

#60-F-224

W.P. #301-60-4

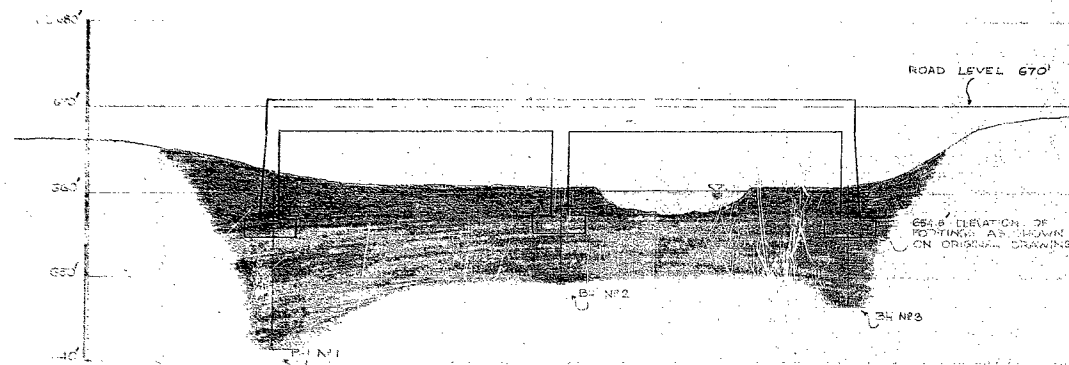
PROP. BRIDGE

WIDENING AT

MCKENZIE CR.

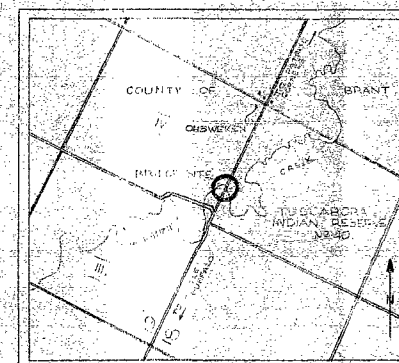
CON. #4

TUSCARORA TWP.



CROSS-SECTION PROFILE
SCALE 1/4" = 10 FEET

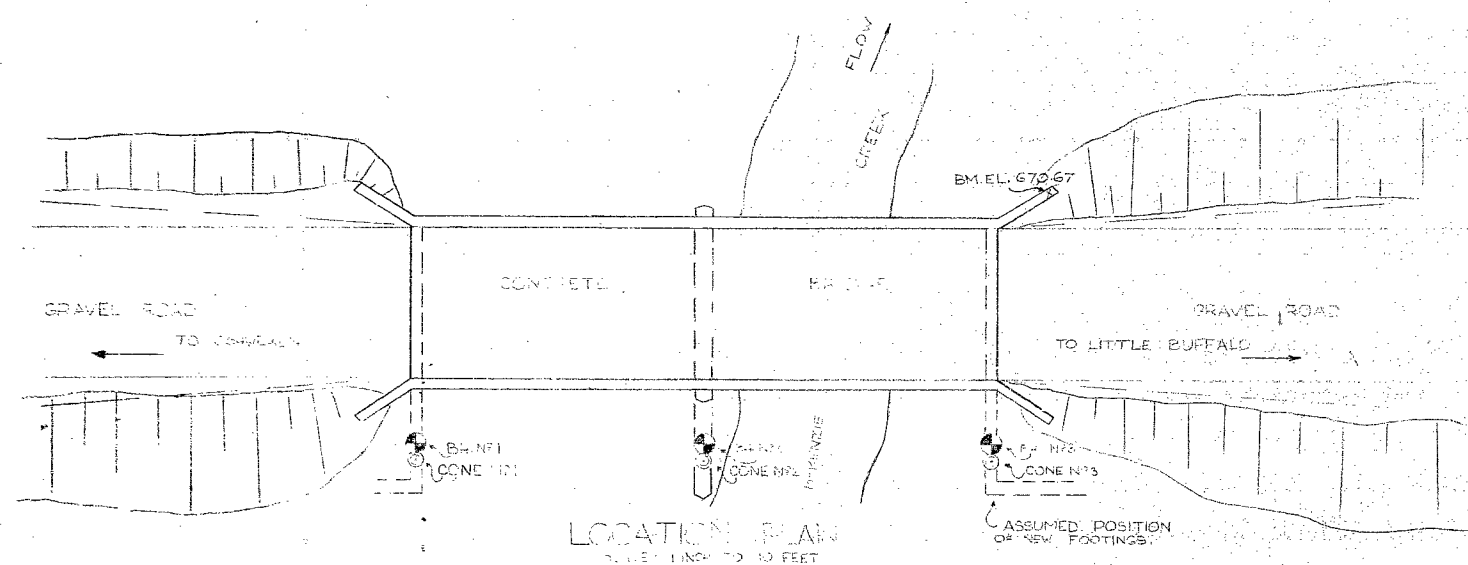
571250E 17 40 PLE
4767350N



KEY PLAN
SCALE 1/4" = 0.5 MI.

LEGEND

- BOREHOLE
- WATERLEVEL ON 8TH NOV. 1960
- SOFT TO MEDIUM STIFF BROWN SANDY ORGANIC CLAY AND SILT
- SOFT GREY CLAY MIXED WITH SAND AND GRAVEL
- HARD LIMESTONE AND HARD BLUE SHALE LAYERS CONTAINING SEAMS OF GYPSUM
- CONE PENETRATION TEST



LOCATION PLAN
SCALE 1/4" = 10 FEET

OUR REF. No. Q-10222	DEPARTMENT OF HIGHWAYS MATERIALS AND RESEARCH SECTION ONTARIO
ENCL. No. 1	PROPOSED WIDENING OF MCKENZIE CREEK BRIDGE SIX NATIONS INDIAN RESERVE CON IV
DATE NOV. 1960	LOTS 18 & 19 TUSCARORA IND. RES. 40 COUNTY OF BRANT
DRAWN BY Checked BY J.B.	DOMINION SOIL INVESTIGATION LIMITED 88 EGLINTON AVENUE EAST TORONTO 12 ONTARIO

Mr. A. M. Toye,
Bridge Engineer.

November 29, 1960.

Materials & Research Section.

FOUNDATION INVESTIGATION REPORT

by: Dominion Soil Investigation, Ltd.

Attention: Mr. S. McCasbie.

Re: McKenzie Creek Bridge -
Lots 18 & 19, Con. IV,
Tuscarora Twp., Dist. 4,
W.P. 301-60-4.

This memo accompanies the report on the foundation investigation carried out at the above structure site, by Dominion Soil Investigation, Ltd. Footings for the extension of the existing abutments and piers can be founded on bedrock which exists at shallow depth at both abutments and pier locations.

At the North abutment location - i.e., Borehole 1, a shallow surface layer (2 ft. thickness) was encountered in the boring. This compressible material should be removed prior to placing the structure backfill. In order to minimise settlements at the approaches, this material should be excavated for a distance of at least 30 ft. back of the abutment backwall.

At the South abutment location - i.e., Borehole 3, the soft subsoil extended from the ground surface to bedrock elevation. This material should also be excavated and replaced for a distance of 30 feet behind the abutment as suggested for the North abutment.

Your attention is drawn to the fact that excavations required to place footings to bedrock elevation, will have to be continuously pumped to maintain a dry condition.

If you have any questions with respect to the contents of this report, or our foregoing comments, please contact our Office.

LGS/MGF
Attach.

cc: Messrs. A. M. Toye (2)

E. A. Tregaskes

D. G. Ramsay

I. C. Campbell

R. E. Richardson

T. J. Kovich

A. Watt

L. G. Soderman,

PRINCIPAL FOUNDATIONS ENGR.

Foundations Office

Gen. Files.

62-67
23-4-1-6-1

1

CONTENTS

	Page
INTRODUCTION	1
I. DESCRIPTION OF SITE AND GEOLOGY.	2
II. FIELD AND LABORATORY WORK	2
III. SUBSURFACE CONDITIONS	2
IV. DISCUSSION AND RECOMMENDATIONS	3
V. SUMMARY	4

ENCLOSURES

KEY PLAN, LOCATION PLAN AND SUBSURFACE PROFILE	Encl. 1
ENGINEERING DATA SHEETS FOR BOREHOLES	Encl. 2 to 4
LABORATORY TEST RESULTS	Encl. 5 & 6

DOMINION SOIL INVESTIGATION LTD.

SOIL MECHANICS • FOUNDATION ENGINEERING

TORONTO 12, ONTARIO

INTRODUCTION

Authorization was received in a letter dated 28th October, 1960 from the Department of Highways, Materials and Research Section, to conduct a soil investigation at the site of an existing bridge which carries a gravel road across McKenzie Creek. The location is shown in the Key Plan on Enclosure No. 1.

The work is connected with the proposed widening of the 2 x 32 foot span bridge. A drawing of the site showing the position of the new section (D.H.O. Plan-E-3892-1) was provided by the Client.

The purpose of the investigation was to determine the subsurface conditions and to obtain the necessary soil data for the design and construction of foundations.

I. DESCRIPTION OF SITE AND GEOLOGY

The site is 14 miles south-east of Brantford and 4 to 5 miles south of the Grand River in the Tuscarora Indian Reserve. The surrounding country undulates between elevations 650 and 700 feet. It is covered with thin forest and scrub, and there is some farming. The McKenzie Creek which meanders through the area drains eastward into the Grand River in adjacent Haldimand County.

The site lies at the western extremity of the Haldimand clay plain which was submerged by the previous Lake Warren, and is underlain by sedimentary rocks of the Salina formation. The rock contains deposits of gypsum which is mined in nearby Caledonia and Hagersville.

II. FIELD & LABORATORY WORK

Field work was carried out on the 7th and 8th November, 1960. It comprised 3 Boreholes and 3 dynamic cone penetration tests at the locations shown on Enclosure No.1.

The holes were wash bored and lined with Bx casing. Split spoon samples were taken using a standard 2" O.D. sampler. The split spoon and dynamic cone were driven with a 140 lb. hammer dropping 30 inches.

Ax core was recovered from the bedrock. The amount of core recovered varied from 20% to 100% and was largely influenced by the variable hardness of the rock and the presence of soft seams of gypsum.

The results of the field tests are recorded on Engineering Data Sheets, Enclosures 2 to 4. The elevations of Boreholes were measured from the Benchmark on the south wing-wall.

Laboratory tests were made on 2 samples for the purpose of classification. The test results are given on Engineering Data Sheets, Enclosures 5 and 6.

III. SUBSURFACE CONDITIONS

The subsurface profile is shown on Enclosure No.1. The strata consist of two shallow layers above bedrock.

- 1) A layer of soft to medium stiff brown weathered organic sandy clay and silt from 3 to 8 feet thick.
- 2) A layer of soft grey clay 2 feet thick containing a proportion of sand and gravel up to 1 inch diameter which increases towards the bedrock.

The bedrock consists of alternating layers of hard brown limestone and hard blue shale, and contains seams of gypsum.

Groundwater was encountered in the Boreholes at approximately the level of water in the creek, viz. El. 660'. Water was observed to rise quickly in the Boreholes demonstrating an unusual perviousness in the soil which is attributable to weathering and the presence of much organic and granular material.

IV. DISCUSSION AND RECOMMENDATIONS

From an inspection of the original drawing, the south abutment and central pier appear to be resting on bedrock. The drawing shows the footing for the north pier at the same elevation, i.e. 2 to 3 feet above the rock which dips in that direction, but it seems unlikely that this footing would not also have been taken down to rock.

There is no positive sign of settlement. Hair cracks in the beams above the central pier caused by negative bending could be the result of settlement or live loading. The deck slopes from north to south with a fall of 0.3 inches and 1.3 inches respectively along the two spans, but without a knowledge of the original elevations, the cause of this is not apparent.

The foundations for the new width should be supported from bedrock. For the north abutment, this will be located at El. 653' and for the central pier and south abutment, at El. 655.5'.

Two types of foundation have been considered:

- a) Spread footings (as in the existing structure)-- Excavations for footings will have to be braced on all sides because of the soft, loose consistency of the soil and it is expected that constant pumping will be necessary to keep them dry. Probably the simplest way to make the excavation would be to sink a prefabricated box shutter or caisson at the location of each footing while diverting the creek through a temporary culvert to take away the bulk of the water.
- b) Piles acting as columns--To avoid the difficulties of excavation and dewatering, it is suggested that steel box or pipe piles be driven open ended to bedrock and filled with concrete. The piles would extend upward to the underside of the bridge beams and be tied in with reinforcing bars, thus eliminating any pile cap. Lateral stability could be achieved by tying in to the existing structure at deck level.

Whichever type of foundation is adopted, a bearing pressure on the rock up to 20 tons per square foot is considered safe and no appreciable settlement is envisaged. If spread footings are used, the rock surface should be clean and free from soft or loose material.

Before placing the new approach fill, the existing ground surface should be stripped of grass and roots. If this reveals more organic material such as was found in the Boreholes near the bed of the creek, excavation should continue until all organics have been removed. The new fill should be granular, and it should be well compacted and drained. If it is found necessary to excavate deeply for the new approach fill, the existing fill will have to be braced to maintain stability under the road.

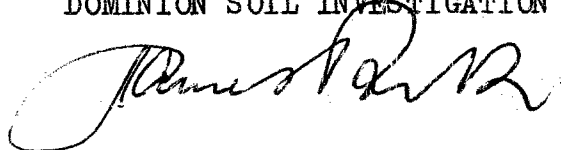
V. SUMMARY

1. The subsoil consists of 3 to 8 feet of soft, brown weathered sandy organic clay and silt followed by a 2 foot layer of soft grey clay mixed with sand and gravel. Below this is bedrock consisting of limestone and blue shale with seams of gypsum.
2. Groundwater was located about El. 660 feet, and water was observed to move easily through the soft weathered strata above the bedrock.
3. The strip footings for the existing bridge are probably resting on bedrock.
4. The foundations for the new width should be carried on the bedrock at El. 653' for north abutment and El. 655.5' for south abutment and pier.

The foundations could be either spread footings as in the existing structure, or end bearing piles acting as columns between the bridge deck and bedrock. A bearing pressure up to 20 tons per square foot is considered safe and no settlement problem is envisaged.

5. If excavations are made for spread footings, these will need to be braced and constant pumping will be required to keep them dry.
6. Before placing the new approach fill, all organic material should be removed and it may be necessary to brace the existing fill depending on the depth excavated. The new fill should be compacted granular material and should be drained.

DOMINION SOIL INVESTIGATION LTD.



James Park, P.Eng.

Toronto, Nov. 1960.

E n c l o s u r e s

Dominion Soil Investigation Ltd.

Engineering Data Sheet for Borehole: 1

Date: NOV. 7, 1960.

Project: MCKENZIE CREEK BRIDGE

Location: BRANT CO. TUSCARORA TWP. CON. IV.

Hole Location: SEE ENCL. 1. LOT 18 & 19

Hole Elevation and Datum: 662.7

Field Supervisor: J.P. Prep.: E.L.

Driller: N.O. Checked: J.P.

LEGEND

Shear Strength (C)

Unconfined compression
Vane test and sensitivity (S)

Penetration Resistance (P)

2" Split tube

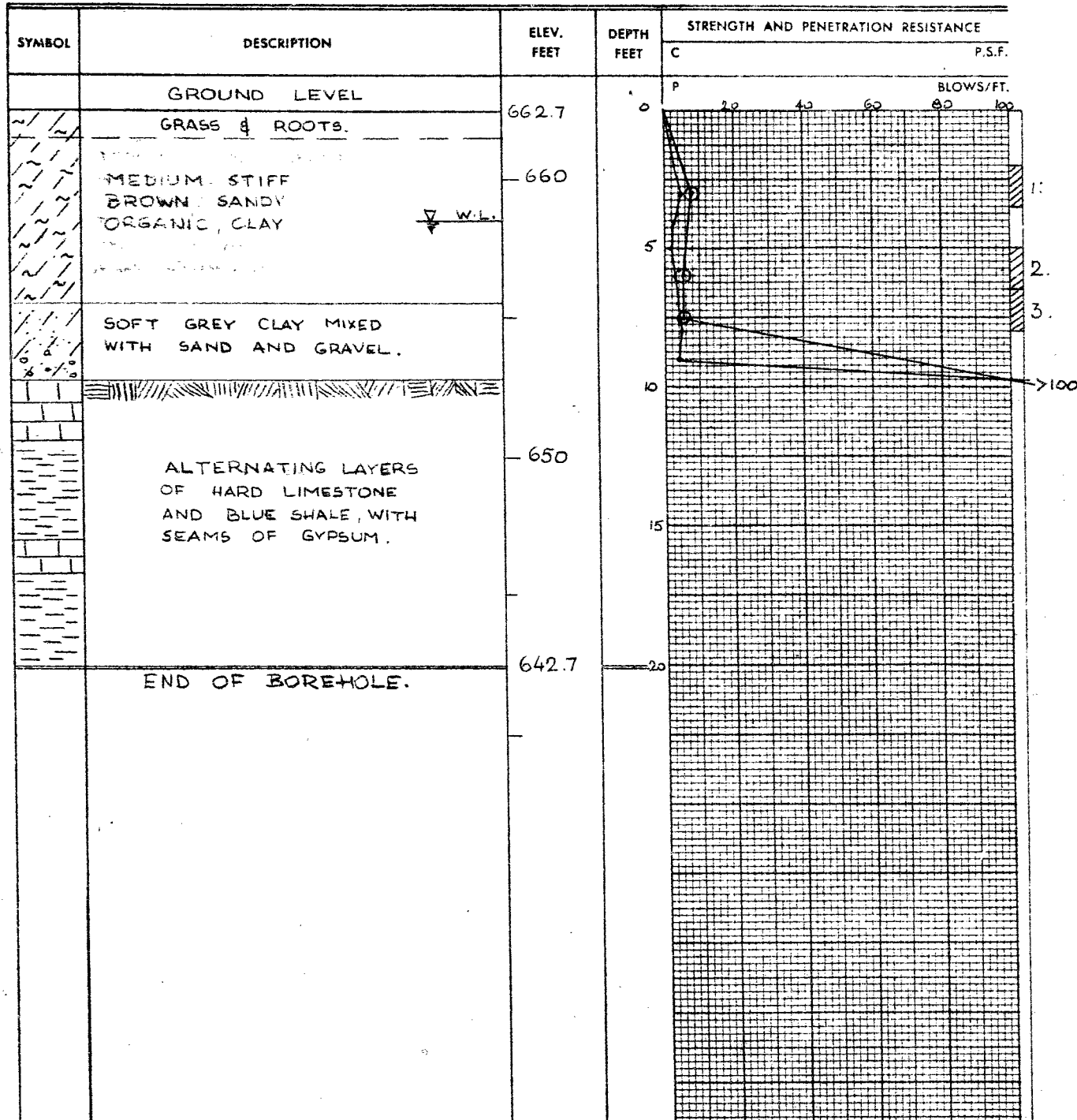
2" Dia. Cone

Casing

Sampling Method

2" Dia. split tube

2" Shelby tube



Dominion Soil Investigation Ltd.

Engineering Data Sheet for Borehole: 2

Date: NOV. 8, 1960.

Project: MCKENZIE CREEK BRIDGE

Location: BRANT CO. TUSCARORA TWP. CON. W.

Hole Location: SEE ENCL. 1.

LOT 18 & 19

Hole Elevation and Datum: 661.0

Field Supervisor: J.D.

Prep.: E.L.

Driller: N.O.

Checked: J.P.

LEGEND

Shear Strength (C)

Unconfined compression

Vane test and sensitivity (S)

Penetration Resistance (P)

2" Split tube

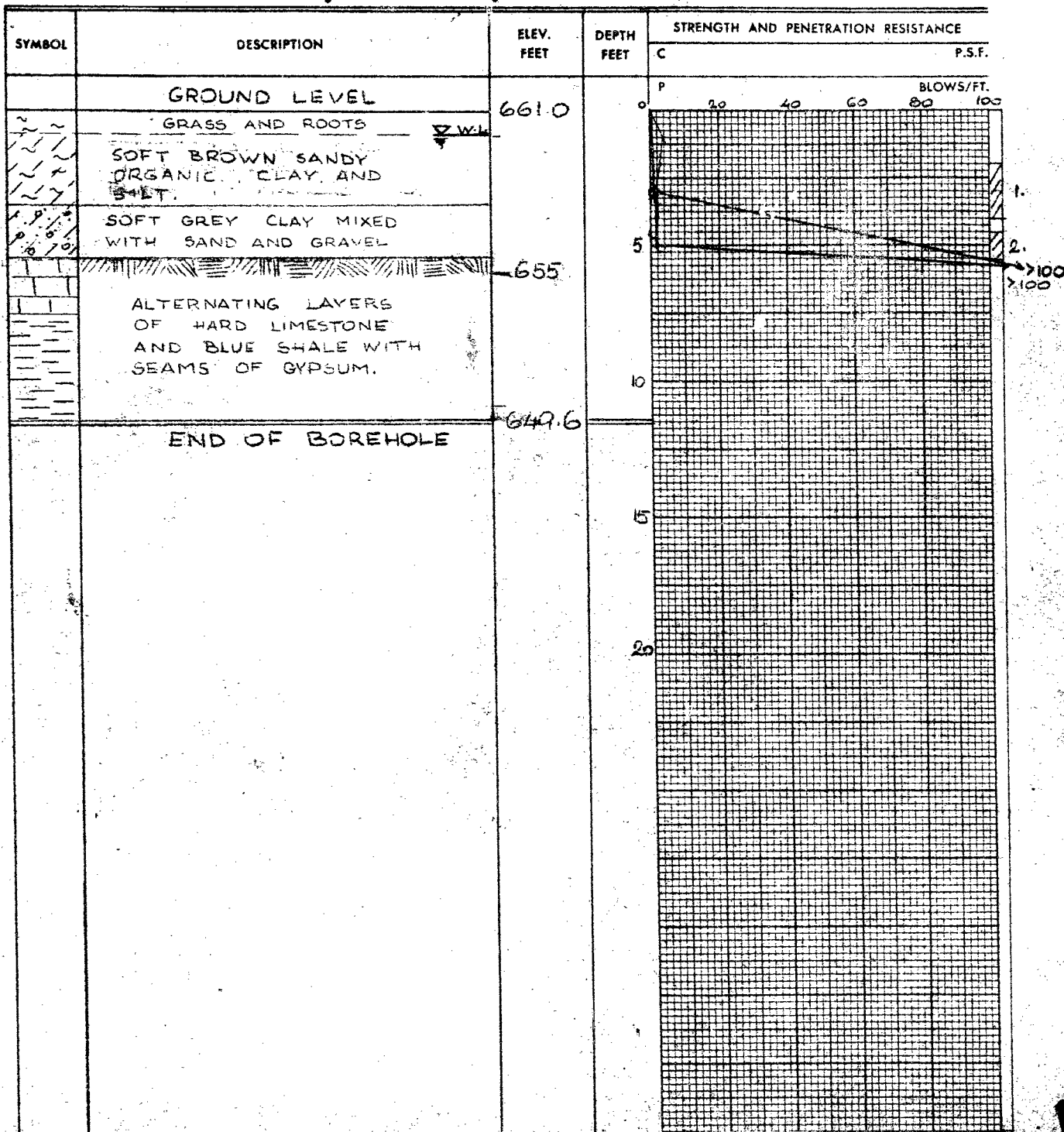
2" Dia. Cone

Casing

Sampling Method

2" Dia. split tube

2" Shelby tube



Dominion Soil Investigation Ltd.**Engineering Data Sheet for Borehole: 3**

Date: NOV. 8, 1960.

Project: McKENZIE CREEK BRIDGELocation: BRANT CO. TUSCARORA TWP. CON. IV.Hole Location: SEE ENCL. 1. LOT 18 & 19Hole Elevation and Datum: 661.0Field Supervisor: J.P. Prep.: E.L.Driller: N.O. Checked: J.P.**LEGEND**

Shear Strength (C)

Unconfined compression

Vane test and sensitivity (S)

Penetration Resistance (P)

2" Split tube

2" Dia. Cone

Casing

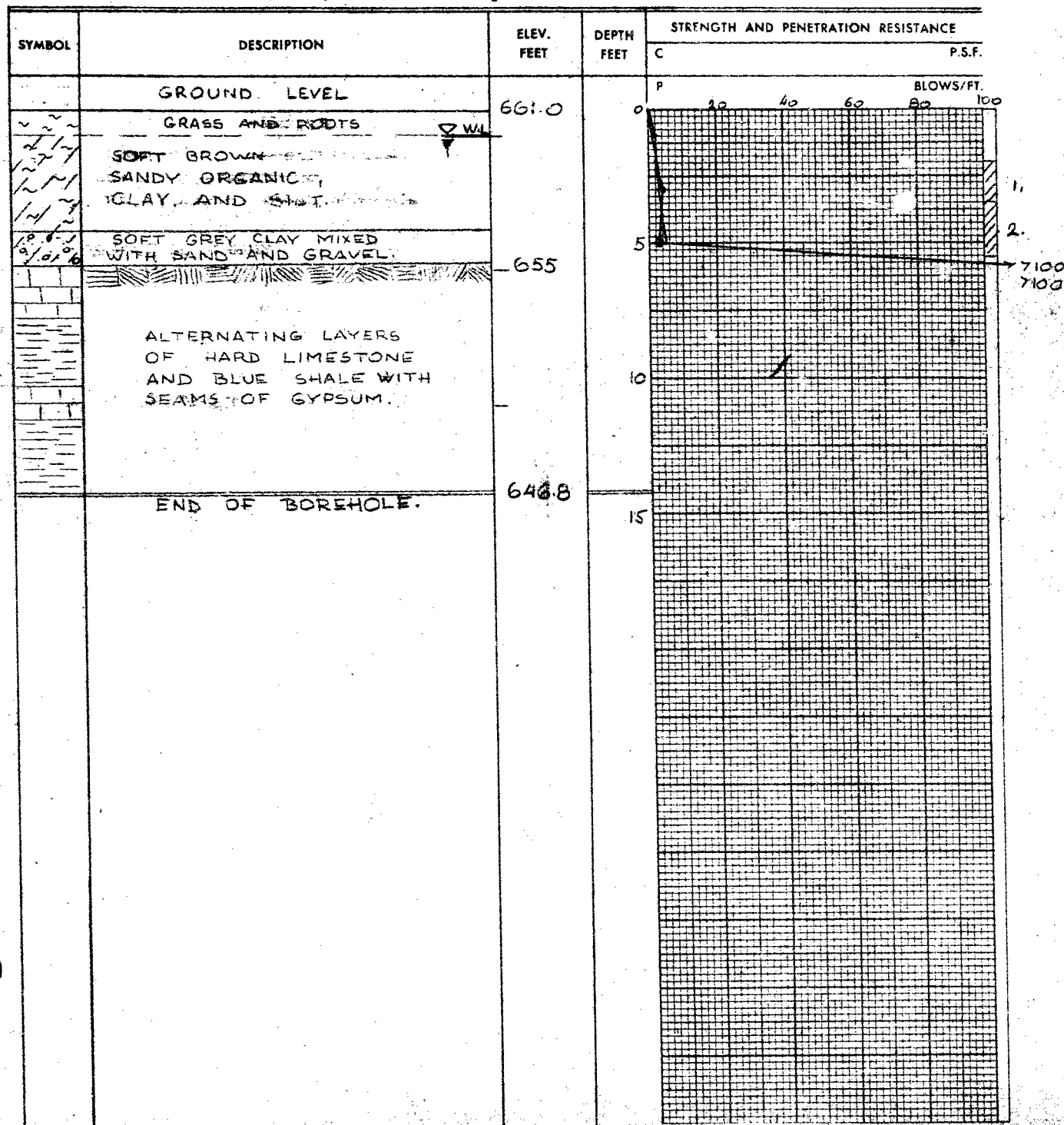
Sampling Method

2" Dia. split tube

2" Shelby tube

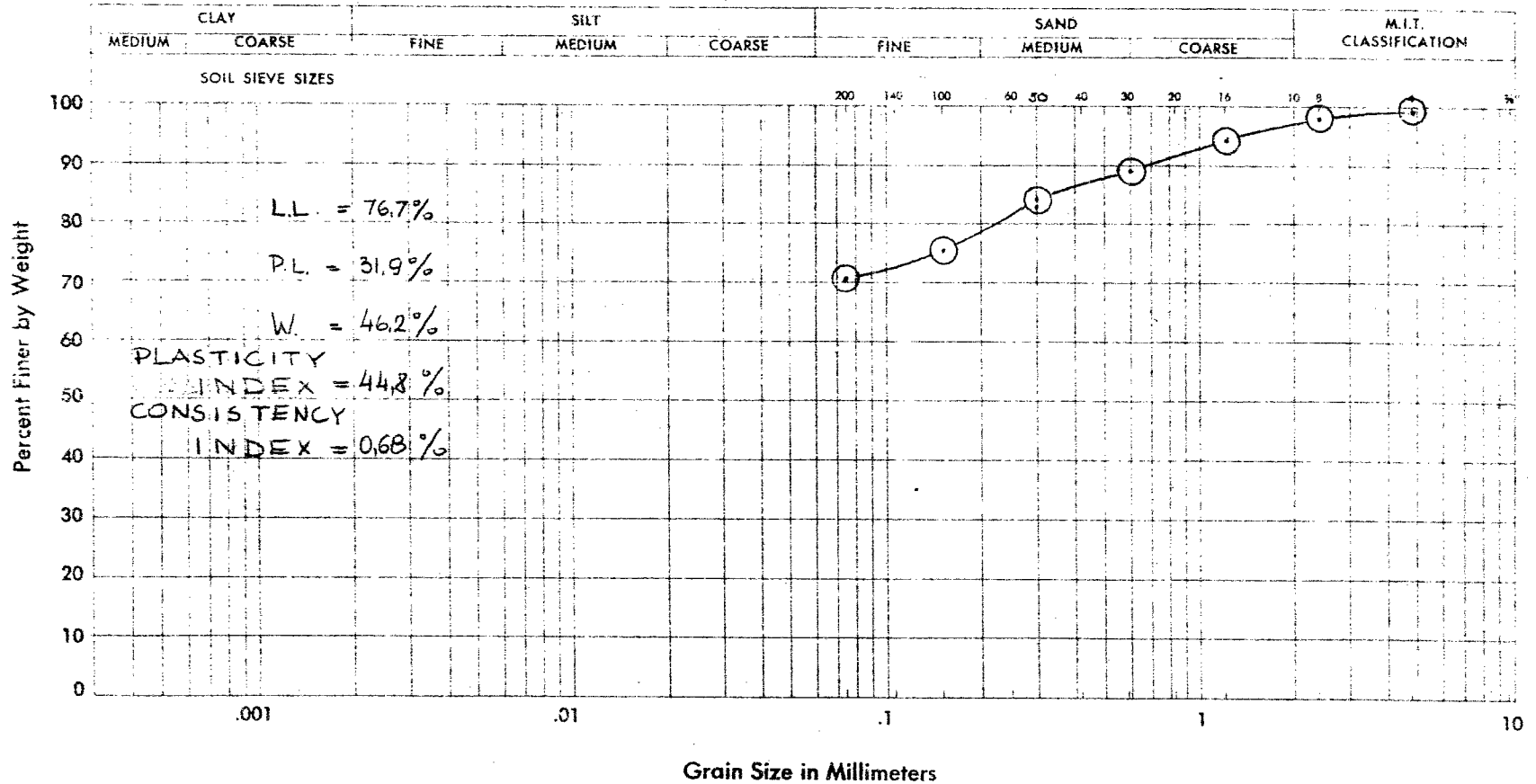
⊕
+3

⊖ ⊖



Dominion Soil Investigation Ltd.

GRAIN SIZE DISTRIBUTION

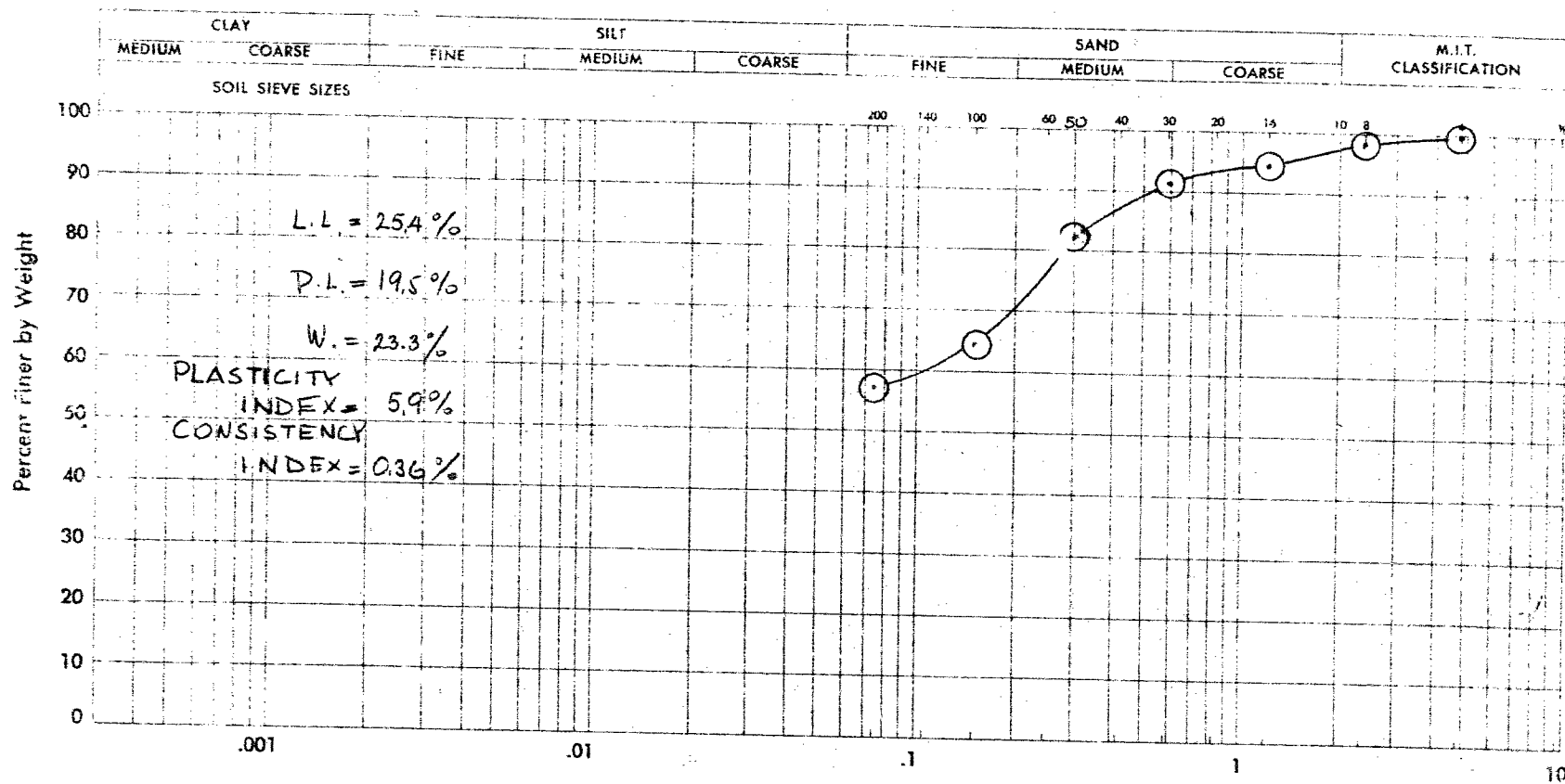


Project MCKENZIE CREEK BRIDGE
LOTS 18 & 19 CON. IX
TUSCARORA TWP. BRANT CO.

—○—○— SIEVE ANALYSIS.

Dominion Soil Investigation Ltd.

GRAIN SIZE DISTRIBUTION



Project MCKENZIE CREEK BRIDGE
LOTS 18 & 19 CON. IV.
TUSCARORA TWP. BRANT CO.

—○— SIEVE ANALYSIS

Grain Size in Millimeters

CLASSIFICATION:
BROWN SILT CLAY OF LOW
PLASTICITY
CONTAINING: 43% SAND.

Order No. O-10-22
BOREHOLE NO. 2.
SAMPLE NO. 1a
DEPTH: 4.0'
ELEVATION: 657.3