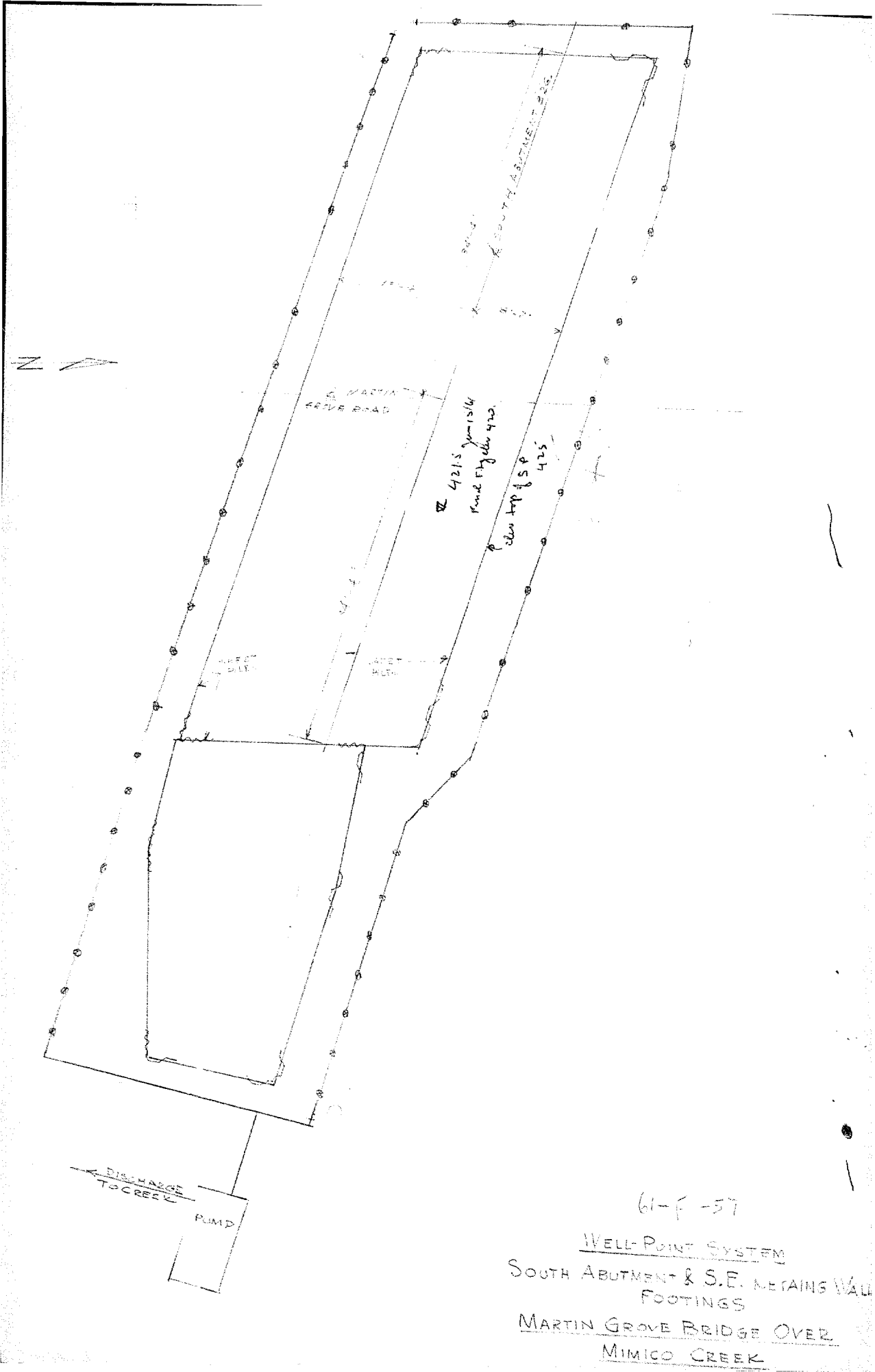

61-F-57

WELL-POINT SYSTEM
SOUTH ABUTMENT & S.E. RETAINING WALL FOOTINGS
MARTIN GROVE BRIDGE OVER MIMICO CREEK

cc: Gen. Files

28-6.

FILES.

June 30, 1961.

SITE VISIT -- June 15, 1961.

Foundations Office.

W.J. 61-F-57.

Re: Martin Grove Bridge over Mimico Creek
District No. 6.

Representatives of the Foundation Section visited the above mentioned site on June 15, 1961, to inspect the vacuum well point system used for dewatering the footing excavation. The following tests were made to see whether the system was properly installed:-

1) A borehole was put down very close to the system in order to determine the subsoil conditions and drainage properties. This showed that the subsoil generally consisted of silty fine sand except for a thin layer of silt within the tip elevation of the well points.

2) Discharge from the well points was observed and recorded. The discharge was approx. 20 gal./min. which is considered very low for sandy materials.

3) The vacuum in the header as well as in the discharge pump, was measured. These measurements indicated the system was perfectly air-tight and no losses were observed.

4) The connections between the header and well points were removed to determine whether the well points were functioning properly. It was found that the majority of well points were partially silted up and clogged at the joints.

It can be concluded from the above mentioned observations that the system was not properly installed due to the inexperience of the contractor in this type of work. This situation could have been eliminated by retaining an organization specializing in this line.

L. G. Soderman,
PRINCIPAL FOUNDATION ENGR.
Per:

M. Devata
(M. Devata,
PROJECT FOUNDATION ENGR.)

Foundations Office (2)
Gen. Files.

Mr. N. D. Smith,
Room 112.
Materials & Research Section,
(Foundations Office)

June 15, 1961.

Re: MIMICO CREEK (Martin Grove Bridge) -- District #6.

61-E-57

This is to inform you that we have hired the services of Dominion Soils to provide drilling only, for one boring at the Mimico Creek (Martin Grove Bridge) job being done by Etobicoke Township, on which we have advised Ken Kleinsteiber. On the basis of our advice, well-pointing was incorporated in the substructure construction. We advised the Consultants to retain the services of a specialist company in well-pointing; this, they have not done. They have let the Contractor, himself, use his own well-pointing system, and after two days' pumping it has not proved effective.

We based our recommendations to Kleinsteiber on the report by E. M. Peto to Laughlin, Wyllie & Ufnal, and this boring is to confirm that Peto's results are, in fact, correct. This will allow us to instruct the Consultants that the Contractor's installation is not adequate, and they can do whatever is necessary to get the proper installation put in.

LGS/MdeF

L. G. Soderman,
PRINCIPAL FOUNDATION ENGINEER

Mr. A. M. Toye,

Bridge Engineer.

Materials & Research Section.

January 9, 1961.

61-F-57

Attention: Mr. K. Kleinsteiber.

Re: Martin Grove Road Bridge over Mimico Creek, Dist. #6,
(Pumping Test from Well Points)

In order to confirm the practicability of dewatering the footing excavation areas of this site by means of well points, two pumping tests have been carried out.

The first tests were carried out on December 14 - 15, 1960, and consisted of sanding in well points to a depth of 12 to 15 feet below creek level and pumping from each point. At each of the three point installation locations, water was extracted and the general observation made by the operator, was that the material was pumpable.

Test No. 1.

This first test was carried out by a competent technician supplied by the contractor. No confirming observations were carried out, either by the consultants, Laughlin, Wyllie & Ufnal, or by the D.H.O., Foundation Sub-section. In view of this, and because of the extreme importance of the decision to use well points, Mr. Wyllie suggested that a second test be carried out which could be observed by members of his organization, and also the D.H.O. The contractor agreed to do this test free of charge.

cont'd. /2 ...

Test No. 2.

In the second test, three well points were jetted in to a depth of 12 feet below creek level. Pumping was carried out from one point which was located 6 feet and 9 feet from the other two point locations. The rate of water extraction from the soil was approximately 2 gallons/min. and during a one-hour period, the water level was drawn down 1.4 feet at a distance of 6 feet away from the point being pumped.

Adjacent Full-Scale Pumping Operation.

In the vicinity of the bridge, along the north side of the Martin Grove Road, a sewer is being built. The contractor has been maintaining his excavation in a workable condition by pumping the water from the excavation. When he nearly reached the desired excavation level, the bottom of the excavation started to come up and "boiling" conditions developed. The sheeting on part of the north side of the excavation subsided for about 4 feet into the ground which lost its bearing capacity due to piping. After this, the contractor resorted to well points which he installed on the north side of the excavation, only. The length of the excavation is about 200 feet and all along there are well points on one side. There are 42 points spaced at intervals ranging from 3 - 5 feet. The points are installed at a distance of approx. 10 feet from the excavation and driven to about 15 - 16 feet below ground level. The pump is situated at the west side of the header pipe and on a pile of soil about 8 feet above the header line. Thus, the practical pumping height has nearly been reached. The discharge was estimated to be in the order of 30 gallons per minute. The excavation has not been dry, but it seems that the ground water level has been lowered for a certain amount to allow further excavation without boiling taking place. This was observed in a small portion of the excavation where work was continued on January 3rd, 1961.

cont'd. /3 ...

The pumping test, as well as the information given above about the sewer excavation, indicate that water can effectively be pumped from the subsoil. It should be noted that the pumping test at the new bridge site, was performed with a pump which is not suitable for this purpose, and also that the well point system used at the sewer excavation was only partly effective due to the reasons stated earlier. With a properly installed well point system, it is believed that no difficulties should be encountered in the process of excavating the footings for the new bridge.

L. G. Soderman,
PRINCIPAL FOUNDATION ENGR.
Per:

Agstermac

(A. G. Stermac,
FOUNDATION OFFICE ENGR.)

AGS/MdeF

cc: Foundations Office
Gen. Files.

e. m. peto associates ltd.

YOUR REFERENCE:-

OUR REFERENCE:- 60185

1287 caledonia road.
TORONTO 19, ONTARIO.
RUssell 9-1126

September 9th, 1960.

30M11-7

The Corporation of the Township of Etobicoke,
c/o Messrs. Laughlin Wyllie and Ufnal,
53 Kipling Ave. South,
Toronto 18, Ontario.

Attention: Mr. H. Scheckenberger

Re: Soil Site Investigation
Martin Grove Bridge - Mimico Creek,
Etobicoke, Ontario.

Dear Sirs:

We have pleasure in forwarding herewith three (3) copies of our soil investigation report. One copy has been sent directly to Mr. W. M. Swann, the Township Engineer, The Corporation of the Township of Etobicoke.

In the following report you will find a detailed description of the soil conditions encountered and our observations and conclusions regarding the foundation of the proposed structure and the approach embankment.

We believe we have covered all the points from the soil mechanics point of view in connection with the foundation of the proposed structure which will permit you to proceed with the final foundation design.

Should you have some questions or require clarification on some of the points mentioned in the report, we will be very pleased to be of further service.

Yours very truly,

E. M. PETO ASSOCIATES LTD.,

E. M. Peto, P. Eng.

BL:sb

THE TOWNSHIP OF ETOBICOKE

c/o MESSRS. LAUGHLIN, WYLLIE & UFNAL

SOILS REPORT

MARTIN GROVE BRIDGE OVER MIMICO CREEK
ETOBICOKE, ONTARIO.

September, 1960

e. m. peto associates ltd.

e. m. peto associates ltd., 1287 caledonia road, Toronto 19, Ontario

Job No. 60185 Client's Ref. No. Date September 9, 1960

Report on

SOIL SITE INVESTIGATION

MARTIN GROVE BRIDGE OVER MIMICO CREEK ETOBICOKE, ONTARIO

for

THE CORPORATION OF THE TOWNSHIP OF ETOBICOKE

c/o MESSRS. LAUGHLIN, WYLLIE AND UFNAL

INTRODUCTION:

We were authorized by the Laughlin, Wyllie and Ufnal, Consulting Engineers, to carry out a subsoil investigation at the Martin Grove Bridge over Mimico Creek in the Township of Etobicoke.

The field investigation was carried out during the period August 24th to 30th, 1960 inclusive. At the latter part of this period two drill rigs were employed on the site.

The investigation was called for in order to obtain details of the sub-soil stratification, the characteristics of strata encountered, its bearing capacities, and any other problems connected with the foundation at the above site.

GENERAL INFORMATION:

(a) The testholes were put down in accordance with our standard procedure as outlined in Appendix A.

(b) The testholes were located according to the drawing No. S.1 supplied by the Consulting Engineers.

(c) The details of the testholes (i.e the elevation at the existing grade, terminal depth of testholes and the diameter of the casing) were as follows:-

GENERAL INFORMATION:

(c) - Cont'd

Testhole	Elevation at Existing grade	Terminal Depth (ft.)	Dia. of casing (inch)
#1	430.8	31'0"	BX (2 1/2")
#2	433.1	50'6"	BX (2 1/2")
#3	426.4	31'0"	BX (2 1/2")
#4	436.4	63'6"	BX (2 1/2")
#5	460.0	21'0"	BX (2 1/2")
#6	435.1	31'0"	BX (2 1/2")

(d) The elevations as given above, in the following report and the appendices refer to the elevation 482.6 denoted for the Bench Mark V13 on the Northeast corner of House No. 317 at Rathburn Road.

(e) The results of the standard penetration test versus elevation and the natural moisture contents versus elevation are shown in graphical form in Appendix B under "Field Test Results".

(f) The Laboratory test results (Mechanical Analyses) are given in Appendix C.

(g) The details of water level readings conducted during the present investigation are given in Appendix D.

(h) The calculated allowable bearing values for a single pile for various length of piles are given in graphical form in Appendix E.

SITE DESCRIPTION:

The site is located at the intersection of Martin Grove Road and Mimico Creek some 300 feet north of the Rathburn Road in the Township of Etobicoke.

The area north of the existing bridge is relatively flat which probably accounts for the meandering course of Mimico Creek. The south side of Mimico Creek at the existing bridge is formed by a steep bank which rises approximately 25 feet over a linear distance of about 300 feet. Particularly south east of the existing bridge the hill has a steep embankment approaching a slope of 1 vertical to 2 horizontal. The slopes on the south side of Mimico Creek show to a considerable extent the effect of surface water erosion. To some extent a surface creep of this slope was observed to exist.

The present bridge is a narrow single span concrete structure (clear span of 75 feet). A settlement crack was seen to exist between the main bridge structure and the north-west portion of the approach contained by a retaining wall (Area of testhole 1). The south-east portion of the abutment was found to be pushed away from the main bridge abutment and a gap of about 3 to 4 inches exists between

SITE DESCRIPTION: - Cont'd

the bridge structure and the abutment through which, it was seen, surface water has an unhindered passage.

At the time of this investigation the construction of a 48 inch watermain was in progress some 80 ft. west of the present right of way.

The four testholes (1,2,3 and 4) flank the abutments of the existing bridge while the two remaining holes (5 and 6) are south and north, respectively, of the existing bridge on Martin Grove Road.

GEOLOGY:

Upon the retreat of the Wisconsin Glacier from the area under investigation, the resultant till was eroded by the stream action. As the streams drained into Lake Iroquois, which at the time occupied the area of the present Lake Ontario, they deposited strata of sand and silt over the glacial material.

Thus the area adjacent to Mimico Creek has been subjected to a glacial environment followed by a fluvial environment.

SOIL CONDITIONS:

During the present investigation the following types of soil were encountered:

(a) Brown to grey-brown sandy and silty loam
(b) Olive-brown very silty fine sand.
(c) Brownish-grey fine sand.
(d) Grey silt to sandy silt
(e) Grey very silty very fine sand.
(f) Grey fine to coarse sand.
(g) Grey-brown medium to coarse sand.
(h) Grey till
(i) Mixed fill
(j) Grey clayey sand
(k) Grey fine sand
(l) Pale-brown to light-brown fine to silty sand
(m) Brown clayey silt
(n) Pale brown sandy silt

As may be seen, a considerable number of various layers exist at the site. Under close scrutiny, it may be seen that they all represent the non-cohesive soils (with one exception of clayey silt). During the examination it was found that in some instances the transition between the individual layers, particularly between sandy silt and very silty very fine sand, was of such a nature that the establishment of a definite stratification boundary was extremely difficult and if such is given in the following report it is an approximation only.

The characteristics of each layer are as follows:-

SOIL CONDITIONS:

(a) Brown to grey-brown sandy and silty loam

This layer was encountered at testholes 2, 3, 4, 5 and 6. In testholes 5 and 6 it was found underlying the mixed fill layer as mentioned under (i). The limits of the sandy to silty loam stratum were established at the following depths below the existing grade:

Testhole	Limits Upper	Lower
2	surface	5'10"
3	surface	4'6"
4	surface	6'6"
5	2'0"	3'0"
6	2'0"	5'2"

At testholes 2, 4 and 5 the general colour was brown; at testhole 3, greyish-brown, and at testhole 6 brown and mixed brown. The examination of the available samples showed that the composition of this stratum varied considerably from a sandy clay soil to a silty fine sand soil. A considerable proportion of organic matter was seeen to be present.

The "N" values (i.e the number of blows per foot penetration as obtained in the standard penetration test) were found to vary between 12 (testhole 4) to 4 (testholes 5 and 6), depending upon the composition of this stratum, the natural moisture content was seen to vary between 25.9% (testhole 2) and 8.4% (testhole 4).

(b) Olive-brown very silty fine sand.

This layer was encountered only at testholes 2 and 4. At testhole 2 it was established between depths of 5'10" and 7'5" and at testhole 4 between depths of 6'6" and 8'6". Thus the maximum observed thickness of the layer was about 2 ft. The stratum was found to contain some organic matter. The layer was slightly denser than the overlying sandy to silty loam layer and the "N" values were in order of 14 to 27. The natural moisture content was at about 15%. (15.2% at testhole 4)

(c) Brownish-grey fine sand.

This stratum was found to exist in the area of testholes 1, 2, 3, 4 and 6, i.e the lower lying area of Mimico Creek valley.

The stratification limits were as follows:-

Testhole	Limits Upper	Lower
1	10'0"	13'0"
2	7'5"	19'0"
3	4'6"	10'0"
4	8'6"	12'0"
6	5'2"	15'0"

SOIL CONDITIONS:

(c) Brownish-grey fine sand - Cont'd

According to the above results the depth of the brownish-grey fine sand layer increases in an easterly direction, i.e from the area of testholes 1 and 4 towards the area of testhole 2. The maximum thickness was found to be 11'7" at testhole 2.

The results of the standard penetration test indicated that the density of the stratum also increases in an easterly direction. The lowest "N" values were obtained at testhole 1 (maximum "N" value of 6) and the maximum "N" value of 41 was recorded at testholes 2 and 6.

The natural moisture contents were found to vary between 38.9% (testhole 2, depth 10'3") and 15.8%. The moisture content of 38.9% as recorded at testhole 2 at the 10'3" depth may be due to a seam of gravel which was encountered at this depth. The average moisture contents were calculated to be as follows:

Testhole 1	-	24.8%
Testhole 2	-	22.8%
Testhole 3	-	23.4%
Testhole 4	-	19.6%
Testhole 5	-	20.1%

and the average moisture content for the whole layer was found to be 22.1%. This value of moisture content suggests that the fine sand layer is in a saturated condition.

The mechanical analyses results were as follows:

Testhole	Depth	Per cent Sand	Silt	Clay
2	12' - 13'	92	8	-
3	7' - 8'	75	25	-

According to these results the textural classification of the soil is a fine sand to a silty sand soil.

The variation in the silt content of the stratum is due to the presence of the thin seams of silt which were found to exist in the matrix of fine sand.

At testhole 1 and embedded in the layer, fragments of wood were encountered at 10 to 11 feet below grade. At testhole 6 between depths of 5'8" and 5'10" a gravel seam was encountered.

SOIL CONDITIONS:

(d) Grey silt to sandy silt
and
(e) Grey very silty very fine sand

As mentioned at the beginning of this section the transition between the silt, sandy silt and the underlying layer of very silty very fine sand was in many instances such that no definite stratification could be established. Thus the characteristics of both layers are given under one heading.

A more or less distinct boundary was seen to exist at the location of testhole 3, and to a lesser degree at testhole 4.

At testhole 3 the grey silt to sandy silt layer was located, roughly, between depths of 10 and 15 ft.; at testhole 4 at first sandy silt from the 12'0" to the 19'6" depth was established, followed by approximately a 5 ft. thick layer with an increased silt content.

At testhole 1 from the 13'0" depth to the end of the testhole (at 31'0") a very fine very silty fine sand (sandy silt) layer was established. At testhole 2 the upper limit of the sandy silt layer was at the 19'0" depth and the lower limit at the 40'6" depth. As mentioned above at testhole 3 from about the 15 ft. depth to the 27 ft. depth a very silty very fine sand was encountered and at testhole 4 the lower limit was at the 39'6" depth.

Thus the upper and the lower limits of the combined stratum of grey silt to sandy silt changing with depth to very silty very fine sand layer can be given as follows:-

Testhole	Upper boundary	Lower boundary
1	13'0"	not established
2	19'0"	40'6"
3	10'0"	27'0"
4	12'0"	39'6"
6	15'0"	not established

A difference in "N" values was seen to exist between the top stratum containing an increased silt content and the lower one. At testhole 2 between a depth of 10 and 15 ft. the "N" values were of about 20 (19 and 21). Where the silt content decreased the "N" values were seen to increase. At testholes 1 and 4 "N" values of over 100 were recorded.

Similarly the natural moisture content was seen to be dependent on the silt content. At testhole 2 at the upper portion of the layer, moisture contents of 24.3% were obtained and of the order of 16 to 19% at the lower portion of this stratum. Generally there is a trend to a decrease of moisture content with depth.

SOIL CONDITIONS:

(d) Grey silt to sandy silt and (e) Grey very silty very fine sand - Cont'd

The variability of this deposit can also be seen from the results of the Mechanical Analyses tests which were as follows:

Testhole	Depth	Per cent Sand	Silt	Clay
2	24'6" - 25'6"	45	52	3
2	29'6" - 30'6"	65	35	-
4	29'6" - 30'6"	35	58	7

As may be seen the silt content varies between 35 and 58% with the corresponding sand content between 65 and 35%.

The results of the mechanical analyses were plotted versus elevation (see Appendix C). Assuming that the average elevation of the upper limit of the stratum is at 418.5 and the lower at 396.2, it may be seen fromthe graph that from elevation 418.5 to elevation 416.5 a silty sand soil exists, from 416.5 to 405.0 a sandy silt, followed again by a silty sand soil.

(f) Grey fine to coarse sand.

At testhole 2 from 40'6" to 45'6", at testhole 3 from 27'0", and at testhole 4 from 42'6" to 50'2" and again from 56'0" to 59'4" depth, a layer of grey fine to coarse sand was found.

This stratum was extremely dense with "N" values of over 100.

The natural moisture content varied between 10 and 12%.

The interbedded character of the various deposits as encountered at testhole 4 (alternate layers of grey fine to coarse sand and fine sand) indicate the seasonal depositions of the layers.

(g) Grey-brown medium to coarse sand.

This layer was found at testhole 2 between depths of 45'6" and 48'8" and at testhole 4 from 59'4".

The density of the material at testhole 2 was found to be less than at testhole 4. (probably due to the difference in depth). At testhole 2 an "N" value of 23 was recorded and at testhole 4 of 163.

Due to the insufficient depths of the remainder of the testholes the continuation of this deposit over the whole investigated area could not be established.

SOIL CONDITIONS:

(h) Grey Till.

As mentioned in the geology of the site the fluvial deposits brought down by the Mimico Creek rest on the eroded glacial deposits. Such a glacial deposit was encountered at testhole 2 from a depth of 48'8" only. Essentially it was a clayey silt soil with grits and pebbles, which is called a till. The "N" values obtained in this layer indicated that the till is extremely hard and a natural moisture content of only 9.6% was recorded.

(i) Mixed Fill.

The uppermost portion of the soil profile at testholes 1, 5 and 6, is formed by a man-made fill. At testhole 1 the material was used as a backfill and consisted of sandy loam, organic matter and stones, - mixed brown in colour. The depth of the fill at testhole 1 was found to be 2 ft.

At testholes5 and 6 similarly, a fill material to a depth of 2 ft. was encountered. At testhole 5 it consisted of sand and gravel subbase topped by the asphalt surface. The colour was mixed grey with some brown.

At testhole 6 the fill consisted of silty fine sand, containing some organic matter.

Generally the fill material was moist and in a loose to compact condition.

(j) Grey clayey sand, organic matter.

In the area of testhole 1 only a layer of grey clayey sand was found. The layer extended from 2 to 10 ft. below existing grade. The top portion consisted of fine sand and pebbles, brownish-grey in colour changing gradually to fine sand with some clay and organic content, olive-brown in colour, and from a depth of about 7 ft. it was classified as clayey sand with steams and layers of organic matter. Due to the presence of the organic matter the natural moisture content of 22.5% was recorded at a depth of 7 to 8 ft. "N" values of 4 were consistent throughout the depth of the layer.

(k) Grey fine sand.

Layers of grey fine sand were encountered at various depths at testhole 4. The upper layer of grey fine sand situated between the strata of sandy silt and grey fine to coarse sand was located between depths of 42'6" and 50'2", whilst the lower layer was found to be underlying the fine to coarse sand from 56'0" to 59'4" below grade.

(k) Grey fine sand - Cont'd

At testhole 6 the sandy silt at a depth of approximately 25 ft. changed to grey fine sand which was seen to continue to the bottom of the testhole.

The fine sand was of dense to extremely dense consistency with "N" values varying from 35 to over 100. The natural moisture content was about 12%, indicating a wet condition.

Area of Testhole 5

During the investigation it was found that apart from the upper two strata of mixed fill and the sandy to silty loam, the stratification at testhole 5 was quite different from the remainder of the area investigated. The reason for such a difference was probably due to the higher location of testhole 5, since the soil was similar in composition and character to the lower lying soils encountered at the other testholes, the main difference being in colour.

From 3'0" to 6'1" a stratum of pale-brown fine sand with some silt content was met. The "N" value was 47 with a corresponding moisture content of 13.0%. It was then followed by a layer of silty fine sand, light brown in colour which was found to extend to 8'9" below grade.

The "N" value of 132 was recorded at a depth of 7 to 8 ft. indicating an extremely dense material, the natural moisture content was lower than the overlying fine sand, and was 9.7%.

Underlying the silty fine sand there was a layer of clayey silt, also pale-brown changing to light-grey in colour. It was estimated that ab about a depth of 15 ft. the clayey silt stratum changed to a sandy silt, pale brown in colour, which extended to the bottom of the testhole.

The results of the mechanical analyses were as follows:

Clayey silt layer (depth 10-11Ft)	-	Sand - 26% Silt - 52% Clay - 22%
Sandy silt layer (depth 20-21 ft.)	-	Sand - 15% Silt - 77% Clay - 7%

Both strata exhibited very dense to extremely dense consistency with moisture contents raning from 12.2% to 18.6%.

WATER CONDITIONS:

According to the detailed water level readings carried out during this investigation (see Appendix D) the following observations and conclusions may be made regarding the water conditions at the site investigated.

1. The short period of the investigation was insufficient to establish a definite level for the G.W.T.

2. Generally (area of testholes 1,2,3, and 4) the water table seemed to be between 12 and 13 ft. below existing grade, although the water level in the Creek was, at the time of investigation, some 7 to 8 ft. below the existing grade (holes 1, 2 and 4). The discrepancy is possibly due to the nearby cofferdam constructed west of the investigated area for the watermain. Here the water level was lowered by a number of well-points, inside the sheeting. This is probably the reason why the observed ground water levels were below the Mimico Creek water level.

3. At the area of testhole 6 (further west of the influence of the cofferdam) the G.W.T. was 5'3" below the existing grade and this depth corresponds closely to the water level in the Mimico Creek at that section.

4. At the depth investigated in the area of testhole 5, no free W.T. was established.

5. The non-cohesive strata as encountered at the above site have a tendency to a "quickening" condition (as seen from the cases where the sand was backing up in the casing during the drilling operations) when the critical hydraulic gradient conditions are set up.

6. The coarse layers underlying the fine to very fine granular material contain water which is under some Artesian pressure.

   This was particularly evident from the conditions encountered at testhole 3, where the water level was some 3 inches above existing grade, i.e at elevation 426.65.

OBSERVATIONS AND CONCLUSIONS:

General Soil Conditions;

1. The stratification of the subsoil due to its fluvial character is more or less horizontal with boundaries between some of the layers being ill defined. In particular the gradual transition between the sandy silt and the very silty
2. fine sand is obscure.

   Generally the deposits are of a non-cohesive type.

OBSERVATIONS AND CONCLUSIONS:

General Soil Conditions. - Cont'd

2. The soil is generally dense to extremely dense.

3. The subsoil is fully saturated with probably a high water table due to the presence of the Creek.

Foundation:

1. A new bridge structure is proposed to replace the existing structure. The proposed structure will probably be a single span structure which will tolerate some differential settlement.

2. The spread footing design.

(a) The allowable bearing values for a spread footing design will be governed mainly by a settlement consideration.

Limiting the total amount of settlement to 1 inch the following allowable bearing values may be given for various proposed elevations and footing sizes:

Proposed Foundation Elevation	Footing Size (ft.)	Allowable bearing Value a +/sq.ft.
425	5	1.35
	10	1.10
	15	1.05
	20	1.00
420	5	2.20
	10	1.80
	15	1.70
	20	1.65
415	5	2.70
	10	2.25
	15	2.10
	20	2.10

These values will limit the settlement to 1 inch. The factor of safety against shear failure will be in nearly every case in excess of 3.

OBSERVATIONS AND CONCLUSIONS:

Foundation:

2. (b) The allowable bearing values considering only the shear criterion (F.S.=3 against shear failure), but which will induce settlements in excess of 1 inch may be given as follows:

Proposed Foundation Elevation	Footing Size (ft.)	Allowable Bearing Value +/sq. ft.
425	5	1.50
	10	1.85
	15	2.20
	20	2.55
420	5	2.95
	10	3.30
	15	3.65
	20	4.00
415	for all footing sizes	4.00

The settlements to be expected if the above given values are used will range from a minimum of 1.2 inch (F. Elev 425; footing size 5 ft.) to a maximum of 2.6 inch (F. Elev. 425, footing size 20 ft.).

3. The Pile Foundation:

(a) In view of the conditions encountered the total bearing value of any pile will consist of an end bearing component and a frictional (adhesion) component.

(b) The remoulded triaxial U.U. tests on the sandy silt and the very silty very fine sand showed that the apparent angle of friction is $\emptyset = 34^{\circ}$.

Based on this figure the allowable bearing values of the pile foundation was calculated and presented in a graphical form in Appendix E.

(c) As may be seen the curve representing the allowable bearing value is a component of two curves.

The lower curve for a pile length from 0 to about 25.4 ft. represents the allowable bearing value of a single pile from the shear criterion.

The upper flatter curve which starts at a pile length of 25.4 and above is derived from the settlement characteristic of the subsoil.

OBSERVATIONS AND CONCLUSIONS:

Foundation

3. (d) Due to the character of the sub-soil, H-piles are best suited, but from a soil mechanics point of view timber piles seem to be of advantage as they will allow a more rapid dissipation of pore pressures which will be set up during the driving operations.

Constructional Problems.

1. The soil conditions as encountered at the site investigated will set-up considerable constructional problems for any type of foundation employed.

2. (a) If a spread footing design is contemplated difficulties will be encountered due to the unfavourable water conditions for any footings placed below the Mimico Creek Water level.

   (b) For excavations exceeding 10 ft. in depth sheeting will be required. Cofferdam construction for the sheeting will be necessary.

   (c) To lower the water table a well-point system will have to be installed outside the excavation area and the sheeting.

   (d) The problem of the heave of the excavations due to the critical hydraulic gradient and seepage taking place under the sheeting will exist in all excavations below the G.W.T.

   (e) Uplift pressures will have to be considered in the calculation for a spread footing type of foundation.

3. (a) For the pile-type of foundation the control of Ground water does not come into consideration, thus from this aspect pile foundation seems to be the better solution.

   (b) However, due to the silty character of the subsoil, considerable difficulties will be experienced in driving the piles below a depth of 25 ft. The resistance to driving set-out in the subsoil will be enormous.

   (c) A dynamic cone penetration test carried out in the vicinity of testhole 2 (5 ft. south of hole 2) showed that 60 blows per foot penetration were reached after only 10 ft. of penetration. This result is indicative of the difficulties to be expected when driving the piles.

OBSERVATIONS AND CONCLUSIONS:

Constructional Problems:

3. (d) Because of the presence of the Artesian conditions, caution is recommended in driving the piles, if they are to be driven into the coarser sand strata; as a temporary loss of adhesion on the piles may result if the Artesian water source is reached.

This condition is thought to be temporary and at the final condition (when superstructure is constructed) all the adhesion will be mobilized.

(e) A temporary liquefaction of the fine-grained soil may result due to pile driving operations. This liquefaction will be of a temporary nature, and will not effect the permanent conditions.

4. Approach Embankment

(a) We understand that it is porposed to raise the existing grade at the bridge some 10 ft.

(b) The results of the testholes 5 and 6 show that no problem will be encountered in placing the approach embankment provided the mixed fill and the loam strata (descrioed under (i) and (a)) are removed.

(c) The approach embankment should consist of a non-frost susceptible material compacted to 95% of the maximum dry density as obtained in Standard Proctor Compaction test.

The fill should be placed and compacted in 6 inch layers.

(d) No settlement is expected to occur due to the embankment loads. If any settlement does take place it will be of short duration and will be completed during the construction period.

5. The installation of drainage system on the south bank of the Mimico Creek, immediately south of the bridge structure, to intercept the surface water and prevent the bank from eroding, and thus increasing the factor of safety of the south bank against any possible slip failure taking place and endangering the bridge structure.

CONCLUSIONS:

1. From the subsoil conditions as encountered at the site, it is our opinion that the most suitable type of foundation is a pile foundation with the allowable bearing values as given in the graph in Appendix E.

CONCLUSIONS: - Cont'd

2. A pile foundation also provides a better solution to the scour problem than a spread footing design.

3. The piles should be driven and the recommended type are H-steel piles.

E. M. PETO ASSOCIATES LTD.,

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

BL/ajm

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e. m. peto associates ltd.

SOIL ENGINEERING SERVICE – TORONTO, ONTARIO

BOREHOLE LOG

Job Name Martin Grove Bridge
Client Corp. of the Twp. of Etobicoke c/o Laughlin, Wyllie & Urnal
Elevation Client's (Geodetic)

Job No. 60185
Casing BX
Compiled By P.A.

Borehole No. #1
Boring Date Aug. 29, 1960
Checked By B.L.

GEOCRES No. 30M11-7

SAMPLE CONDITION

- UNDISTURBED
- FAIR
- DISTURBED
- LOST

SAMPLE TYPE

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

ABBREVIATIONS

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
			0'0"						
Sandy loam, organic matter Mix. br. stones (mixed fill)			430.8 / 2'0"			C.S.			Dry
fine sand, some pebbles	Brownish Gr.	Loose			1	S.S.	8	10.7	Moist
Fine sand some clay cont. org. matt.; frag. of stones	Grevish-br.	V.loose to loose	5'0"		2	S.S.	4		Moist
Claydy sand, lavers& seams of org. matter	Olive-grey	V.loose to loose			3	S.S.	4	22.5	Q. moist
			10'0"						
Silty sand and frag. of wood	Brownish-Gr.	V.loose to loose			4	S.S.	4	20.3	Sat.
Silty sand, some clay	"	Loose	13'0"		5	S.S.	6	23.4	Sat.
			15'0"						
Very silty fine sand	Grey	Dense to v. dense			6	S.S.	51	19.3	Q. moist - wet
			20'0"						
"	"	Ext.dense			7	S.S.	85	16.6	Q. moist-wet
			25'0"						
"	"	Ext.dense			8	S.S.12 5/6"			Recovered as W.S.
			30'0"						
"	"	Ext.dense	31'0"		9	S.S.	104	17.5	Q. moist - wet

Test hole terminated at 31'0"

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SOIL ENGINEERING SERVICE – TORONTO, ONTARIO

BOREHOLE LOG

Job Name Martin Grove Bridge — Job No. 60185 — Borehole No. 2

Client Corp. of Twp. of Etobicoke c/o Laughlin, Wylie & Ufnal — Casing BX — Boring Date Aug. 23, 1960

Elevation Client's (Geodetic) — Compiled By B.L. — Checked By C.F.F.

GEOCRES No. 30M-11-7

SAMPLE CONDITION

- UNDISTURBED
- FAIR
- DISTURBED
- LOST

SAMPLE TYPE

- 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

ABBREVIATIONS

- 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
			0'0"						
Sandy loam topsoil, roots	Brown		433.1		1	C.S.			J.M.
Sandy silt	Brown	V. loose to loose	3'0"		2	S.S.	0	20.8	J. M. to M.
As above, trace clay & org. matter	do. with rust marking	V. loose to loose	5'10"		3	S.S.	5	25.0	Moist Wet at 5'10"
					4	S.L.			
Very silty fine sand, g. & p. Fine sand	Olive brown	Compact	7'5"		5	S.S.	27	22.9	Sat. at 7 ft. Water in hole after sampling to 9 ft. *stone in sampler. Wet. Stone fragments from 10ft.
Fine sand	Brownish Gr.	Dense	10'0"		6	S.S.	38* at 10'3"	28.0	
As above, stratified	"	Dense			7	S.S.	41	19'3"	Used wash water from 13 ft. sat.
			15'0"						Sand backing up casing
As above, stratified with thin silt seams	Brownish gr. & grey	Dense			8	S.S.	39	20.3	From 15'3" casing at 14'6". Sat.
			19'0"						
Silty very fine sand	Grey	Dense			9	S.S. W.S.	39		
Very silty, v. fine sand	Grey	Dense to v. dense	25'0"		10	S.S.	49	21.0	Hole cased to 24'6" sand backing up casing after bailing hole.
As above	"	V. dense	30'0"		11	S.S.	59	46.0	Wet Sand backing up casing
As above	"	Compact to dense	35'0"		13	S.S.	33		Recovered at W.S.
Fine to coarse sand, stones	Grey	Extr. dense	40'6"		13	S.S.	171	8.1	Sand backing up casing Moist
									Sand backing up casing after chipping inside casing
Med. to coarse sand	Gr. brown	Compact	45'0"		14	S.S.	23	11.9	to 45'0" O. Moist
			49'8"						
Clayey silt, g. & p.	Grey	V. hard	50'0"		15	S.S.	100/5"	9.6	Moist

SOIL ENGINEERING SERVICE – TORONTO, ONTARIO

BOREHOLE LOG

Job Name: Martin Grove Bridge — Job No.: 60185 — Borehole No.: 2
Client: Corp. of Twp. of Etobicoke c/o Laughlin, Wylie & Uffnal — Casing: BX — Boring Date: Aug. 23, 1960
Elevation: Client's (Geodetic) — Compiled By: B.L. — Checked By: C.F.F.

GEOCRES No. 30M-11-7

SAMPLE CONDITION
- UNDISTURBED
- FAIR
- DISTURBED
- LOST

SAMPLE TYPE
- 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

ABBREVIATIONS
- 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
			0'0"						
Sandy loam topsoil, roots	Brown		433.1		1	C.S.			J.M.
Sandy silt	Brown	V. loose to loose	3'6"		2	S.S.	6	20.8	J. M. to M.
As above, trace clay & org. matter	do. with rust marking	V. loose to loose	5'10"		3	~~S.S.~~	~~5~~	~~25.0~~	Moist Wet at 5'10"
						S.L.			
Very silty fine sand, g. & p. Fine sand	Olive brown	Compact	7'5"		4 5	S.S.	27	22.9	Sat. at 7 ft. Water in hole after sampling to 8 ft. *stone in
Fine sand	Brownish Gr.	Dense	10'0"		6	~~S.S.~~	~~38~~ at 10'3"	~~28.0~~	sampler. Wet. Stone fragments from 10ft.
As above, stratified	"	Dense			7	S.S.	41	19'3"	Used wash water from 13 ft. sat.
			15'0"						Sand backing up casing
As above, stratified with thin silt seams	Brownish gr. & grey	Dense			8	S.S.	39	20.3	From 15'3" casing at 14'6". Sat.
			19'0"						
Silty very fine sand	Grey	Dense			9	~~S.S.~~ W.S.	~~39~~		
Very silty, v. fine sand	Grey	Dense to v. dense	25'0"		10	~~S.S.~~	~~40~~	~~21.0~~	Hole cased to 24'6" sand backing up casing after bailing hole.
As above	"	V. dense	30'0"		11	~~S.S.~~	~~59~~	~~46.0~~	Wet Sand backing up casing
As above	"	Compact to dense	35'0"		12	S.S.	33		Recovered as W.S.
Fine to coarse sand, stones	Grey	Extr. dense	40'6"		13	S.S.	171	8.1	Sand backing up casing Moist
									Sand backing up casing after chipping inside cas.
Med. to coarse sand	Gr. brown	Compact	45'6"		14	S.S.	23	11.9	to 45'0" O. Moist
			48'8"						
Clayey silt, g. & p. (till)	Grey	V. hard	50'6"		15	S.S.	100/5"	9.6	Moist

Test hole completed at 50'6½" depth.

e. m. peto associates ltd.

SOIL ENGINEERING SERVICE – TORONTO, ONTARIO

BOREHOLE LOG

Job Name: Martin Grove Bridge
Corp. of Twp. of Etobicoke
Client: c/o Laughlin, Wyllie, & Ufnal
Elevation: Client's (Geodetic)

Job No.: 60185
Casing: BX
Compiled By: B.L.

Borehole No.: 3
Boring Date: Aug. 27/60
Checked By: C.F.F.

SAMPLE CONDITION

- UNDISTURBED
- FAIR
- DISTURBED
- LOST

SAMPLE TYPE

- 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

ABBREVIATIONS

- 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
			0'0"						
			426.4						
Sandy clay, g. & p., org. matter	Gr. - brown	Loose to compact	4'6"		1	s.s.	9	13.8	W.T.F.L.
Fine sand, slightly silty	Brownish-grey	Compact			2	s.s.	22	24.1	V. wet to sat.
As above	As above	Compact to dense			3	s.s.	29	21.2	Wet
			10'0"						
Silt	Grey	Compact			4	s.s.	21	22.6	Sat.
"	"	Compact			5	s.s.	19	24.3	Sat.
			15'0"						
V. silty fine sand	"	V. dense			6	s.s.	54	20.8	V. wet
			20'0"						Recovered as a W.S.
"	"	V. dense			7	s.s.	54		
			25'0"						Recovered as a W.S.
"	"	Dense			8	s.s.	45		
			27'0"						
			30'0"						
Fine to coarse sand, some stones	Grey	Extr. dense	31'0"		9	s.s.	111	11.9	Q. moist

Test hole terminated at 31'0"

this margin reserved for binding

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SOIL ENGINEERING SERVICE - TORONTO, ONTARIO

BOREHOLE LOG

Job Name: Martin Grove Bridge | Job No. 60185 | Borehole No. # 4

Client: Corp. of Twp. of Etobicoke c/o Laughlin, Wyllie & Ufnal | Casing: BX | Boring Date: August 25th-26th, 1960

Elevation (Geodetic): | Compiled By: B. Lewicki | Checked By: AM / CFF

SAMPLE CONDITION

- UNDISTURBED
- FAIR
- DISTURBED
- LOST

SAMPLE TYPE

- 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

ABBREVIATIONS

- 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

30 m - 7

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
			0'0"						
Very sandy silt some clay content & organic matter	Brown		436.4		1	C.S.			
Very sandy silt	Brown	v. loose to loose			2	S.S.	5	8.4	almost dry
As above, grits, pebbles & stones, some organic matter	Brown	loose to compact	5'0"		3	S.S.	12	9.8	moist
			6'6"						
Very silty fine sand, somestones	Olive brown	Compact	8'6"		4	S.S.	14	15.2	moist
Fine sand slightly silty	Brownish-grey with rust marking	Compact	10'0"		5	S.S.	20	19.6	C. moist
			12'0"						
Silty very fine sand	Grey	Compact to dense			6	S.S.	31	19.8	C. moist
Silty very fine sand	Grey	very dense	15'0"		7	S.S.	77	18.6	C. moist
			19'6"		8	S.S.	68	17.9	Saturated
Sandy silt	Grey	very dense							
Silty fine sand	Grey	exir. dense	25'0"		9	S.S.	102	18.4	C. moist
Very silty fine sand (sandy silt)	Grey	exir. dense	30'0"		10	S.S.	87	17.6	Sand backing up casing after sampling to 30'6" C. wet
		Exir. dense	35'0"		11	S.S.	121		Recovered as W.S.
Fine sand	Grey	Exir. dense	39'6"		12	S.S.	170	19.1	C. moist
			42'6"						
			45'0"		13	S.S.	116	12.2	
Fine to coarse sand, pebbles	Grey	Exir. dense							Wet

			0'0"						
Very sandy silt some clay content & organic matter	Brown		433.4	1	C.S				
Very sandy silt	Brown	v. loose to loose		2	S.S.	5	8.4	almost dry	
As above, grits, pebbles & stones, some organic matter	Brown	loose to compact	5'0"	3	S.S.	12	9.9	moist	
			6'6"						
Very silty fine sand, somestones	Olive Brown	Compact	8'6"	4	S.S.	14	15.2	moist	
Fine sand slightly silty	Brownish-grey with rust marking	Compact	10'0"	5	S.S.	20	19.6	C. moist	
			12'0"						
Silty very fine sand	Grey	Compact to dense		6	S.S.	31	19.8	C. moist	
Silty very fine sand	Grey	very dense	15'0"	7	S.S.	77	18.6	C. moist	
			19'6"	8	S.S.	68	17.0	Saturated	
Sandy silt	Grey	very dense							
Silty fine sand	Grey	extr. dense	25'0"	9	S.S.	102	18.4	C. moist	
Very silty fine sand (sandy silt)	Grey	extr. dense	30'0"	10	S.S.	87	17.6	Sand backing up casing after sampling to 30'6" C. wet	
		Extr. dense	35'0"	11	S.S.	121		Recovered as W.S.	
Fine sand	Grey	Extr. dense	39'6"	12	S.S.	170	19.1	C. moist	
			42'6"						
			45'0"	13	S.S.	116	12.2		
Fine to coarse sand, pebbles	Grey	Extr. dense						Wet	
			50'2"						
Fine sand	Grey	extr. dense		14	S.S.	228	14.2	Wet	
								Sand backing up casing	
			56'0"						
Medium to coarse sand	Grey								
			59'4"						
Fine to medium sand, g&p	Grey-brown	Extr. dense	63'6"	15	S.S.	163		Wet	
		Hole terminated at 63'6"							

e. m. peto associates ltd.

SOIL ENGINEERING SERVICE – TORONTO, ONTARIO

BOREHOLE LOG

Job Name: Martin Grove Bridge Corp. of Twp. of Etobicoke — Job No.: 60185 — Borehole No.: 5

Client: c/o Laughlin, Wyllie, & Ufnal — Casing: BX — Boring Date: Aug. 30/60

Elevation: Client's (Geodetic) — Compiled By: B.L. — Checked By: C.F.F.

GEOCRES No. 30M11-7

SAMPLE CONDITION

- UNDISTURBED
- FAIR
- DISTURBED
- LOST

SAMPLE TYPE

- 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

ABBREVIATIONS

- 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
			0'0"						
Sand, gravel (till) & asphalt Surface	Mixed grey some brown		400.0 2'0"			C.S.			Moist
Silty sand, pebbles & stones	Brown	V. loose to loose	3'0"		1	S.S.	4	14.1	Q. moist
Fine sand, slightly silty	Pale brown	Dense	6'1"		2	S.S.	47	13.0	Moist
Silty fine sand	Light brown	Extre. dense	8'9"		3	S.S.	132	9.7	Q. moist
			10'0"						
Clayey silt	Pale brown	Extr. dense			4	S.S.	113	12.2	M.D.T.P.L.
Clayey silt, grits.	Light grey	V. dense			5	S.S.	72	13.9	M.D.T.P.L.
			15'0"						
Sandy silt	Pale brown	V. dense			6	S.S.	75	13.7	Moist
As above	As above		21'0"		7	S.S.	141	18.6	
Testhole terminated at 21'0"									

this margin reserved for binding

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SOIL ENGINEERING SERVICE – TORONTO, ONTARIO

BOREHOLE LOG

Job Name Martin Grove Bridge Job No. 60185 Borehole No. 6

Client Corporation Twp. of Etobicoke c/o Laughlin, Wyllie & Ufnal Casing BX Boring Date Aug. 29, 1960.

Elevation Client's (Geodetic) Compiled By B.L. Checked By C.F.F.

GEOCRES No. 30M11-7

SAMPLE CONDITION

- UNDISTURBED
- FAIR
- DISTURBED
- LOST

SAMPLE TYPE

- 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

ABBREVIATIONS

- 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
			0'0"						
Sandy loam (Silty f. sand)Mix. brown			435.1		1	c.s.			Moist
some org. matter			2'0"						
V. fine silty sand, org. matter	Brown	V. loose to loose			2	s.s.	4	16.7	Moist
					3	c.s.			Q. moist
Silty fine sand, org. matter, Fine to coarse sand, stones	Mixed brown		5'2"						
	Brownish-grey	Compact			4	s.s.	20	15.8	V. wet
									Layer of gravel 5'8"-5'10"
Fine sand	Brownish-grey	Compact to dense			5	s.s.	30	21.2	Saturated
			10'0"						
"	"	Dense			6	s.s.	41	20.8	Sat.
"	"	Dense			7	s.s.	35	22.6	Sat.
			15'0"						
"	"	Dense			8	s.s.	40	19.0	Sat.
			20'0"						
Very fine sand	Grey	Dense			9	s.s.	35	24.1	Sat.
			25'0"						
Fine sand	"	Dense			10	s.s.	35		Wet
"	"	Dense	31'0"		11	s.s.	41		Wet
			Testhole terminated at 31'0"						

APPENDIX A

STANDARD PROCEDURE

The field investigation work is carried out by means of a skid-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 nose.

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 Acker vane 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. Undisturbed samples are returned to the laboratory for later examination and testing as required.

The test holes 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 standard penetration blows and the natural moisture contents are plotted against elevation as a graph, and these graphs form part of the appendices, together with laboratory test result details, ground water readings and other soil characteristics which can be best illustrated in graphical form.

Thus the appendices comprise:

Appendix A Standard Procedure
Appendix B Field Test Results
Appendix C Laboratory Test Results (where applicable)
Appendix D Ground Water Readings (where applicable)
Appendix E Soil Characteristics versus elevation (where applicable)

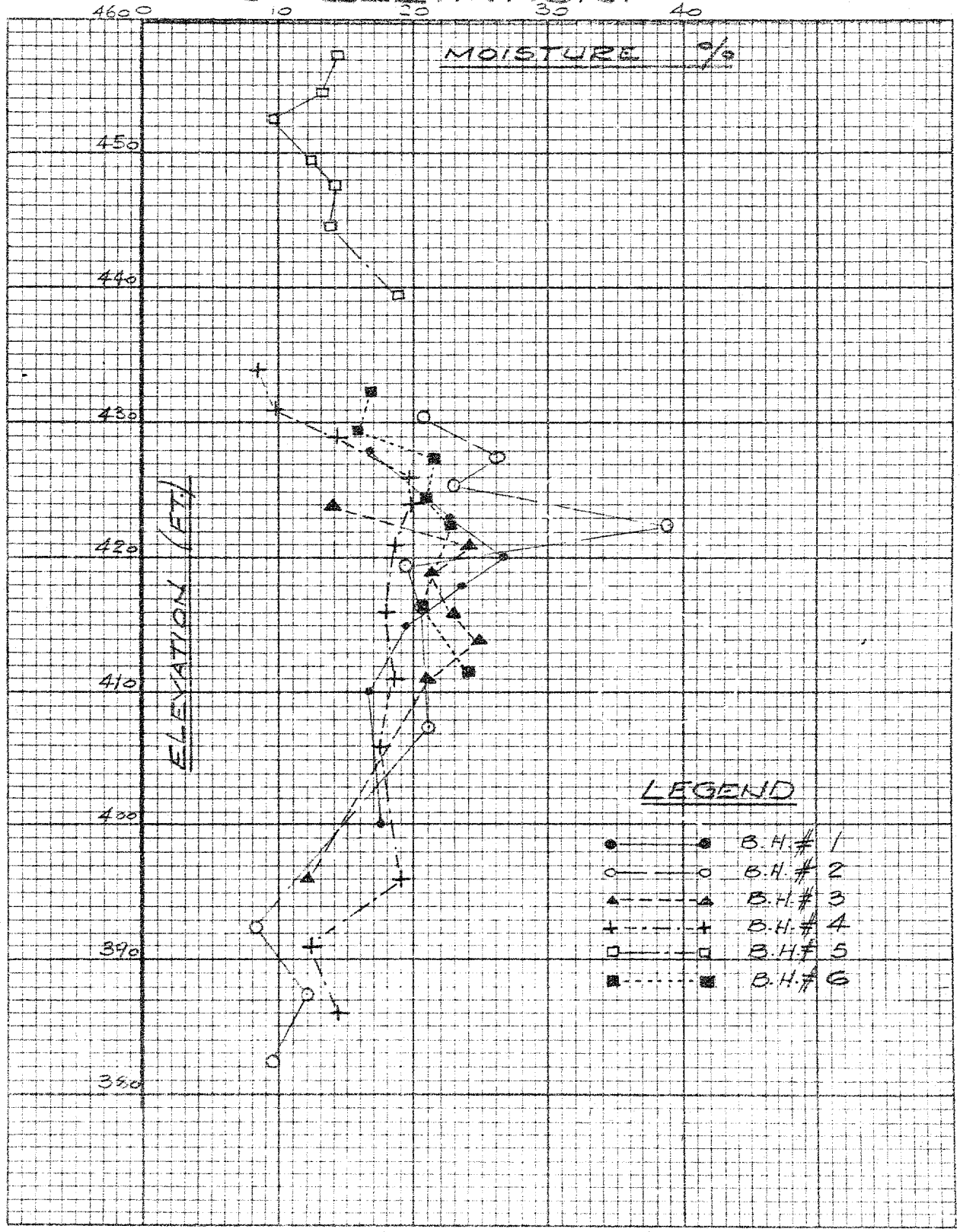
APPENDIX B

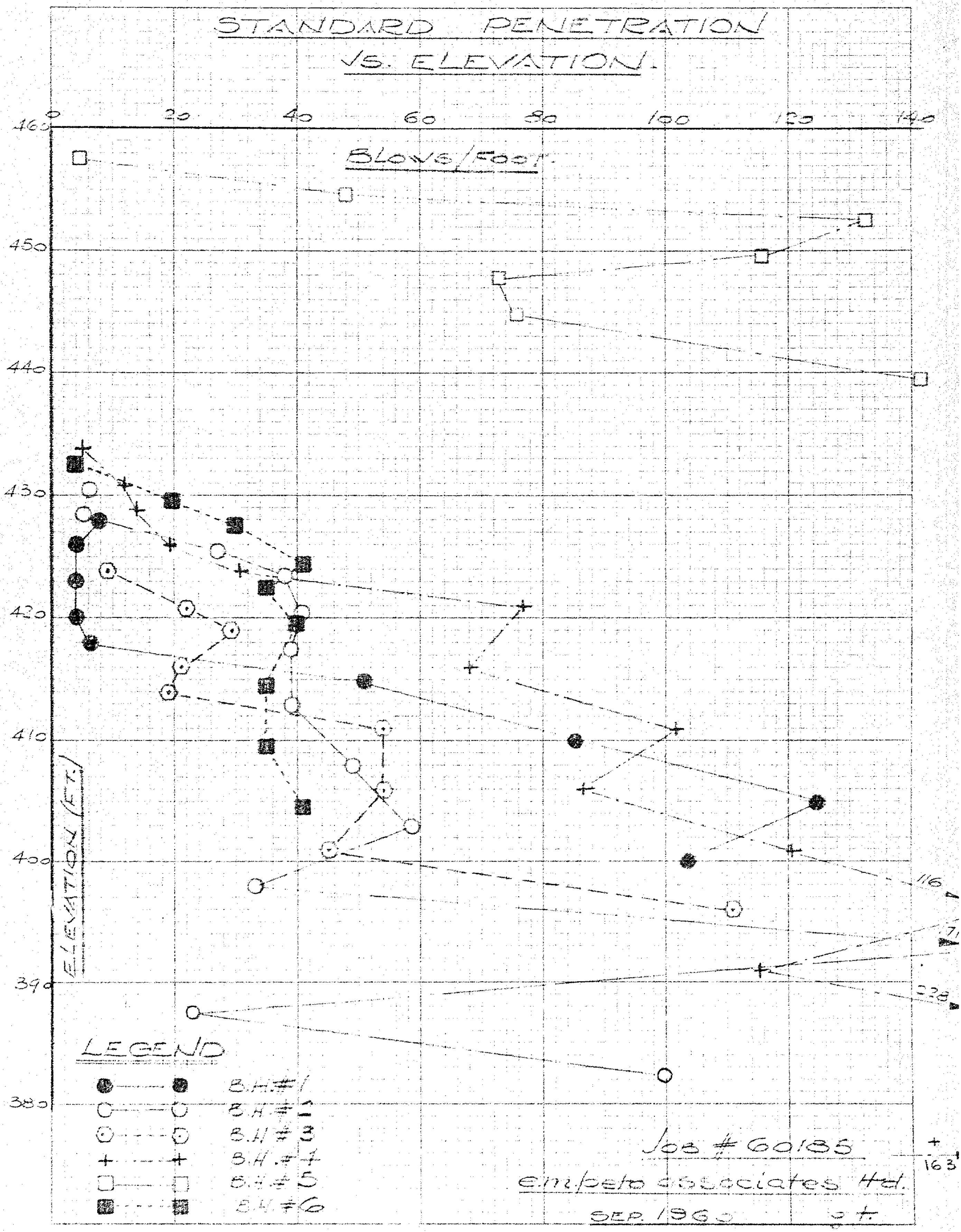
FIELD TEST RESULTS

e. m. peto associates ltd.

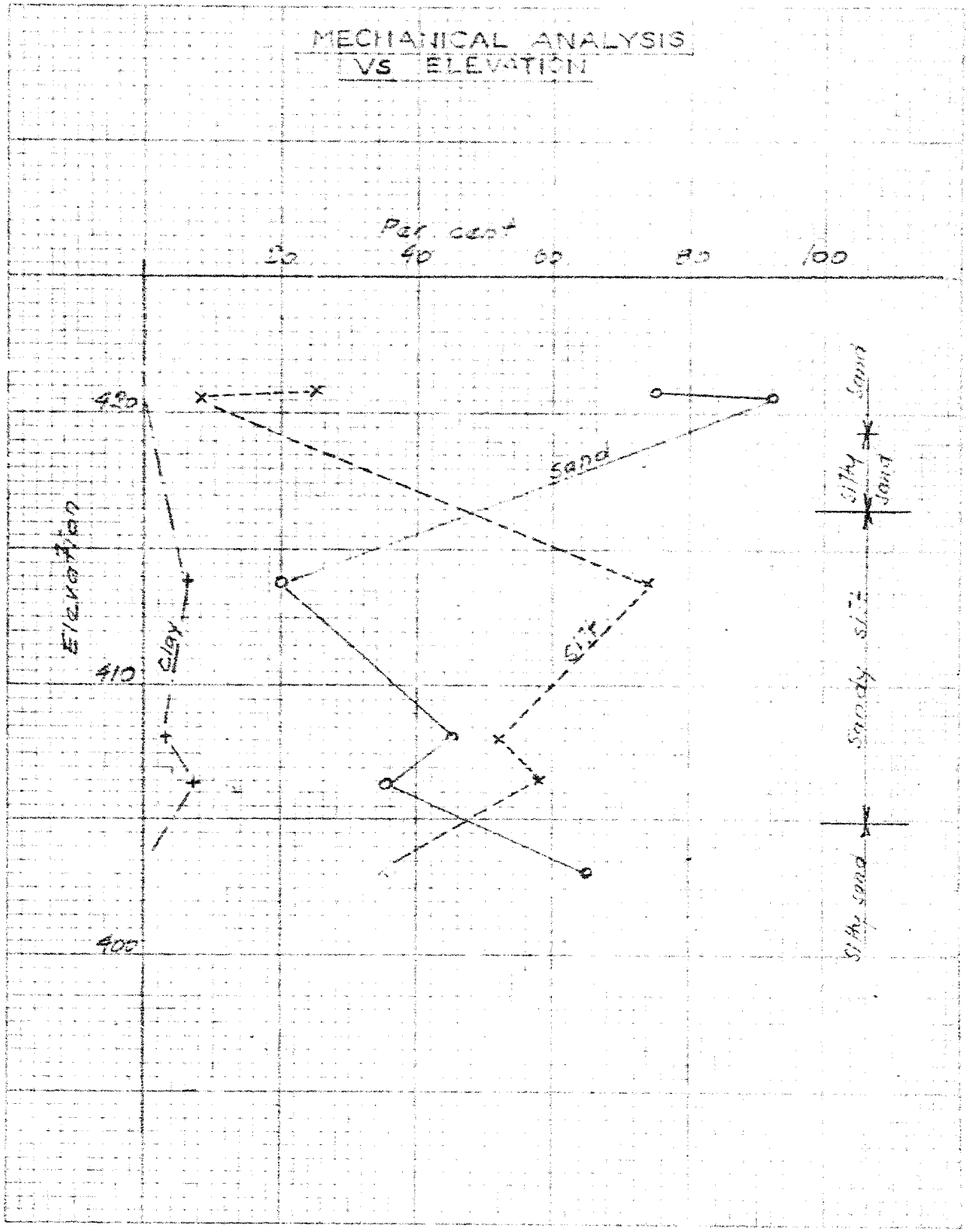
JOB No. 60185 PROJECT MARTIN GROVE BRIDGE DATE SEPT., 1960

NATURAL MOISTURE CONTENT VS. ELEVATION.





STANDARD PENETRATION
VS. ELEVATION.
Blows/Foot
0 20 40 60 80 100 120 140
460 450 440 430 420 410 400 390 380
ELEVATION (FT.)
116
71
338
163
LEGEND
B.H.#1
B.H.#2
B.H.#3
B.H.#4
B.H.#5
B.H.#6
Job #60185
Embelto Associates Ltd.
SEP. 1960


MECHANICAL ANALYSIS
VS ELEVATION
Per cent
20
40
60
80
100
420
410
400
Elevation
Clay
Sand
Silt
Silty sand
Sandy silt
Silty sand

APPENDIX C

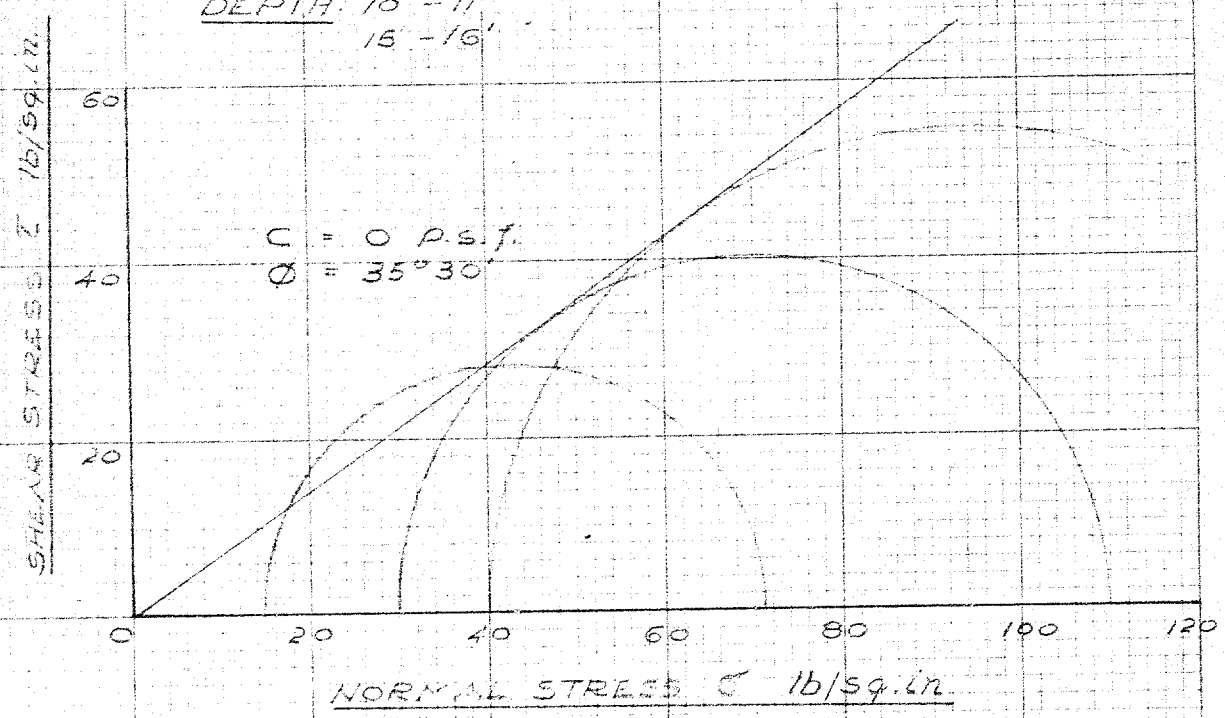
LABORATORY TEST RESULTS

TRIAXIAL QUICK DRAINED COMPRESSION TEST

BOREHOLE # 3

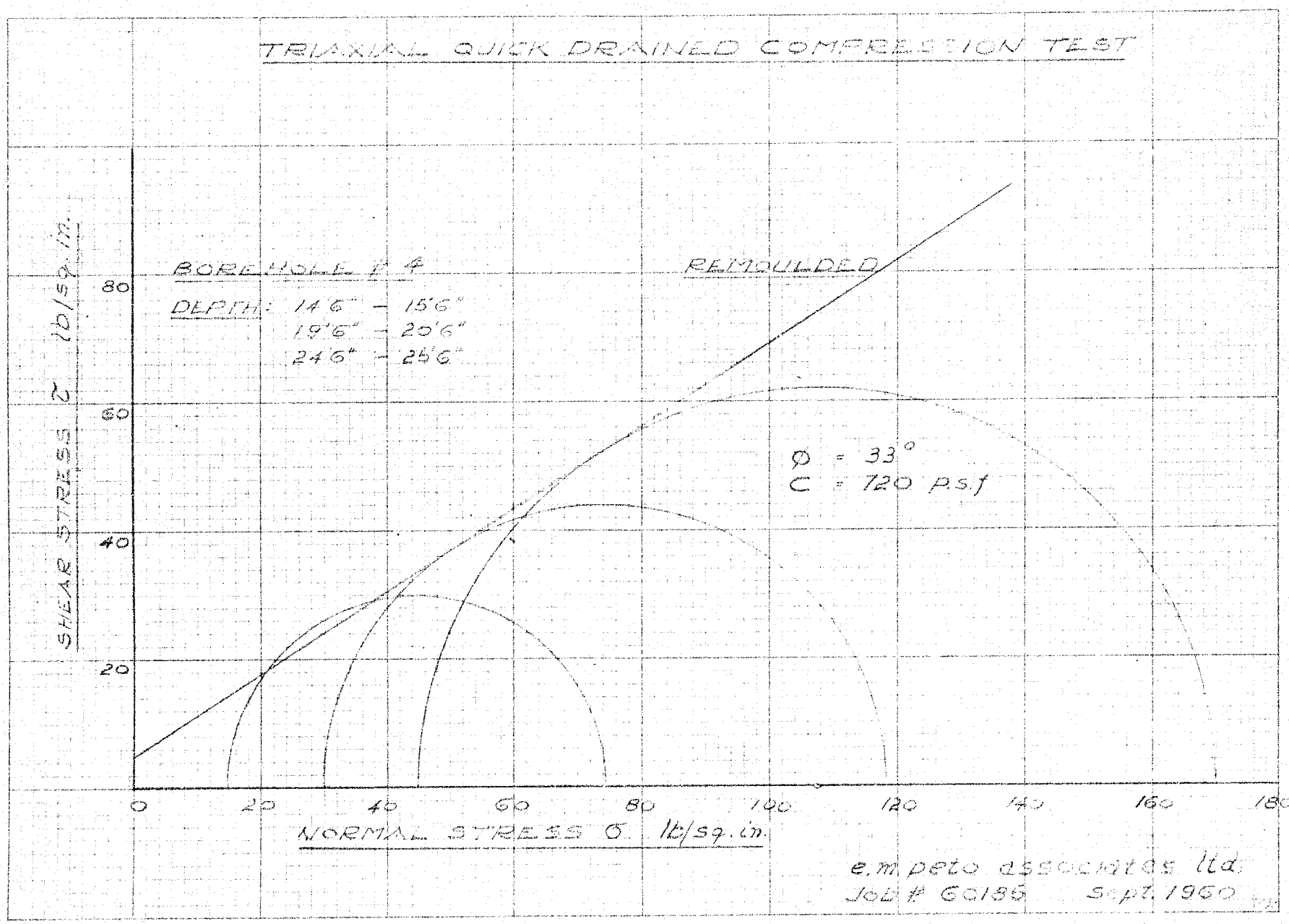
DEPTH 10' - 11'
15' - 16'

REMOULDED



e.m. peto associates ltd.
Job # 60185 Sept. 1960

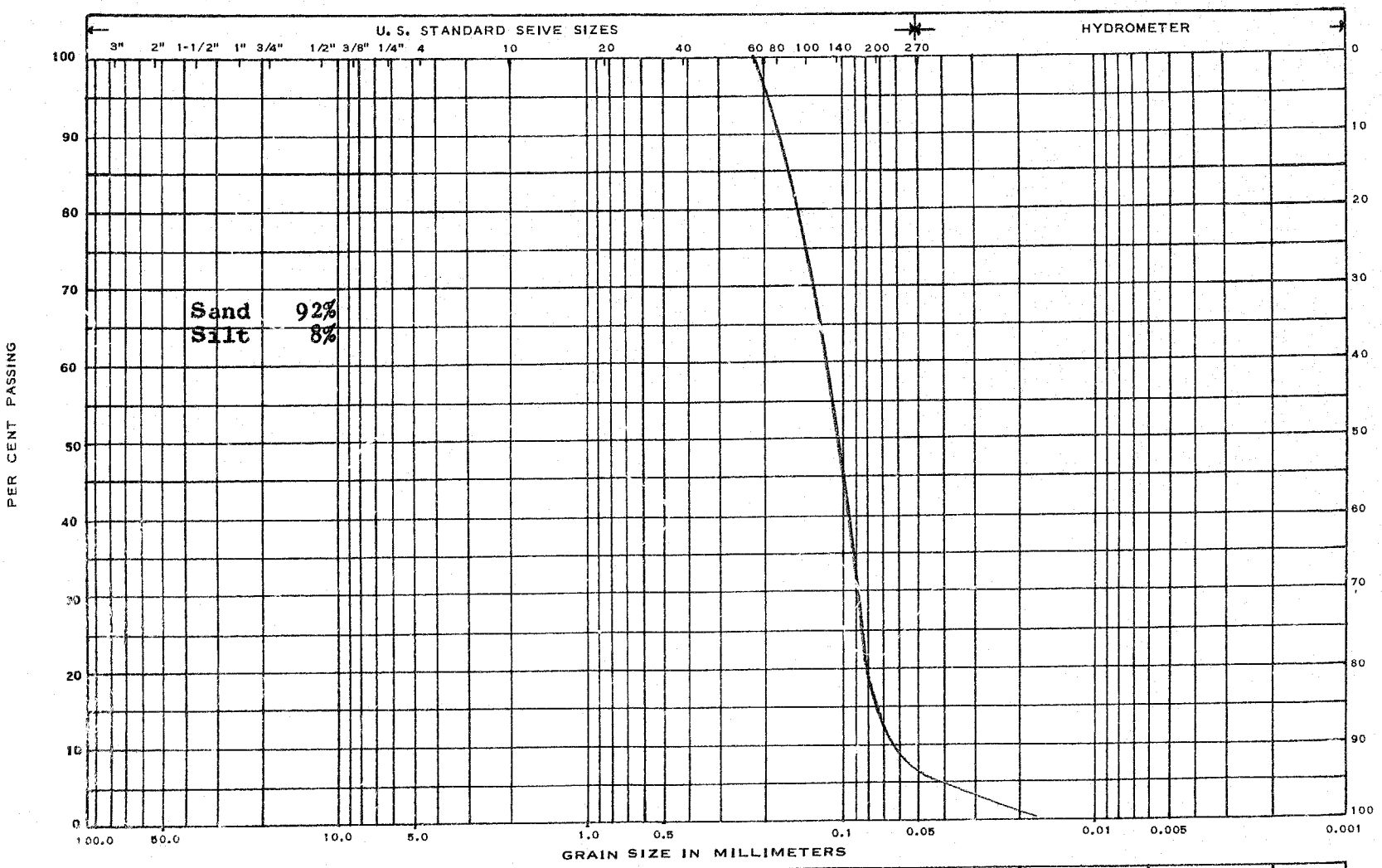
TRIAXIAL QUICK DRAINED COMPRESSION TEST



empeto associates ltd.
Job # 60185 Sept. 1960

e. m. peto associates ltd.

Toronto 19, Ontario



STONES	GRAVEL	COARSE SAND	MED. SAND	FINE SAND	COARSE SILT	MED. SILT	FINE SILT	CLAY

MASS. INST. OF TECH. CLASSIFICATION

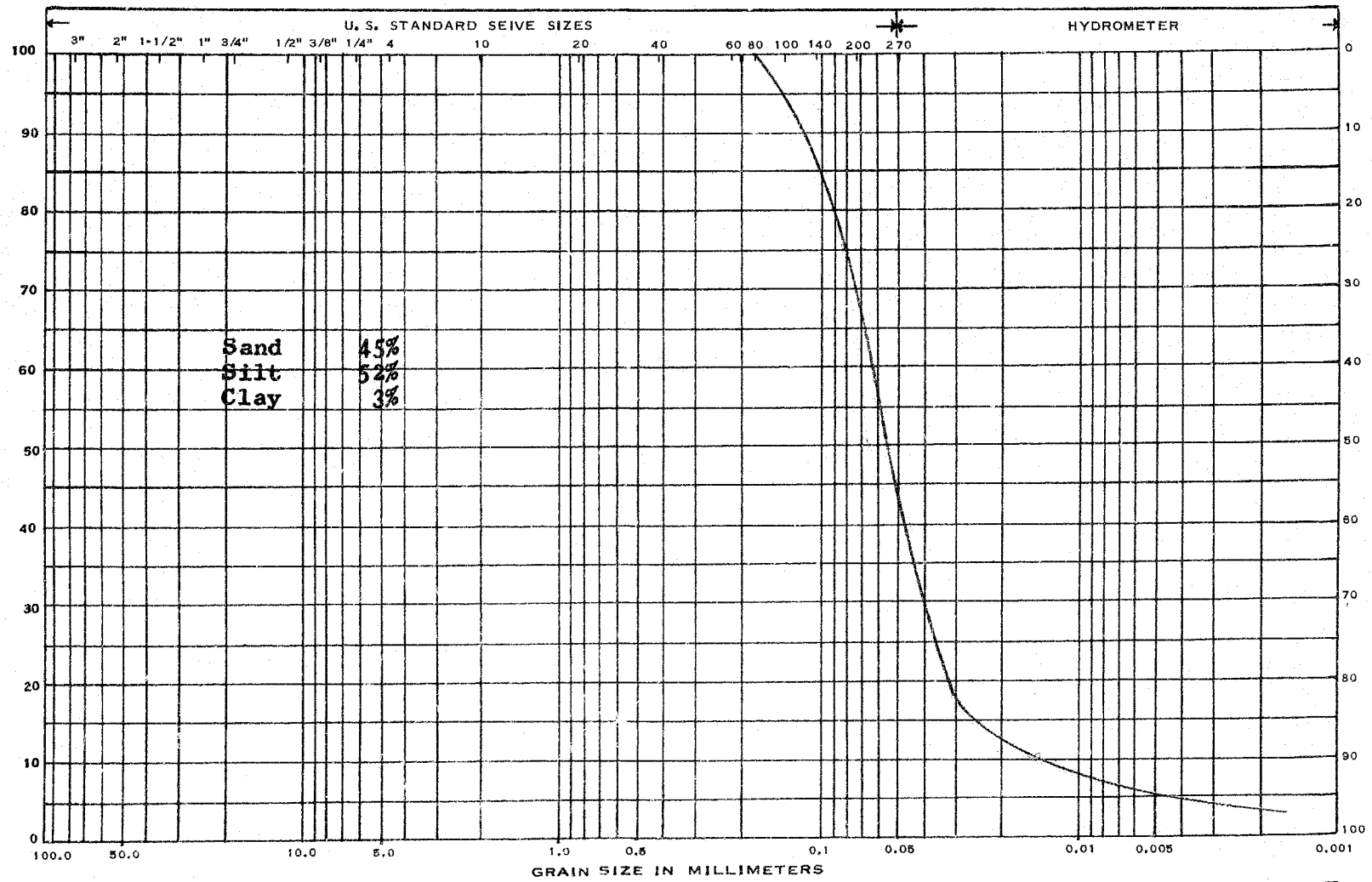
JOB NAME Martin Grove Bridge JOB NO. 60185 HOLE NO. 2 SAMPLE NO. _____

DEPTH 12'-13' ELEVATION _____ REMARKS Sand

GRAIN SIZE DISTRIBUTION

e. m. peto associates ltd.

Toronto 19, Ontario



STONES	GRAVEL	COARSE SAND	MED. SAND	FINE SAND	COARSE SILT	MED. SILT	FINE SILT	CLAY

MASS. INST. OF TECH. CLASSIFICATION

JOB NAME Martin Grove Bridge JOB NO. 60185 HOLE NO. 2 SAMPLE NO.

DEPTH 24'6" - 25'6" ELEVATION REMARKS Sandy silt

GRAIN SIZE DISTRIBUTION

e. m. peto associates ltd.

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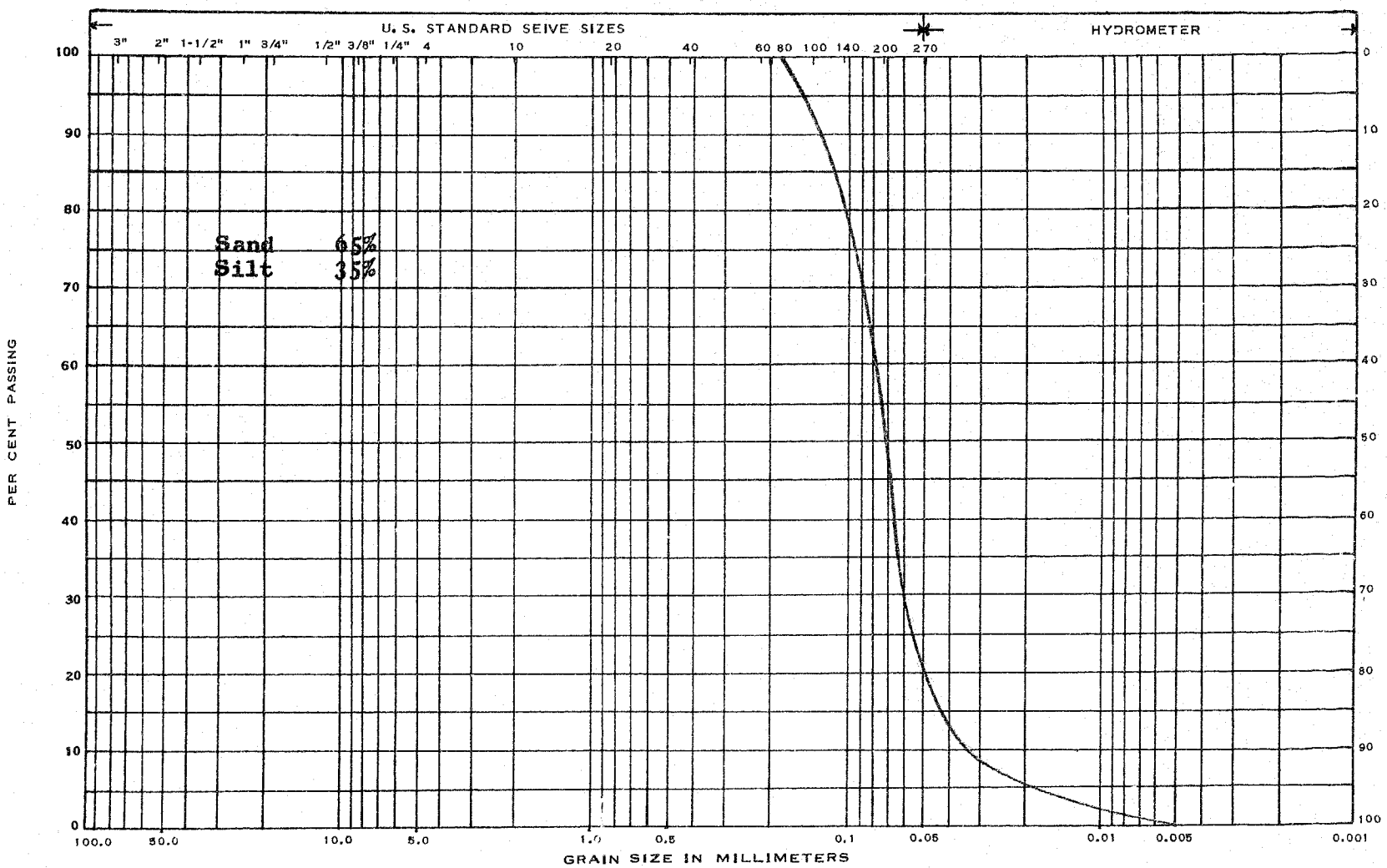

STONES	GRAVEL	COARSE SAND	MED. SAND	FINE SAND	COARSE SILT	MED. SILT	FINE SILT	CLAY

MASS. INST. OF TECH. CLASSIFICATION

JOB NAME Martin Grove Bridge JOB NO. 60185 HOLE NO. 2 SAMPLE NO. _____

DEPTH 29'6" - 30'6" ELEVATION _____ REMARKS. Silty sand

GRAIN SIZE DISTRIBUTION

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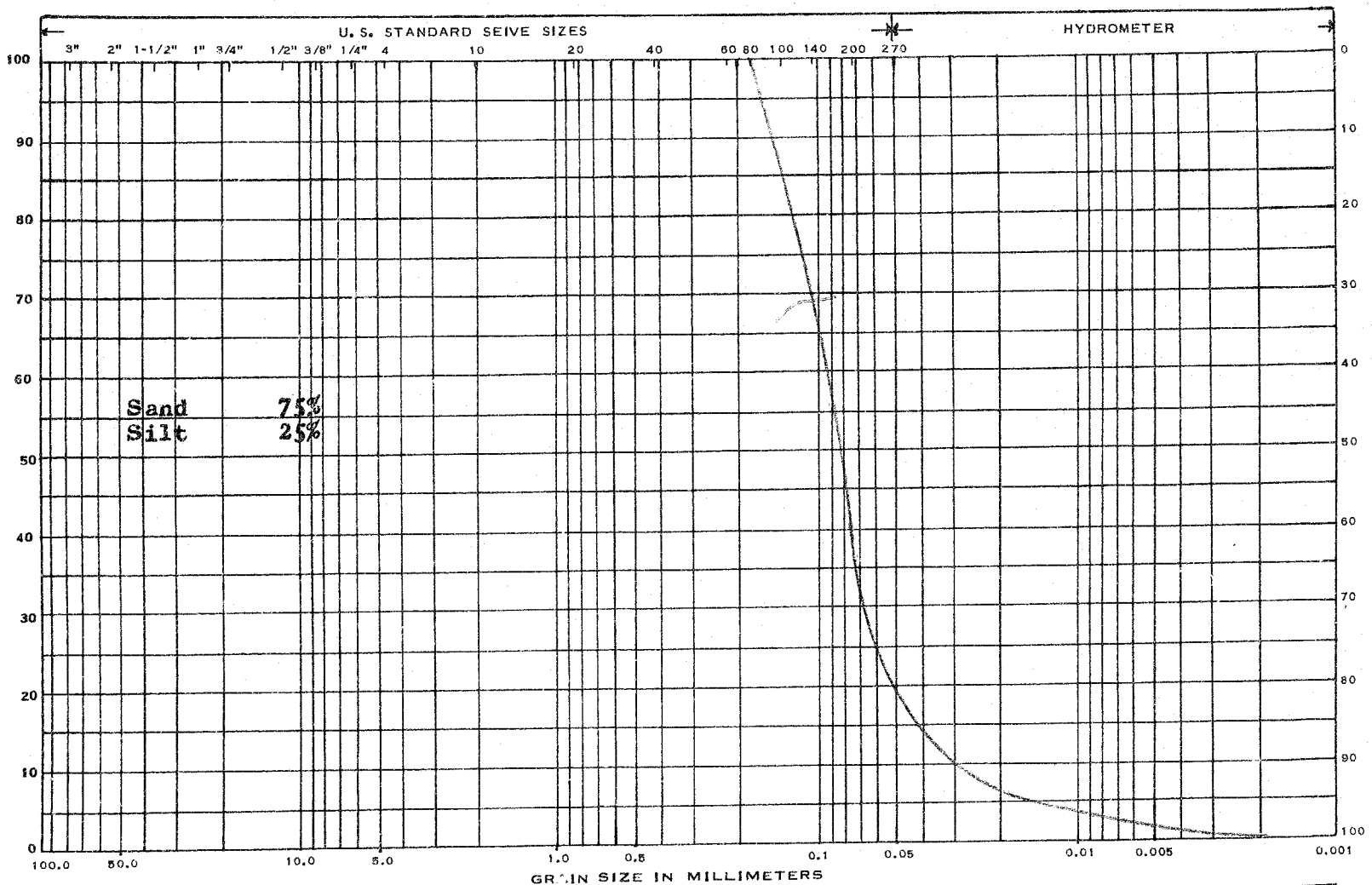
Toronto 19, Ontario



STONES	GRAVEL	COARSE SAND	MED. SAND	FINE SAND	COARSE SILT	MED. SILT	FINE SILT	CLAY

MASS. INST. OF TECH. CLASSIFICATION

JOB NAME Martin Grove Bridge JOB NO. 60185 HOLE NO. 3 SAMPLE NO. _____

DEPTH 7'-8' ELEVATION _____ REMARKS Silty sand

GRAIN SIZE DISTRIBUTION

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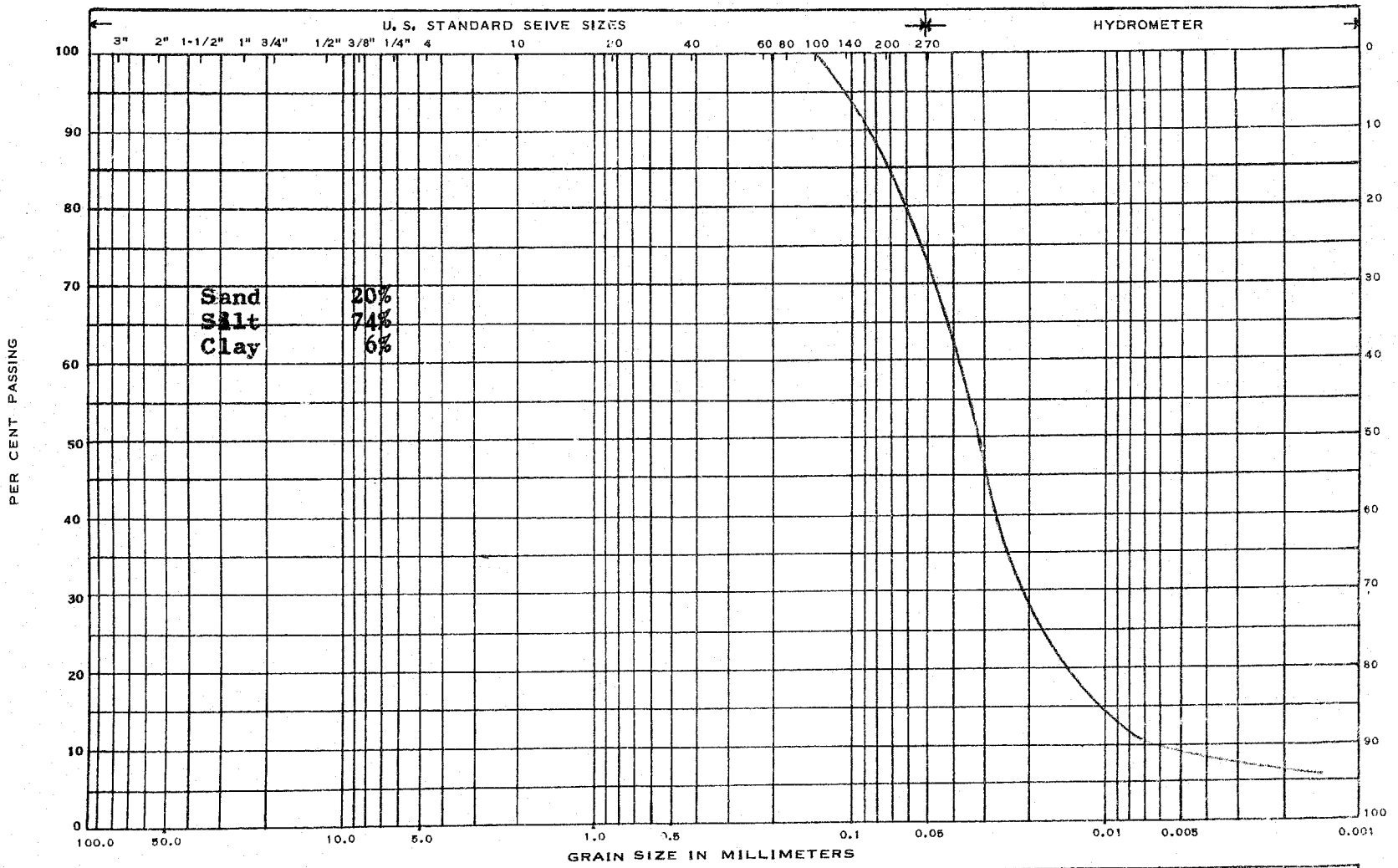
Toronto 19, Ontario



STONES	GRAVEL	COARSE SAND	MED. SAND	FINE SAND	COARSE SILT	MED. SILT	FINE SILT	CLAY

MASS. INST. OF TECH. CLASSIFICATION

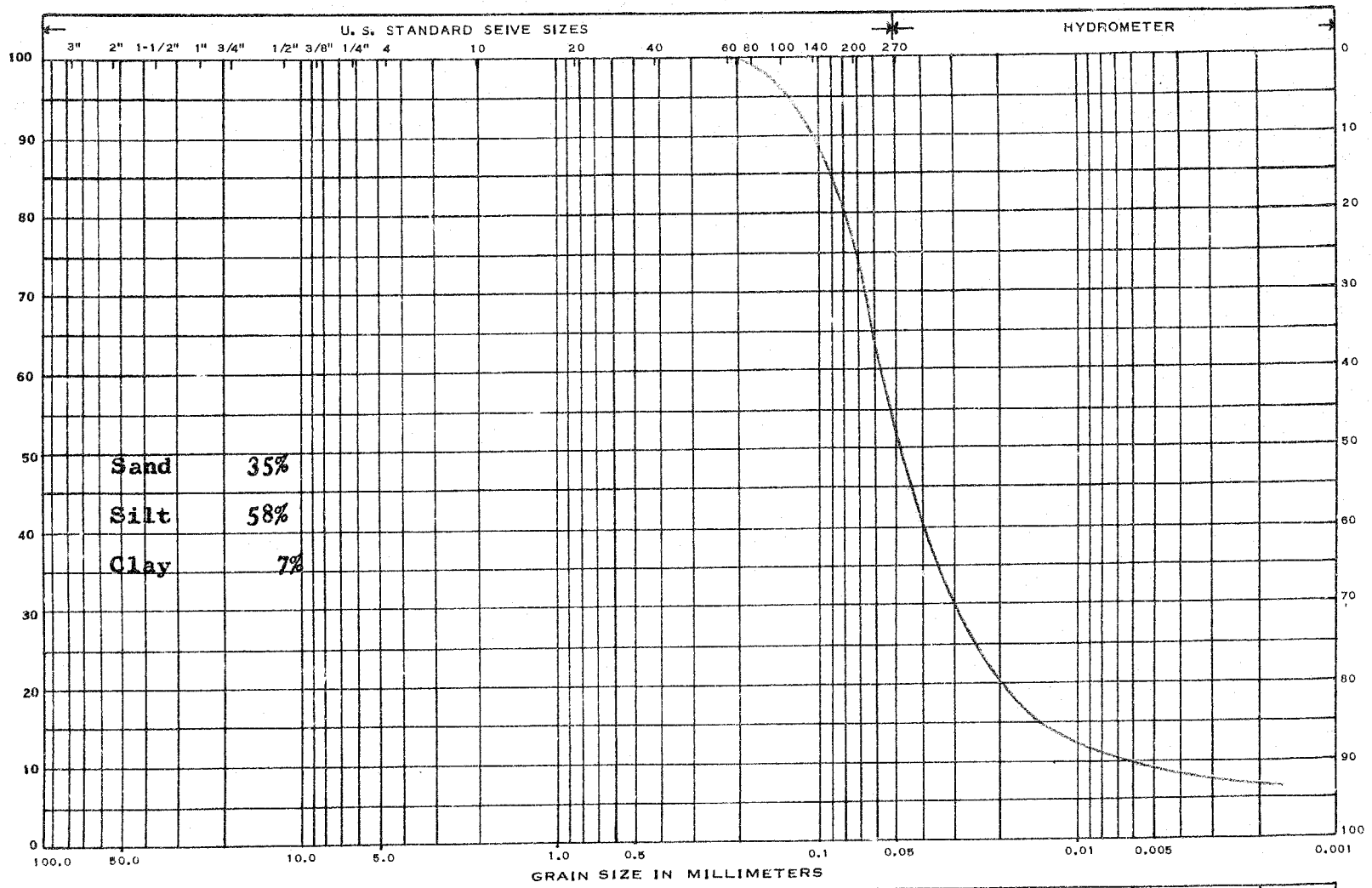
JOB NAME Martin Grove Bridge JOB NO. 60185 HOLE NO. 3 SAMPLE NO. _____

DEPTH 12'-13' ELEVATION _____ REMARKS Sandy Silt

GRAIN SIZE DISTRIBUTION

e. m. peto associates ltd.

Toronto 19, Ontario



STONES	GRAVEL	COARSE SAND	MED. SAND	FINE SAND	COARSE SILT	MED. SILT	FINE SILT	CLAY

MASS. INST. OF TECH. CLASSIFICATION

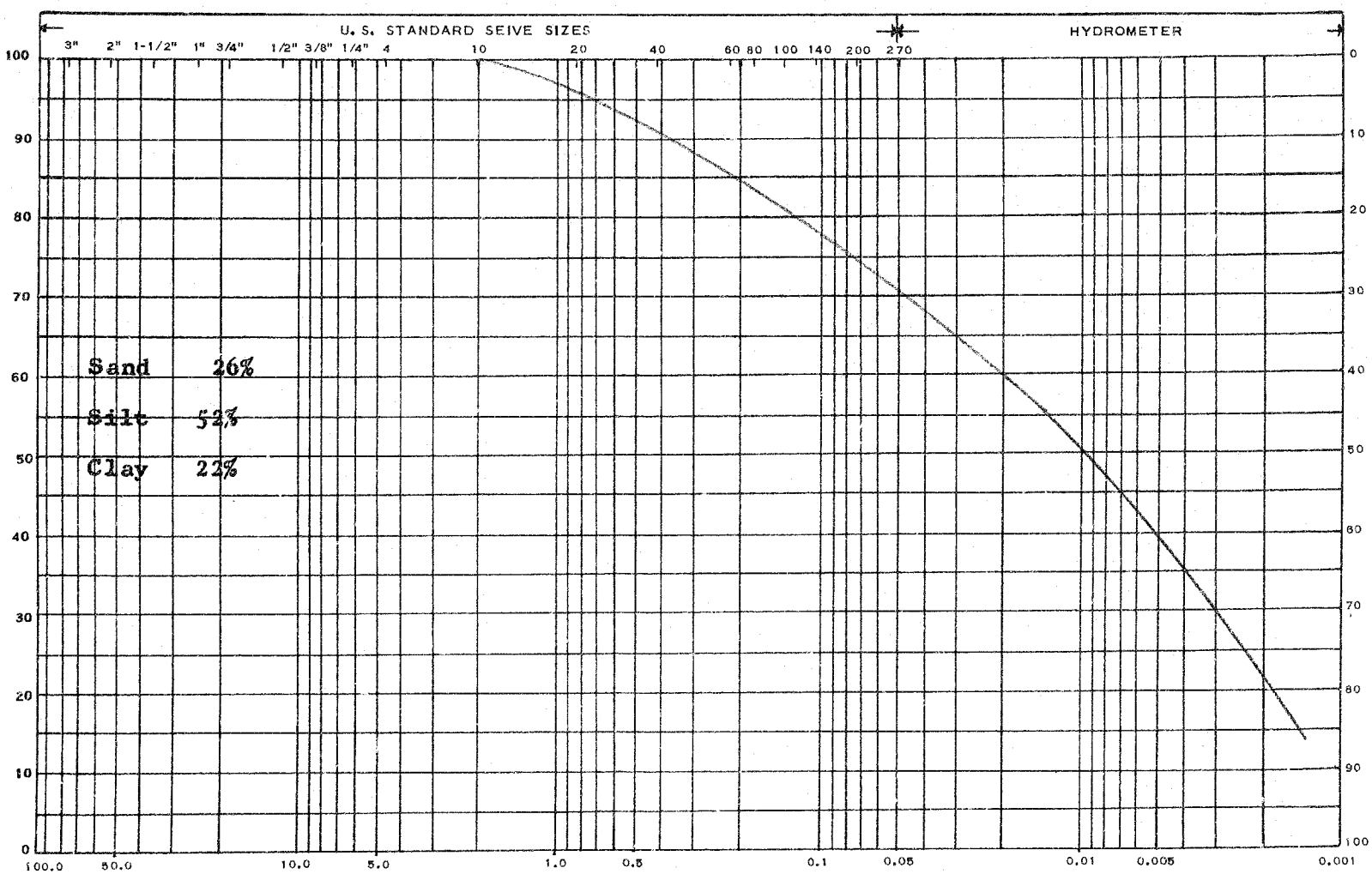
JOB NAME Martin Grove Bridge JOB NO. 60185 HOLE NO. 4 SAMPLE NO.

DEPTH 29'6" - 30'6" ELEVATION REMARKS Sandy silt

GRAIN SIZE DISTRIBUTION

e. m. peto associates ltd.

Toronto 19, Ontario



STONES	GRAVEL	COARSE SAND	MED. SAND	FINE SAND	COARSE SILT	MED. SILT	FINE SILT	CLAY

MASS. INST. OF TECH. CLASSIFICATION

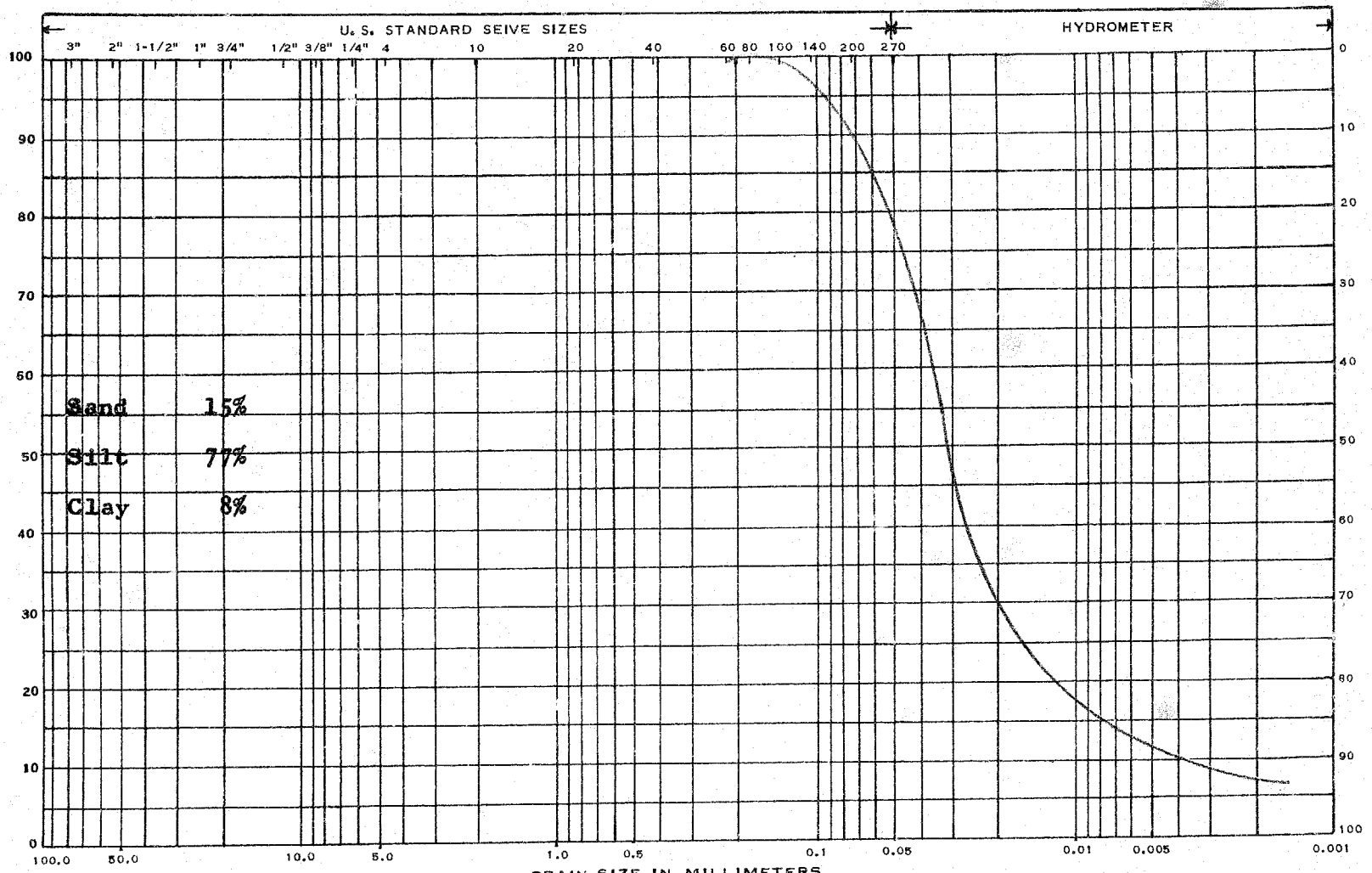
JOB NAME Martin Grove Bridge JOB NO. 60185 HOLE NO. 5 SAMPLE NO. _____

DEPTH 10'-11' ELEVATION _____ REMARKS Clayey silt silt

GRAIN SIZE DISTRIBUTION

e. m. peto associates ltd.

Toronto 19, Ontario



STONES	GRAVEL	COARSE SAND	MED. SAND	FINE SAND	COARSE SILT	MED. SILT	FINE SILT	CLAY

MASS. INST. OF TECH. CLASSIFICATION

JOB NAME Martin Grove Bridge JOB NO. 60185 HOLE NO. 5 SAMPLE NO.

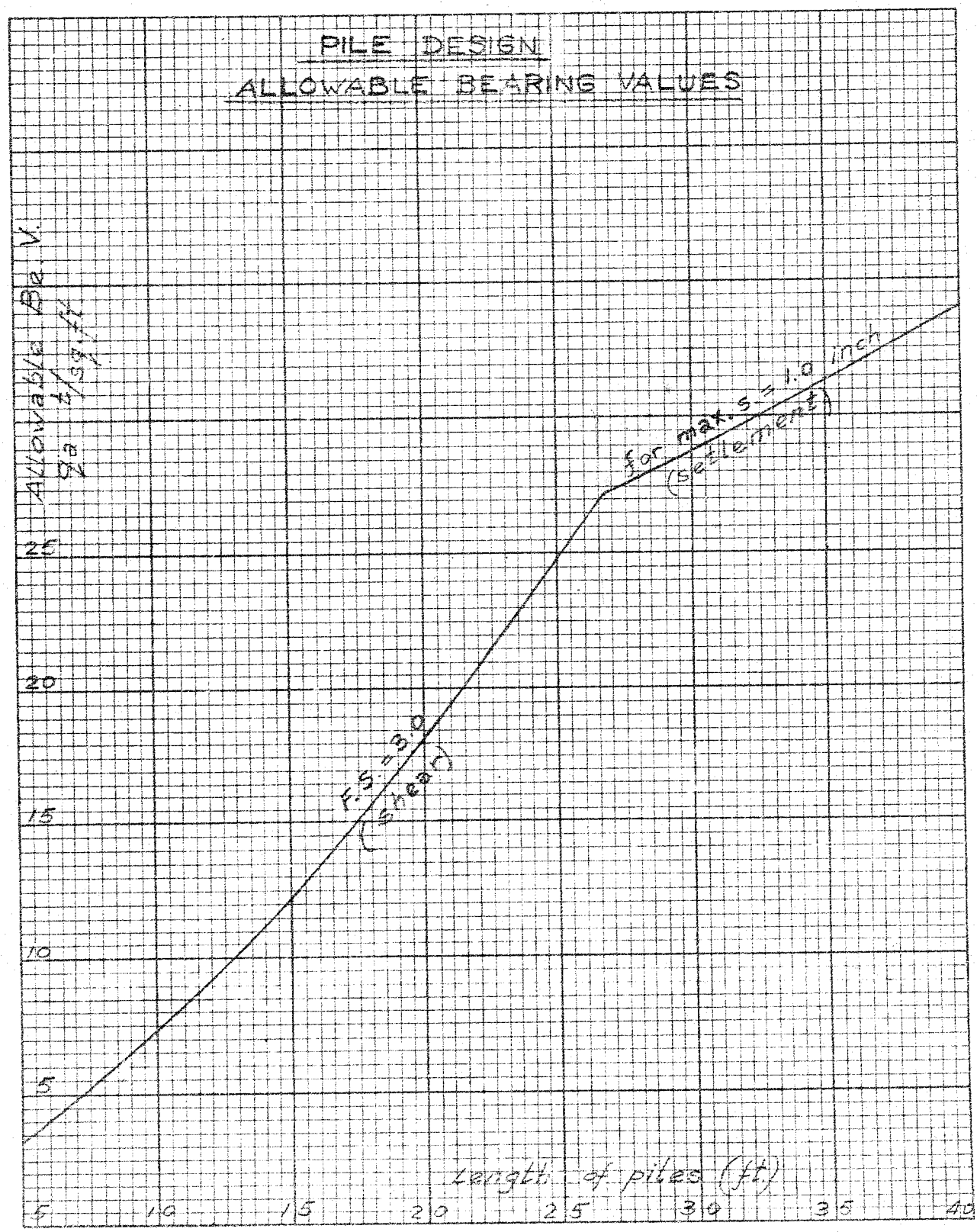
DEPTH 20'-21' ELEVATION REMARKS Sandy silt

GRAIN SIZE DISTRIBUTION

APPENDIX E

CALCULATED ALLOWABLE BEARING VALUES FOR A SINGLE PILE & VARIOUS LENGTHS OF PILES

JOB No. 60185 PROJECT MARTIN GROVE BRIDGE DATE SEP. 1960



APPENDIX D

GROUND WATER READINGS

GROUND WATER READINGS

Hole No.	Date	Time	Depth of Hole	Depth of Casing	Other Circumstances	Depth to Water
1	Aug. 29		9'3"	10'0"	After sampling to 11 ft. depth	6'10"
		4:05 p m	22'6"	30'0"	After bailing out	20'6"
		4:06	22'6"	30'0"		18'11"
		4:08	22'6"	30'0"		17' 4"
		4:13	22'6"	30'0"		16' 8"
		4:18	22'6"	30'0"		15' 6"
		4:23	19'0"	30'0"	Hole caved in at 19'0"	15' 2"
	Aug. 30	8:00 am	19'0"	30'0"		13' 2"
		8:45	10'1"	None	Hole caved in at 10'1"	5' 0"
2	Aug. 23		8'0"	4'6"	Hole dry to 7 ft. depth	7' 0"
		2:22 pm	14'5"	14'6"	After bailing out	12' 5"
		2:26	14'5"	14'6"		12' 5"
		2:55	19'0"	19'6"	Sand backing up from 20'6" to 19'0"	
					W. L. after bailing out	15' 9"
		2:57	19'0"	19'6"		12' 7"
		3:00	15'3"	19'6"	Sand backing up to 15'3" depth	11'11"
		3:57	18'1"	24'6"	After bailing out	16' 8"
		4:00	18'1"	24'6"		14' 3"
		4:05	15'9"	24'6"	Sand backing up	13'10"
		4:10	15'9"	24'6"	After sampling to 25'6" depth	13' 1"
	Aug. 24	8:00 am	14'6"	24'6"		11'10"
		9:04	18'3"	29'6"	After bailing out	15' 4"
		9:06	18'3"	29'6"	Sand backing up after sampling to 30'6"	15' 4"
		9:10	17'3"	29'6"		15' 2"
		10:28	28'2"	40'0"	Sand backing up from 41'0" depth after bailing out	26' 1"
					Water filled hole too fast to bail below 26'1" depth.	
		10:30	27'6"	40'0"		25' 1"
		10:35	27'6"	40'0"		21'10"
		10:40	27'6"	40'0"		21' 0"
		12:10pm	32'5"	45'0"	After bailing out	24' 0"
					Impossible to bail out below 24'0" depth.	
		12:15	30'3"	45'0"		22'9"
		1:10	27'5"	45'0"	Sand backing up after sampling to 46'0"	8' 7"
		3:15	50'5"	50'0"	After bailing out	27' 3"
		4:18	5'7"	None	Hole caved in at 5'7"	None

Hole No.	Date	Time	Depth of Hole	Depth of Casing	Other Circumstances	Depth to Water
3	Aug. 27	11:30 a.m.	2'0"	None		0' 2"
		4:02 p.m.	31'0"	30'0"		At G.L. i.e. 0'0"
		4:12	31'0"	30'0"		+ 0'5" above G.L.
	Aug. 29	8:00 a.m.	31'0"	30'0"		+ 0'5" above G.L.
		9:00	10'1"	None	Caved in at 10'1"	0'2"
4	Aug. 25	12:20 p.m.	12'4"	9'6"	Wet at bottom	
		12:24	12'4"	9'6"	as above	
		12:54	11'5"	9'6"	as above	
		1:53	14'6"	15'4"	After bailing out	14' 8"
		1:55	14'6"	15'4"		13' 1"
		2:00	14'6"	15'4"		12'11"
		4:10	24'0"	29'6"	Sand backing up after sampling to 30'6". W.L. after bailing out	23' 3"
	Aug. 26	8:00 a.m.	21'2"	29'6"		14' 1"
	Aug. 27	8:00	55'10"	59'6"	Sand backing up	6' 3"
		9:00	4'2"	None	Hole caved in at 4'2"	None
5	Aug. 30th	3:20 pm.	21'0"	15'0"		None
		3:25	21'0"	None		None
6	Aug. 29		3'0"	None		None
		12:05 p.m.	6'0"	None		4' 8"
		12:10	6'0"	None		4' 6"
		12:20	6'0"	None		4' 6"
		2:30	26'0"	25'0"	Sand backed up to 24'6"	5' 9"
		2:35	26'0"	25'0"	As above	4' 8"
		3:20	31'0"	30'0"		3' 2"
		4:05	31'0"	30'0"	Sand backed up to 27'0"	5' 1"
		4:15	31'0"	30'0"	After bailing out Sand backed up to 19'0"	15' 0"
		4:17	31'0"	30'0"	Sand backed up to 18'6"	15' 0"
		4:25	31'0"	30'0"	ditto	14' 3"
	Aug. 30	8:55 a.m.	31'0"	30'0"	ditto	4' 9"
			31'0"	25'0"		5'10"
			31'0"	20'0"		6' 6"
			31'0"	15'0"	Hole caved in at 17'0"	5' 3"
			17'0"	10'0"	Hole caved in at 13'1"	5' 3"
			13'1"	None	Hole caved in at 6'10"	5' 9"

61.F.57

MARTIN GROVE

ROAD AND

MIMICO CREEK

30M11-7