (2)
H. A. Fregaskes
D. G. Ramsay
J. Ford
L. E. Walker
J. E. Gruspier
A. Watt
Foundations Office
Gen. Files.


L. G. Soderman,
PRINCIPAL FOUNDATIONS ENGR.
Per:

A. Stermac
(A. Stermac,
FOUNDATIONS OFFICE ENGR.)

RACEY, MACCALLUM AND ASSOCIATES
LIMITED

A COMPANY OWNED, DIRECTED AND OPERATED BY

Consulting Engineers
AND ASSOCIATED STAFF

MONTREAL  VANCOUVER

TORONTO

DONALD C. MACCALLUM, B.ENG., M.E.I.C., P.ENG.

H. JOHN RACEY, B.Sc., M.E.A.C., P.ENG.

GEORGE L. HOGGINTON, A.M.I.N.E.C.E., M.E.I.C., P.ENG.

TORONTO DIVISION
27 CARLTON STREET

Reference: S-500/T-2279
- Report -

28th June, 1960

Department of Highways for Ontario,
Materials and Research Section,
C/o Parliament Buildings,
TORONTO - Ontario.

Attention: Mr. A. Rutka.

RE: D.H.O. W.P.115-59
PROPOSED CROSSING OF
HIGHWAY NO 401 AND WESTLEY
CREEK, GLENGARRY COUNTY, ONT.

Dear Sirs,

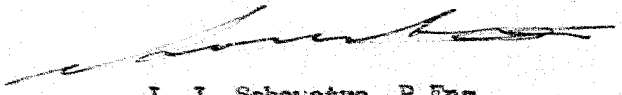
60-F-313C

The enclosed report presents the results of our investigation at the above location.

We hope the report is satisfactory to you; if you have any questions about it please do not hesitate to get in touch with us.

Thank you for this opportunity of being of service to you.

Yours very truly,
RACEY, MacCALLUM AND ASSOCIATES LIMITED,


J. J. Schoustra, P.Eng.,
Divisional Soil Engineer.

JJS/YDP

Department of Highways for Ontario,
Materials and Research Section,
C/o Parliament Buildings,
Toronto, Ontario.

D.H.O. W.P. 115-59
PROPOSED CROSSING OF
HIGHWAY NO 401 AND WESTLEY
CREEK, GLENGARRY COUNTY, ONT.

Reference: S-500/T-2279
- Report -

Racey, MacCallum and Associates
Limited.

28th June, 1960

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VANCOUVER

TORONTO

DONALD C. MACCALLUM, B.ENG., M.Eng., P.Eng.

H. JOHN RACEY, B.Sc., M.Eng., P.Eng.

GEORGE L. HOUGHTON, A.M. M.Eng., P.Eng.

TORONTO DIVISION
27 CARLTON STREET

Reference: S-500/T-2279
- Report -

26th June, 1960

D.R.O. W.P. 115-59
PROPOSED CROSSING OF
HIGHWAY NO 401 AND WESTLEY
CREEK, GLENGARRY COUNTY, ONT.

INTRODUCTION :

The above project was investigated in conjunction with that reported under job No S-500/T-2281 (W.P. 178-60). It consisted of a diversion of the Westley Creek, eliminating a bend in the creek at the location of the proposed crossing, and the construction of a bridge. Originally, it was thought that this structure would become an integral part of the crossing described in W.P. 178-60, but with re-location of the latter site the creek crossing will be a simple, low one-span bridge.

Field work was carried out in the same manner as that described under job No S-500/T-2281. A total of two borings and five cone penetration tests was completed.

SUBSOIL PROFILE :

The subsoil at the site consists of a layer of soft and sensitive marine clay, the top 5 to 10 feet of which shows an increased shear strength due to desiccation, underlain by a coarse sand gravel and boulder till. The clay stratum extends to Elevation 117 - Elevation 124 feet. The boulder till was penetrated as much as 20 feet by diamond drilling without encountering bedrock. Further penetration into the till proved to be very slow and costly and, considering the multitude and size of the boulders (up to 4 feet), it was felt no purpose was served in searching for bedrock as conventional piles would not penetrate that far.

Shear strength measurements by means of vane tests were found to average between 550 psf and 900 psf for the two locations

Reference: S-500/T-2279

28th June, 1960

- Report -

tested. Considering the low height of fill embankment required, no stability problem was anticipated and hence no further testing was carried out on samples obtained.

The locations of all borings are indicated on the site plan, Enclosure No 1. The boring results are plotted on the data sheets, Enclosures No 2 to 6 inclusive.

RECOMMENDATIONS :

The results of this investigation have led to recommendations concerning the diversion, fill embankments and structure foundations, which will be discussed in the following paragraphs :

Creek diversion :

The problem of straightening the creek bed on itself will be fairly simple. The creek is only about 3 to 4 feet deep and the new creek bed will be at approximate Elevation 150 feet. Thus the new channel can be excavated easily and the old bed can be filled up after removal of about one foot of very soft deposits of recent origin. However, excavation in the sensitive clay will cause a considerable amount of disturbance of the sensitive clay, and it must be assumed that excavation will take place under difficult site conditions. The sides of the new channel will require very gentle slopes to retain their stability.

The filling in of the old bed would be a simple operation. It will, of course, result in a non-symmetrical soil profile under the approaches to the bridge, which in turn would cause some difference in settlement between the North and South halves of the road. However, a difference of 3 feet in about 30 feet of compressible material will not be too serious, particularly since the top layer has been preconsolidated by desiccation.

Embankments :

The originally proposed embankment height was Elevation 160 feet. Even if this height should be maintained after the above-mentioned re-location of the side road crossing, no stability problem does exist. It would be advisable, of course, to keep the embankment back some distance from where piles will be driven because disturbance would reduce the shear strength considerably for some time.

Reference: S-500/T-2279
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Settlement calculations, based on the consolidation results reported under job No S-500/T-2281 (W.P. 178-60) would indicate settlements of the order of 25 - 35 inches under a fill embankment extending from Elevation 153 to Elevation 160 feet. This presents a serious problem, particularly since the consolidation period would be very slow (roughly 10 years for 50% consolidation). Since the high water level recorded is only Elevation 155 feet, it may be advisable to consider lowering the grade.

Foundations :

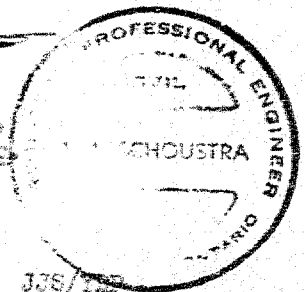
The clay layer offers no suitable support for spread footings and a pile foundation for the bridge is a logical alternative. Displacement piles, driven some 5 to 8 feet into the coarse till layer (or approximately Elevation 113 - 118 feet) could safely support loads up to 40 tons per square foot. They would cause much disturbance, however, and it would be preferable to use steel H piles driven to refusal on the boulders, or to approximate Elevation 100 - 110 feet.

CONCLUSIONS :

1. The subsoil at the site consists of a 30 - 40 foot layer of sensitive, soft clay underlain by a coarse granular till.
2. Strength and compressibility properties of the clay stratum are identical to those reported under job No S-500/T-2281, W.P. 178 - 60.
3. The proposed creek diversion will cause poor working conditions as the result of remoulding of the clay, but no serious problems are envisaged.
4. Settlements under the presently proposed embankment height would be quite high; it is recommended that the possibility of lowering the grade be studied. No stability problem does exist however, if the now proposed grade is maintained.
5. The bridge structure should be founded on piles, preferably on H-piles driven to refusal in the boulder till.

Prepared by :
E. J. Mazenke, B.Sc., M.Sc.,
Project Engineer - Racey, MacCallum
and Associates, Toronto Division.

J. J. Schoustra, P.Eng.,
Divisional Soil Engineer



RACEY MacCALLUM AND ASSOCIATES LTD.

Foundation Engineering Division

Engineering Data Sheet for Borehole 1

Project: HIGHWAY #401.
 Location: WESTLEY CREEK.
 Hole Location: See Enclosure No 1.
 Hole Elevation and Datum: 154.6 feet
 Field Supervisor: H.J.M. Prep.: H.J.M.
 Driller: H.G. Checked: Date:

LOGND

Soil Strength: C.

Standard compaction

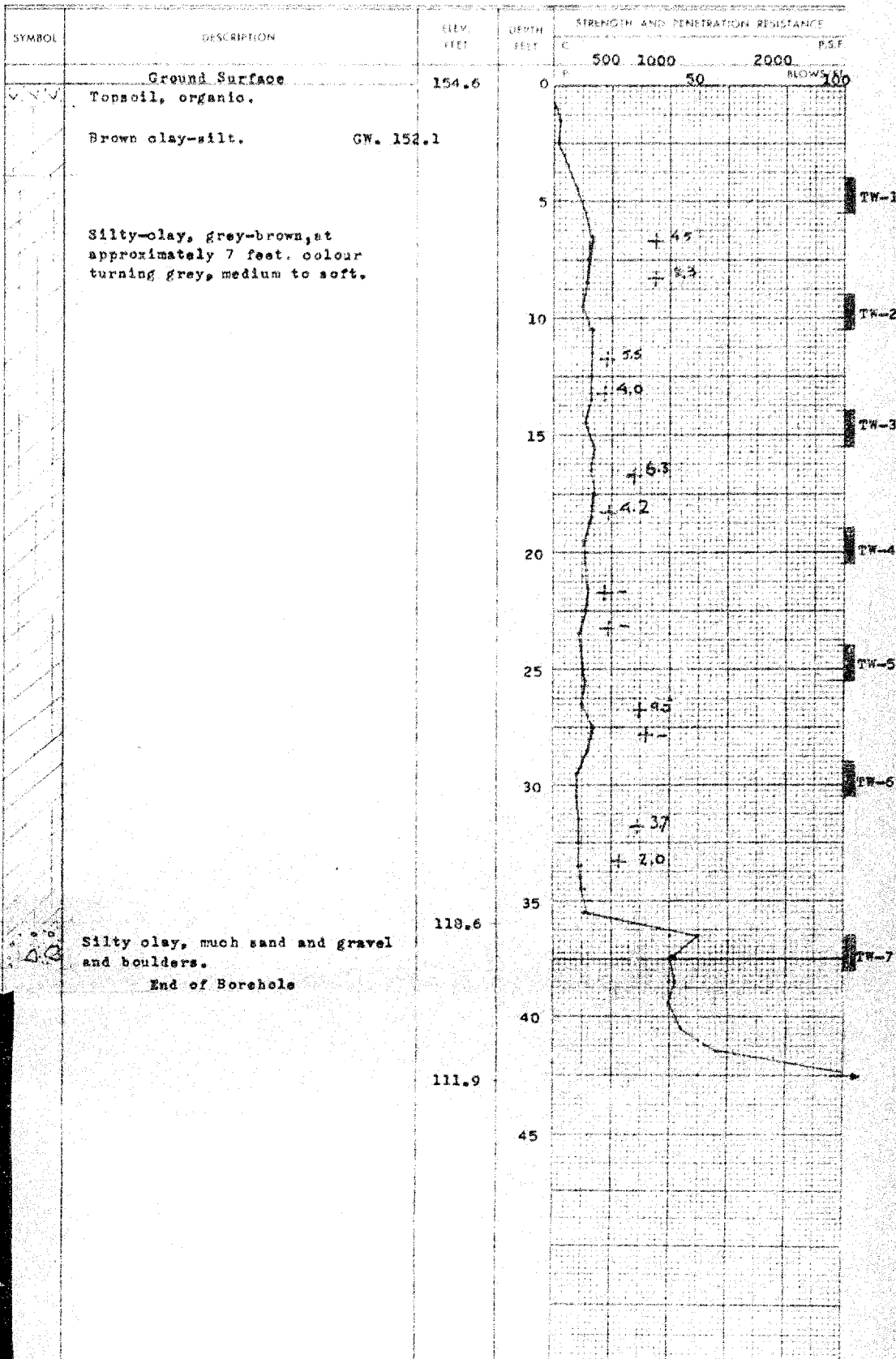
Vane test and sensitivity: 35

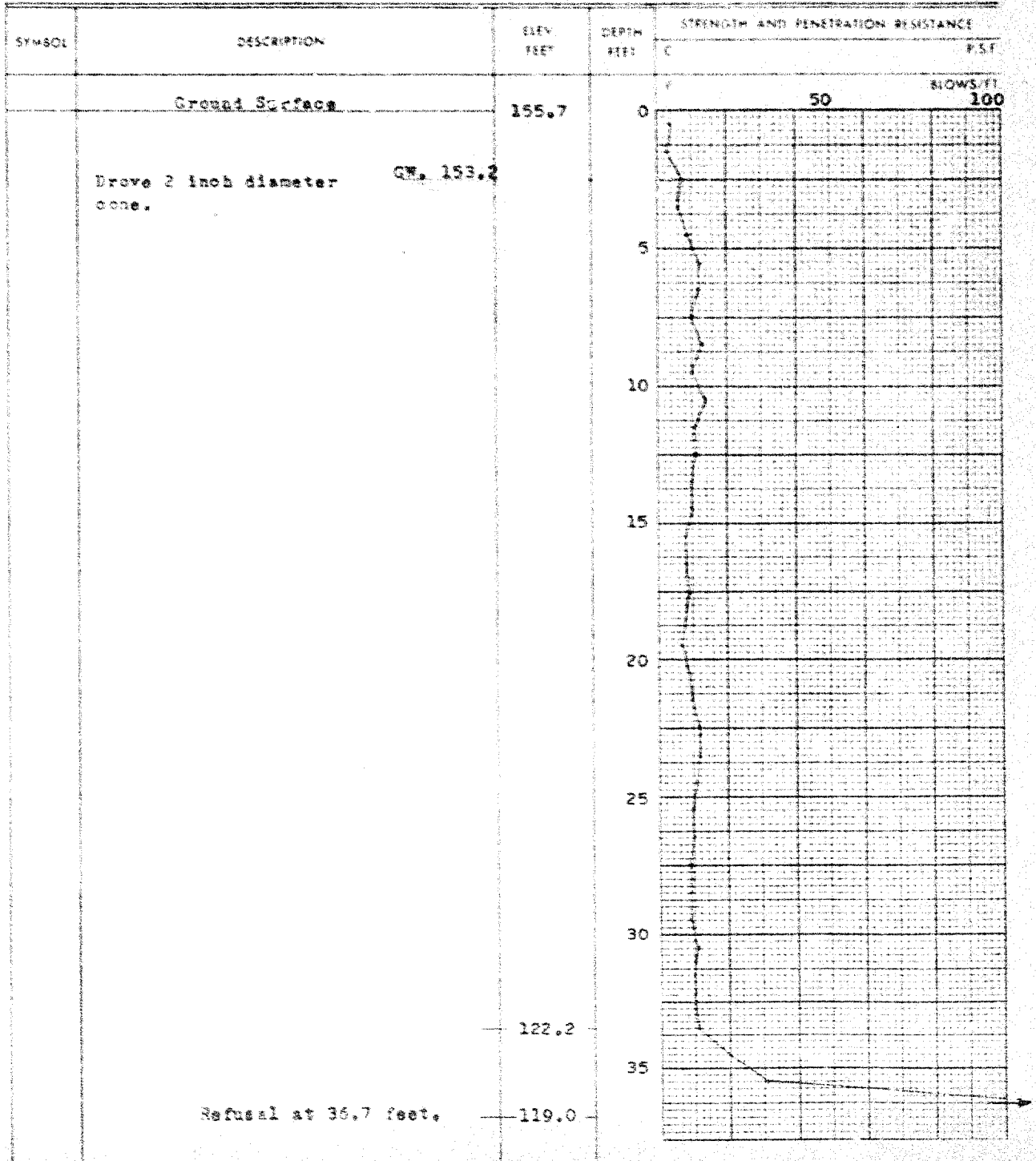
Penetration Resistance (PR)

2" Split tube

2" Dia. Cone

Casing





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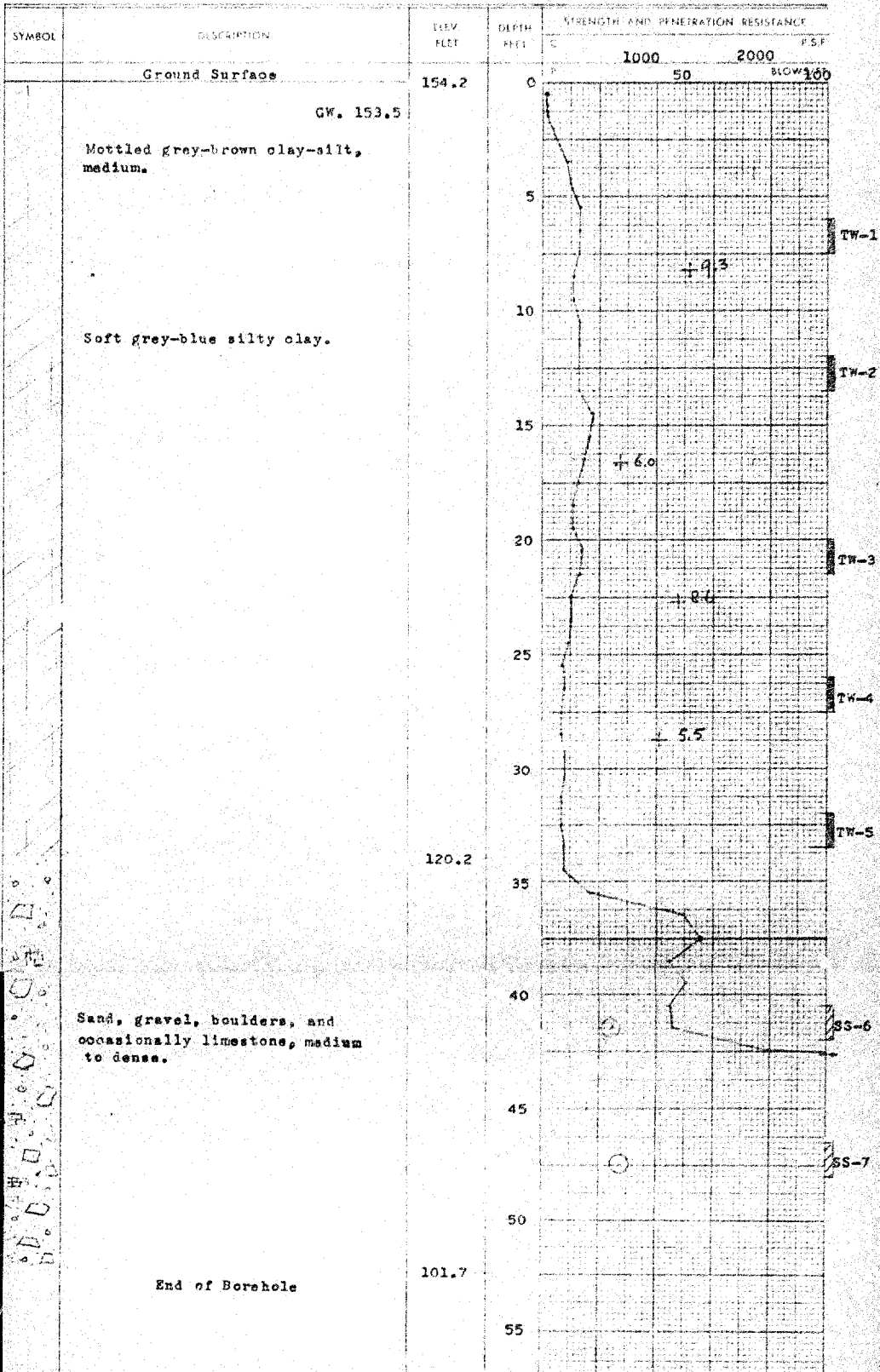
Foundation Engineering Division

Engineering Data Sheet for Borehole: 3

Project: HIGHWAY #101.
 Location: WESTLEY CREEK.
 Hole Location: See Enclosure No 1.
 Hole Elevation and Datum: 154.2 feet
 Field Supervisor: O.L.W. Prep.: H.J.M.
 Driller: O.R. Checked: Date:

LEGEND

Shear Strength (C)
 Unclassified compression
 Vane test and sensitivity (S)
 Penetration Resistance (P)
 2" Split tube
 2" Dia. Cone
 Casing



RACEY MacCALLUM AND ASSOCIATES LTD.

Foundation Engineering Division

Engineering Data Sheet for Borehole: 4

Project: HIGHWAY #401.
 Location: WESTLEY CREEK.
 Hole Location: See Enclosure No. 1.
 Hole Elevation and Datum: 154.8 feet
 Field Supervisor: O.L.W. Prep.: D.J.W.
 Driller: O.R. Checked: Date:

LEGEND

Shear Strength (C)

Unconfined compression

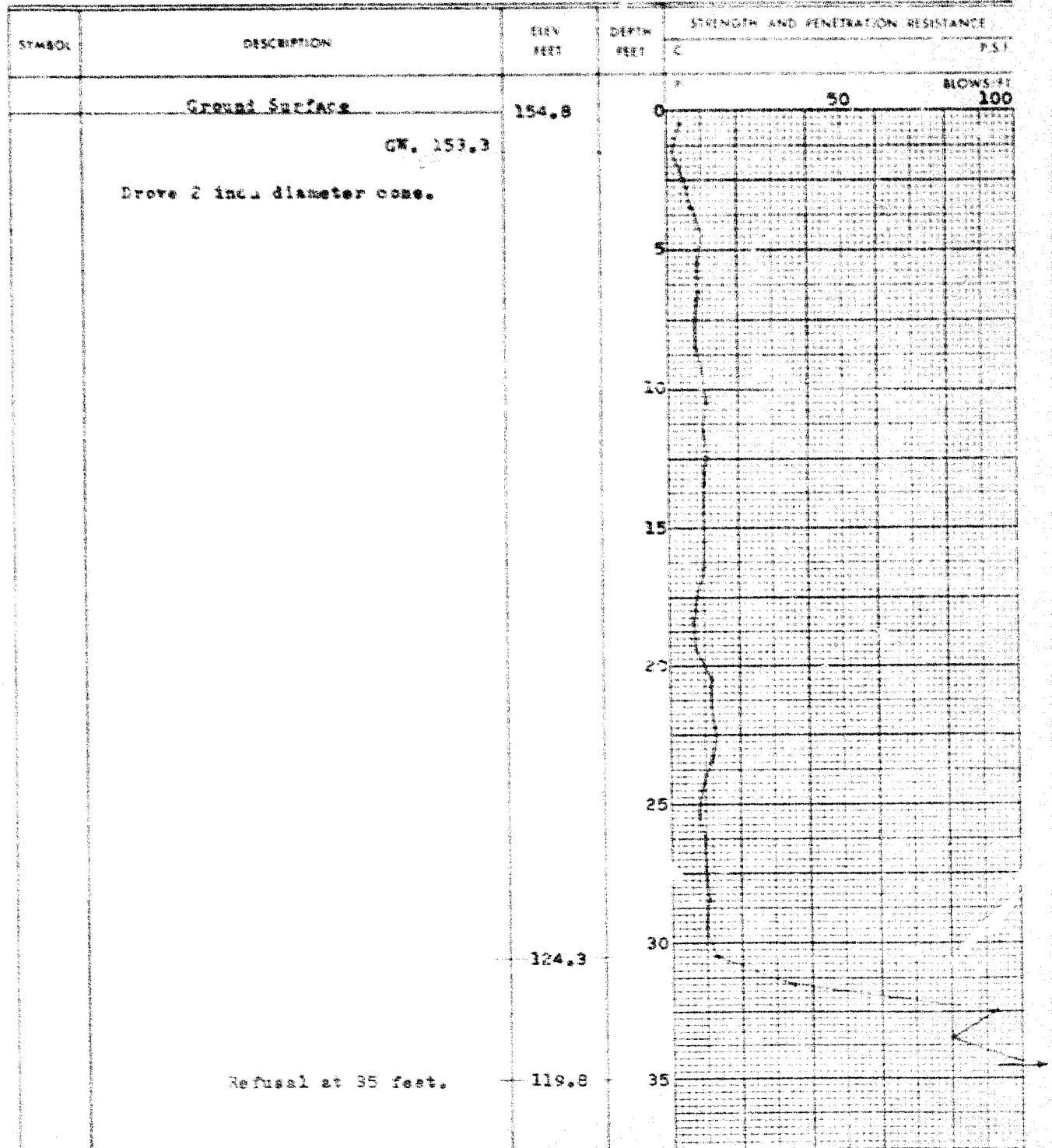
Vane test and sensitivity (S)

Penetration Resistance (P)

1. Split Tube

2. Dry Cone

Coring



RACEY MacCALLUM AND ASSOCIATES LTD.

Foundation Engineering Division

Engineering Data Sheet for Borehole: 5

Project: HIGHWAY #401.
 Location: WESTLEY CREEK.
 Hole Location: See Enclosure No 1.
 Hole Elevation and Datum: 155.2 feet
 Field Supervisor: O.L.W. Prep: H.J.M.
 Driller: O.R. Checked: Date:

LEGEND

Linear Strength (C)

Unconfined compression

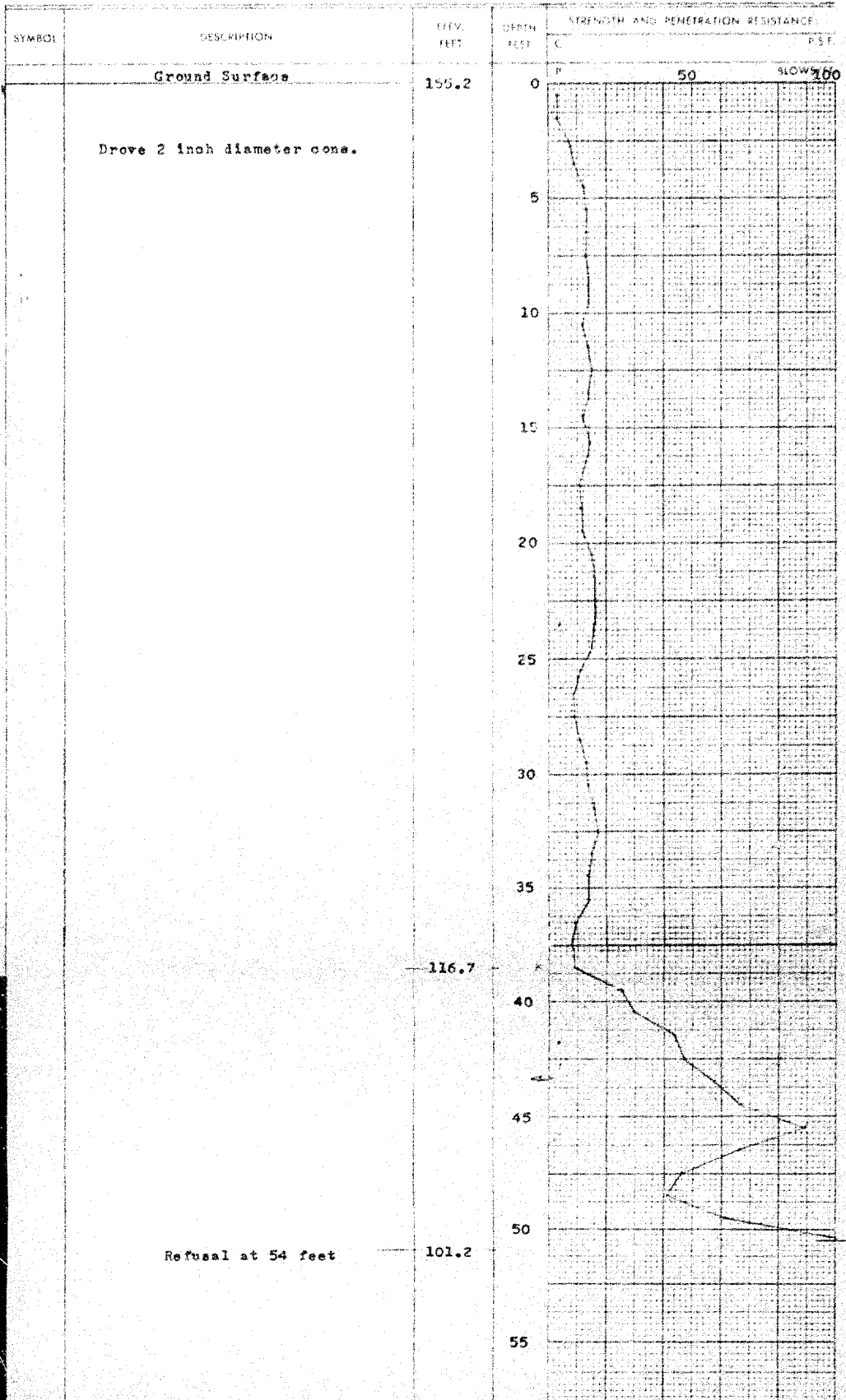
Vane test and sensitivity: 5.

Penetration Resistance (P)

2" Spill tube

2" Dia. Cone

Casing



60-F-313C
W.P. 115-59
Hwy. #401
WESTLEY CREEK

