

62-F-267M

PROTON ROAD No. 21

RACEY, MACCALLUM AND ASSOCIATES  
LIMITED

BA-1A05

28-5

A COMPANY OWNED, DIRECTED AND OPERATED BY

Consulting Engineers  
AND ASSOCIATED STAFF

MONTREAL



OTTAWA

TORONTO

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

M. JOHN RACEY, B.Sc., M.E.I.C., P.ENG

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

TORONTO DIVISION  
59 CURLEW DRIVE  
DON MILLS, ONT.

Reference: S-896/T-3531

- Report -

February 27, 1962

Corporation of the County of Grey,  
Court House,  
Owen Sound, Ontario.

62-1-267M

Attention: Mr. J. H. Beatty, P.Eng.,  
County Engineer.

FOUNDATION INVESTIGATION,  
PROTON ROAD NO. 21,  
CONCESSION VI, PROTON TOWNSHIP,  
COUNTY OF GREY.

Dear Sirs:

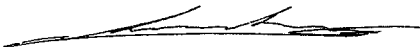
The enclosed report presents the results of our  
soil investigation at the above location.

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/EA

Corporation of the County of Grey,  
Court House,  
Owen Sound, Ontario.

FOUNDATION INVESTIGATION,  
PROTON ROAD NO. 21,  
CONCESSION VI, PROTON TOWNSHIP,  
COUNTY OF GREY.

Reference: S-896/T-3531  
- Report -

Racey, MacCallum and Associates  
Limited

February 27, 1962.

RACEY, MACCALLUM AND ASSOCIATES  
LIMITED

A COMPANY OWNED, DIRECTED AND OPERATED BY

Consulting Engineers  
AND ASSOCIATED STAFF

MONTREAL



OTTAWA

TORONTO

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

N. JOHN RACEY, B.SC., M.E.I.C., P.ENG

GEORGE L. NOUGHTON, A.M.I. MECH. E., M.E.I.C., P.ENG

TORONTO DIVISION  
59 CURLEW DRIVE  
DON MILLS, ONT.

Reference: S-896/T-3531

- Report -

February 27, 1962

FOUNDATION INVESTIGATION,  
PROTON ROAD NO. 21,  
CONCESSION VI, PROTON TOWNSHIP,  
COUNTY OF GREY.

INTRODUCTION:

A subsurface investigation was carried out to determine soil conditions relevant to the forthcoming renewal of the above bridge over the South Saugeen River.

Two boreholes were put down, one on each side of the creek. Soil samples were taken at intervals of a few feet.

This report gives the results of the investigation and presents engineering recommendations for design and construction.

FIELD WORK:

The locations of the boreholes are shown on the accompanying site plan (Enclosure No. 1).

Elevations quoted in this report are derived from a benchmark on a nail in an elm tree, west of the road and just north of the bridge. The elevation of the nail was given as 100.17.

Each borehole was preceded by an adjacent dynamic cone probe in which a two-inch diameter steel cone with an apex angle of sixty degrees was driven by a 140 lb. weight falling a distance of 30 inches. The number of blows required to drive the cone each foot provides a comparison of the densities of the soils through which the cone passes. These values are plotted on the borehole data sheets.

Reference: S-896/T-3531

- 2 -

February 27, 1962

FIELD WORK - Cont'd

The boreholes were advanced by standard wash-boring methods using a skid-mounted standard diamond drill rig. Split spoon samples were taken at various depth intervals.

The split spoon sampler was driven by the same falling weight as the dynamic cone and the number of blows required to drive it constitutes the standard penetration test for soils, the results of which are also plotted on the data sheets.

DISCUSSION OF RESULTS:

Quantities of fill were present on both sides of the creek. At Borehole 1, on the south side, there was 10 ft. 9 in. of brown mixed fill consisting of sand, silt and gravel, the compaction of which had not been thorough. Similar material - though of slightly higher density - was found at Borehole 2 to a depth of 15 ft. 1 1/2 ins. Decomposed timber fragments were also found throughout the fill.

Beneath the fill in both boreholes was a stratum of grey or grey-brown silty fine sand which was about fifteen feet deep in Borehole 1 and five feet deep in Borehole 2. Standard penetration and cone resistance increased throughout this stratum. Typical grain size curves of this layer are presented on Enclosure No. 4.

The sand overlays clayey and silty tills of medium to high density, the main recent geological stratum of this area. It extends to the maximum depth tested. It contains seams or lenses of coarse sand. The density becomes very high below El. 70 ft. at Borehole No. 1 and below El. 80 ft. at Borehole No. 2.

Groundwater at Borehole No. 1 was established at El. 95.4 ft. At Borehole No. 2, the water in the borehole remained at El. 101.2 ft. upon casing withdrawal. The latter must be considered a perched level as the result of drilling.

RECOMMENDATIONS:

As far as could be established during winter conditions, the existing structure has not suffered scour damage. It may be assumed therefore that the minimum depth for the bridge foundation can be taken at 5 ft. below the creek bed, or approximate El. 82 ft. At this level the North abutment would be founded on the silty fine sand, and the South abutment on the clayey silt. Both layers are quite suitable for supporting the abutment footings.

Considering the length of the proposed structure, it may be assumed that a single span rigid frame or a single span, simply supported bridge will be contemplated. Neither of these bridge types

Reference: S-896/T-3531

- 2 -

February 27, 1962

RECOMMENDATIONS - Cont'd

is very sensitive to differential settlements between the abutments, and the fact that the two abutments are supported by differential soil types is no reason for concern.

Based on the standard penetration results in the sand and in the clayey silt, it is recommended to allow a maximum pressure of 5,000 psf for abutment footings on both sides. This value may be adhered to for all footing sizes, in view of the increasing density with depth on both sides. (The lower penetration resistance in the sand seam at borehole No. 1 is assumed to be the result of disturbance from washing).

Dewatering of the excavation will present its problems. On the South side (Borehole No. 2), the seepage will come mainly from the fill and the sand between El. 95 and El. 83 feet, i.e., from the sides of the excavation. Although not absolutely necessary for the preservation of the bearing properties of the soil, closed sheeting is recommended for easier excavation and less cave-in. On the North side, seepage will also come through the sand at the excavation bottom. This would disturb the base too much to be acceptable. Three possible methods may be contemplated:

1. Lower the watertable with wellpoints to below footing level prior to excavation, and maintain wellpoint drainage until after backfilling to creek level.
2. Drive closed sheeting into the till layer to approx. El. 75 feet prior to excavation.
3. Lower foundations to the top of the till layer at El. 78 feet and treat excavation as is recommended for the South abutment.

Each of above methods has its merits, and the final choice will depend on the selection of foundation level and the size of the foundations.

CONCLUSIONS

The results of this investigation may be summarised as follows:

1. The soil profile at the two bridge abutments consists of the following types:

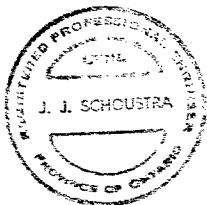
Reference: S-896/P-3531

- 4 -

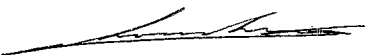
February 27, 1962

CONCLUSIONS - Cont'd

1.  
(cont'd) (a) Fill, consisting of silt, sand, clay and gravel,  
from 10-16 feet in thickness;  
(b) Compact silty sand, from 5-14 feet in thickness;  
(c) Stiff clayey and silty till from 20-25 feet down  
to the maximum depth tested, becoming very hard  
with depth.
2. Groundwater level may be assumed to be equal to creek level.
3. Foundations on spread footings at 5 feet or more below  
creek bed level can be designed for 5,000 psf pressure.
4. Dewatering of the excavations will present difficulties,  
particularly at the North abutment. Several alternative  
solutions are presented in the report.



JJS/KA

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

## RACEY MacCALLUM AND ASSOCIATES LTD.

Foundation Engineering Division

Engineering Data Sheet for Borehole: 1.

Project: BRIDGE ON PROTON ROAD NO. 21, CON. VI,

Location: TOWNSHIP OF PROTON, COUNTY OF GREY.

Hole Location: See Enclosure No. 1.

Hole Elevation and Datum: 103.5 ft. B.M. = 100.17

Field Supervisor: J. McG. Prep.: I.G.B.

Driller: R.R. Checked: J.J.S. Date: 25-1-'62.

## LEGEND

Shear Strength (C)

Unconfined compression

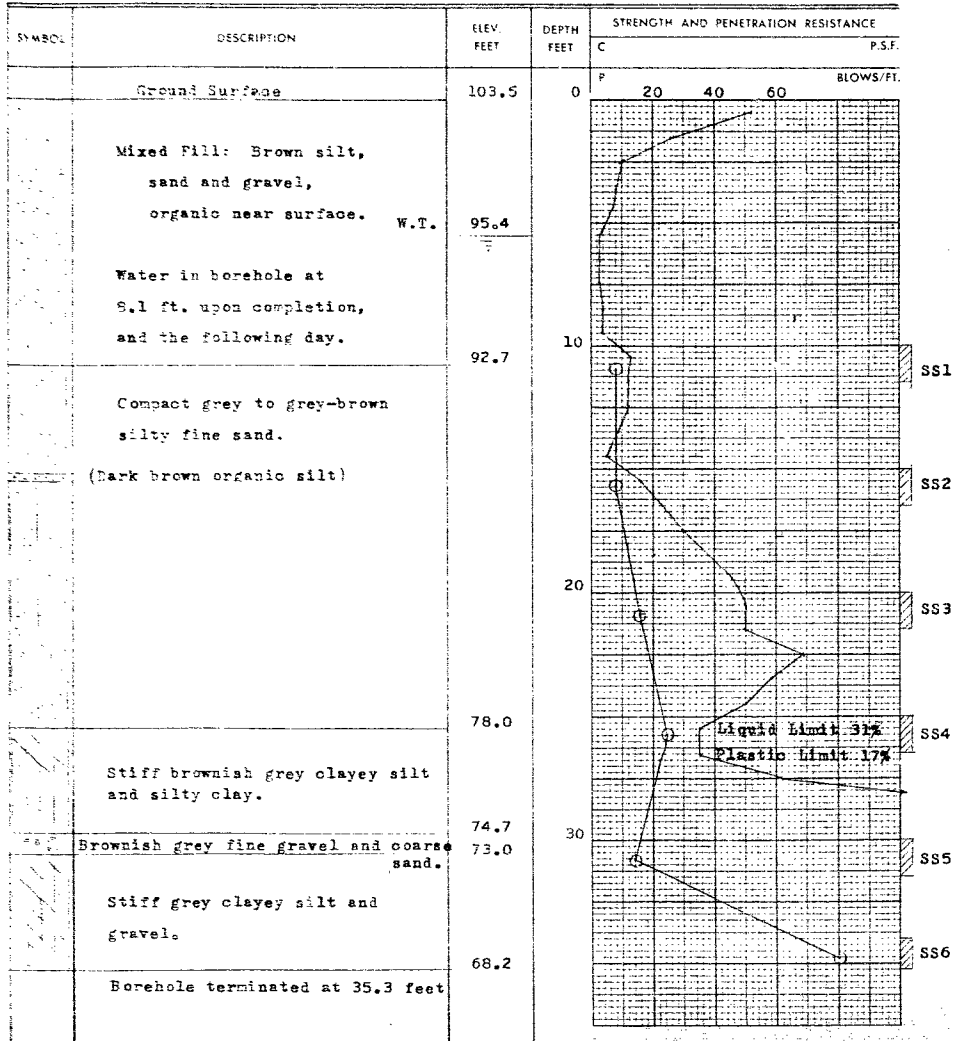
Vane test and sensitivity (S)

Penetration Resistance P

2" Split tube

2" Dia. Cone

Casing

⊕  
+1



**RACEY MacCALLUM AND ASSOCIATES LTD.**

Foundation Engineering Division

Engineering Data Sheet for Borehole- 2.

Project BRIDGE ON PROTON ROAD NO. 21, CON. VI,

Location: TOWNSHIP OF PROTON, COUNTY OF GREY.

Hole Location: See Enclosure No. 1.

Hole Elevation and Datum: 103.0 ft. B.M. = 100.17

Field Supervisor: J.M.G. Prep.: I.G.B.

Driller: R.R. Checked: J.J.S. Date: 24-1-'62

**LEGEND**

Shear Strength (C)

Unconfined compression

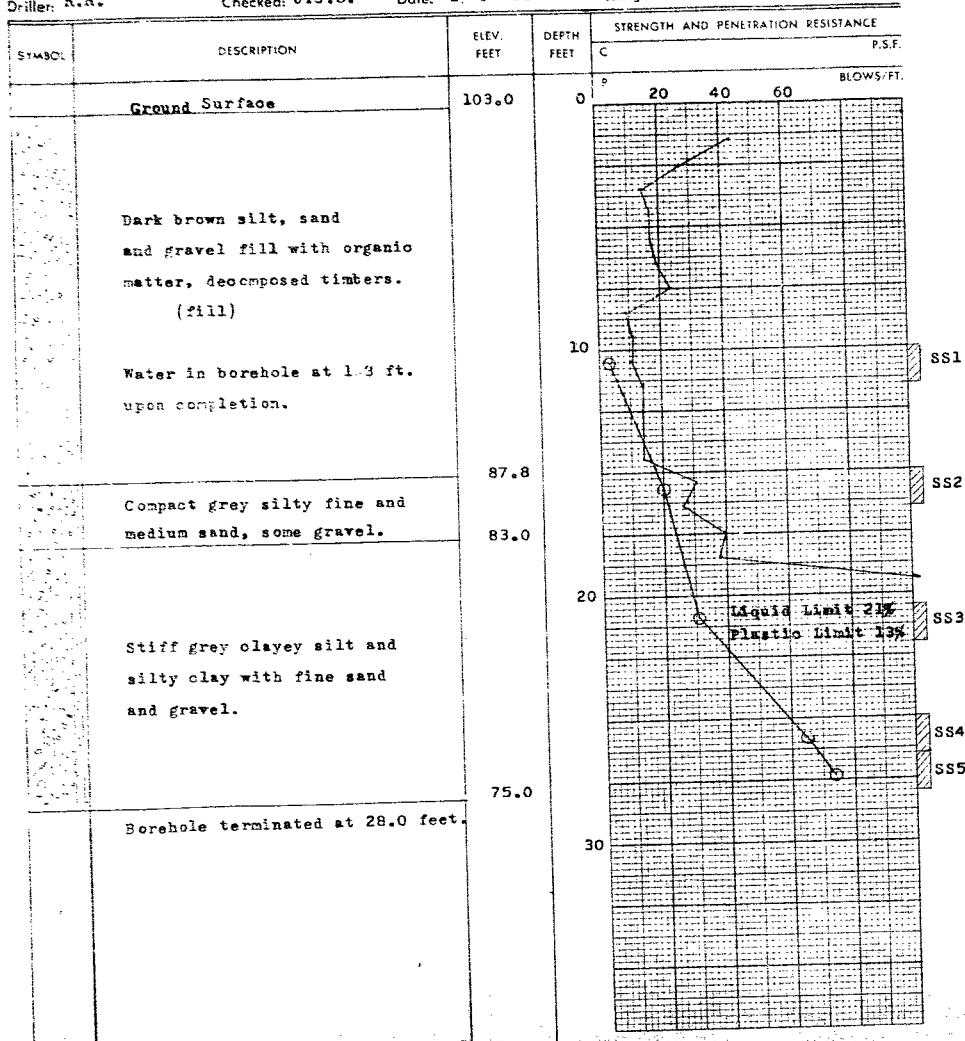
Vane test and sensitivity (S)

Penetration Resistance (P)

2" Split tube

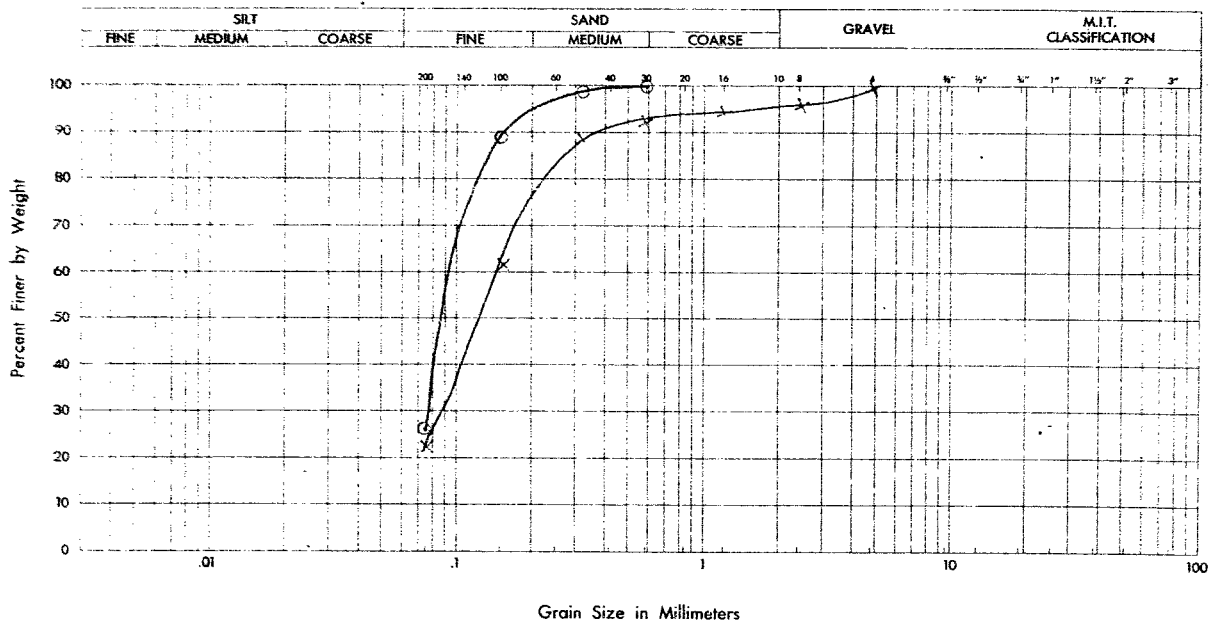
2" Dia. Cone

Casing

⊕  
+3

# RACEY MacCALLUM AND ASSOCIATES LTD.

## GRAIN SIZE DISTRIBUTION

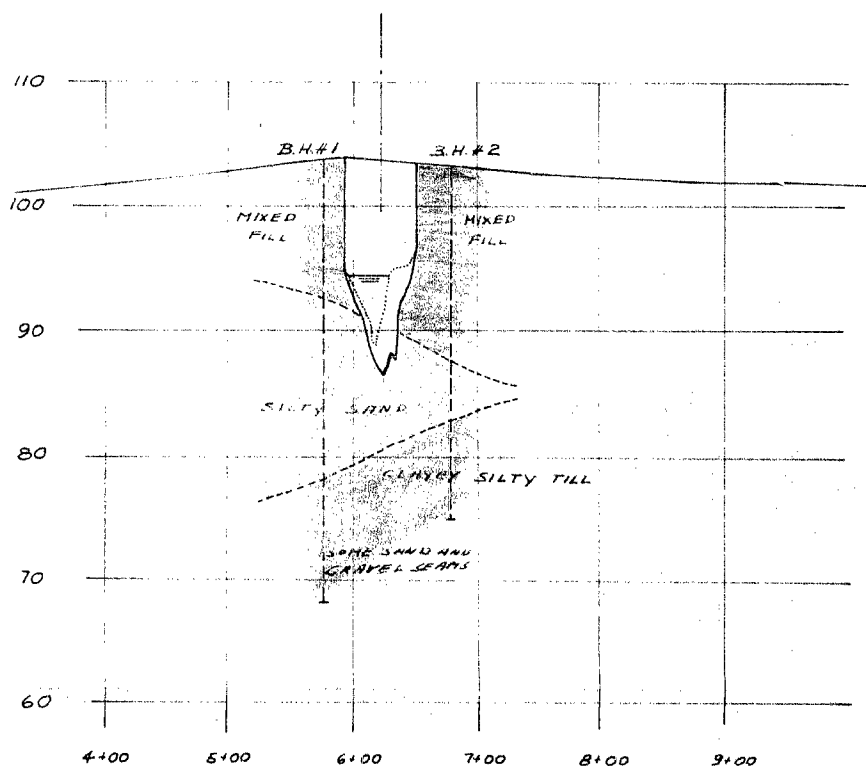
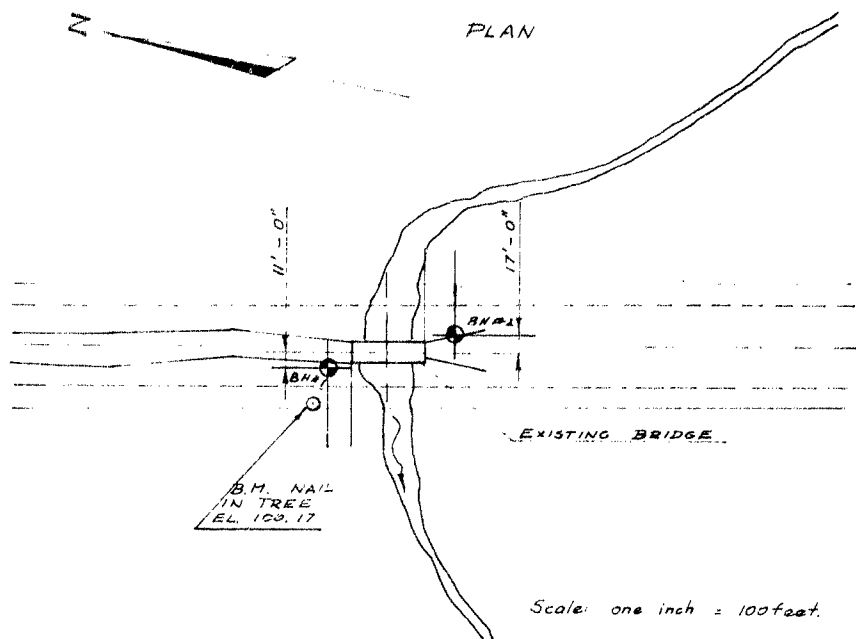


Project Bridge on Proton Road No. 21, Con. VI.

Legend B.H. #1 ; SS-3

B.H. #2 ; SS-2

Order No. S-896/T-3531



PROFILE

BRIDGE RELOCATION  
PROTON ROAD NO. 21, CONC. VI  
TWP. OF PROTON, COUNTY OF GREY  
Locations of Test Borings.