

DOCUMENT MICROFILMING IDENTIFICATION

GEOCRES No. 40 J16 - 55

W.P. No. _____

CONT. No. _____

W. O. No. _____

STR. SITE No. _____

HWY. No. _____

LOCATION PROP. REC. OF TWP.
BR. N° 38, CO. of LAMBTON

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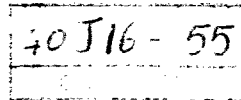
OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT. NONE

REMARKS: _____

E.M. PETO ASSOCIATES LIMITED

BA 1290

Job No. 6138



1237 Caledonia Road,
Toronto 19, Ontario.

April 28th, 1961.

11024

Mr. G. Van Dears,
County Engineer,
Lambton County Building,
Christiann Street North,
Sarnia, Ontario.

Re: Soil Investigation for Township Bridge No. 38.

Dear Sir:

We have pleasure in submitting one copy of our Report No. 6138 on the above site investigation. Three further copies have been dispatched directly to Mr. J. D. Nisbet, Consulting Engineer.

The subsoll conditions were found to be favourable and the bridge foundations in the form of normal footings can be placed near the top of the stiff clayey till layer. A suitable elevation for the footings, with a 25 foot bridge span, appears to be from 626 downwards.

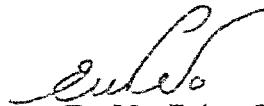
The bearing capacity at this elevation has been assessed as 3 tons/sq. ft. However, should you wish to use a higher value, we would be able to check the safety with the knowledge of the exact size and position of the foundations which you would propose to employ. Also, we could undertake a more detailed assessment of the likely settlements.

In this way, thanks to the reliable picture of the soil strength profile which we have succeeded in establishing, it may be possible to effect savings in the size of the footings.

We shall be forwarding the report on soil conditions at Township Bridge No. 15 early next week.

Yours very truly,

E. M. PETO ASSOCIATES LIMITED

A handwritten signature in cursive script, appearing to read 'E. M. Peto', written in dark ink.

E. M. Peto, P. Eng.

RK/bl
Encl:

THE COUNTY OF LAMBTON
C/O JAMES D. KIBRET, CONSULTING ENGINEER

SOILS REPORT
PROPOSED RECONSTRUCTION OF TOWNSHIP BRIDGE NO. 38,
COUNTY OF LAMBTON
ONTARIO.

E. M. PETO ASSOCIATES LIMITED

1885 CALDWELL ROAD,
WILLOW RIDGE, ONTARIO

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A. INTRODUCTION

The work described in this report was authorized verbally by Mr. O. VanDuren, County Engineer, County of Lambton.

A new bridge is to be constructed to replace an existing old bridge crossing the Perch Creek and carrying La Salle Road, which divides the Townships of Sarnia and Moore.

A site investigation was required to determine the subsoil conditions for the construction of new bridge foundations.

The new bridge is visualized as a simply supported, reinforced concrete structure, of 25 ft. span.

B. GENERAL INFORMATION

1. Positions and Depths of Testholes.

Two testholes were drilled, 39 ft. apart, near the diagonally opposite corners of the existing bridge.

Testhole No. 1 was located 5 ft. east of the north-eastern corner of the existing bridge and its depth was 61 ft.

Testhole No. 2 was drilled 13 ft. west-north-west of the south-eastern corner of the bridge, and was 46 ft. deep.

B. GENERAL INFORMATION - Cont'd

The depths to which the testholes were put down were chosen so as to establish the possible existence of a soft to very soft layer of the clayey till stratum, below a stiff crust, and which is characteristic of the subsoil conditions in the Farnia area. As testhole No. 1 has indicated that the subsoil to a depth of 61 ft. is sufficiently firm as not to give rise to concern about the safety of the new bridge foundations, testhole No. 2 was drilled to a depth sufficient only to prove the horizontal continuity of the subsoil conditions.

The ground elevations at the positions of the testholes were supplied by Mr. James D. Nisbet, Consulting Engineer, and are indicated on the enclosed borehole logs and drawing; the latter also shows the positions of the testholes.

2. Drilling Operations.

The field work was carried out between April 7th and 11th, 1961 by our field crew using drilling rig no. 4. Our standard drilling and sampling procedures were followed, as outlined in the enclosed Appendix A. Testhole No. 1 was lined with 4 inch and BX casing and testhole no. 2 with BX casing only.

Details of the soil conditions found in the testholes are shown on the enclosed borehole logs.

B. GENERAL INFORMATION - Cont'd

3. Soil Testing.

Standard penetration tests have been performed at regular intervals in the boreholes; the results have been entered on the borehole logs, which contain also the in-situ moisture contents, determined on soil samples.

The following tests were carried out in the soil mechanics laboratory:

Consolidation test	(1)
Undrained shear strength by unconfined compression test	(12)
Atterberg Limits	(3)
Particle Size Distribution	(2)

The results of these tests are enclosed in Appendix B.

The variation of the main geotechnical properties with depth has been plotted on Graph No. 1.

C. SITE AND GEOLOGY

The new bridge is to be constructed at the site of an existing old bridge carrying the La Salle Road, which separates the Sarnia and Moore Townships, over the Parch Creek. The site is located roughly 10 miles north-east of the centre of Sarnia, and lies 11.6 miles east of St. Clair River.

C. SITE AND GEOLOGY - Cont'd

Geologically, the area is located within the St. Clair Clay Plain, where glacial processes have deposited a thick mantle of fill over a shale bedrock.

The terrain at the site is nearly flat, and Perch Creek has cut a shallow channel within the clay fill stratum, which was found to rise to the ground surface.

D. SOIL CONDITIONS

Details of the soil conditions found at the site are shown on the enclosed borehole logs, while a simplified subsoil profile, as determined from these logs and from the laboratory examination and testing of the soil samples, has been plotted on the enclosed drawing, in the form of a cross-section through the two testholes.

The subsoil at the positions of the proposed bridge abutments was found to consist of a sandy gravel and clay fill, followed by a silty clay with pebbles. This extended to the bottom of both boreholes, i.e. at least to the elevation of 576.4.

The two above soil types will now be described in turn.

1. Fill Materials.

The subgrade behind the abutments of the existing bridge has been built up from the level of the surrounding terrain

D. SOIL CONDITIONS - Cont'd

with a fill material, apparently consisting of the silty clay till, mixed with some sand and stones. This was covered with a 12 to 15 inch thick course of sand and gravel. The total thickness of fill appeared to be 7 ft. in testhole 1 and 4 ft. 3 in. in testhole 2.

A grainsize distribution curve determined on a sample of the sand and gravel layer has been plotted on Graph No. 2a and shows a 35% content of fine to medium gravel, 54% of well-graded sand and 10% of silt. It is considered that, provided that the samples obtained in the two borings are typical of this fill blanket, the top 12 to 15 inches of the material at the existing embankment can be retained for covering the approaches to the new bridge abutments.

The silty clay fill, with sand and stones, which was discovered under the sand and gravel blanket, is considered suitable for retention in the rebuilt embankment, but, due to its high proportion of clay and silt fractions, should be covered after compaction with a blanket of sand and gravel fill as a protective measure against frost heave. The grainsize distribution curve shown on Graph No. 2b can be considered as representative of the clay portion of this fill.

2. Silty Clay Till.

(a) Thickness and Composition.

This material is a clay till, deposited during the ice age, and forms the main overburden over the bedrock around Sarnia. Its thickness at the site was not established, but a testhole was washed to

D. SOIL CONDITIONS - Cont'd

refused at the site of the proposed Township Bridge No. 35, over Talfourd Creek, which is situated 8 1/2 miles west of this site and indicated the possible elevation of the shale bedrock as 496.7. Although the surface of the bedrock is believed to rise gently towards the east, a thickness of the clayey till of about 100 ft. at the present bridge site is possible.

The material consists mainly of silty clay with some sand and pebbles. It is mottled brown and grey in the upper, weathered zone and becomes gray to gray-brown with depth. A grainsize distribution curve on a sample from the depth of 20 ft. was plotted on Graph No. 2b, and shows 30% content of clay, 37% of silt, 28% of sand and 5% of fine gravel. The sand content was found to decrease with depth.

(b) Consistency and Shear Strength.

Variation of consistency of the material with depth is illustrated on Graph No. 1, on which standard penetration test results, moisture content and Atterberg Limit distribution and undrained shear strength profiles have been plotted.

Atterberg Limits have been determined on three typical samples of the material, and the results were as follows:

D. SOIL CONDITIONS - Cont'd

B.F. & Sample No.		2/4	2/7	2/16
Depth		7'-8'	15'-16'	45'-46'
Liquid Limit	%	37.3	34.5	38.1
Plastic Limit	%	17.7	17.4	19.6
Plasticity Index	%	19.6	17.1	18.5
In-situ moisture content	%	18.4	17.0	23.7

The flow curves obtained in these tests are enclosed in Appendix B (Graphs 3a and b.). The results show that the plastic properties of the material can be considered to remain approximately uniform with depth, although some increase in plastic limit, probably due to a diminishing sand content, is noticeable at 45'-46'.

In-situ moisture content was near or below the plastic limit in the upper portion of the stratum, indicating the existence of a stiff desiccated upper crust, of sufficient strength to provide a sound basis for bridge foundations. Moisture content increased with depth, and reached 33.4% at the elevation 599, indicating a considerable decrease of strength. Near this elevation, a critical zone of lowest shear strength, commonly found in the clayey till in the Sarnia area, was apparently reached, as at lower levels the water content was found to decrease.

The consistency profile, as inferred from the water content distribution, was in agreement with the results of standard penetration tests and with the shear strength as measured by unconfined

D. SOIL CONDITIONS - Cont'd

compression test.

The standard penetration test N-values decreased with depth from as high as 40 blows per foot of penetration at the elevation 627 to between 8 and 10 in the lower zone of least strength. Similarly, the undrained shear strength fell from as much as 9000 lb./sq. ft. at the depth of 10 ft. to about 1000 lb./sq. ft. at 55 ft., accompanied by a fall in bulk density from 136 to 122 lb./cu. ft.; the corresponding dry densities were 120 and 97 lb./cu. ft.

The shear strengths and densities have been listed in Table I, enclosed with Appendix B. The scatter of the results is due to local variations in moisture content, to random occurrence of pebbles and to some sampling disturbance, unavoidable in this type of material, which is known to be fairly sensitive.

(c) Compressibility.

A consolidation test was carried out on an undisturbed typical sample of the clayey till, from a depth of 19 ft. in testhole 2, which is roughly at the likely average depth of the soil zone most stressed by the new bridge abutments. The results have been presented on Graph No. 4 in the form of Void Ratio - log pressure curve. The coefficients of consolidation, C_v , and compressibility, m_v , for the various loading stages, are also shown on Graph No. 4 in tabular form.

For a load increase of 1 ton/sq. ft. from the

D. SOIL CONDITIONS - Cont'd

existing effective overburden pressure, the compressibility coefficient, m_v , has been estimated as 0.0051 sq. ft./ton. This is a low value and indicates that settlements under the new abutments will not cause serious problems.

E. WATER CONDITIONS

No free ground water was encountered in the two borings, and the position of the permanent water table can be considered to be controlled by the level of water in Perch Creek.

It is considered that due to the low permeability of the clayey till stratum, within which the channel of the stream appears to be located, very little seepage of water will occur into any excavation for bridge foundations sunk to below the river level. Any seepage from the stream could easily be cut off by driving a short length of sheeting on the stream side of the excavation, or by temporarily diverting the flow in Perch Creek.

F. CONCLUSIONS AND RECOMMENDATIONS

1. Summary of Subsoil Conditions.

The two testholes drilled at the site have shown that a stratum of silty clay with pebbles (clay, till) begins between the elevations of 570 (testhole No. 1) and 633 (testhole No. 2), and extends

F. CONCLUSIONS AND RECOMMENDATIONS - Cont'd

at least to the elevation 575. This material was covered at the existing bridge approach embankments by 3 to 6 ft. of a backfill consisting of silty clay with some sand and stones and 12 to 15 inches of sand and gravel.

The clayey till stratum possesses a strong upper crust which will safely support the new bridge foundations. The shear strength of this upper portion of the till exceeds 2000 lb./sq. ft. down to the elevation 610. For foundations placed at the likely elevation of 626 to 628, a shear strength of 3000 lb./sq. ft. can be assumed.

Although the clayey till stratum becomes weaker with depth, only a small proportion (less than 10%) of the stresses due to the bridge abutments will be transmitted to the soft zone, which begins near the elevation 592.

2. Location of New Bridge Foundations.

It is considered that abutments of the new bridge can be founded near the top of the clayey till stratum, but below the existing embankment backfill. Provided that the soil conditions as established in the two testholes are representative of the areas at the proposed new bridge abutments, the foundations can be placed at or below the elevation 626.

As Birch Creek is not known to be subject to flooding, no other than normal precautions for the protection of

F. CONCLUSIONS AND RECOMMENDATIONS - Cont'd

foundations against scour appear to be necessary.

3. Bearing Capacity and Settlements.

The allowable load bearing capacity of the subsoil at the proposed positions of footings has been estimated as not less than 3 tons/sq. ft., with a factor of safety of 3.

An exact calculation of the theoretical settlement could only be made when the dimensions, elevation and loading of the foundations of the proposed bridge are known. However, an estimated value of 0.5 inches of final settlement was obtained assuming a 30 ft. by 5 ft. abutment located at the elevation 626 and carrying a uniformly distributed load of 2000 lb./sq. ft.; this figure can serve as a guide to the order of settlement to be expected.

Some swelling of the clayey till could occur if a foundation excavation was left open any length of time, particularly if there should be access for water. Such swelling would lead to additional settlements when the abutments are constructed. We therefore strongly recommend that no access of water, either from the Creek or from the atmosphere be allowed to the excavated formation level under the foundations. If such an excavation is to be left open even for a few days before construction of the abutment, the floor should be protected by a seal in the form, for instance, of a layer of lean concrete.

F. CONCLUSIONS AND RECOMMENDATIONS - Cont'd

Little or no settlement of the subsoil under the bridge approach embankments is expected. However, the embankments themselves should be carefully compacted and preferably allowed to settle before the final road surface is placed, to avoid a step forming between the bridge and the backfill.

4. Embankment Materials.

As has been stated in Section D (1), the existing fill materials appear to be acceptable as a backfill for the bridge approaches; also, the virgin clayey till, where it will be removed in an excavation, can be used as a backfill. However, a layer of granular material at least 12 inches thick, should be placed on top of the compacted clayey backfill, to protect the pavement against frost heave.

C. F. Freeman.

RK/bl

C. F. Freeman, P. Eng.,
Chief Engineer.

APPENDIX A
STANDARD PROCEDURES

The field investigation work is carried out by means of a self-mounted diamond drill rig.

Standard sampling procedures are followed. Casing is driven and cleaned, either by augers, tubes or by wash water.

Samples are recovered ahead of the casing at frequent intervals, with either a 2 inch or 3 inch O. D. split barrel sampling tube, Shelby tube, or split barrel sampling tube fitted with brass liners and special sharp cutting wires.

The standard penetration test results are recorded when sampling with the regular 2 inch O. D. split barrel sampler, these being the number of blows of a 140 pound hammer falling 30 inches, required to drive the sampling tube a distance of one foot into undisturbed soil.

The Dutch Cone probe test is made by driving the drill rods into the ground with a 2 inch dia. x 60° cone tip. The number of 4200 inch pound blows per foot of penetration are recorded, as in the standard penetration test.

Where required, "in situ" shear strength tests are made ahead of the casing, using Modified Alber cone test equipment.

Disturbed samples are visually classified in the field, sealed in sample jars, and are re-examined and tested as necessary in the soils laboratory. Unaltered samples are returned to the laboratory for later examination and testing as required.

The test pipes are bailed or pumped out during the work as necessary at the end of the day, and on completion. Subsequent water level readings are taken for the duration of the field work. Water pressure readings are recorded when Artesian water conditions are encountered. Moisture content samples are recovered at frequent intervals to assist in the soil classification and the interpretation of water table results.

Borehole logs are prepared giving details of the soil description and condition as recorded in the field. These logs form the basis of the soil profile, which indicates the general stratigraphy assumed to exist between the boreholes as represented by the borehole logs.

The boreholes are normally set out by the Field Engineer, who also records the ground elevations referred to a temporary bench mark or known reference point. If the Client has been responsible for setting out the boreholes and recording their ground elevations this is stated in the preamble to the report.

A plan is drawn up from drawings supplied by the Client or his representatives, showing the locations of the boreholes and the T.B.M., where applicable.

Normally the water penetration blow and the natural moisture contents are plotted against elevation on a graph, and these graphs form part of the appendices, together with laboratory test result details, ground water readings and other soil data information which can be best illustrated in graphical form.

APPENDIX B

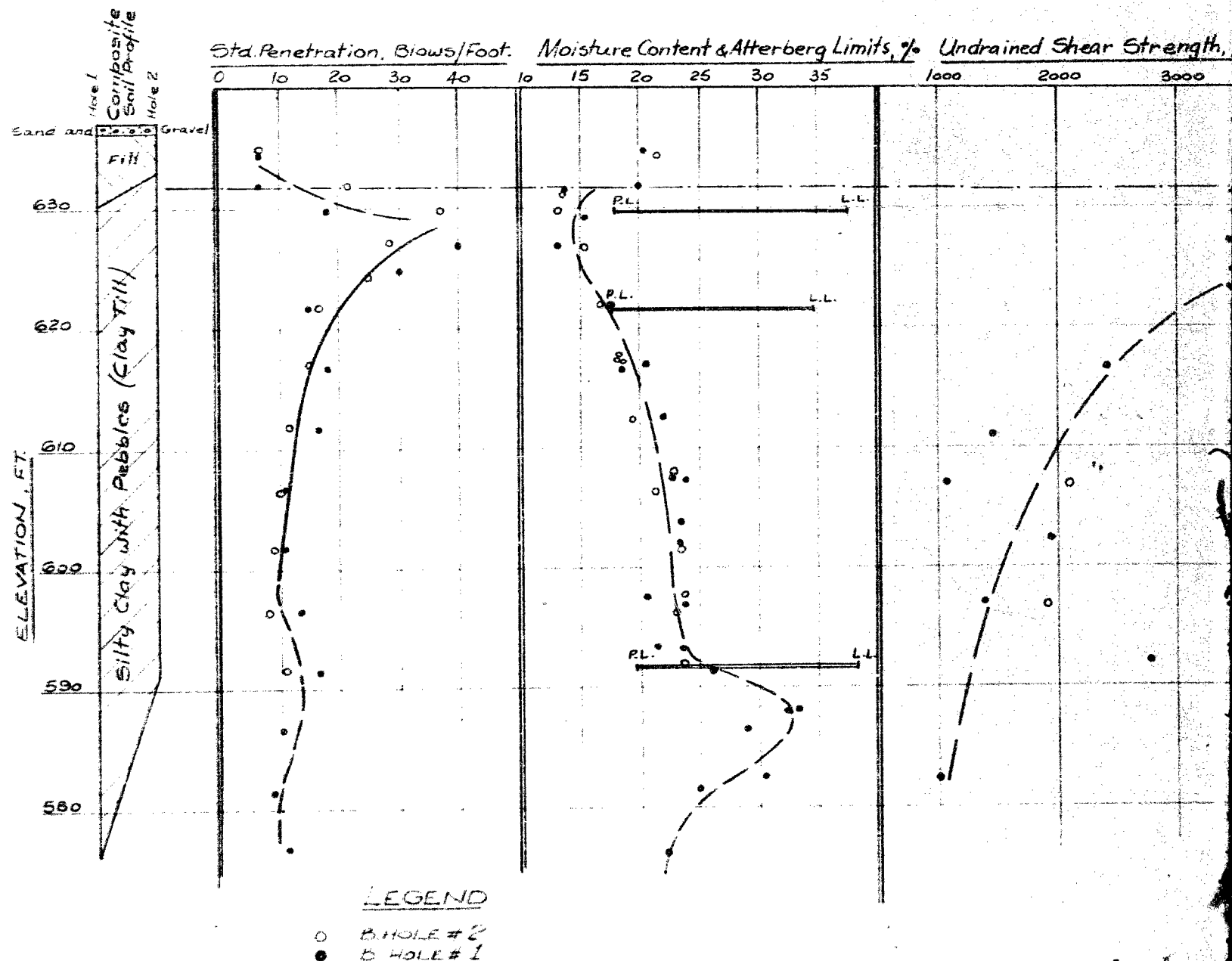
Laboratory Test Results

E. M. PETO ASSOCIATES

UNCONFINED COMPRESSION TEST DATA SHEET

Borehole Number	Sample Number	Depth Feet	Water Content	Wet Density p.c.f.	Dry Density p.c.f.	Void Ratio, e	u/c Shear Strength pounds per sq. ft.
1	5	10'-11'	18.9	135	118.5	.42	9000
1	6	12'-13'	15.2	140	121.5	.39	4020
1	8	19'6"-20'	20.7	136.0	113.0	.491	2430
1	10B	24'6"-25'	22.0	134.4	110.2	.528	1460
1	12B	29'6"-30'	23.8	134.4	108.8	.550	1080
1	13B	34'6"-35'	23.3	132.0	107.0	.575	1940
1	15B	39'6"-40'	20.7	133.7	111.0	.518	1390
1	17B	44'6"-45'	21.5	134.4	110.8	.524	2790
1	21B	54'6"-55'	30.3	126.3	97.0	.740	1000
2	11B	29'6"-30'	22.7	133.7	109.0	.548	2100
2	14C	39'6"-40'	23.8	133.7	108.0	.561	1930

GEOTECHNICAL PROPERTIES OF CLAYEY TILL

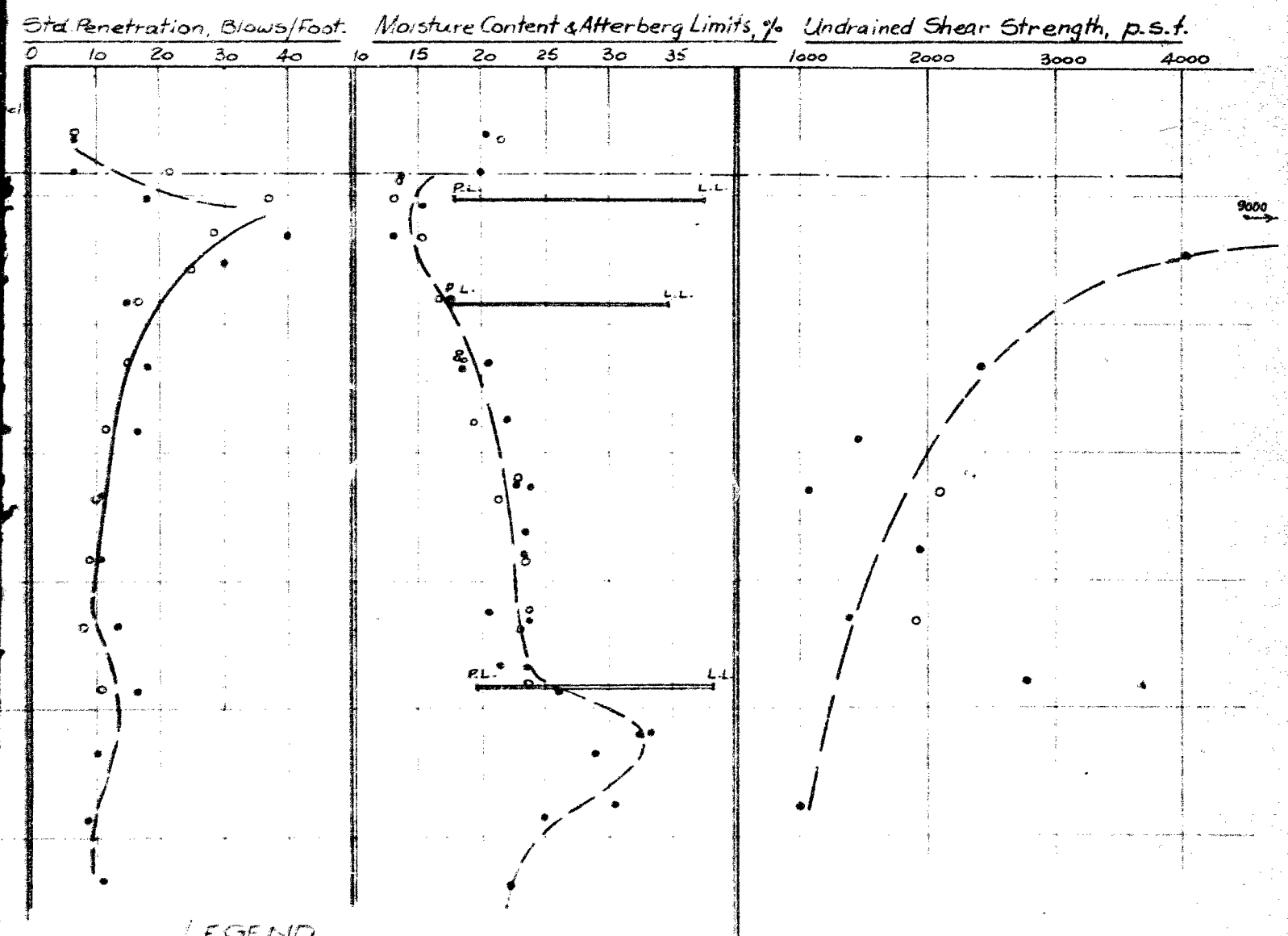


Job #613

empeto associ

April 1966

GEOTECHNICAL PROPERTIES OF CLAYEY TILL.

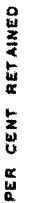


LEGEND

- B. HOLE #2
- B. HOLE #1

Job #6138
 emp.eto associates ltd.
 April 1961 g.f.

Toronto 19, Ontario



Graph No. 2b

STONES	GRAVEL	COARSE SAND	MED. SAND	FINE SAND	COARSE SILT	MED. SILT	FINE SILT	CLAY
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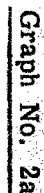
MASS INST. OF TECH. CLASSIFICATION

JOB NAME Township Bridge No. 38 JOB NO. 6138 HOLE NO. 2 SAMPLE NO. 9

DEPTH 20'-21' ELEVATION _____ REMARKS Silty clay with pebbles (clayey till)

GRAIN SIZE DISTRIBUTION

Toronto 19, Ontario



MASS. INST. OF TECH. CLASSIFICATION

GRAIN SIZE DISTRIBUTION

e. m. peto associates ltd.

Toronto 19, Ontario

LIQUID LIMIT TEST

FLOW LINE CHARTS

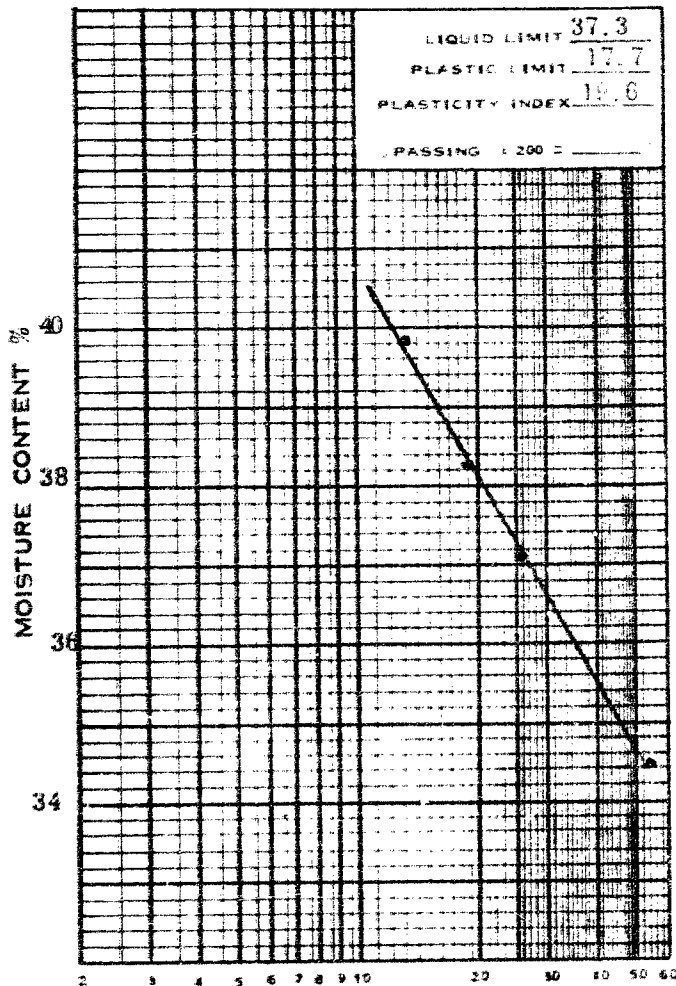
JOB NO. 6138 PROJECT Township Bridge No. 38

SAMPLE FROM B.H. #2 Sa. 4

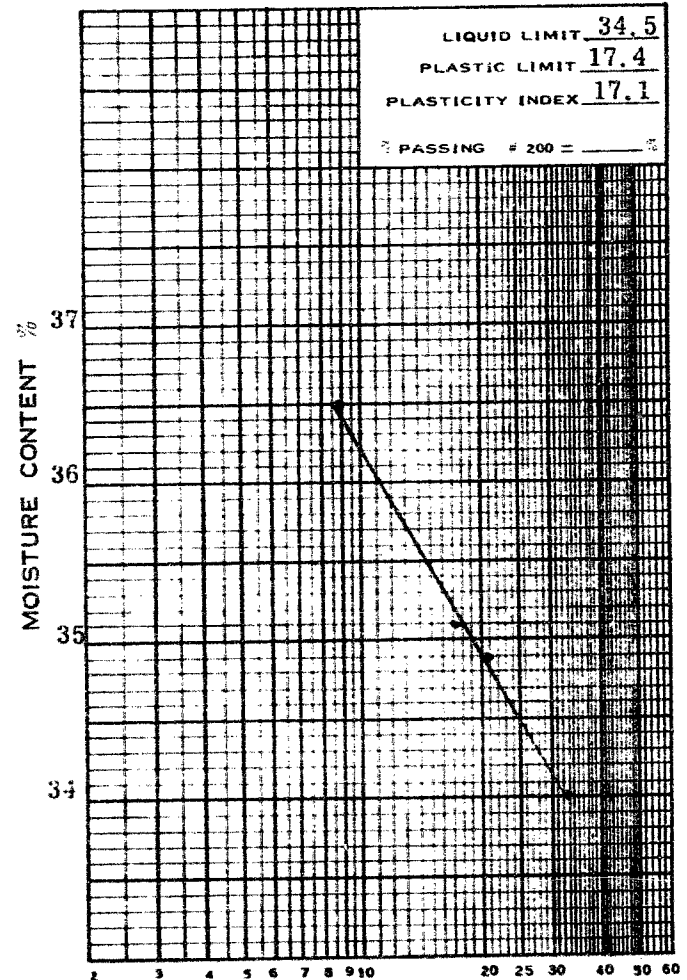
SAMPLE FROM B.H. #2 Sa. 7

DEPTH 7'-8'

DEPTH 15'-10'



NO. OF BLOWS (LOG SCALE)



Graph # 3a

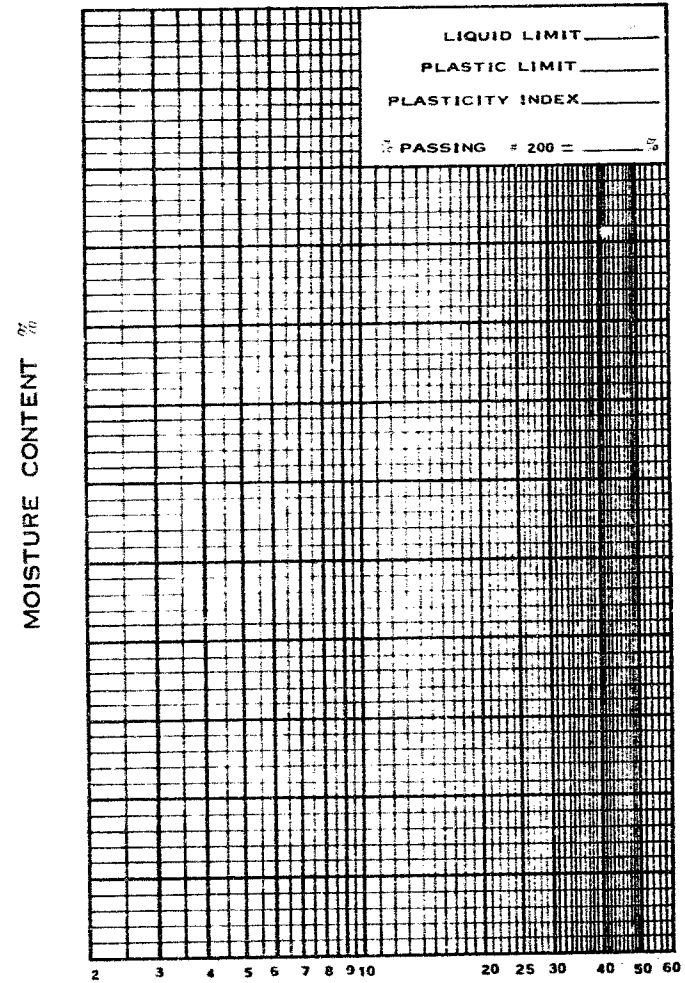
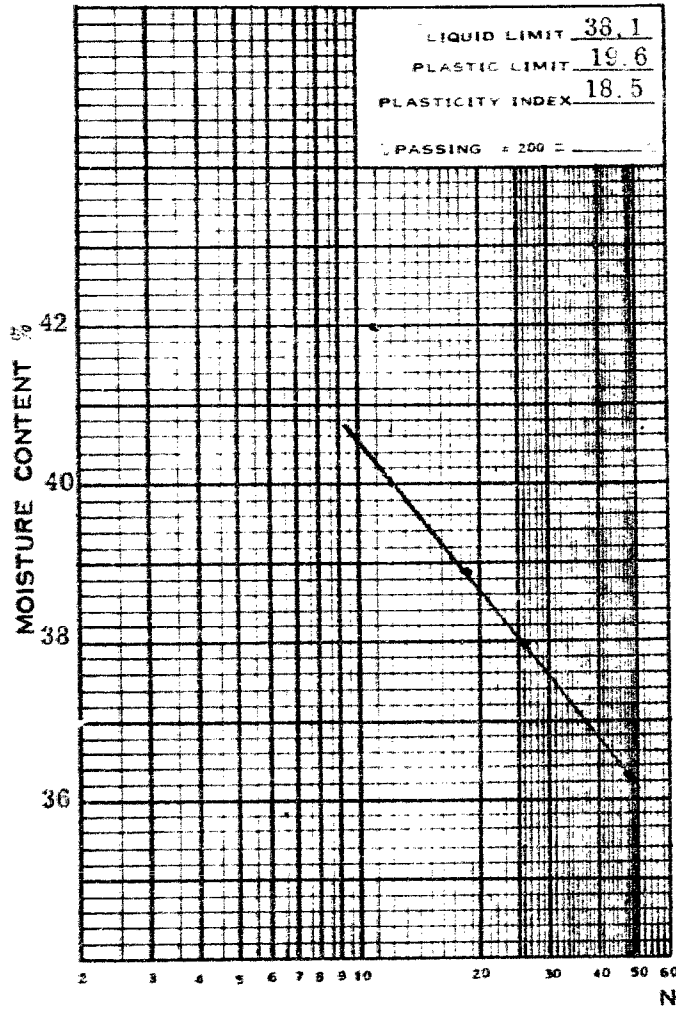
e. m. peto associates ltd.

Toronto 19. Ontario

LIQUID LIMIT TEST

FLOW LINE CHARTS

JOB No. 6138 PROJECT Township Bridge No. 38
SAMPLE FROM B.H. =2 Sa. 16 SAMPLE FROM _____
DEPTH 45'-46' DEPTH _____



Graph # 3b

TOWNSHIP BRIDGE NO 38
CONSOLIDATION TEST PRESSURE VOID RATIO CURVE

Borehole # 2

Sample # 8

Depth 19'2" - 19'6"

Grey-brown silty clay with
pebbles (clayey fill)

Initial moisture content 18.1%

Load stage	Coefficients	
	Compressibility m_v in ² /ton	Consolidation C_v in ² /year
1/8 - 1/4	.0286	24.7
1/4 - 1/2	.0152	20.6
1/2 - 1	.0115	26.7
1 - 2	.0098	32.8
2 - 4	.0048	49.3
4 - 8	.0042	43.0

Job # 6138

Empire Associates Inc.

RMF April 61

Pressure Kip/sq.ft →

GRAPH # 4

e. m. peto associates ltd.

SOIL ENGINEERING SERVICE - TORONTO, ONTARIO





BOREHOLE LOG

Job Name Township Bridge No. 38Job No. 6138Borehole No. 1Client The County of LambtonCasing 4" & BXBoring Date April 7, 8 & 10th, 1961Elevation Client'sCompiled By R. K.Checked By B. L.

SAMPLE CONDITION


























SAMPLE TYPE

ABBREVIATIONS

-  UNDISTURBED
 FAIR
 DISTURBED
 LOST

- A.S. AUGER SAMPLE
 C.S. CASING SAMPLE
 S.S. 2" STANDARD SPLIT TUBE SAMPLE
 S.L. SPLIT BARREL WITH LINERS
 S.T. THIN-WALLED SHELBY TUBE SAMPLE
 W.S. WASH SAMPLE
 R.C. ROCK CORE

- V.T. IN SITU VANE SHEAR TEST
 C. SOIL SHEAR STRENGTH LBS/SQ.FT.
 W.L. WATER LEVEL IN CASING
 W.T. GROUND WATER TABLE IN SOIL
 W.T.P.L. WETTER THAN PLASTIC LIMIT
 D.T.P.L. DRIER THAN PLASTIC LIMIT

SOIL DESCRIPTION	COLOUR	Density or Consistency	Depth Elevation	Legend	Sample No. and Condition	Sample Type	No. of Blows per Ft.	Natural Moisture Content	WATER LEVELS & REMARKS
			637.39 0'0"						
Sandy and gravel fill	brown		1'3"		1	C.S.			Moist
Sandy clay with pebbles (fill)	dark brown	soft			2	S.S.	7	20.8	
"	"	"	5'0"		3	S.S.	7	20.0	
			7'0"		4	S.S.	18	15.6	
Silty clay with pebbles	mottled brown	stiff			5	S.S.	40	13.0	Stiffening at 9 feet.
(Clayey till)		very stiff	10'0"		6	S.S.	30	15.4	
"	brown grey				7	S.S.	15	17.5	
"	grey to grey brown	firm	15'0"		8	2"SL	tapped	20.7	
			20'0"		9	S.S.	18	18.4	
"	"	"			10a	2"SL	tapped	22.0	
			25'0"		10b	2"SL	tapped	17	18.8
"	"	"			11	S.S.			Softening at 28'6"
			30'0"		12a	2"SL	pushed	23.8	
		soft			12b	S.S.	11		
"	"				13a	2"SL	pushed	23.3	
			35'0"		13b	S.S.	11	22.6	
"	"	"			14	S.S.			
			40'0"		15a	2"SL		20.7	
					15b	S.S.	13	23.1	
"	"	"			16	S.S.			Getting softer at 44'
			45'0"		17a	2"SL	pushed	21.5	
					17b	S.S.	17	23.7	Thin silt seam at 46'
"	"	"			18	S.S.		26.0	
			50'0"		19a	2"SL	pushed	33.4	Softening at 48'
					19b	S.S.		32.3	

SAMPLE CONDITION

SAMPLE TYPE

ABBREVIATIONS



UNDISTURBED



FAIR



DISTURBED



LOST

A.S. AUGER SAMPLE

C.S. CASING SAMPLE

S.S. 2" STANDARD SPLIT TUBE SAMPLE

S.L. SPLIT BARREL WITH LINERS

S.T. THIN-WALLED SHELBY TUBE SAMPLE

W.S. WASH SAMPLE

R.C. ROCK CORE

V.T. IN SITU VANE SHEAR TEST

C. SOIL SHEAR STRENGTH LBS/SQ.FT.

W.L. WATER LEVEL IN CASING

W.T. GROUND WATER TABLE IN SOIL

W.T.P.L. WETTER THAN PLASTIC LIMIT

D.T.P.L. DRIER THAN PLASTIC LIMIT

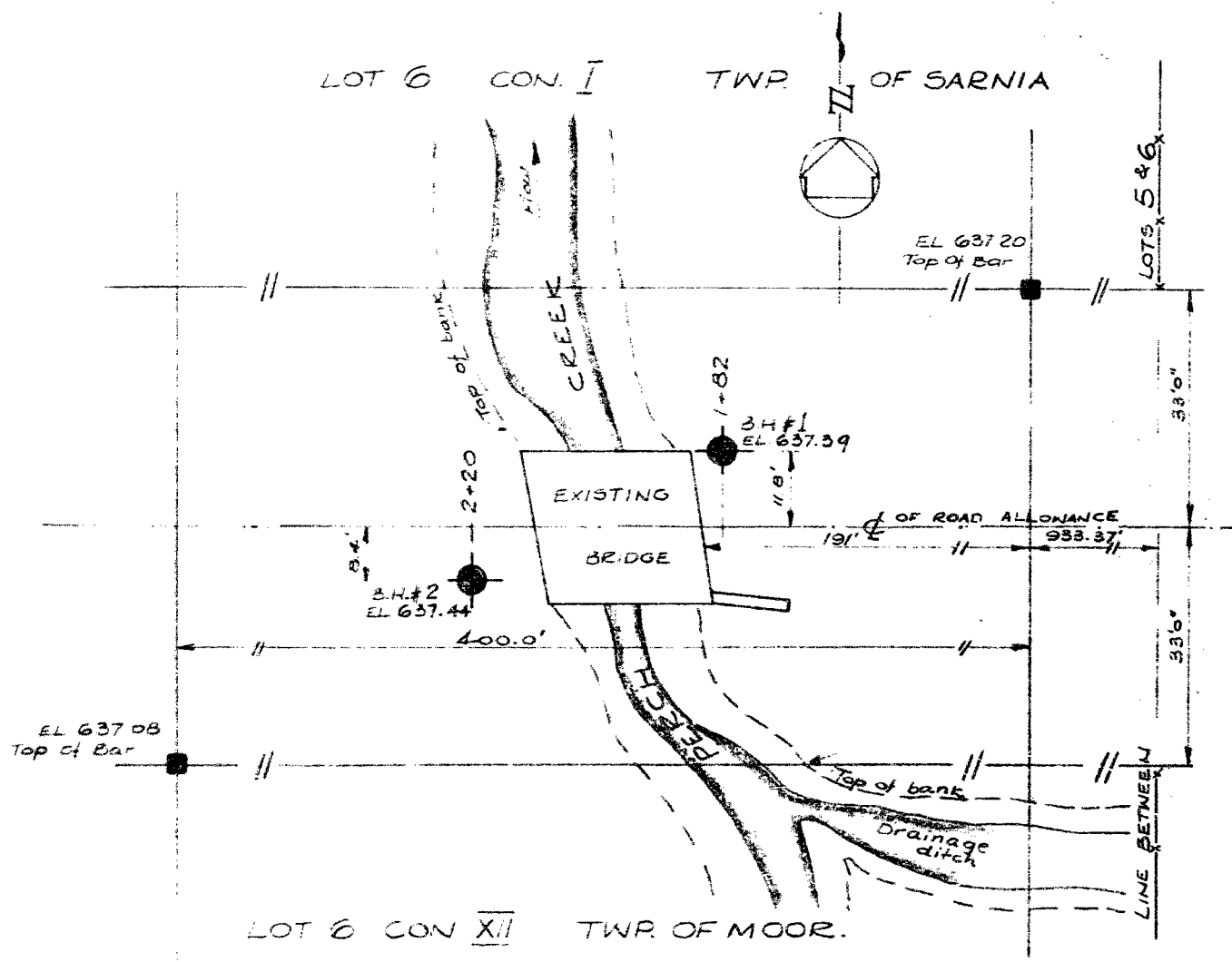
SOIL DESCRIPTION	COLOUR	Density or Consistency	Depth Elevation	Legend	Sample No. and Condition	Sample Type	No. of Blows per Ft	Natural Moisture Content	WATER LEVELS & REMARKS
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Sandy clay with pebbles (fill)	dark brown	soft			2	S.S.	7	20.8	
"	"	"	5'0"		3	S.S.	7	20.0	
			7'0"		4	S.S.	18	13.9 15.6	
Silty clay with pebbles	mottled brown	stiff							Stiffening at 9 feet.
(Clayey till)		very stiff	10'0"		5	S.S.	40	13.0	
"	brown grey				6	S.S.	30	15.4	
"	grey to grey brown	firm	15'0"		7	S.S.	15	17.5	
			20'0"		8	2"SL tapped		20.7	
					9	S.S.	18	18.4	
"	"	"							
			25'0"		10a 10b	2"SL tapped		22.0	
					11	S.S.	17	18.8	
"	"	"							Softening at 28'6"
			30'0"		12a 12b	2"SL pushed		23.8	
		soft				S.S.	11		
"	"								
			35'0"		13 13a 13b	2"SL pushed		23.3	
					14	S.S.	11	22.6	
"	"	"							
			40'0"		15a 15b	2"SL		20.7	
					16	S.S.	13	23.1	
"	"	"							
			45'0"		17a 17b	2"SL pushed		21.5 23.7	Getting softer at 44'
					18	S.S.	17	26.0	Thin silt seam at 46'
"	"	"							
			50'0"		19a 19b	2"SL pushed		33.4 32.3	Softening at 48'
					20	S.S.	10	28.9	
			55'0"		21a 21b	2"SL pushed		30.3	
"	"	"			22	S.S.	9	25.0	
			61'0"		23	S.S.	11	22.5	

TESTHOLE TERMINATED AT 61'0"

Job Name Township Bridge #38 Job No. 6138 Borehole No. 2
Client County of Lambton Casing 4" Boring Date April 10 & 11th, 1961
Elevation Client's Compiled By R. K. Checked By B. L.

V.T. IN SITU VANE SHEAR TEST
C. SOIL SHEAR STRENGTH LBS/SQ.FT.
W.L. WATER LEVEL IN CASING
W.T. GROUND WATER TABLE IN SOIL
W.T.P.L. WETTER THAN PLASTIC LIMIT
D.T.P.L. DRIER THAN PLASTIC LIMIT

[illegible]



SITE PLAN
Scale: 1" = 20'0"

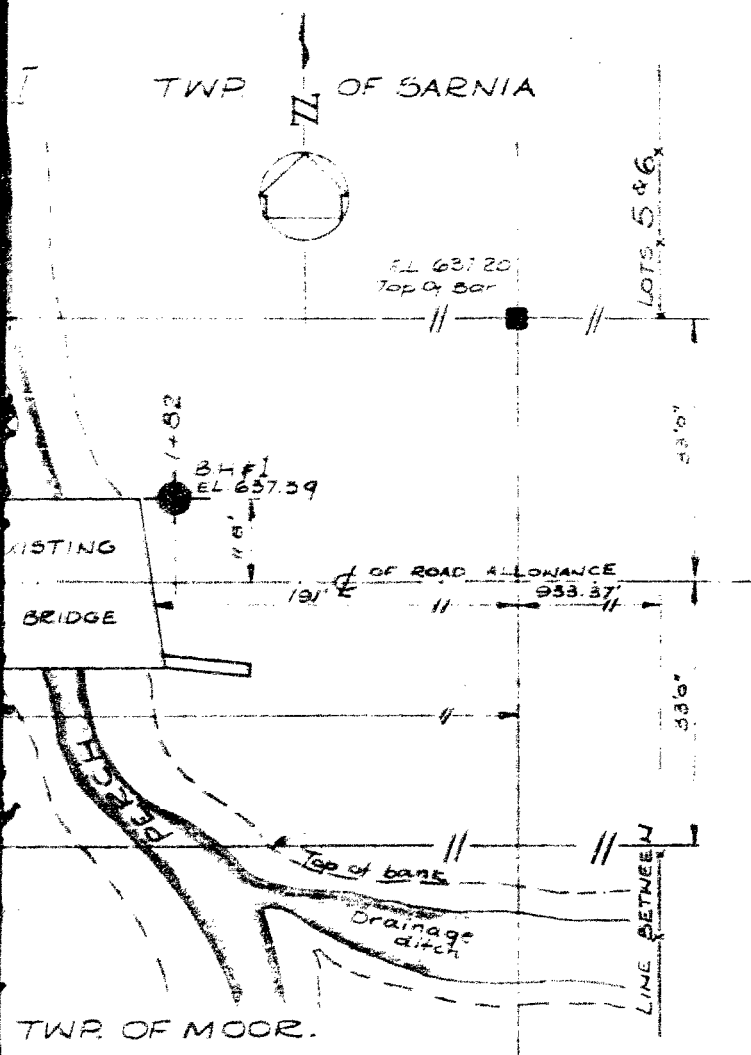
LEGEND

- Borehole
- ⑬ Blows/ft

NOTE:

See borehole 15

Complete Soil D



PLAN

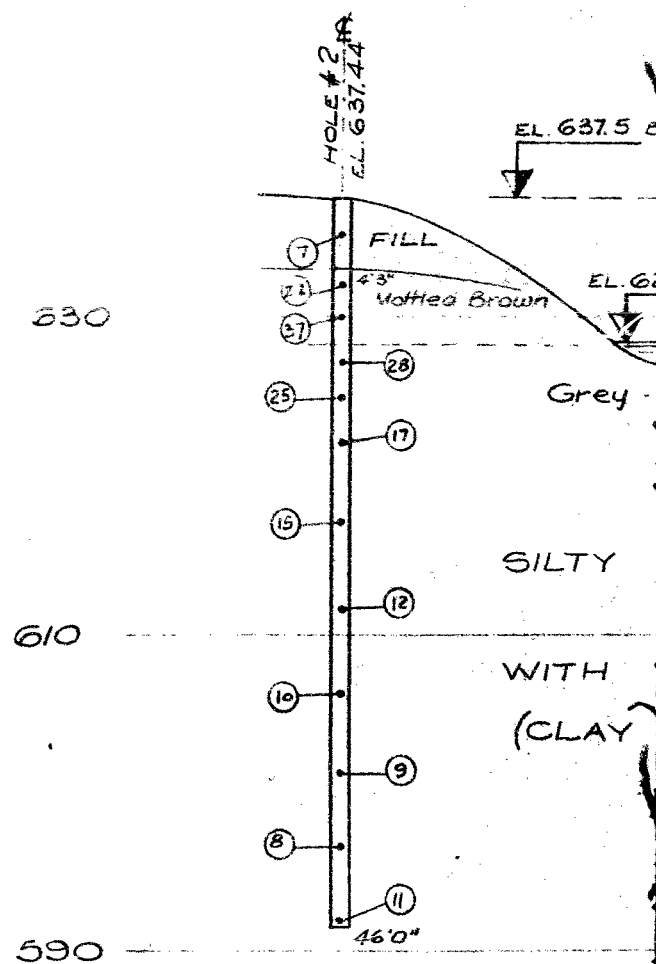
1" = 20' 0"

LEGEND

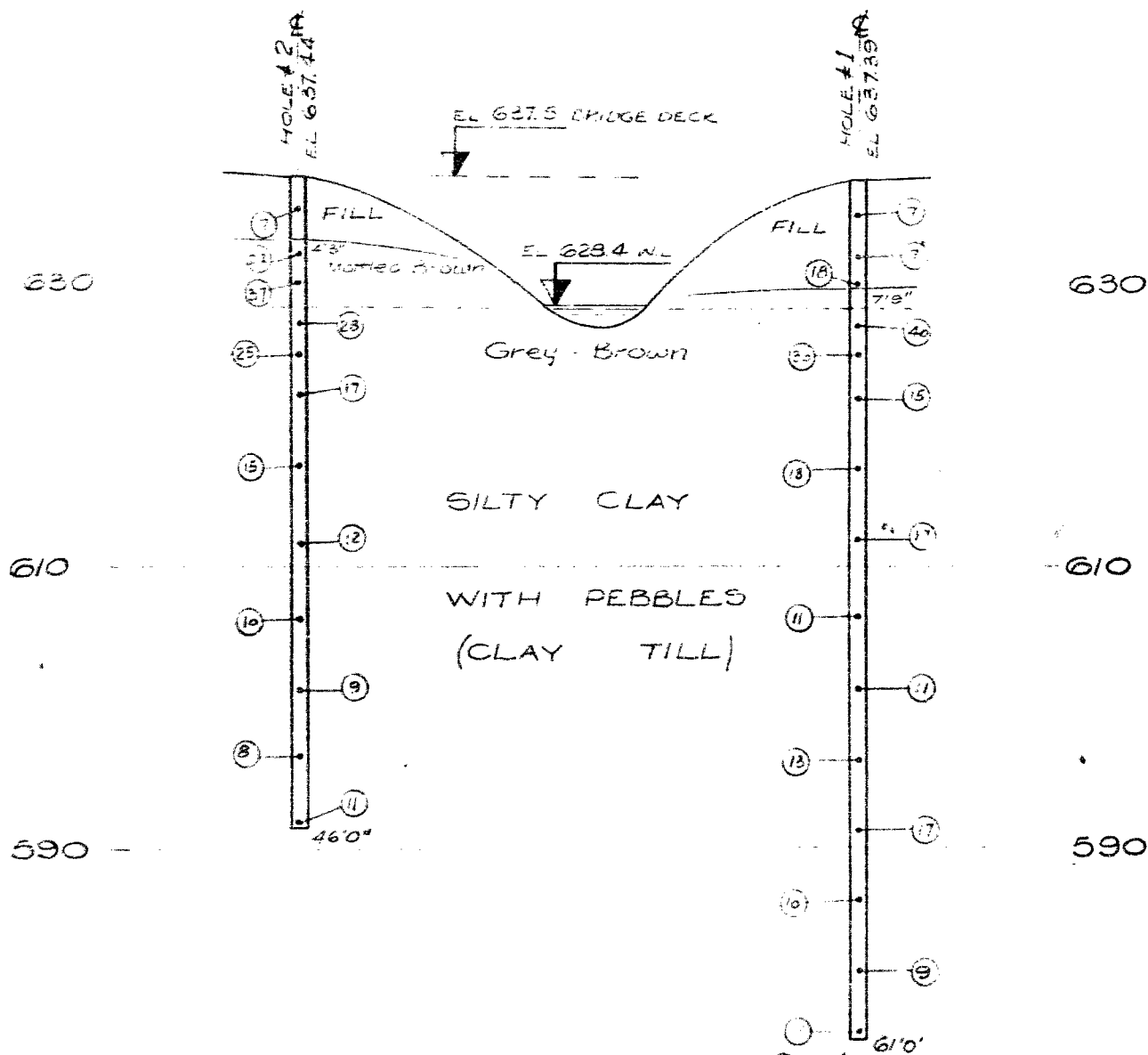
- Borehole.
- (15) — Blows/Foot.

NOTE:

See borehole logs for
complete Soil Details.



SECTION ON
Scales: Hor. &



SECTION ON HOLES 2 & 1
 Scales. Hor & Vert. 1"=10'0"

40J16-55
 GLOCRES No.

Job #6138
 e.m.peto associates ltd.
 April 1961 g.t.

D.
 le.
 Foot.

ago for
 details.