

58-F-249-C

IMPROVEMENTS

ON HWYS. 3 & 4

ST. THOMAS

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., PENG

H. JOHN RACEY, B.SC., M.E.I.C., PENG

A. ERIC RANKINE, B.SC., M.E.I.C., A.M.I.ELEC.E., PENG

TORONTO DIVISION
27 CARLTON STREET

Reference: S-500/T-1207

10 July, 1958

Department of Highways of Ontario,
Bridge Office,
280, Davenport Road,
TORONTO - Ontario.

Attention: Mr. J. McAllister

RE: SOIL INVESTIGATION FOR PROPOSED
IMPROVEMENTS ON THE KING'S HIGHWAYS
NO 3 AND NO 4, ST. THOMAS - 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,

Ronald F. Scott

Ronald F. Scott, P.Eng.,
Divisional Soil Engineer.

RFS/YDP

Department of Highways of Ontario,
Bridge Office,
280, Davenport Road,
Toronto - Ontario.

SOIL INVESTIGATION FOR PROPOSED
IMPROVEMENTS ON THE KING'S HIGHWAYS
NO 3 AND NO 4, ST. THOMAS - ONTARIO.

Reference: S-500/T-1207

Racey, MacCallum and Associates
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10 July, 1958.

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TORONTO DIVISION
27 CARLTON STREET

Reference: S-500/T-1207

10 July, 1958

SOIL INVESTIGATION FOR PROPOSED IMPROVEMENTS ON THE KING'S HIGHWAYS NO 3 AND NO 4, ST. THOMAS - ONTARIO.

This investigation was carried out between 12 May and 30 May, 1958, and consisted of a total of 9 borings with adjacent cone penetration tests and four probings. The purpose of this investigation was to determine the subsoil conditions along the proposed new centreline of the above highways, particularly at the crossings of this line with Dodd's Creek and Kettle Creek. This report gives a summary of the test results at four different sites where borings were carried out, and recommendations regarding the suitability of the soil for the proposed projects.

DESCRIPTION OF SITE AND FIELD WORK :

The locations of the different sites are shown on a sketch, Enclosure No 1. The sites were numbered in succession of field work as follows :

Site I

Proposed new bridge across Dodd's Creek,
Station No 46 + 50 approximately.

Site II

Proposed bridge across Dodd's Creek,
Station No 29 + 80 approximately.

Site III

Proposed diversion of Kettle Creek and
bridge across this diversion, Station No
18 + 50 approximately.

Reference: S-500/T-1207

10 July, 1958

- Continued -

Site IV

Proposed embankment extension at existing gravel road, Station No 10 + 00. to 3 + 00 approximately.

Drilling was carried out on all sites using a standard type diamond drill, with BX size flush joint and 3-inch heavy duty casing. Samples were taken using a standard 2-inch outside diameter split spoon sampler in granular soils, and 2-inch inside diameter thin walled sampler in cohesive soils. At depths adjacent to the latter samples, field vane tests were made which give the in situ shear strength of the soil. Near each borehole a 2-inch diameter cone was driven using the same driving energy as for the split spoon sampler, (140 lb hammer and a 30 inch drop). At some locations a probing only was carried out, the subsoil profile being sufficiently evident without further borings. A detailed description of each site follows in separate sections.

SITE NO 1 :

This site is located next to the existing bridge of combined Highways No 3 and 4 across Dodd's Creek, just downstream of a rather sharp curve, on the west side of St. Thomas. One boring was carried out on the west bank, and two on the east bank, (see Engineering Data Sheets for Borings No's I - 1 to I - 3, Enclosures No 2 to 4). The west bank is some 5 feet lower than the east bank, and will be flooded during periods of very high water levels. It can be seen from the results of Boring No 1 that the original clay till soil has been eroded and replaced by loose, sandy, river deposits for 9 feet below ground surface. Apart from this layer, the soil profile is very consistent, and consists on both sides of a stiff to very stiff glacial clay till down to approximate Elevation 625 feet, below which depth a very dense sand and boulder layer begins. The shear strength of the till layer varies from about 1500 psf to 3000 psf. The lowest strength values occur at greater depths, which can be explained by the phenomenon observed at Boring No I - 3, namely a slight artesian pressure in the sand layer underlying the till. This would tend to soften the clay immediately above.

The field vane test results and the Atterberg limit determination classify the till as a silty clay, relatively insensitive to remoulding but still susceptible to appreciable compression under higher loads. The moisture content is, in most cases, well below the liquid limit. On first sight it would be considered a safe base for founding the bridge footings. It would appear that the latter could be founded safely at any depth below Elevation 672 feet on the east bank, or Elevation 663 feet on the west bank, as

- 3 -

Reference: S-500/T-1207

10 July, 1958

- Continuation -

far as the shear properties of the soil are concerned. The danger of scour, however, is a factor that must be taken into consideration. The water level in the creek varies from Elevation 672.5 to Elevation 664 feet, and the currents in the spring will be fairly high. No information has been obtained yet about the soil conditions in the river bed. If the probings prove that the till bed has been replaced to some depth by coarse material, the bridge foundation should be placed below this depth. Our present recommendations are to build the bridge footings at a depth of at least 5 feet below the creek bed, or approximate Elevation 654 feet. The ultimate bearing capacity for a footing foundation at that depth, based on the shear strength value of 2200 psf, can be determined using the equation :

$$q = c \times N_{cq} + \gamma D^*$$

where : q = ultimate bearing capacity,
 c = shear strength of soil,
 N_{cq} = bearing capacity factor; depending on
 depth/width ratio of foundation,
 γD = effective weight of overlying soil.

For a footing not exceeding 10 feet in width, the bearing capacity factor would be approximately 8.0, and the ultimate bearing capacity would be 19,300 psf. Applying a factor of safety of 3, this would give a safe bearing capacity of 6400 psf. Because of the wide changes in ground water table, this factor of safety has also been applied to the overburden weight.

Considering the depth of approximately 29 feet of clay till below the footings, it would seem worthwhile to evaluate the amount of settlement to be expected under such loads. A fairly good estimate of the compression index of the clay till can be obtained from the equation :

$$C_c = 0.009 \times (L_w - 10\%) \text{ by Skempton and others.}$$

With an average liquid limit of 35.5%, the C_c value would be 0.23. The average unit weight being 120 pcf and the average moisture content 22%, the average void ratio of the clay till would be 0.70. Based on these values, the settlements under a 10 foot wide footing with a 6400 psf load would be of the order of 6 - 7 inches; consequently, much lower loads should be applied. For an allowable settlement of one inch the bearing value should not exceed 2000 psf. This allowable bearing value would increase at greater depths, because of the effective weight of the soil replaced, by an amount

* G. G. Meyerhof "Bearing Capacity of Foundations",
 Geotechnique Vol. II.

- 4 -

Reference: S-500/T-1207

10 July, 1958

- Continuation -

of 60 psf per foot of depth.

In view of the rather low safe bearing capacity for a footing foundation, it might be worthwhile to consider a pile foundation driven down to the dense layer at Elevation 625 feet. Piles will find refusal within one foot of penetration into this layer, and could be utilised to their capacity in the dense material. If the pile caps are located below the lowest river level, timber piles could be used.

The embankment fill required would be approximately 8 feet on the west bank. This will cause some settlements of the 9 foot layer of loose sand, which would take place during construction. Additional settlements due to consolidation of the clay till must be anticipated. The width of the embankment at its base would be about 60 feet. The sand layer will cause some spreading of the load, and a total settlement of the till layer below the embankment will be of the order of 8 inches. These settlements will take place rather slowly, and it would be advisable to bring in and place the embankment fill at this site some considerable time before the rest of the construction is begun to allow the underlying soil to consolidate as much as possible.

The recommendations regarding Site I can be summarised as follows :

1. The soil at the site consists, apart from a rather loose river deposit on the west bank, of a medium stiff, clay till, changing into a hard till at about 50 foot depth.
2. Because of the possibility of scour damage no abutment or wingwall foundation should be built above Elevation 654 feet. The safe bearing capacity at that depth would be 2000 psf, based on settlement considerations.
3. A pile foundation down to Elevation 624 feet could be utilised, designing for the maximum allowable load for the type of pile used.
4. The settlements under the 8 foot high embankment on the west bank would be of the order of 8 inches.

- 5 -

Reference: S-500/T-1207

10 July, 1958

- Cont. nation -

SITE NO II :

This site is located in a flat, low-lying area, which will be flooded by the Dodd's Creek in periods of high water. The proposed level of the highway pavement will be approximately 8 feet above the present grade. Similar to Site No I nearby, the difference between high and low water level is relatively high.

Because of the uniformity of surface conditions and the relatively small size of the proposed structure, only one boring and two probings were carried out on each bank, instead of the originally planned total of six borings. The subsoil consists of a 5 to 6 foot layer of rather loose, sandy river deposits, underlain by 23 feet of very silty clay till, which turns sandy and very dense below this depth.

The clay till was found to have a shear strength of about 1700 psf in the top 10 feet, increasing with depth. The Atterberg limit tests reveal a much lower liquid limit than encountered at Site No I, indicating a higher silt content. As the relation given on page 3 above between liquid limit and compression index gives less accurate results for low liquid limit values, a consolidation test was set up for one sample, TW3 taken at 15 - 16 foot depth in Boring No II - 2. The results are shown on Enclosure No 15. The C_c value is about half of that found for Site No I.

The safe bearing capacity in view of the shear strength of approximately 1700 psf can be determined in a fashion similar to that given for Site No I. The depth of the foundation would have to be at least 5 feet below the creek bed, or Elevation 653 feet, since the construction of the bridge will result in a reduction of the flow cross-section of the stream, particularly during the Spring, and the increased current velocity may lead to deep erosion. If a narrow span is planned, a more detailed scour investigation may be required.

A calculation identical to that used for Site No I leads to a safe bearing capacity of 4300 psf, using a factor of safety of 3 against shear failure. The settlements under this load for a 10 foot wide footing would be of the order of $4\frac{1}{2}$ inches however, and the safe bearing load would have to be reduced to 2000 psf for an allowable settlement of one inch. The latter value will increase by about 60 psf per foot depth below Elevation 653 feet. Below Elevation 645 feet the safe bearing capacity will increase from 2500 psf to 5 tons per square foot at Elevation 635 feet.

If the above allowable footing load is too low, the bridge could be founded on piers or short piles at approximate Elevation 635 feet. The former could be loaded safely to about 6 tons per square foot; piles driven about one foot into the dense layer could be loaded to their maximum value, depending on the type of pile used.

Reference: S-500/T-1207

10 July, 1958

- Continued -

Settlements under the 8 foot high embankment will be of the order of 6 to 7 inches. Based on the consolidation results a 90% consolidation can be expected to take place in about one year to 15 months.

Conclusions regarding Site II are summarised as follows :

1. Subsoil strata consist of 5 feet of loose sand, 25 feet of medium stiff to stiff very silty clay till, and very dense sand and gravel.
2. Bridge foundations should not be constructed above Elevation 653 feet. Safe bearing capacity of a 10 feet wide footing at that depth is 2000 psf, based, once again, on settlement considerations.
3. Consolidation settlements under the 8 foot embankment will be about 7 inches in 1 to $1\frac{1}{4}$ year.

Reference: S-500/T-1207

10 July, 1958

- Continuation -

SITE NO III :

At this site a diversion of the creek is projected, with a bridge across it. The site is located on a stretch of very flat land, at approximate Elevation 665 feet, which is flooded at periods of high water. At the time of the borings the field was seeded, and only Borings No III - 1, III - 2 and III - 3, could be carried out. It is felt, however, that the results of these three borings can be considered representative of the site conditions.

At each boring approximately 10 feet of loose, sandy creek deposits cover the same till layer as found on Sites No I and II. The silty clay till layer here is only about 8 feet thick, and below this a very dense sand and gravel layer begins.

Excavation for a creek diversion in the loose silty sand may cause some difficulties. The ground water table corresponds closely with the water level in the creek, and slope retention measures will be required. The extent of these will depend on the proposed width of the channel. The excavated soil cannot be considered a favourable source of material for embankment construction. After completion of the channel some permanent forms of slope protection will be required, particularly on both sides of the new bridge.

Bridge footings on the clay till layer at approximate Elevation 654 feet can safely support about 2000 psf on a 10 foot wide footing, with a maximum settlement of one inch. This value increases to 2500 psf at Elevation 650 feet, and to 5 tons per square foot at Elevation 646 feet.

The silt content of the top 10 feet is not high enough to endanger the stability of this layer under the 10 - 18 foot high embankment. The embankment fill will be applied over an appreciable period of time, and the silty sand layer will be subject to some immediate settlements due to the fill loading. Consolidation settlements in the clay till layer will be of the order of $3\frac{1}{2}$ inches and less over a period of about 6 months.

Summarised conclusions for Site III :

1. Subsoil strata comprise 10 feet of loose sand, 8 feet of silty clay till and very dense sand and gravel.
2. Some excavation difficulties should be anticipated with the proposed creek diversion.

Reference: S-500/T-1207

10 July, 1958

- Continued -

3. Safe bearing capacity for a 10 foot wide footing at Elevation 654 feet would be 2000 psf, at Elevation 650 feet 2500 psf, and at Elevation 646 feet 10,000 psf.
4. Consolidation settlements under 18 foot high embankment would be about $3\frac{1}{2}$ inches in six months' time.

Reference: S-500/T-1207

10 July, 1958

- Continued -

SITE NO IV :

The proposed highway line will roughly follow the direction of an existing gravel road between Stations No 10 + 00 and 4 + 00. The gravel road interrupts the slope from Talbot Street downwards to the Kettle Creek. It is rather narrow and steep, and additional fill up to 30 feet high will be required. In view of this it was thought advisable to carry out a slope stability analysis on the cross-section which would exist after the construction of the highway at what may be considered a representative section, Station 6 + 00. Since no cross-section could be obtained of the existing situation, it has been assumed from the observations on the site, that the natural slope is $1\frac{1}{2}$ to 1, from which a schematic cross-section at the above Station is drawn on Enclosure No 16. It may be anticipated that the soil conditions at this location are identical to those found at Boring No IV - 1, at Station 7 + 68. This boring was taken down from Elevation 710 feet to Elevation 635 feet. Apart from about 6 feet of fill below the surface of the gravel road, a layer of stiff clay till extends down to Elevation 655 feet, below which a hard sand and gravel till begins. On the cross-section sketch it is assumed that the slope above the gravel road to the existing highway consists of the same clay till which was found below the road. The width of the proposed new embankment and the presence of the hard sand and gravel layer at Elevation 655 feet make a slip failure a remote possibility. Coarse material should be used in the embankment and drainage tiles should be provided between the embankment and till layer, to prevent seepage into the till layer and subsequent softening of this soil.

When cross-sections of this stretch of road are obtained, they should be checked against Enclosure No 16. If steeper natural slopes are found than those sketched, a detailed stability analysis will be required.

The settlements under the embankment load will vary considerably both in each cross-section and over the length of this stretch of road. The till appears to be somewhat more clayey than on Sites No II and No III, and the coefficient of compressibility of 0.2 may be anticipated. The fill load being as high as 30 feet above the gravel road, settlements of the order of 2 feet will have to be expected. It would be most advisable, therefore, to bring on as much fill as possible at an early stage of construction, so that consolidation can proceed before more rigid structures are built.

- 10 -

Reference: S-500/T-1207

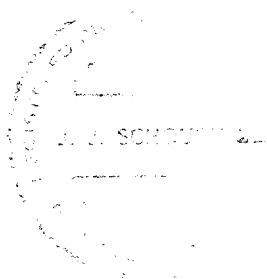
10 July, 1958

- Continued -

SUMMARY :

The results of the complete series of investigations for the proposed road improvement can be summarised as follows :

1. At each site the same clay till soil was found at a depth that would have been suitable for the foundations of the different bridges, but for the compressible nature of this soil. It may be assumed, therefore, that this layer cannot be evaded by re-location of the proposed structures.
2. The compressibility of the clay till layer is an unfavourable factor with regard to the different proposed embankments of appreciable heights. An early start with the construction of the latter would appear to be advisable.
3. At each site, the clay till is underlain by a very dense sand and gravel till, which forms an excellent base for deep footings, pier or pile foundations.



J. J. Schoustra, P.Eng.,

JJS/YDP

RACEY MacCALLUM AND ASSOCIATES LTD.

Foundation Engineering Division

Engineering Data Sheet for Borehole: I - 1

Project: Highways No. 3 and No. 4 Improvements,

Location: St. Thomas, Ontario,

Hole Location: See Enclosure No. 1

Hole Elevation and Datum: 672.4 Ft. M.S.L.

Field Supervisor: H.G. Prep.: J.S.

Driller: M.C. Checked: J.S.

Date: 18/6/58

LEGEND

Shear Strength (C)

Unconfined compression

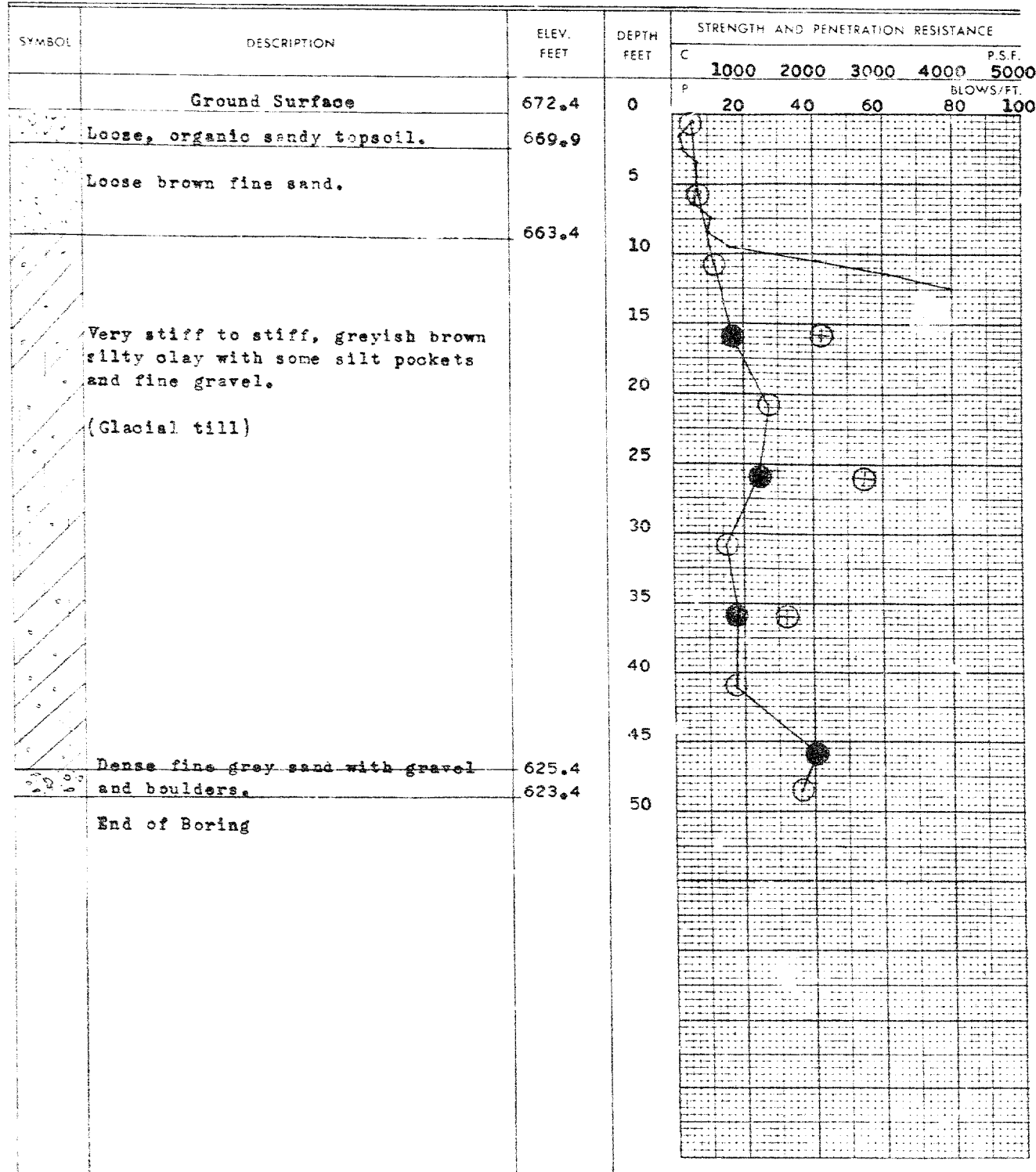
Vane test and sensitivity (S)

Penetration Resistance (P)

2" Split tube

2" Dia. Cone

Casing

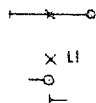
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⊕

RACEY MacCALLUM AND ASSOCIATES LTD.

Foundation Engineering Division

Engineering Data Sheet for Borehole: **I - 1****LEGEND****Consistency**

Natural moisture and
Liquidity Index (LI)
Liquid limit
Plastic limit

**Sampling Method**

2" Dia. split tube



2" Shelby tube



DEPTH FEET	CONSISTENCY				SAMPLE	NATURAL UNIT WT. P.C.F.	REMARKS
	MOISTURE CONTENT, % DRY WEIGHT						
0	10	20	30	40			
					1		
5					2		
10					3		
15					4	124	
20					5		
25					6	125	
30					7		
35					8	119	
40					9		
45					10		
50					11		

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Foundation Engineering Division

Engineering Data Sheet for Borehole: **I - 2**Project: **Highways No. 3 and No. 4 Improvements,**Location: **St. Thomas, Ontario,**Hole Location: **See Enclosure No. 1**Hole Elevation and Datum: **677.8 Ft. M.S.L.**Field Supervisor: **H.G.** Prep.: **J.S.**Driller: **M.C.** Checked: **J.S.** Date: **18/6/58****LEGEND**

Shear Strength (C)

Unconfined compression

Vane test and sensitivity (S)

Penetration Resistance (P)

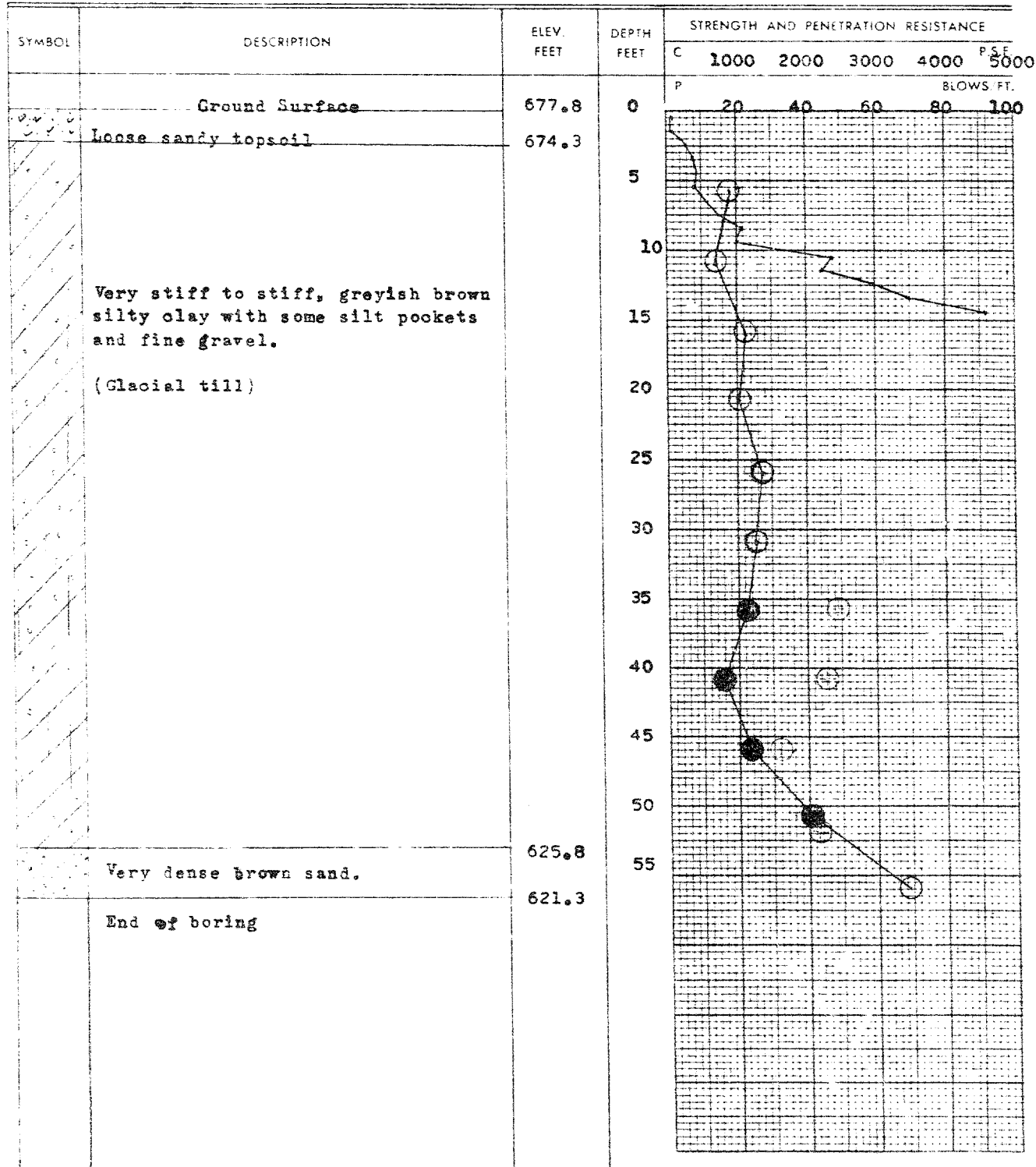
2" Split tube

2" Dia. Cone

Casing

⊕
+s

⊕ ⊕ ⊕



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Foundation Engineering Division

Engineering Data Sheet for Borehole: **I - 2****LEGEND****Consistency**

Natural moisture and
Liquidity Index (LI)
Liquid limit
Plastic limit



x LI

**Sampling Method**

2" Dia. split tube



2" Shelby tube



DEPTH FEET	CONSISTENCY				SAMPLE	NATURAL UNIT WT. P.C.F.	REMARKS
	MOISTURE CONTENT	%	DRY WEIGHT				
0	10	20	30	40			
5					1		
10					2		
15					3		
20					4		
25					5		
30					6		
35					7	125	
40					8	117	
45					9	116	
50					10	122	
					11		

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Foundation Engineering Division

Engineering Data Sheet for Borehole: **I - 3**

Project: Highway No. 3 and No. 4 Improvements,

Location: St. Thomas, Ontario,

Hole Location: See Enclosure No 1,

Hole Elevation and Datum: 677.4 Ft. M.S.L.

Field Supervisor: H.G. Prep.: J.S.

Driller: M.C. Checked: J.S.

Date: 18/6/58

LEGEND

Shear Strength 'C'

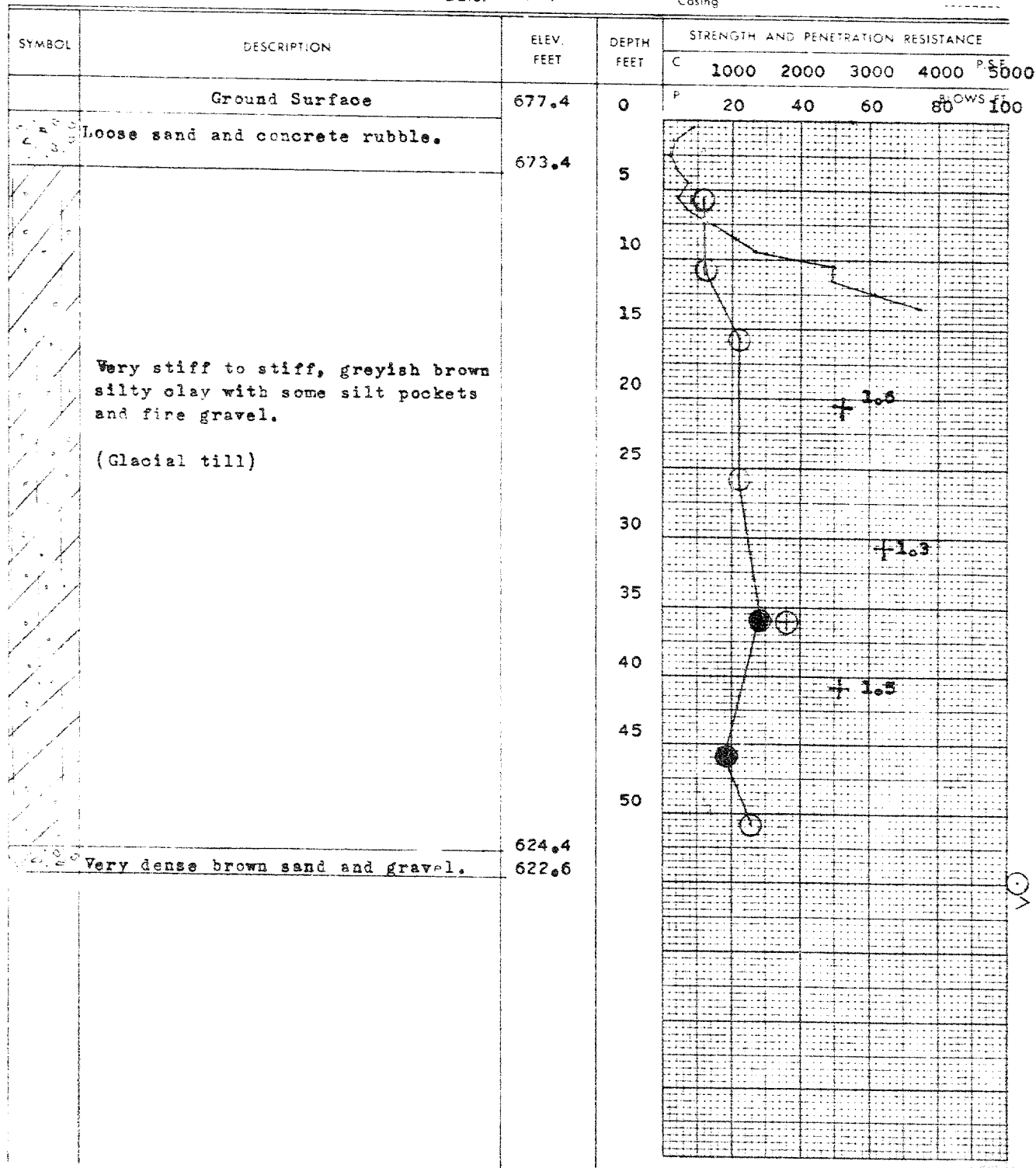
Unconfined compression
Vane test and sensitivity (S)

Penetration Resistance (P)

2" Split tube

2" Dia. Cone

Casing

⊕
+S⊕
⊕
⊕

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Foundation Engineering Division

Engineering Data Sheet for Borehole: I - 3

LEGEND

Consistency

Natural moisture and
Liquidity Index (LI)

Liquid limit

Plastic limit

Sampling Method

2" Dia. split tube

2" Shelby tube

[illegible]

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Foundation Engineering Division

Engineering Data Sheet for Cone test **II - 1**Project: Improvements Highways No. 3 and No. 4Location: St. Thomas, Ontario,Hole Location: See Enclosure No. 1Hole Elevation and Datum: 665.0 Ft. M.S.L.Field Supervisor: H.G. Prep.: J.S.Driller: M.C. Checked: J.S.Date: 18/6/58**LEGEND**

Shear Strength (C)

Unconfined compression
Vane test and sensitivity (S)

Penetration Resistance (P)

2" Split tube

2" Dia. Cone

Casing

⊕
+S

⊕ ⊕

SYMBOL	DESCRIPTION	ELEV. FEET	DEPTH FEET	STRENGTH AND PENETRATION RESISTANCE				
				C	1000	2000	3000, 4000	5000
	Ground Surface	665.0	0	P	20	40	60	80 100
	Drove 2" diameter cone		5					
			10					
	Refusal at 16 Ft.	649.0	15					

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Foundation Engineering Division

Engineering Data Sheet for Borehole: II - 2

Project: Highways No. 3 and No. 4 Improvements,

Location: St. Thomas, Ontario,

Hole Location: See Enclosure No. 1

Hole Elevation and Datum: 664.8

Field Supervisor: H.G. Prep.: J.S.

Driller: M.C. Checked: J.S.

Date: 18/6/58

LEGEND

Shear Strength (C)

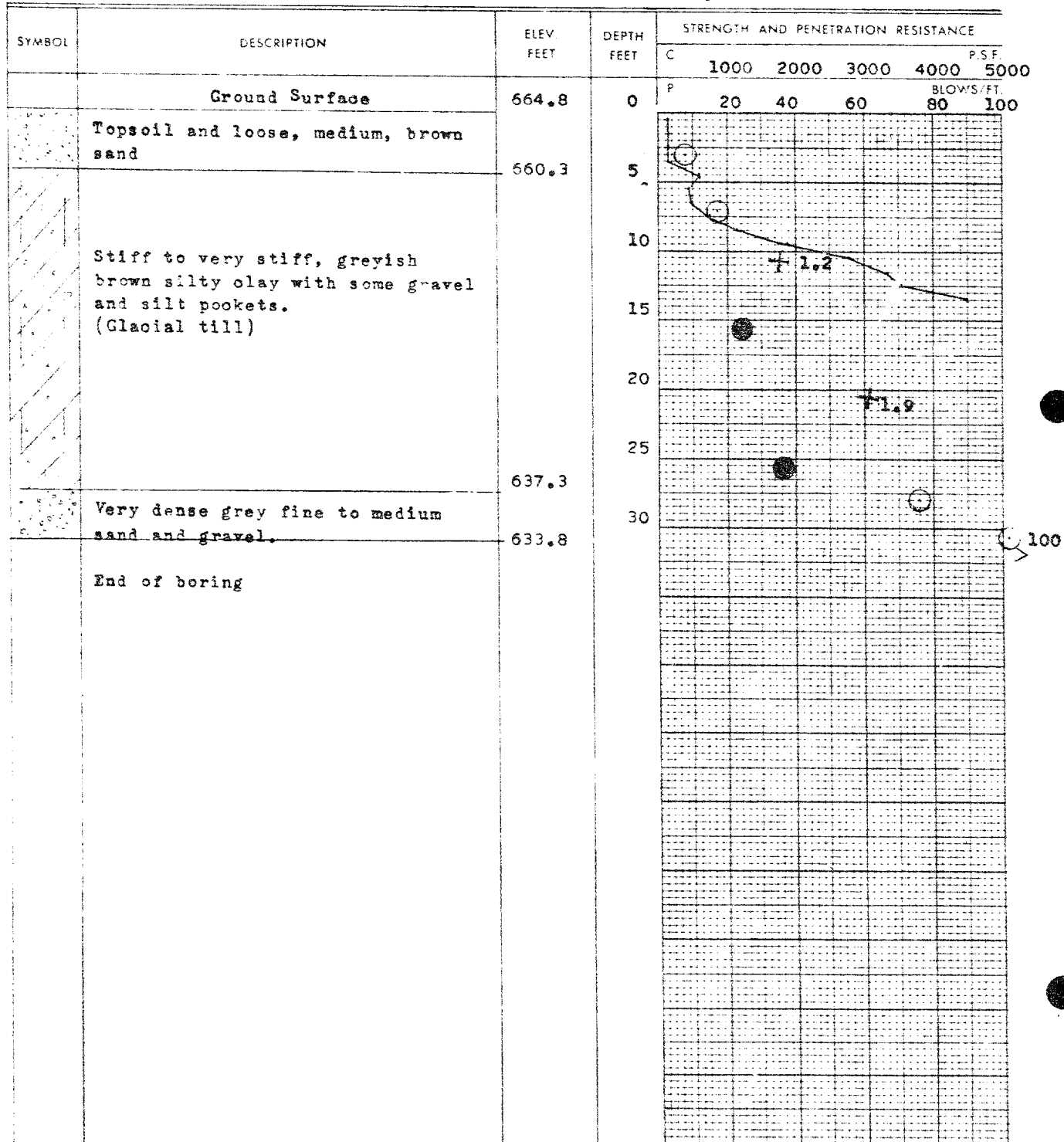
Unconfined compression
Vane test and sensitivity (S)

Penetration Resistance (P)

2" Split tube

2" Dia. Cone

Casing

⊕
+S⊕
⊕

RACEY MacCALLUM AND ASSOCIATES LTD.

Foundation Engineering Division

Engineering Data Sheet for Borehole: II - 2

LEGEND

Consistency

Natural moisture and
Liquidity Index (LI)

Liquid limit

Plastic limit



\times 4



Sampling Method

2" Dia. split tube

2" Shelby tube



DEPTH FEET	CONSISTENCY		SAMPLE	NATURAL UNIT WT. P.C.F.	REMARKS
	MOISTURE CONTENT, % DRY WEIGHT				
0	10	20	30	40	
5					1
10					2
15					3
20					
25					4
30					5
					6

Sample lost and retaken by split spoon.

RACEY MacCALLUM AND ASSOCIATES LTD.

Foundation Engineering Division
 Engineering Data Sheet for ~~Basehole~~ **Cone test II - 3**

Project: **Highways No. 3 and No. 4 Improvements,**Location: **St. Thomas, Ontario,**Hole Location: **See Enclosure No. 1**Hole Elevation and Datum: **665.2 Ft. M.S.L.**Field Supervisor: **H.G.** Prep.: **J.S.**Driller: **M.C.** Checked: **J.S.** Date: **18/6/58****LEGEND**

Shear Strength (C)

Unconfined compression

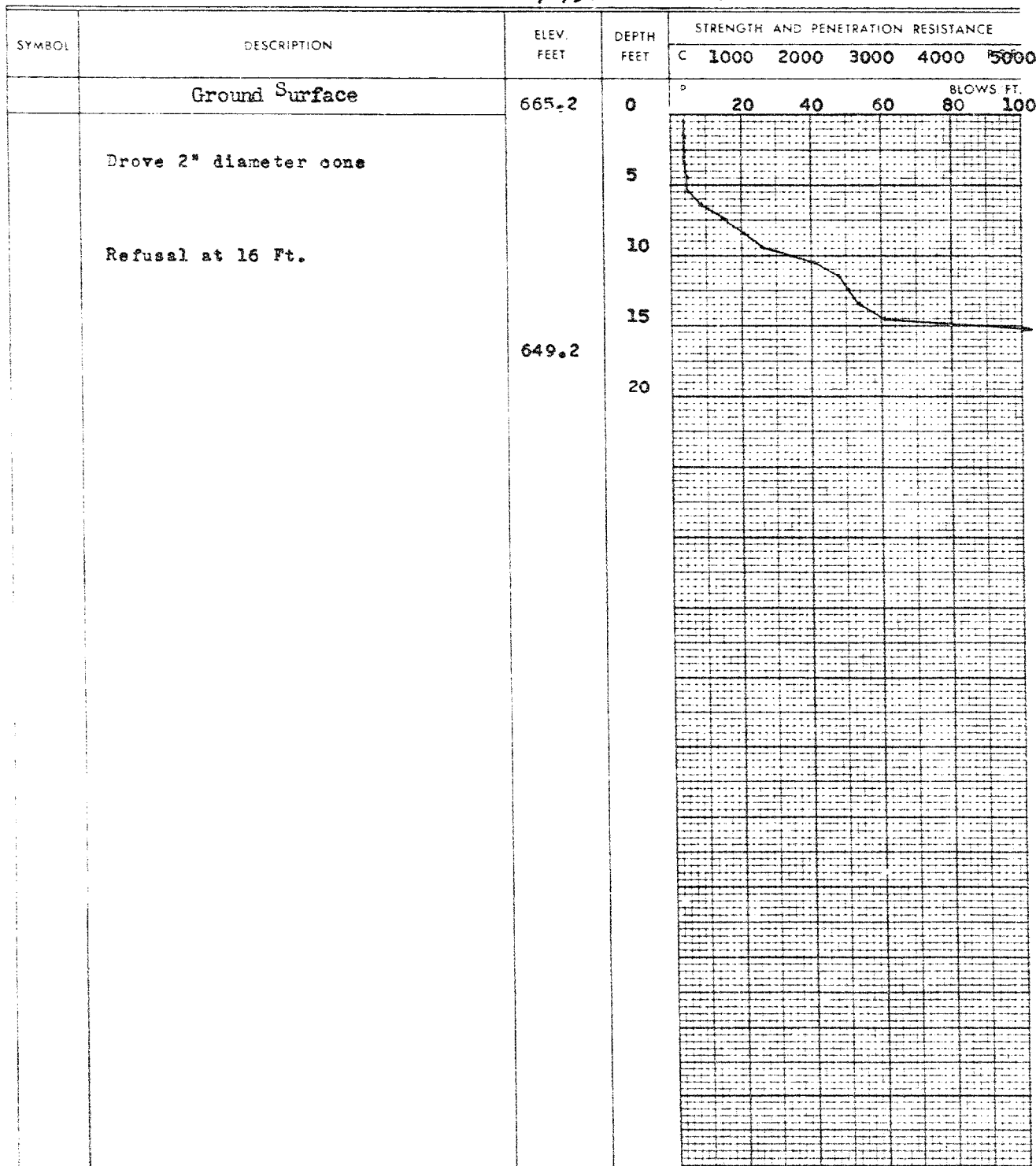
Vane test and sensitivity (S)

Penetration Resistance (P)

2" Split tube

2" Dia. Cone

Casing

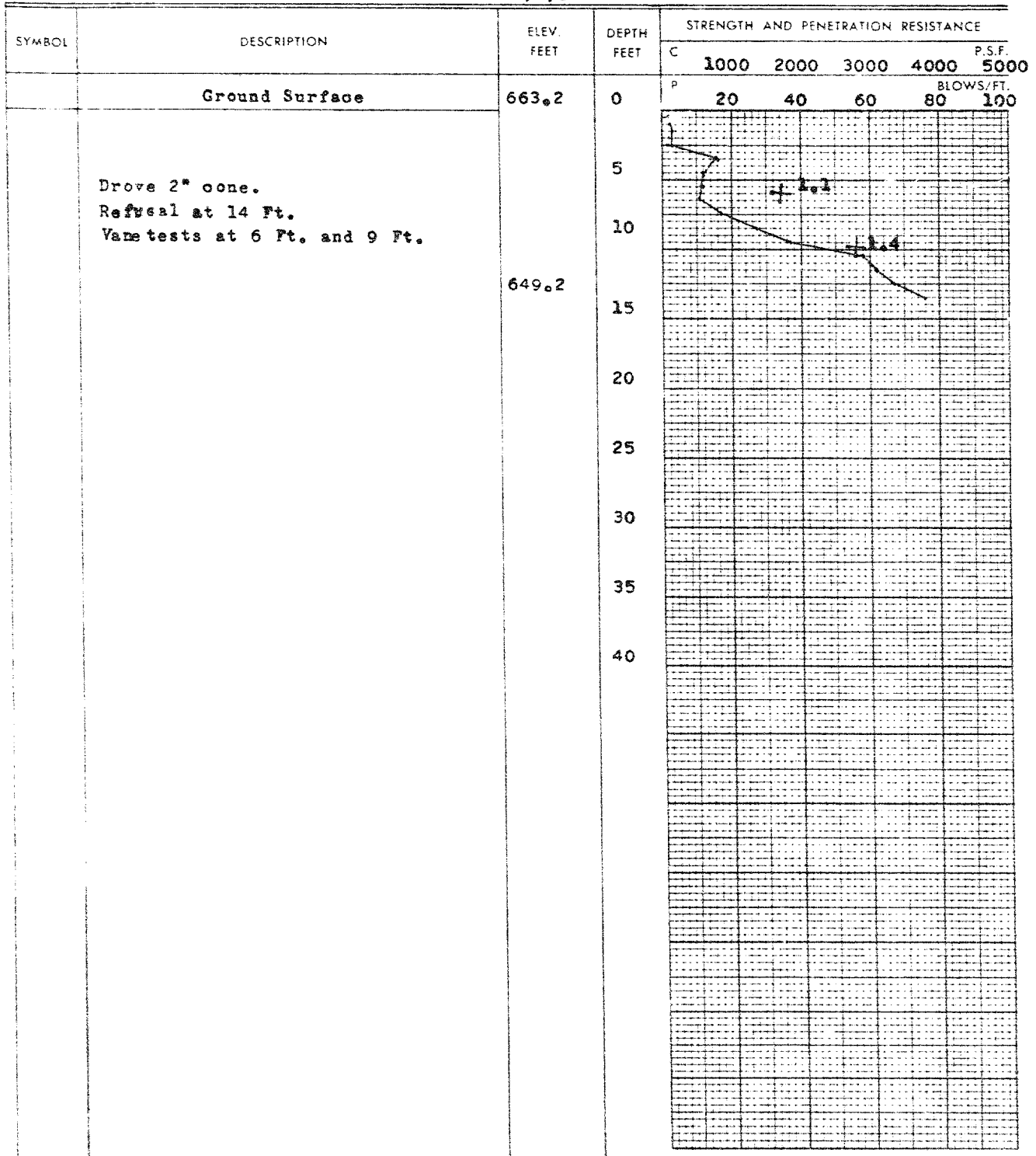
⊕
+s

RACEY MacCALLUM AND ASSOCIATES LTD.

Foundation Engineering Division

Engineering Data Sheet for Borehole: **II - 4**Project: **Highways No. 3 and No. 1 Improvements,**Location: **St. Thomas, Ontario,**Hole Location: **See Enclosure No. 1**Hole Elevation and Datum: **663.2 Ft. M.S.L.**Field Supervisor: **H.G. Prep.: J.S.**Driller: **M.C. Checked: J.S.**Date: **18/6/58****LEGEND****Shear Strength (C)**Unconfined compression
Vane test and sensitivity (S)**Penetration Resistance (P)**2" Split tube
2" Dia. Cone
Casing⊕
+5

⊕ ⊕



RACEY MacCALLUM AND ASSOCIATES LTD.

Foundation Engineering Division

Engineering Data Sheet for Borehole: **II - 5**Project: **Highway No. 3 and No. 4 Improvements,**Location: **St. Thomas, Ontario,**Hole Location: **See Enclosure No. 1**Hole Elevation and Datum: **663.6 Ft. M.S.L.**Field Supervisor: **H.G.** Prep.: **J.S.**Driller: **M.C.** Checked: **J.S.** Date: **18/6/58****LEGEND**

Shear Strength (C)

Unconfined compression

Vane test and sensitivity (S)

Penetration Resistance (P)

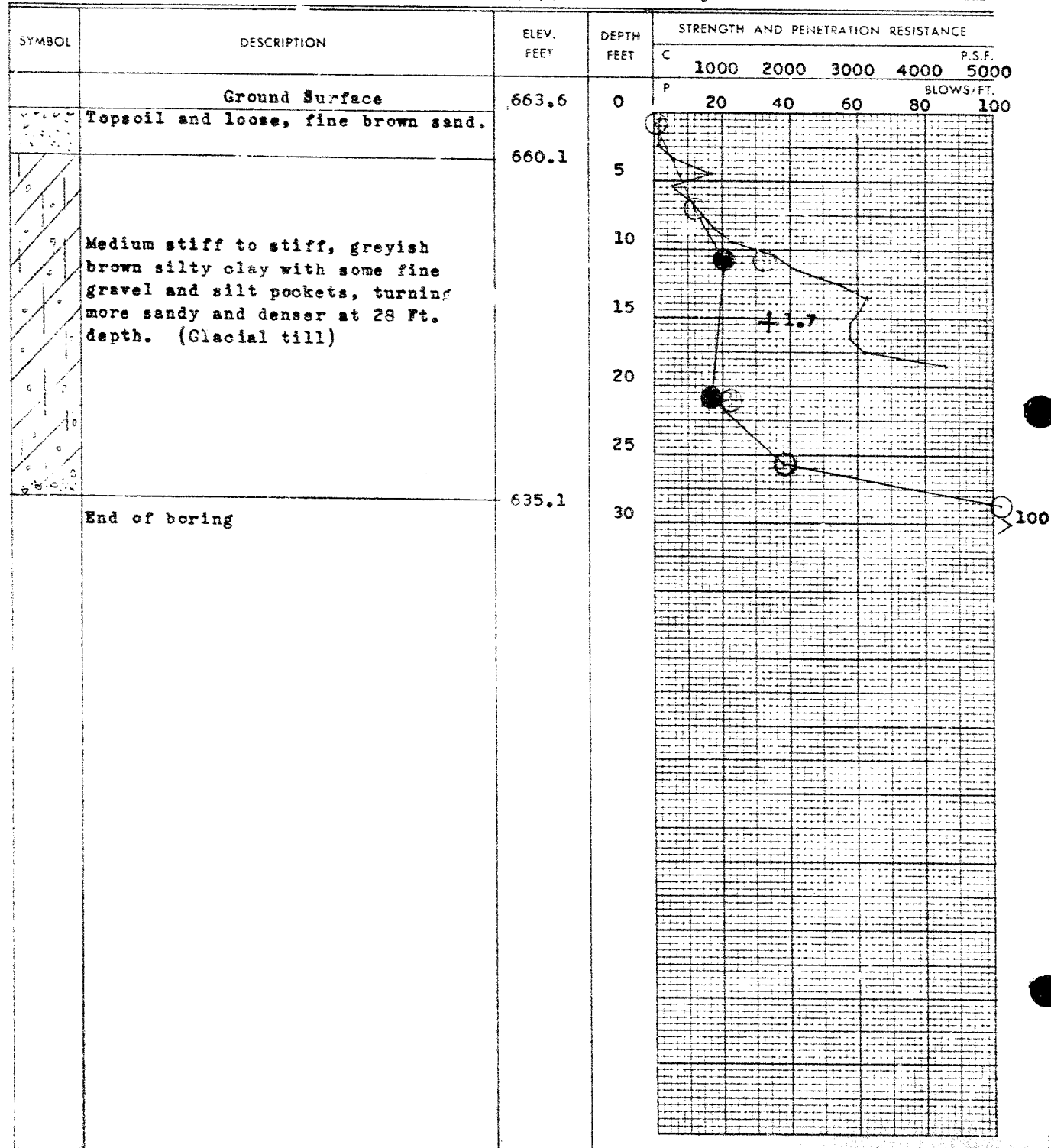
2" Split tube

2" Dia. Cone

Casing

⊕
+S

⊕ ⊕



RACEY MacCALLUM AND ASSOCIATES LTD.

Foundation Engineering Division

Engineering Data Sheet for Borehole: II - 5

LEGEND

Consistency

Natural moisture and

Liquidity Index (LI)

Liquid limit

Plastic limit



X Li



Sampling Method

2" Dia. split tube



2" Shelby tube



DEPTH FEET	CONSISTENCY				SAMPLE	NATURAL UNIT WT. P.C.F.	REMARKS
	MOISTURE CONTENT, % DRY WEIGHT						
0	10	20	30	40			
					1		
5					2		
10					3	131	
15							
20							
25					4	128	
30					5		
35					6		

RACEY MacCALLUM AND ASSOCIATES LTD.

Foundation Engineering Division

Engineering Data Sheet for Core test II - 3Project: Highways No. 3 and No. 4 Improvements,Location: St. Thomas, Ontario,Hole Location: See Enclosure No. 1Hole Elevation and Datum: 664.3 Ft. M.S.L.Field Supervisor: H.G. Prep.: J.S.Driller: M.C. Checked: J.S.Date: 18/6/58**LEGEND**

Shear Strength (C)

Unconfined compression

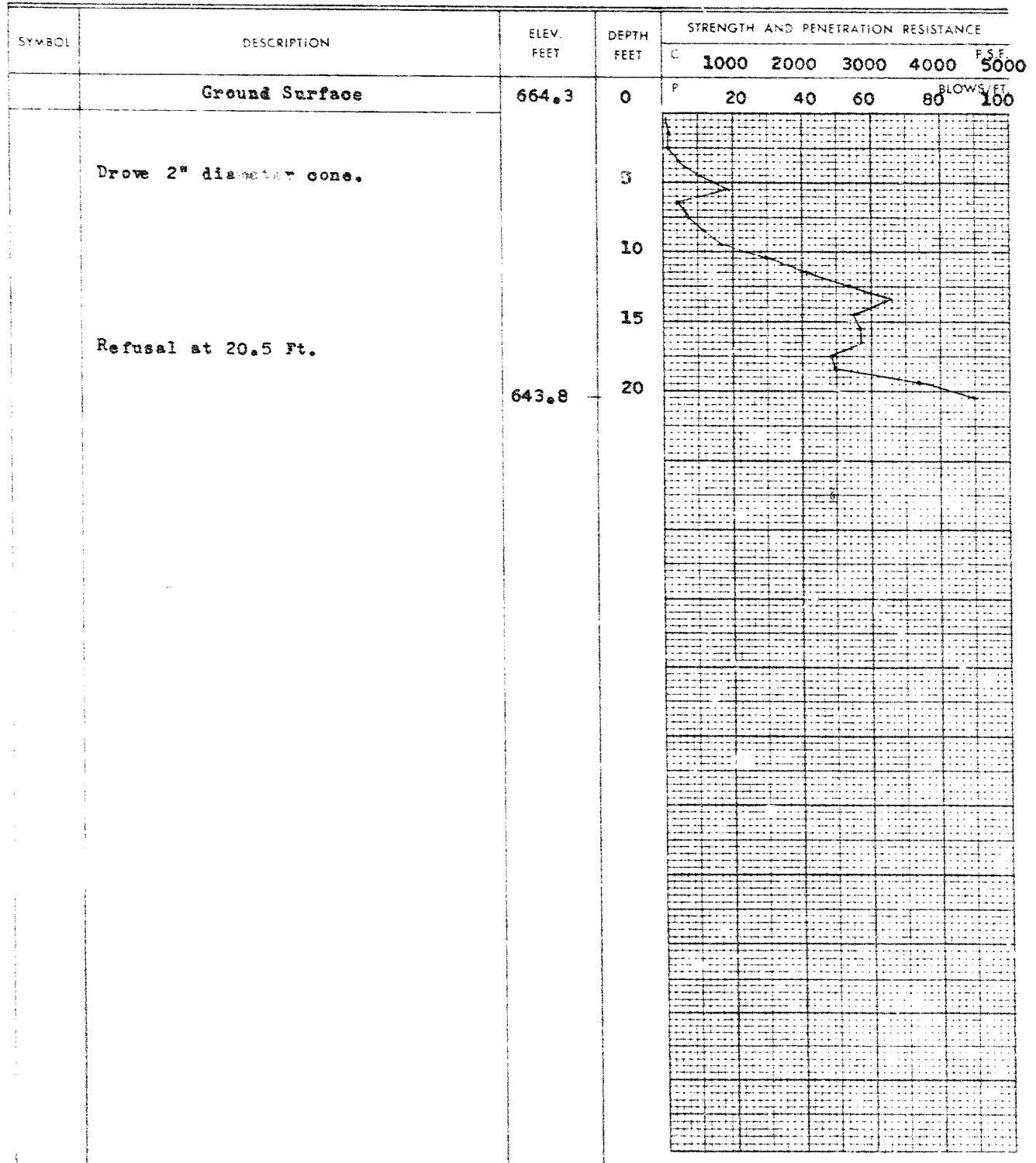
Vane test and sensitivity (S)

Penetration Resistance (P)

2" Split tube

2" Dia. Cone

Casing



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Foundation Engineering Division

Engineering Data Sheet for Borehole: **III - 1**Project: **Highways No. 3 and No. 4 Improvements,**Location: **St. Thomas, Ontario,**Hole Location: **See Enclosure No. 1**Hole Elevation and Datum: **665.0 Ft. M.S.L.**Field Supervisor: **H.G.** Prep.: **J.S.**Driller: **M.C.** Checked: **J.S.**Date: **18/6/58****LEGEND**

Shear Strength (C)

Unconfined compression

Vane test and sensitivity (S)

Penetration Resistance (P)

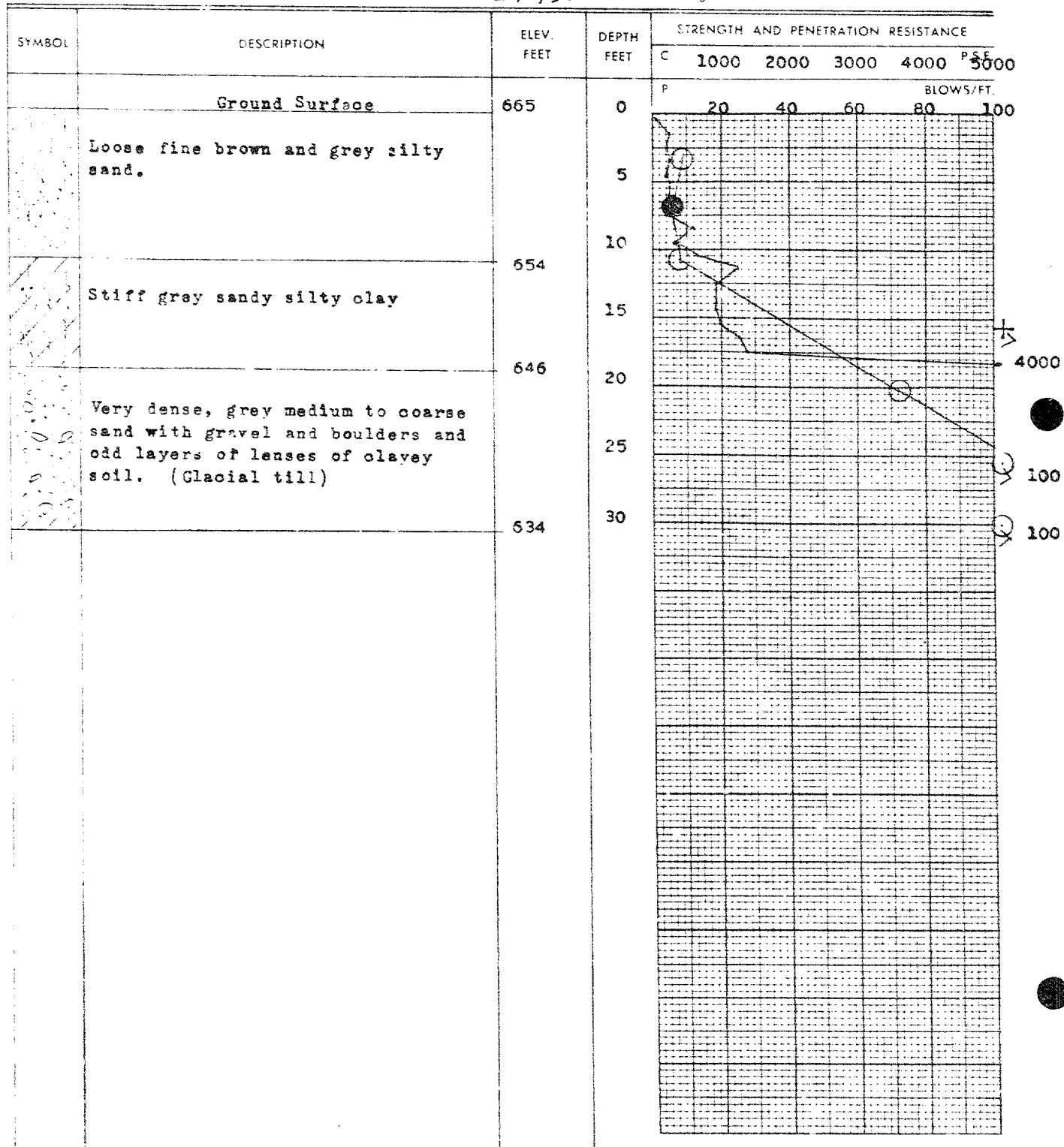
2" Split tube

2" Dia. Cone

Casing

⊕
+s

⊕ ⊕



RACEY MacCALLUM AND ASSOCIATES LTD.

Foundation Engineering Division

Engineering Data Sheet for Borehole: III - 1

LEGEND

Consistency

Natural moisture and

Liquidity Index (LI)

Liquid limit

Plastic limit

—*—

✱

4

Sampling Method

2" Dia. split tube

2' Shelby tube

[illegible]

RACEY MacCALLUM AND ASSOCIATES LTD.

Foundation Engineering Division

Engineering Data Sheet for Borehole: III - 2

Project: Highways No. 3 and No. 4 Improvements,

Location: St. Thomas, Ontario,

Hole Location: See Enclosure No. 1

Hole Elevation and Datum: 665 Ft. M.S.L.

Field Supervisor: H.G. Prep.: J.S.

Driller: M.C. Checked: J.S. Date: 18/6/58

LEGEND

Shear Strength (C)

Unconfined compression

Vane test and sensitivity (S)

Penetration Resistance (P)

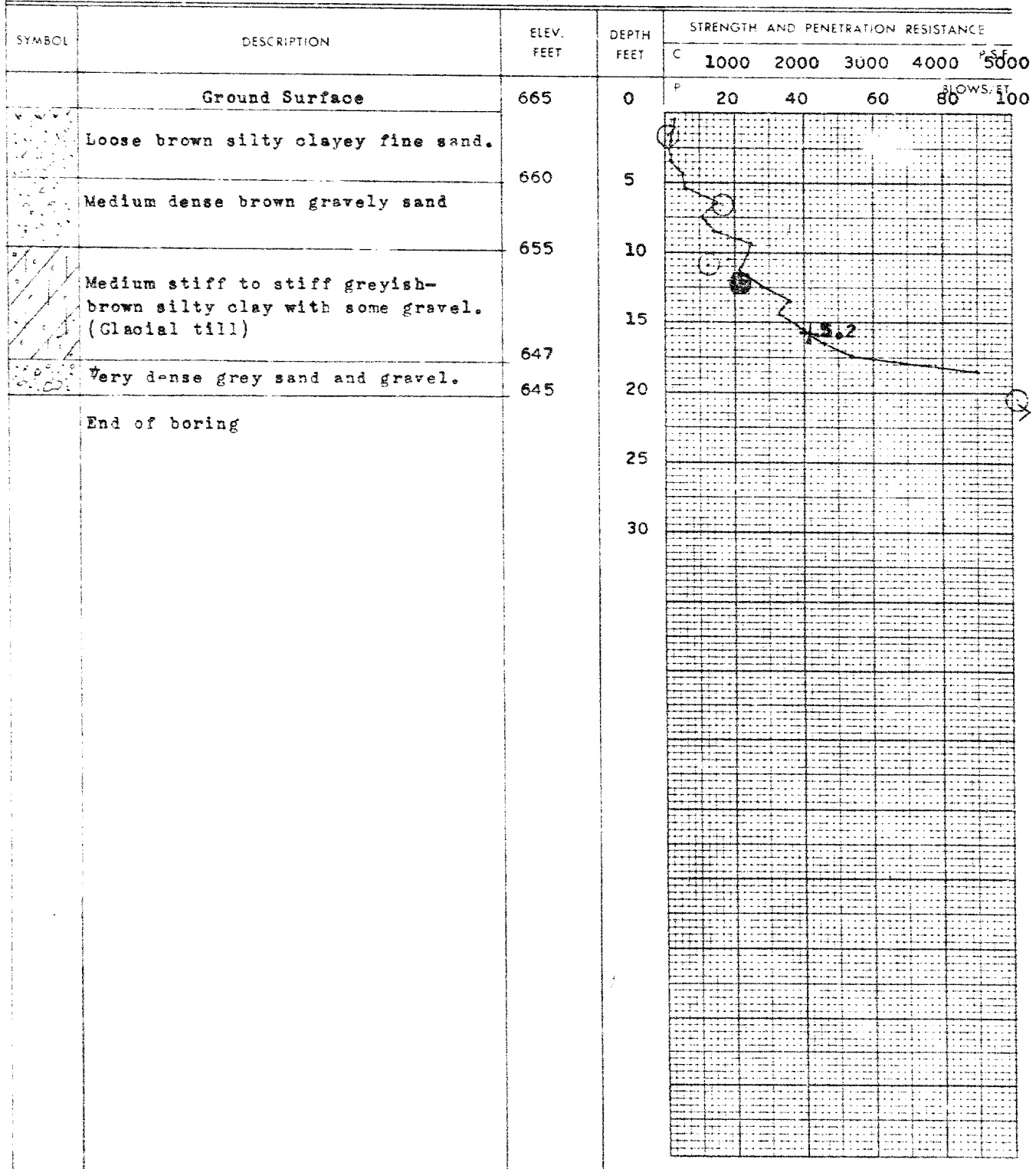
2" Split tube

2" Dia. Cone

Casing

⊕
+S

⊕ ⊕ ⊕



RACEY MacCALLUM AND ASSOCIATES LTD.

Foundation Engineering Division

Engineering Data Sheet for Borehole: III - 2

LEGEND

Consistency

Natural moisture and

Liquid:

Liquid limit
Plastic limit



X LI



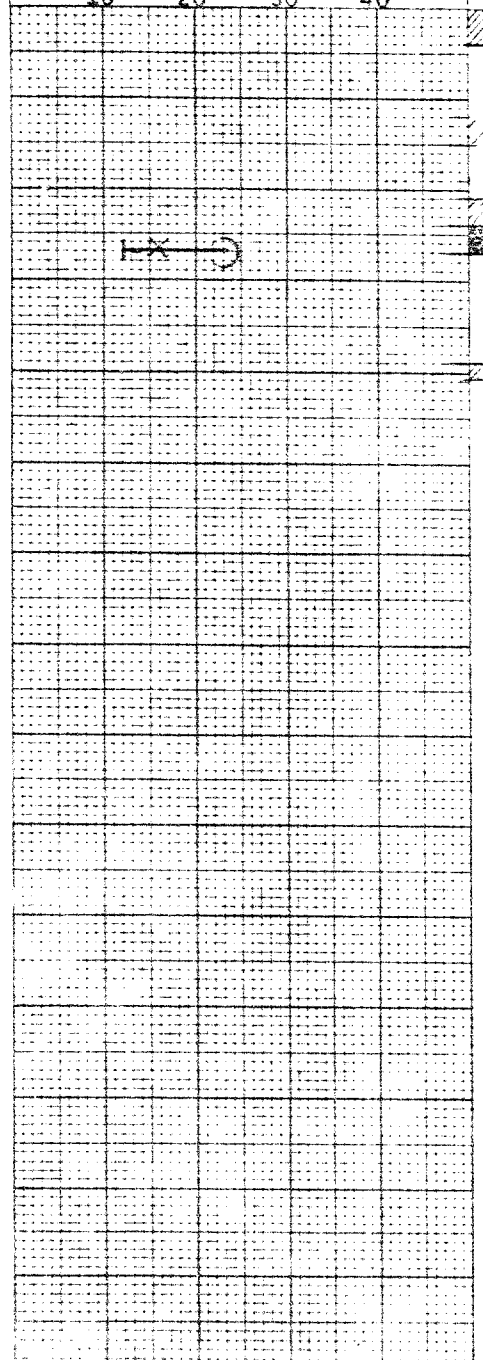
Sampling Method

2" Dia. split tube



2" Shelby tube



DEPTH FEET	CONSISTENCY		SAMPLE	NATURAL UNIT WT. P.C.F.	REMARKS
	MOISTURE CONTENT, % DRY WEIGHT				
	10	20	30	40	
					
5					
10					
15					
20					
25					

RACEY MacCALLUM AND ASSOCIATES LTD.

Foundation Engineering Division

Engineering Data Sheet for Borehole: **III - 3**Project: **Highways No. 3 and No. 4 Improvements,**Location: **St. Thomas, Ontario,**Hole Location: **See Enclosure No. 1**Hole Elevation and Datum: **665 Ft. M.S.L.**Field Supervisor: **H.G.** Prep.: **J.S.**Driller: **M.C.** Checked: **J.S.**Date: **18/6/58****LEGEND**

Shear Strength (C)

Unconfined compression

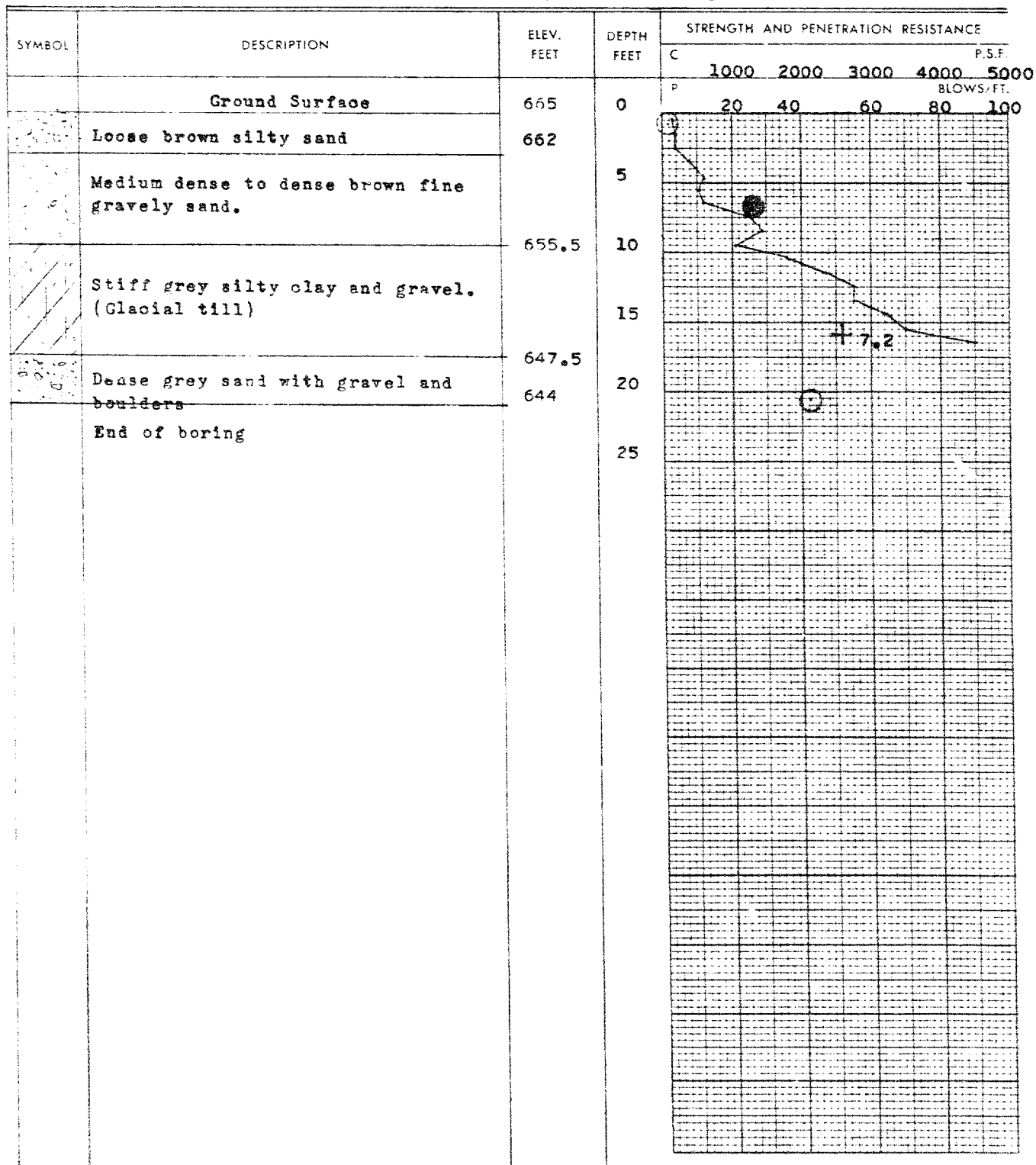
Vane test and sensitivity (S)

Penetration Resistance (P)

2" Split tube

2" Dia. Cone

Casing

⊕
+5

RACEY MacCALLUM AND ASSOCIATES LTD.

Foundation Engineering Division

Engineering Data Sheet for Borehole: **EV - 1**

Project: Highways No. 3 and No. 4 Improvements,

Location: St. Thomas, Ontario.

Hole Location: See Enclosure No. 1

Hole Elevation and Datum: 710 Ft. approx.

Field Supervisor: H.G. Prep.: J.S.

Driller: M.C. Checked: J.S.

Date: 18/6/58

LEGEND

Shear Strength (C)

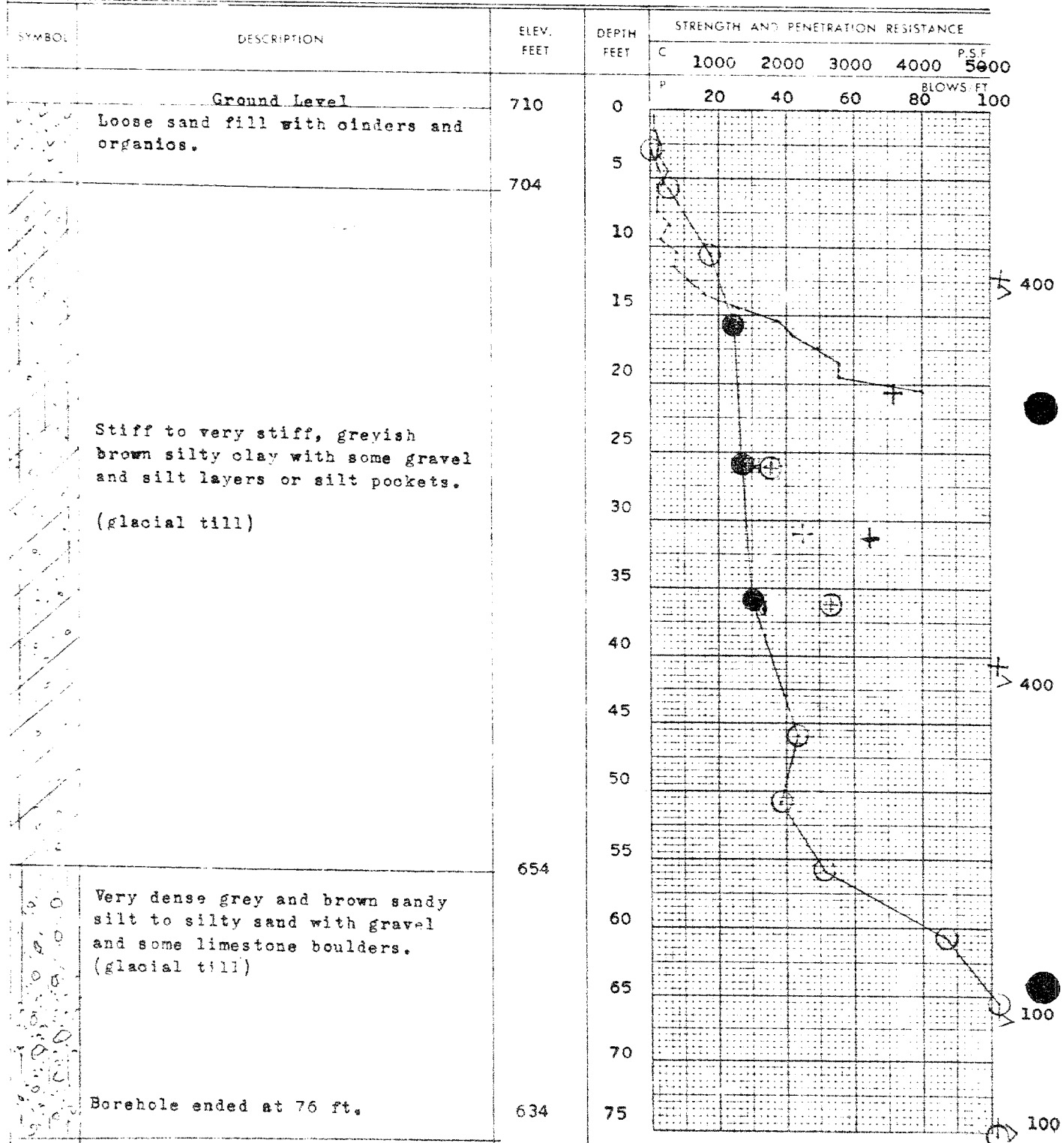
Unconfined compression
Vane test and sensitivity (S)

Penetration Resistance (P)

2" Split tube

2" Dia. Cone

Casing

⊕
+S⊕
⊕
⊕

RACEY MacCALLUM AND ASSOCIATES LTD.

Foundation Engineering Division

Engineering Data Sheet for Borehole: IV - 1**LEGEND****Consistency**

Natural moisture and
Liquidity Index (LI)
Liquid limit
Plastic limit

—*—○
× LI
—○
—

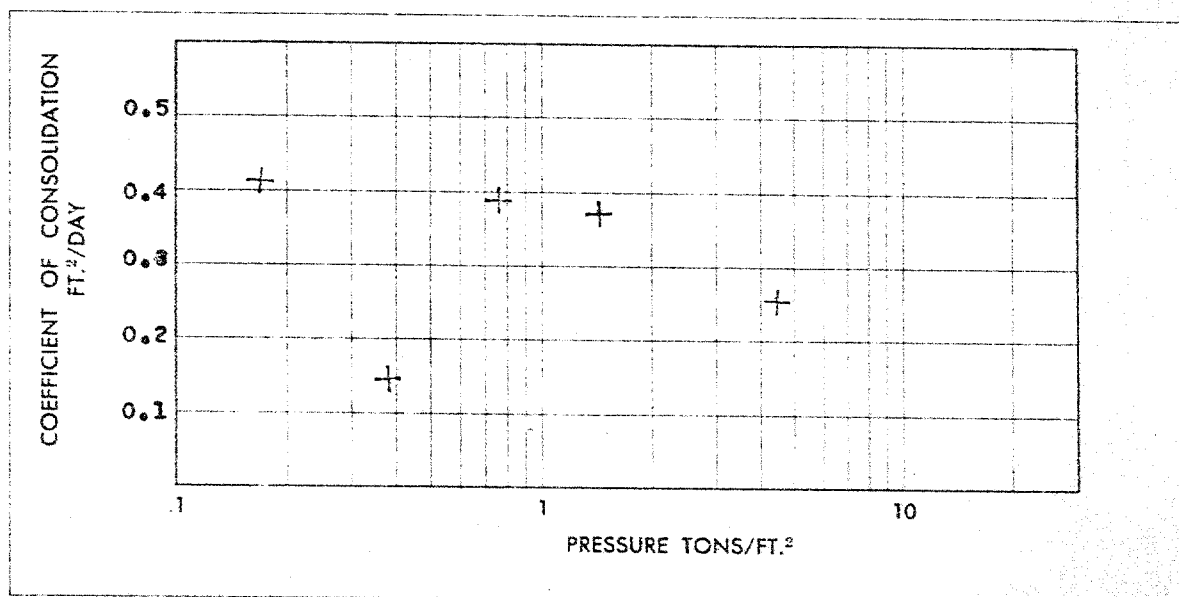
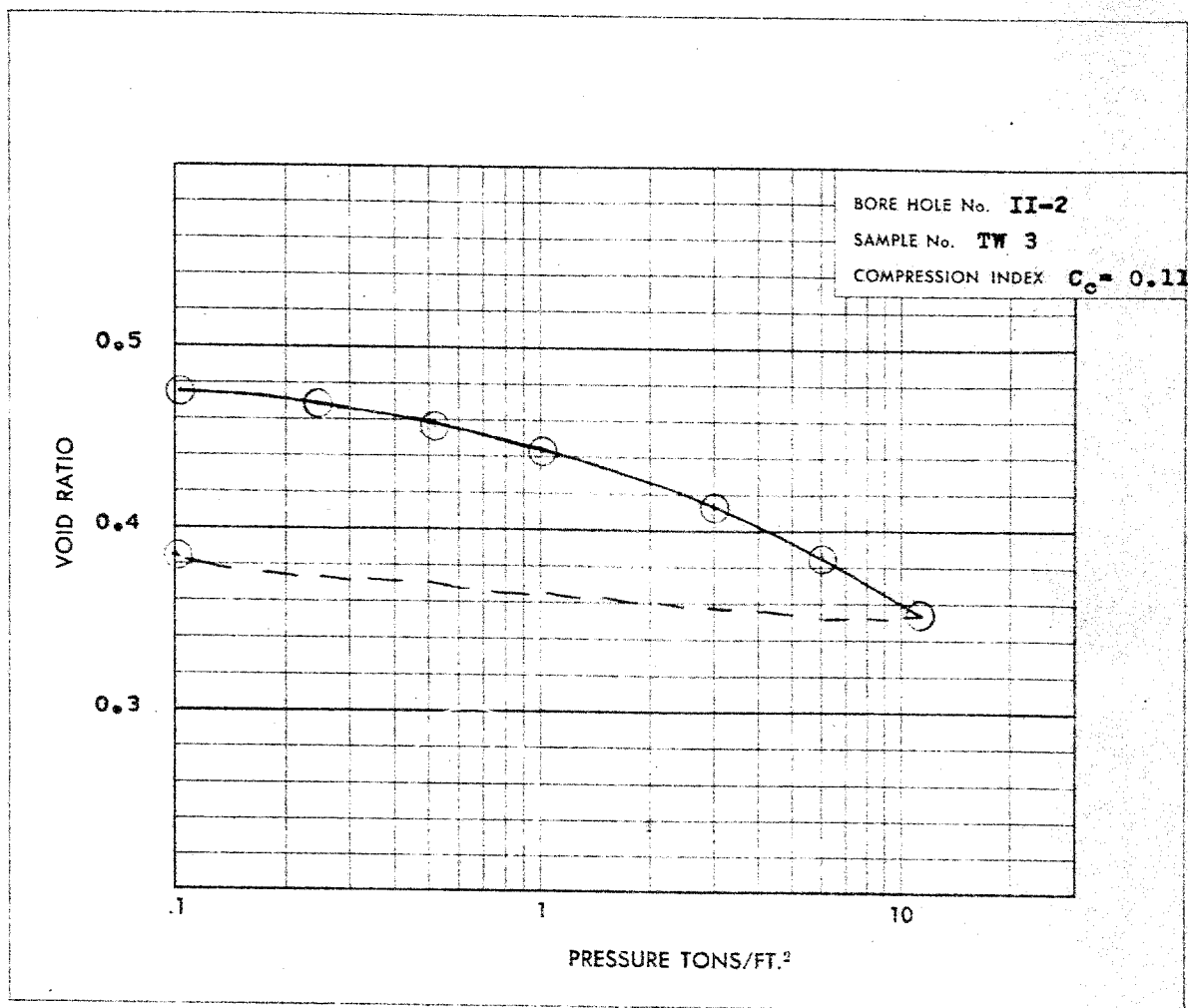
Sampling Method

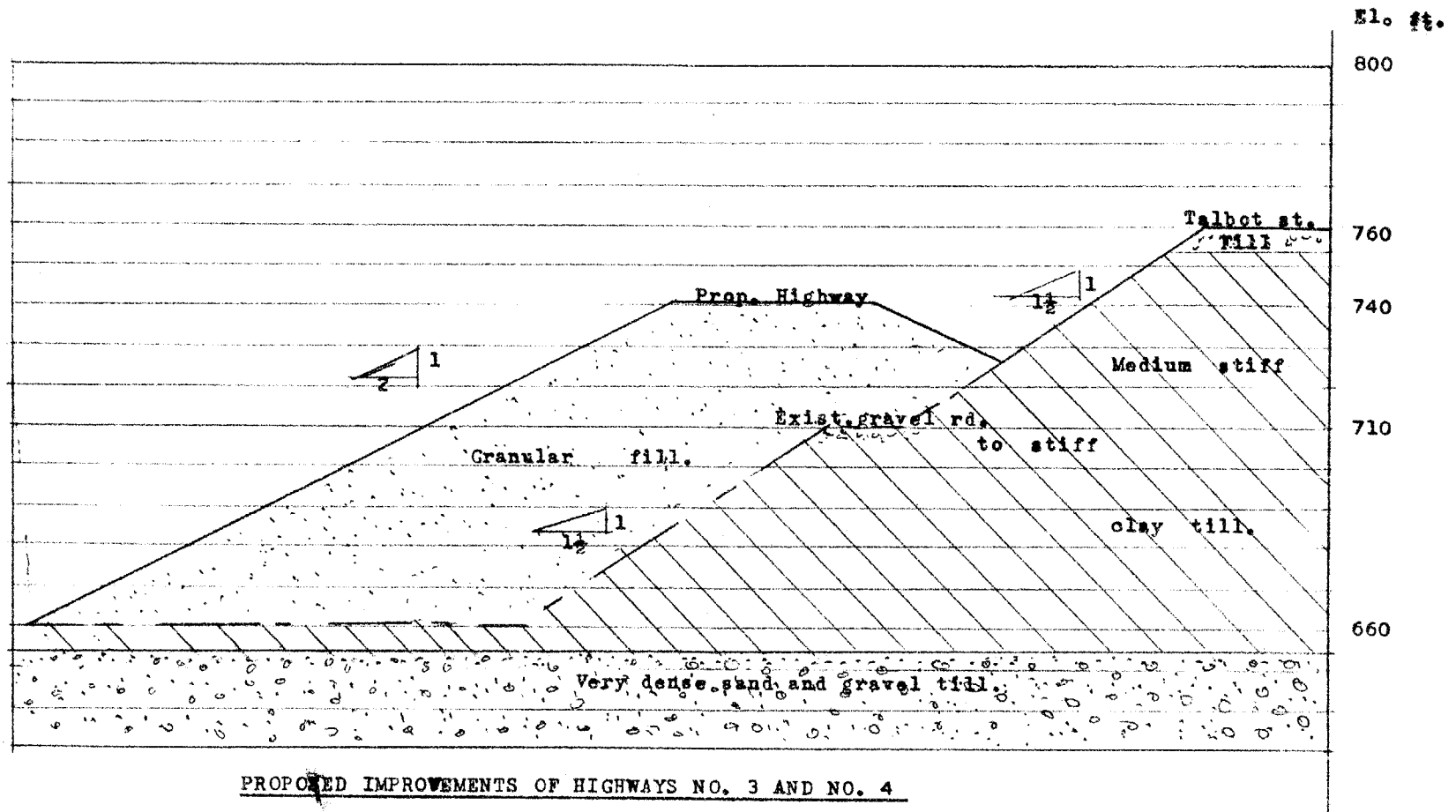
2" Dia. split tube
2" Shelby tube



DEPTH FEET	CONSISTENCY				SAMPLE	NATURAL UNIT WT. P.C.F.	REMARKS
	MOISTURE CONTENT, % DRY WEIGHT						
0	10	20	30	40			
					1		
5					2		
10					3		
15					4		
20							
25					5	124	
30							
35					6	120	
40							
45					7		
50					8		
					9		Core sample
55					10		
60					11		
65					12		
70					13		
75					14		

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CONSOLIDATION TEST

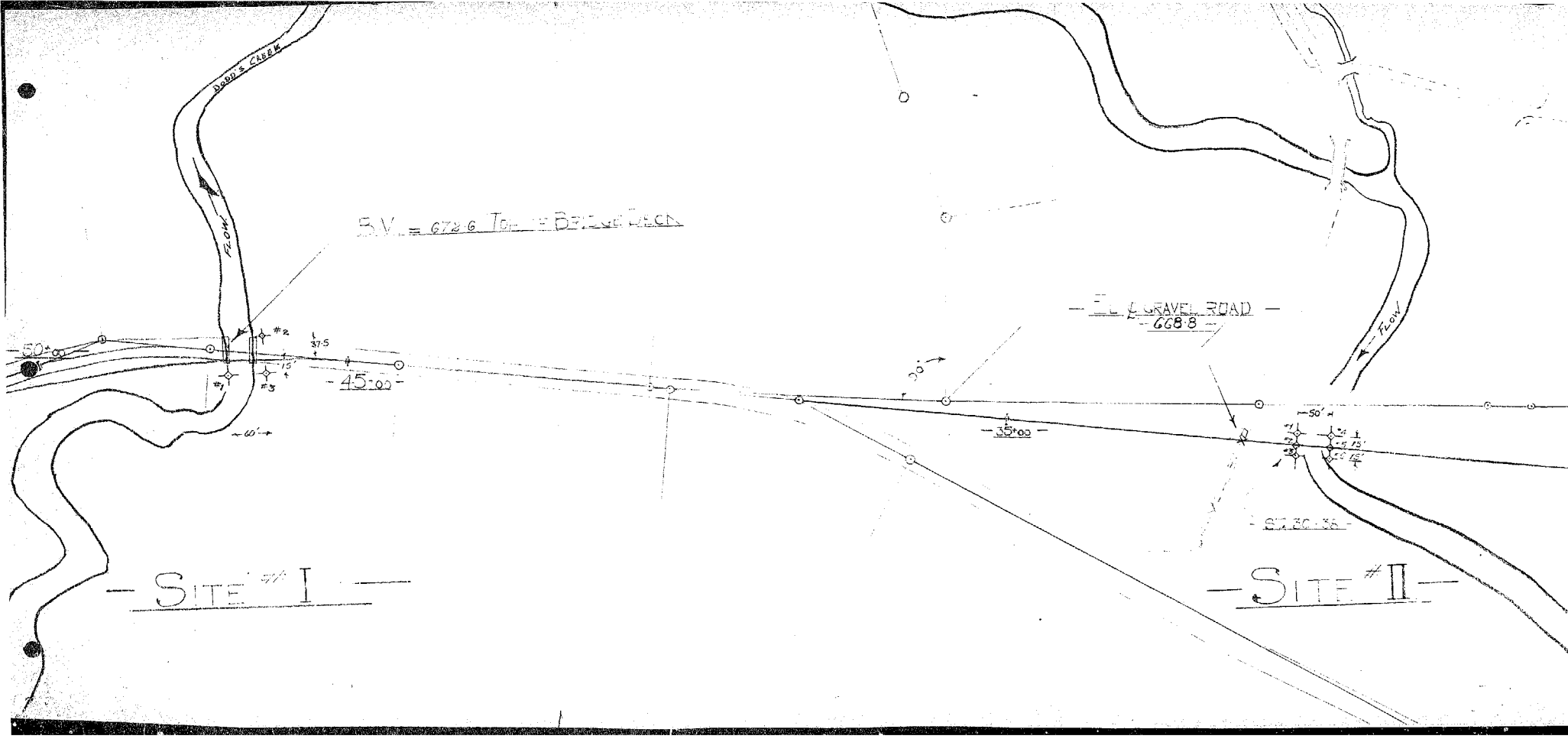




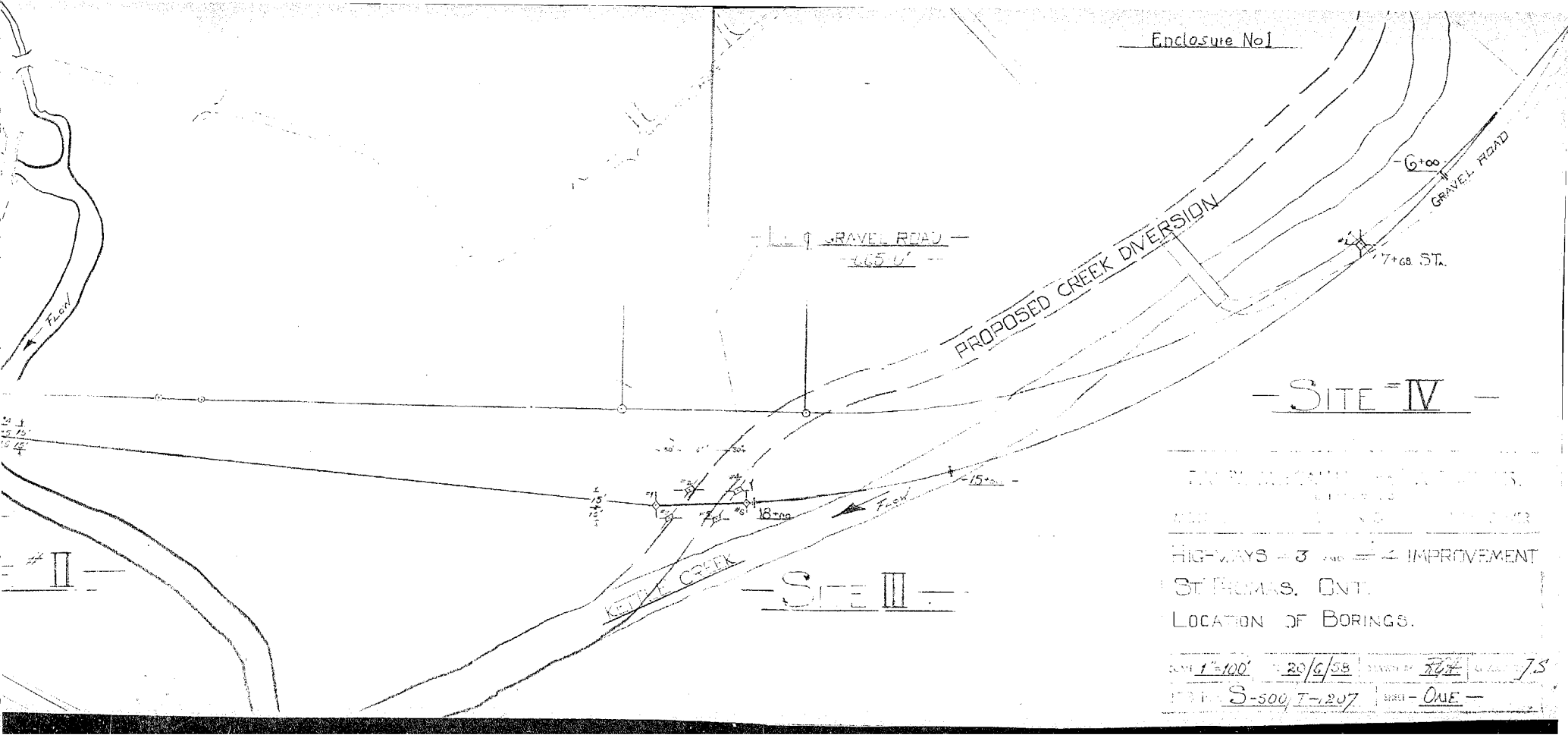
PROPOSED IMPROVEMENTS OF HIGHWAYS NO. 3 AND NO. 4

Schematic cross-section at Sta. 6 + 00

Scale: 1 inch = 40 ft.



Enclosure No 1



- SITE IV -

THE PROPOSED CREEK DIVERSION
AND GRAVEL ROAD
HIGHWAYS 3 AND 4 IMPROVEMENT
ST. THOMAS, ONT.
LOCATION OF BORINGS.

SCALE 1"=100' DATE 20/6/58 DRAWN BY J.G.H. CHECKED BY J.S.
PROJECT S-500, T-207 SHEET - ONE -