

58-F-251C

THUNDER B.

CREDIT R.

CALEDON Twp.

RACEY, MacCALLUM AND ASSOCIATES  
LIMITED

A COMPANY OWNED, DIRECTED AND OPERATED BY

Consulting Engineers  
AND ASSOCIATED STAFF

58-F-251C

MONTREAL  VANCOUVER

TORONTO

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

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

A. ERIC BANKING, P.ENG., M.E.I.C., A.M.A.S.T.C.E., P.ENG.

TORONTO DIVISION  
27 CARLTON STREET  
Toronto 2.

Reference: S-610/T-11491.

1 December, 1958.

County of Peel,  
Court House,  
BRAMPTON - Ontario.

Attention: Mr. J. M. Hubicki.

RE: FOUNDATION INVESTIGATION FOR PROPOSED  
THUNDER BRIDGE, CREDIT RIVER, 6th SIDEROAD,  
CALEDON TOWNSHIP, ONTARIO.


Dear Sir,

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 do not hesitate to get in touch with us.

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

Yours sincerely,  
RACEY, MacCALLUM AND ASSOCIATES LIMITED,

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

JJS:YDP

County of Peel,  
Court House,  
Brampton - Ontario.

FOUNDATION INVESTIGATION FOR PROPOSED  
THUNDER BRIDGE, CREDIT RIVER, 8th SIDEROAD,  
CALEDON TOWNSHIP, ONTARIO.

Reference: S-610/T-1491.

Racey, MacCallum and Associates  
Limited.

26 November, 1958.

# 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.I.C., P.ENG.

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TORONTO DIVISION  
27 CARLTON STREET  
Toronto 2.

Reference: Report S-610/T-1191.

28 November, 1958.

## FOUNDATION INVESTIGATION FOR PROPOSED THUNDER BRIDGE, CREDIT RIVER, 8th SIDEROAD, CALEDON TOWNSHIP, ONTARIO.

### INTRODUCTION :

The existing bridge across Credit River is to be replaced by a new structure to be located slightly down stream. In order to advise on foundation conditions prevalent at this new location, a soil investigation programme was undertaken. The field work was commenced on 17 November, 1958 and was completed on 19 November, 1958.

### FIELD WORK :

The borings were carried out using a standard diamond drill rig equipped with soil sampling equipment. Soil samples were obtained by driving a standard 2-inch diameter split spoon sampler into the soil by means of a 110 lb hammer. The number of blows of this hammer falling 30 inches necessary to drive the sampler one foot is termed the standard penetration resistance. This value bears an established empirical relationship to the relative density of the subsoil.

A continuous record of the soil density change with depth can be obtained by driving a 2-inch diameter 60-degree point angle cone into the soil. The same driving energy as for driving the 2-inch outside diameter split spoon is used for driving the cone.

Subsoil conditions were investigated at four locations in the proposed realignment area. These locations are indicated on Enclosure No 1. Sixty degree point angle cones were driven at all four locations. It was only felt necessary, however, to carry out borings and soil sampling at the locations noted as Boreholes No 1, 3 and 4.

Samples were taken, where practically possible, at all changes of material with depth. The cone penetration test, which was

Reference: Report No  
S-610/T-11491 - Continued.

28 November, 1958.

conducted before a boring commenced, was a useful guide in determining at what depths samples were necessary. In this way a reliable composite soil profile was obtained.

The noted elevations refer to an arbitrarily fixed bench mark designated an elevation of 100 feet. This bench mark was the top hinge of the East gate post of the Meadowland Estate. This location is also noted on Enclosure No 1.

#### SUBSOIL CONDITIONS :

The soil profiles, penetration resistances and additional pertinent details are plotted for each borehole and are included as Enclosures No 2, 3, 4 and 5. Reference to geological records indicates that the proposed structure is sited over a pre-glacial valley in which, during Pleistocene times, glacial drift was dumped.

The main deposit encountered was a pervious medium dense to very dense deposit of unsorted sub-angular to angular sand, gravel, cobbles and boulders, tightly packed in a matrix of grey brown silt. The percentage of medium to coarse gravel in this till was generally high. Small lenses and pockets of loose sand and silt were noted in this material. It is rather difficult to judge from the cone penetration record how frequent and how extensive are these pockets of less dense material.

In Borehole No 3 a less pervious deposit of dense to medium dense grey to reddish brown silty fine sand was contacted at Elevation 60.1 feet. Between Elevation 71.7 feet and 53.4 feet in Borehole No 1 18 feet of this material was passed through and contact then re-established with the dense glacial till.

The recorded ground water levels in the three boreholes were found to be approximately the same as the river level.

#### BRIDGE FOUNDATIONS :

From a visual inspection of the area around the old bridge structure it was concluded that very little scouring action should be expected. Department of Highways for Ontario requirements for protection of footings against scour, are that spread footings be placed at least five feet below the invert level of the river. For the case in point, therefore, footings must not be placed higher than Elevation 80 feet.

Spread footings could be used for the foundations on the West bank. They should be installed at Elevation 80 feet and a permissible bearing pressure of 8000 psf used for their structural design. This permissible bearing pressure was suggested on the basis of a maximum

Reference: Report No  
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28 November, 1958.

allowable total settlement of one inch and a maximum allowable differential settlement of three-quarters of an inch. The penetration resistance does not increase with depth, so that there is no indication that a higher bearing capacity could be taken advantage of if the footings were to be founded deeper than this elevation.

Slightly different subsoil conditions prevail in the East bank area. The penetration resistance for the initial 17 feet of glacial till is relatively low and variable. Hence, in order to install spread footings, excavation through 17 feet of glacial till to Elevation 73.5 feet must be undertaken. At this elevation the recommended bearing pressure for footing design purposes is 4000 psf. For this loading the settlement criteria hold as for the West bank.

The spread footings for the East and West bank foundations will differ in elevation by 6.5 feet. Thus, for a rigid frame structure the side thrusts on each leg of the frame will be unbalanced. From this point of view it is suggested that a flexible structure would be more suitable. } imp

#### EXCAVATION :

Excavation to footing elevation will take place mainly below the water table. There appear to be three alternative schemes for excavating to footing elevation :

1. Sheet piles could be driven and excavation to the required grade would take place in the wet. Concrete placement could then proceed also in the wet with no dewatering arrangements necessary.
2. After driving sheet piles and excavating to rough grade inside the cofferdam, a sump below grade could be installed and this used to enable the excavation to be dewatered. By drawing the water level down below grade in this manner there would be a danger that the foundation grade would heave.

Calculations were carried out to determine the required depth of sheet pile penetration below foundation grade to ensure stability under these conditions. It was assumed that the sump would not be deeper than one foot. In order to ensure stability it was found that sheet piles would have to be continued below footing elevation for a depth at least equal to the depth from present ground level to the proposed excavation level.

3. Well points at ten foot intervals could be installed along the East and West sides of the proposed excavation. Excavation and subsequent placing of footings could then be carried out in the dry.

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28 November, 1958.


The sidewalls of the excavation would not remain stable without adequate timber bracing.

On the basis of economic considerations it is felt that either method No 1 or 3 would be suitable.

CONCLUSIONS :

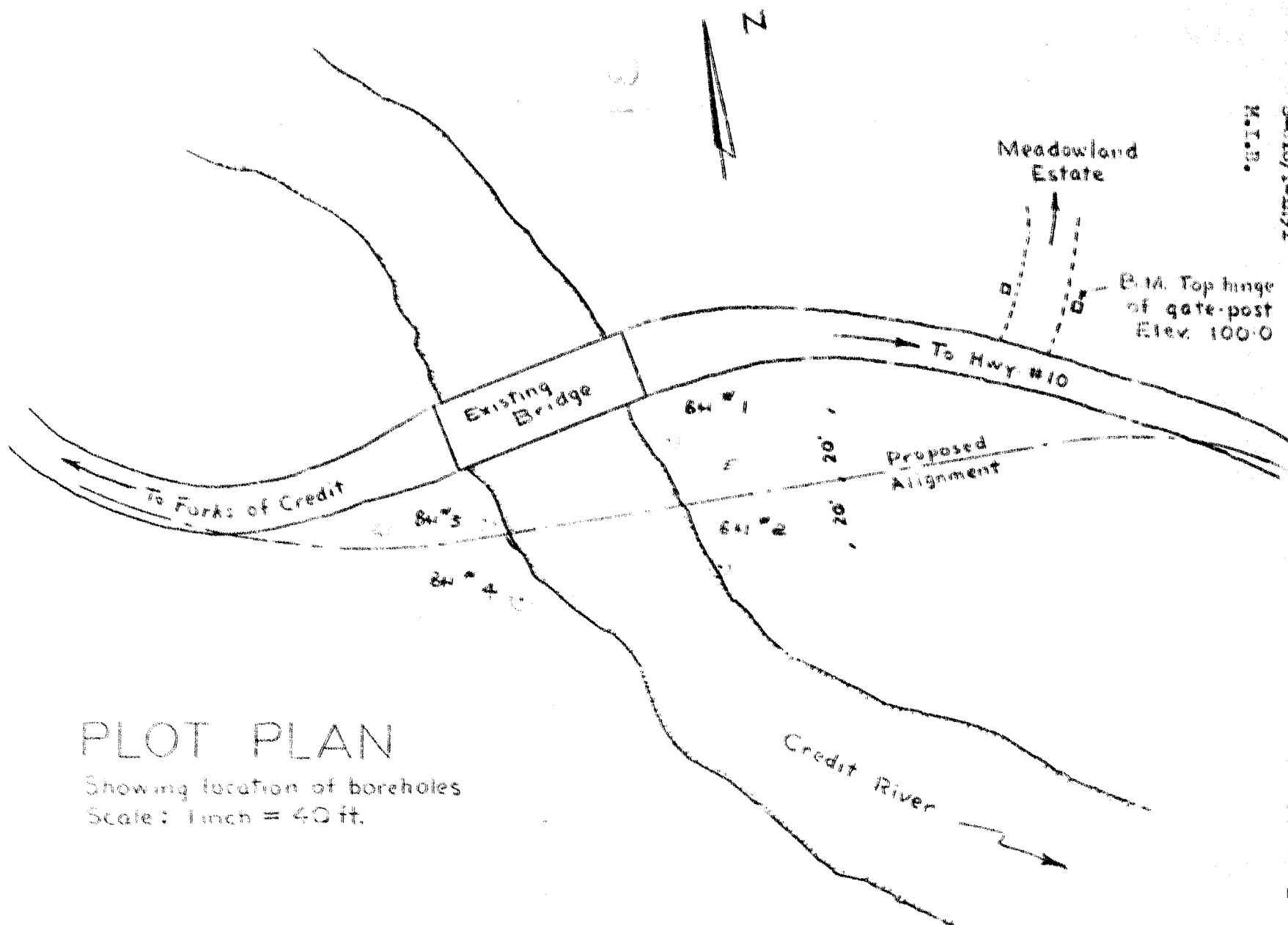
For convenience, the conclusions drawn and recommendations arising from results of the soil investigation are listed below :

1. The subsoil is a dense to medium dense, pervious, gravelly glacial till, containing scattered lenses of less dense silt and sand. A large lens of silty fine sand up to 18 feet thick was encountered.
2. Footings on the West bank should be installed at Elevation 80 feet and a bearing pressure of 8000 psf used for design purposes.
3. The East bank footings should be placed at Elevation 73.5 feet, and they should be designed on the basis of a 4000 psf allowable bearing pressure.
4. A flexible span structure founded on spread footings would be the most suitable arrangement.
5. It would appear feasible either to carry out foundation construction in the wet, or resort to the use of well points to enable operations to proceed in the dry.



M. I. Beeby, P.Eng.,  
Project Engineer.

MIS:YDP



## PLOT PLAN

Showing location of boreholes  
Scale: 1 inch = 40 ft.



**RACEY MacCALLUM AND ASSOCIATES LTD.**

Foundation Engineering Division

Engineering Data Sheet for Borehole: 1

Project: **PROPOSED THUNDER BRIDGE,**  
 Location: **CREDIT RIVER, COUNTY OF PEEL, ONTARIO.**  
 Hole location: **See Enclosure No 1.**  
 Hole Elevation and Datum: **90.7 Feet.**  
 Field Supervisor: **R.H.** Prep: **L.P.W.**  
 Driller: Checked: **M.I.B.** Date:

**LEGEND**

Shear Strength (C)

Unconfined compression

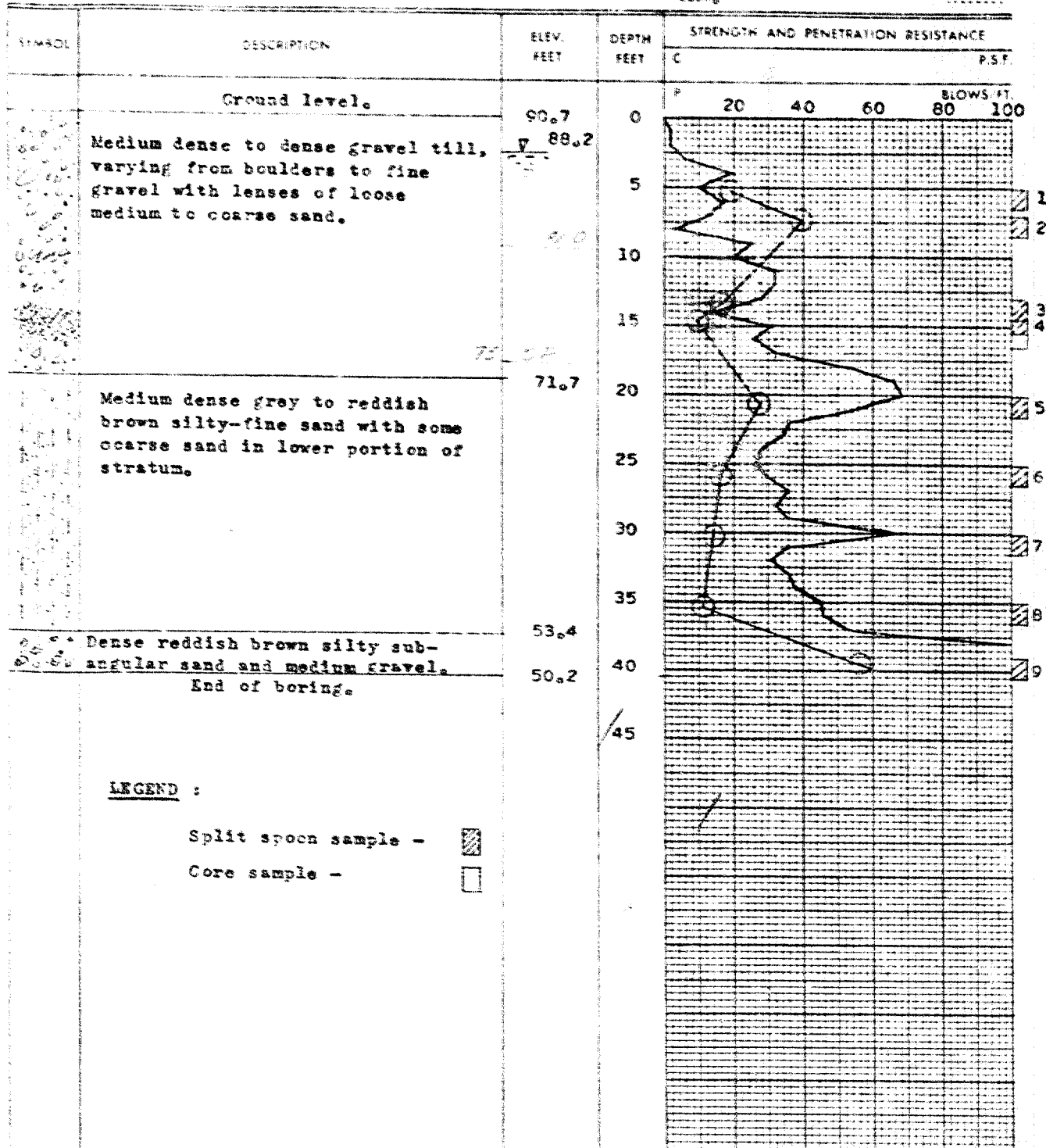
Vane test and sensitivity (S)

Penetration Resistance (P)

2" Split tube

2" Dia. Cone

Casing



**RACEY MacCALLUM AND ASSOCIATES LTD.**

Foundation Engineering Division

Engineering Data Sheet for Borehole: 2

Project: **PROPOSED THUNDER BRIDGE,**  
 Location: **CREDIT RIVER, COUNTY OF PEEL, ONTARIO.**  
 Hole Location: **See Enclosure No 1.**  
 Hole Elevation and Datum: **90.1 Feet.**  
 Field Supervisor: **R.H.** Prep.: **L.P.W.**  
 Driller: Checked: **M.T.B.** Date:

**LEGEND**

Shear Strength (C)

Unconfined compression  
Vane test and sensitivity S

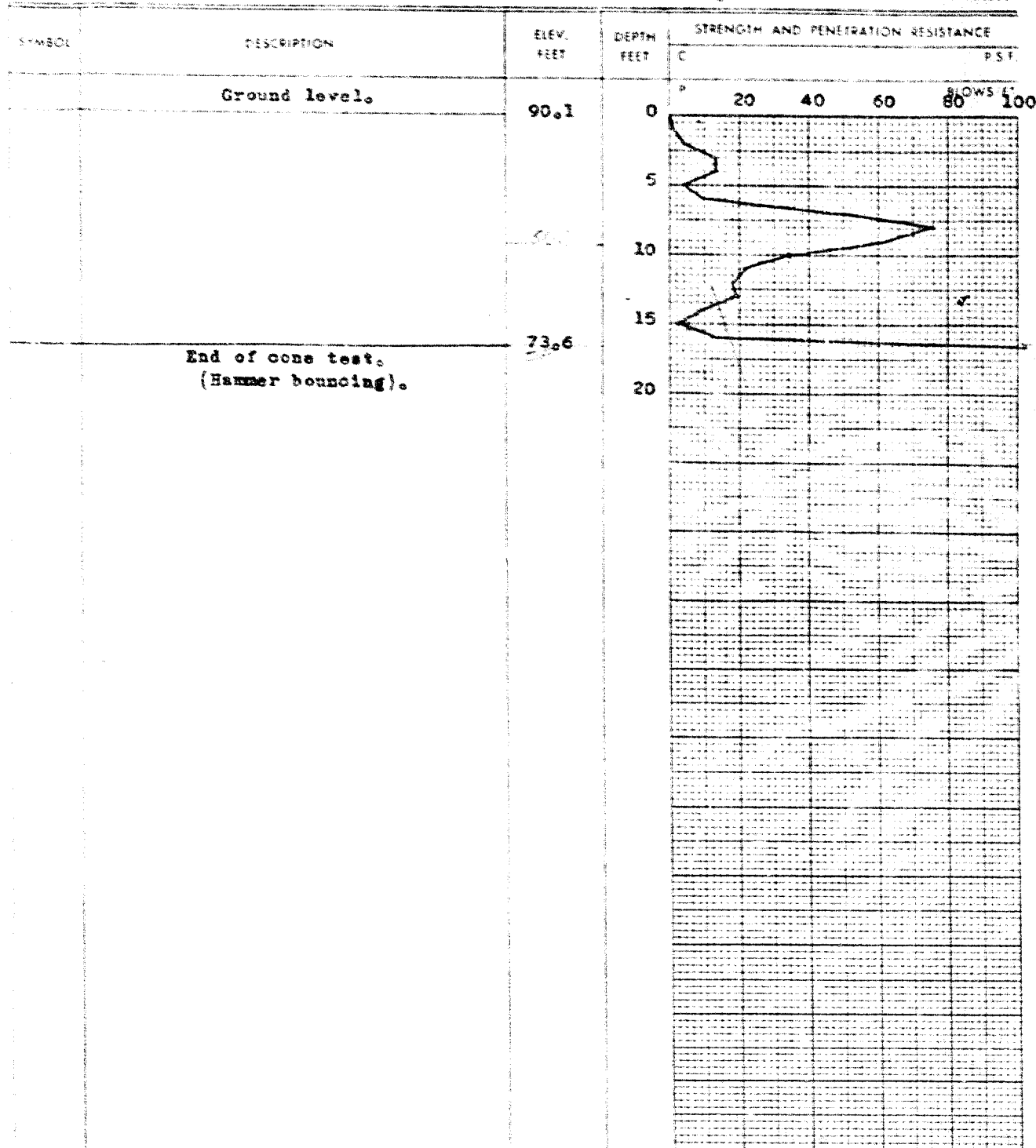
Penetration Resistance (P)

2" Split tube

2" Dia. Cone

Casing

S



**RACEY MacCALLUM AND ASSOCIATES LTD.**

Foundation Engineering Division

Engineering Data Sheet for Borehole: **3**

Project: **PROPOSED THUNDER BRIDGE,**  
 Location: **CREDIT RIVER, COUNTY OF PEEL, ONTARIO.**  
 Hole location: **See Enclosure No 1.**  
 Hole Elevation and Datum: **91.1 Feet.**  
 Field Supervisor: **R.H.** Prep.: **M.I.B.**  
 Driller: Checked: **M.I.B.** Date:

**LEGEND**

Shear Strength (C)

 Unconfined compression  
 Vane test and sensitivity: S

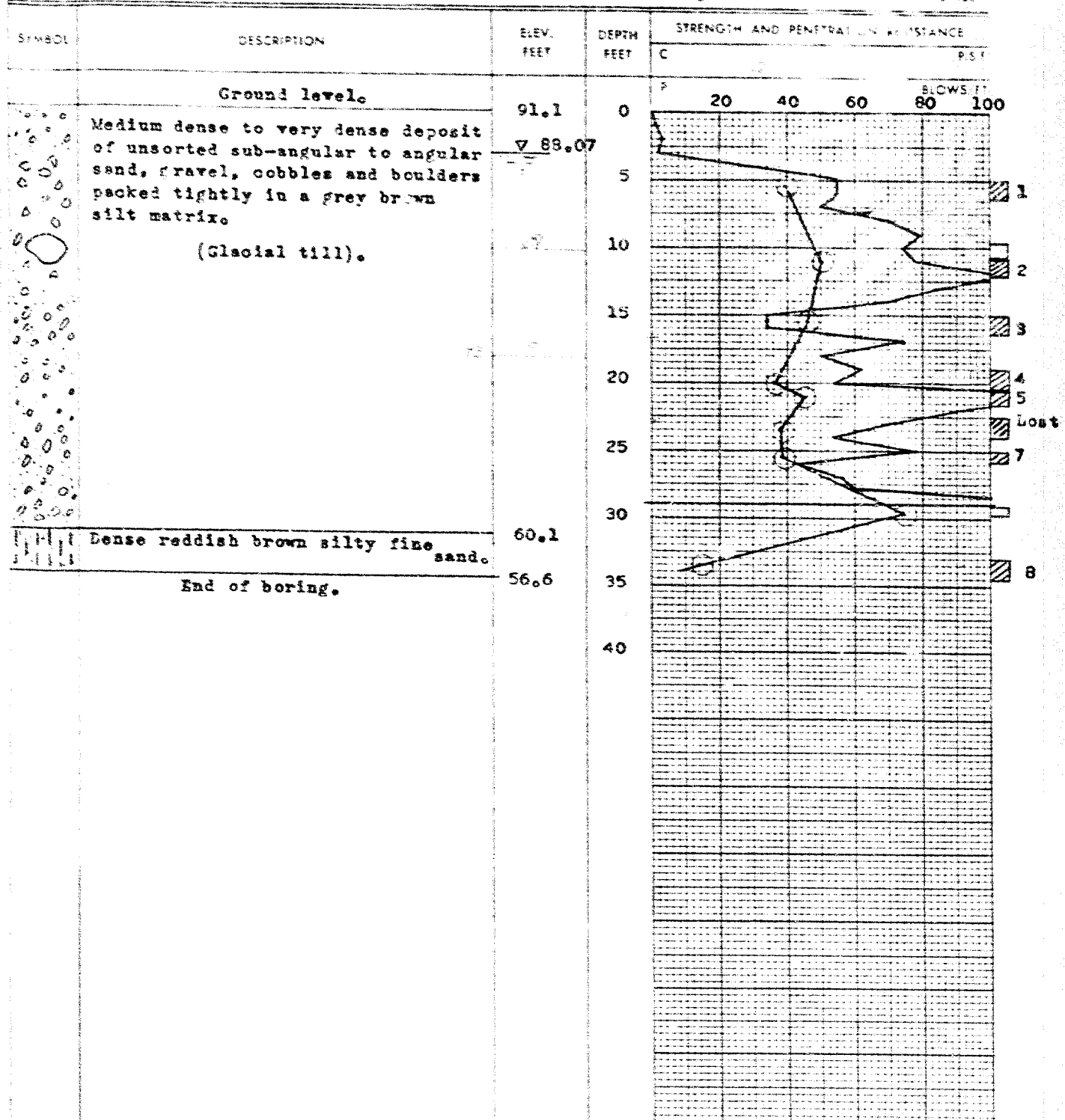
Penetration Resistance (P)

2" Split tube

2" Dia. Cone

Casing

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**RACEY MacCALLUM AND ASSOCIATES LTD.**

Foundation Engineering Division

Engineering Data Sheet for Borehole: 4

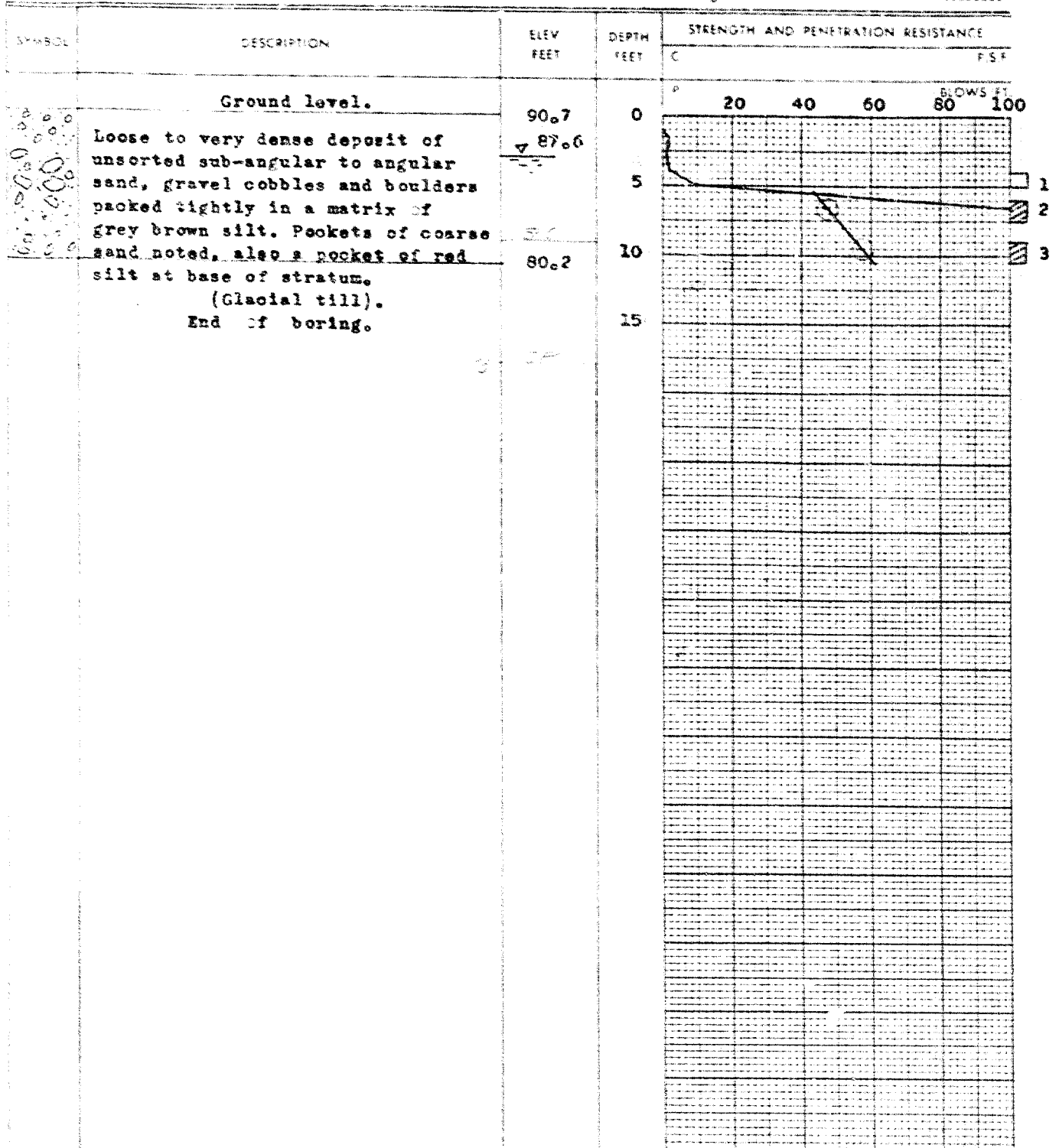
Project: **PROPOSED THUNDER BRIDGE,**  
 Location: **CREDIT RIVER, COUNTY OF PEEL, ONTARIO.**  
 Hole Location: **See Enclosure No 1.**  
 Hole Elevation and Datum: **90.7 Feet,**  
 Field Supervisor: **R.H.** Prep.: **L.P.W.**  
 Driller: **Checked: M.I.B.** Date:

**LEGEND**Shear Strength  $C$ Unconfined compression  
Vane test and sensitivity  $IS$ Penetration Resistance  $P$ 

2" Split tube

2" Dia. Cone

Casing



Mr. A. M. Toye,

October 21, 1959.

Bridge Engineer.

Materials & Research Section.

Re: Proposed Thunder Bridge over  
Credit River, 8th Ridgeway,  
Caledon Twp.

Attention: Mr. J. McAllister.

In response to your request, we have reviewed the soil conditions as reported by Racey, MacCallum & Associates, at the above structure location, and herewith submit our comments with respect to your suggestion that the foundation design proposed, consist of spread footings at the West abutment, and timber piles at the East abutment. Our comments are as follows:-

1. A rigid frame structure supported on spread footings at both abutment locations can be safely designed.
2. The West abutment footing can be placed at Elev. 81.0' or below, and a gross bearing pressure of 4 tons/sq.ft. can be used for the footing design.
3. The East abutment footing can be placed at Elev. 81.0' or below, and the recommended footing pressure to be used at this elevation is 3 tons/sq.ft.
4. To provide protection against undermining of the abutment footings and also to permit excavation to be carried out through the water-bearing sand stratum, and footing concrete to be poured in the dry, it appears necessary to drive interlocking steel sheet piling around the perimeter of the footings. This sheet piling should be specified as a heavy rigid section, typically ZP @ 36 lb./lineal foot of wall. This piling should be driven to elevation 73.0' and left in place. Excavation within the sheet pile cofferdam can then proceed to Elev. 81.0'. The cell can be dewatered and concrete placed in the dry. The above sheet pile tip elevation is sufficient at both the East and West abutment locations, and this piling should also be left in place at the abutment locations.

The use of a heavy pile section is necessary because of the dense nature of the material through which piles will have to penetrate. A flat web section would not have sufficient rigidity to penetrate this material. Elevations noted, correspond to those given in the foundation report submitted by Racey, MacCallum.

cont'd. /2 ...

5. The proposal to use a pile-supported footing at the East abutment is apparently based upon the results of penetration tests which indicate an apparent loose stratum occurring at a depth of 12 to 16 ft. below ground surface at the location of the East abutment. Racey, MacCallum have recommended that footings be founded below this loose layer. Samples obtained from this stratum have been examined and this material was found to be a one-sized sand containing no compressible fines. With the sheet piling driven below the lower horizon of this layer, sufficient confinement will result to allow spread footings to be placed at Elev. 81.0', as specified in Item (2) of our comments. If examination of this loose material had shown the stratum to be cohesive in nature, then the proposal to use a pile-supported abutment would have been acceptable.

If you have any further questions in regard to the comments outlined above, please contact our office.

LGS/MdeF

*L. G. Soderman*  
L. G. Soderman,  
PRINCIPAL SOILS & FOUNDATIONS ENGINEER

cc: Messrs. A. M. Toye  
S. McCombie  
Foundation Section  
Gen. Files.✓

OVER

*the proposed bridge to be 8/10 as per plan placed at this elevation.*

*the agreed upon*



ONTARIO  
DEPARTMENT OF HIGHWAYS

Toronto 5,  
October 13, 1959.

MEMORANDUM TO:

Mr. L. G. Soderman,  
Principal Soils & Foundation Engineer,  
Downsview, Ontario.

Re: Thunder Bridge over Credit River  
8th Sideroad,  
Caledon Township.

Attached please find a copy of a soil report  
submitted by Racey, MacCallum & Associates and a  
print of the site plan.

The proposal is to use spread footings at the  
west abutment and timber piles at the east abutment.

We would be pleased to have your comments on  
this report and the proposed structure.

*J. C. McAllister*

J. C. McAllister,  
for S. McCombie,  
Bridge Planning Engineer.

JCMCA:bh

① The ~~abutment~~ footing for east abutment  
can be founded at elevation 81.0 using a ~~design~~  
for ~~10~~ gross beam pressure of 3 tons/sq ft.  
Sheet pile should be driven over the  
footing pile as at the west abutment with  
sheet pile penetration to elevation 73.0.  
Material contained in the sheet pile application in the

Reporting to Abolishment.

R best 86.

Tolypat 2

-1 T/37 ft -

① Any sign should be reported in  
Special form as to supply used at  
the site.

② The steel sheet piling should be  
at least 81.0 ft below sea surface  
from point of entry of water into  
a form bay.

③ - To provide protection against  
~~blow~~ ~~and~~ ~~to~~ ~~formulate~~ ~~in~~ ~~terms~~!  
~~leaking~~ ~~film~~ of the abandoned form -  
and also to permit excavation to flow  
the form is the by steel sheet piling  
should be driven around the damaged  
piling / the form. A heavy rigid  
sheet piling center typically 2 P @ 36  
thence a spacer. ~~for~~ The film should  
be driven to also 73.0 and left in place.