DOCUMENT MICROFILMING IDENTIFICATION

GEOCRES No. 30M16-7

DIST. 7 REGION CENTRAL

W.P. No. 757-56

CONT. No. 58-203

W. O. No. 57F-215C

STR. SITE No. 21-231

HWY. No. 401

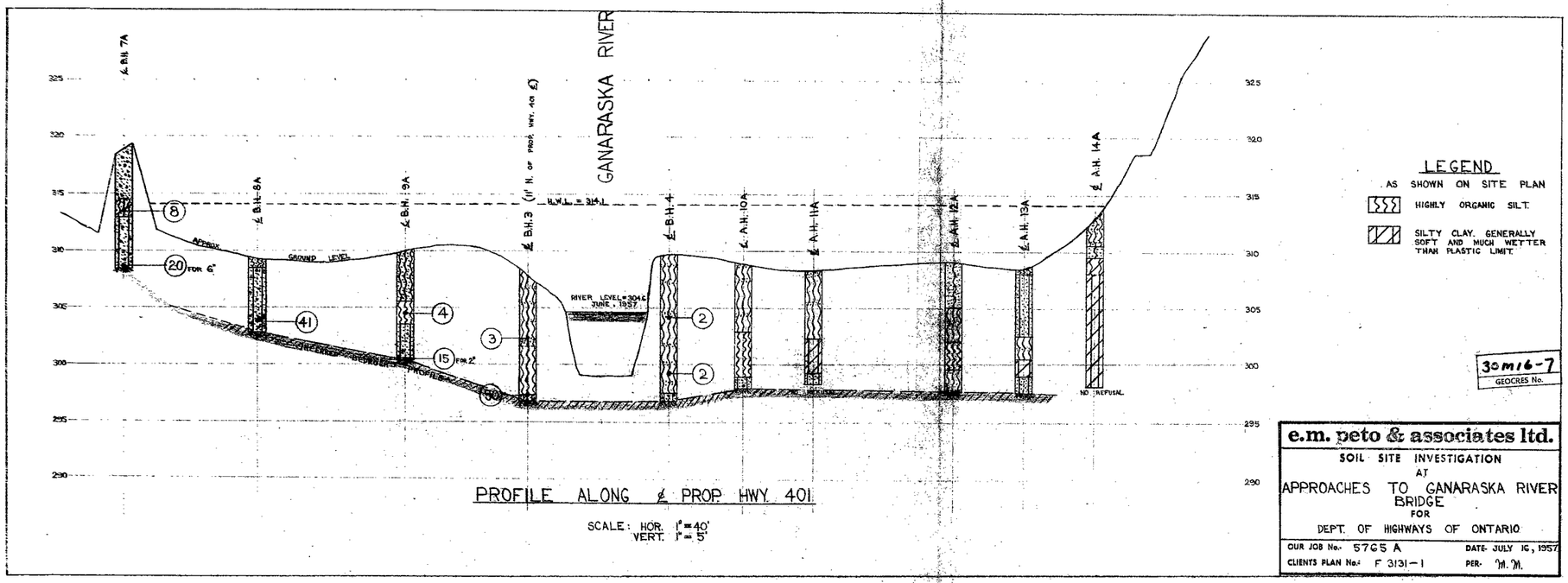
LOCATION GANARASKA RIVER 1 KM E HWY 401

OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT. 1

REMARKS: ① TO BE ADDED TO EXISTING MICRO FICHE 30M16-7

② DOCUMENTS TO BE UNFOLDED BEFORE MICROFILMED

G.I-20 SEPT. 1976



PROFILE ALONG ℄ PROP HWY 401

SCALE: HOR. 1"=40'
VERT. 1"=5'

LEGEND

AS SHOWN ON SITE PLAN

HIGHLY ORGANIC SILT

SILTY CLAY, GENERALLY SOFT AND MUCH WETTER THAN PLASTIC LIMIT

30M16-7
GEOCRES No.

e.m. peto & associates ltd.

SOIL SITE INVESTIGATION
AT
APPROACHES TO GANARASKA RIVER BRIDGE
FOR
DEPT. OF HIGHWAYS OF ONTARIO

OUR JOB No. 5765 A — DATE JULY 16, 1957
CLIENTS PLAN No. F 3131-1 — PER. M. M.

#

57-F-215C

#

W.P. 757-56

#

HWY 401

GANARASKA R.

BAG/8

AN INDEPENDENT ORGANIZATION PROVIDING A COMPLETE SOIL ENGINEERING & INVESTIGATION SERVICE

e. m. peto associates ltd.

YOUR REFERENCE:-

OUR REFERENCE:- 5765

850 roselawn avenue,
TORONTO, ONTARIO.
RUssell 1 - 4955.

July 12, 1957.

Department of Highways of Ontario
280 Davenport Road
Toronto, Ontario.

re: Soil Investigation, Hwy. 401-
Ganaraska River Bridge

Attention: Mr. J. C. McAllister

Dear Sir,

Enclosed herewith are four copies of the report on soil and foundation conditions at the above site, dealing specifically with the proposed bridge.

The supplementary field work, consisting of 3 short boreholes to refusal and 5 auger holes was completed this date, and a supplementary report on the riverbank soils will follow as soon as the samples have been checked and the results interpreted.

We trust that this arrangement will be to your satisfaction.

Yours very truly,

E. M. PETO ASSOCIATES LTD.

E. M. Peto, P. Eng.

EMP/mm

AN INDEPENDENT ORGANIZATION PROVIDING A COMPLETE SOIL ENGINEERING & INVESTIGATION SERVICE

e. m. peto associates ltd.

YOUR REFERENCE:- BA 618, 618A

OUR REFERENCE:- 5765

850 roselawn avenue,
TORONTO, ONTARIO.
RUssell 1 - 4955.

October 7th, 1957.

BA

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

Re: Soil Conditions - Ganaraska River Bridge

Dear Sirs:

Further to a telephone conversation with Mr. Lount, Consulting Engineer for the Ganaraska River Bridge project, we wish to make the following comments.

It is our understanding that the 35 ft. high embankments are to be placed first, sloping down to the piers which are to be located adjacent to the river edge, at a 2:1 slope. Steel H-piles for the open-type abutments are then to be driven through the fill. We understand that it is then proposed to drive steel sheet piling to bedrock to form large diameter caissons at the river bank, inside which the concrete piers will be constructed.

As we have already stated in our previous reports, the existing soil will fail under the load of the 35 ft. high embankments, probably by the time the embankment reaches a height of 17 feet. The samples examined in our laboratory indicated many seams up to 1/4" thick of fine sand in the otherwise predominantly clayey silt subsoil and we therefore do not anticipate any major build up of pore water pressure. The failure of the natural soil should be progressive as the embankment is raised and there should be some up lift of the existing grade beyond the toe of the embankment. We anticipate some failure at the river bank or in the bed of the river beyond the end of the approach embankment. These failures will all occur during the placement of the fill or very shortly thereafter.

We do not anticipate any appreciable additional failure will be caused by the driving of the Steel H-beams for the abutments. We do not anticipate any problem with the construction of the circular open caissons for the concrete piers. The sheeting for these caissons will be driven with so little resistance that we do not advise the use of diesel pile-driving equipment. We do not anticpate any further failure as a result of the construction of these caissons.

Should you wish to minimize the displacement of the natural soil towards the river bank due to the high embankment and to safe-guard against any possibility of minor displacement during the construction of the abutment or piers, then we would recommend that prior to the placement of the embankment fill, a 5 foot deep trench of at least 30 feet width should be cut through the existing poor soil along the road centre line for a distance of at least 100 feet back from each river bank. This excavation or trench should be reconstituted with a properly compacted granular fill before commencing the final placement of the embankment fill. We understand that Mr. Lount believes that this method will provide a complete safe guard against failure of the new embankment during the construction of the bridge and we agree with him in this respect.

Yours very truly,

E. M. PETO ASSOCIATES LTD.,

EMP:sb

E. M. Peto, P. Eng.

BA 618 A

AN INDEPENDENT ORSANIZATION PROVIDING A COMPLETE SOIL ENGINEERING & INVESTIGATION SERVICE

e. m. peto associates ltd.

YOUR REFERENCE:-

OUR REFERENCE:- 5765A

850 roselawn avenue,
TORONTO, ONTARIO.
RUssell 1 - 4955.

SUPPLEMENTARY REPORT

APPROACHES TO HWY. 401 - GANARASKA RIVER BRIDGE

Due to the fact that it is proposed to place a great amount of fill (35 to 40 feet) at the Highway 401 - Ganaraska River crossing, the behaviour of the native soil when very heavily loaded by the fill is a problem of prime importance. Therefore, after the field work at the proposed bridge abutment had been completed and the results checked it was decided after discussion with D.H.O. officials to send a crew back to the site to perform a number of test holes along the Hwy. 401 centre-line. On the West approach, which is easily accessible, our standard type soil sampling was carried out, using a Sullivan "12" drilling machine. On the East bank of the river a number of auger holes were put down, using a post-hole auger in the upper strata and a screw-type auger adapted to fit A-drill rods in the lower strata. The numbers and locations of these test holes are shown on the revised site plan attached at the rear of this report.

After all the samples had been checked, a profile along the highway centre-line was drawn, and this is also included at the rear of this report.

A cohesive soil type with high natural moisture content was encountered on the East approach only, and some laboratory tests were carried out in order to classify it. The hydrometer grain size distribution diagram is included in this report. According to textural classification, this soil is a very clayey silt, but actually its engineering properties are those of a clay. This material is an A-7.5 soil under the U.S. Public Roads classification system, which means that it may be highly elastic as well as subject to considerable volume change. Fortunately the occurrence of this material on the site is limited only to portions of the East bank well back from the river.

The weight of a 35 ft. embankment of well compacted fill containing some granular materials is in the order of 2.3 tons per sq. ft., which is well in excess of the compressive shearing strength of the native soils. However it must be remembered that due to the arching effect the entire total dead weight of the fill will not act at any one point. The native soils are saturated and, except for the predominately sand portions, seem to be highly compressible.

The centre line profile shows that the bedrock on the East approach is fairly flat and is presently overlain by from 10 to 12 feet of soil. On the Western approach the bedrock dips down towards the river, and is overlain by approximately 6 feet of soil at chainage 421 + 00 and approximately 12 feet of soil at chainage 423 + 00.

No predominately clay material was encountered on the West approach, and it is likely that any settlement under the weight of surcharge will be gradual, will increase to a certain limiting value as the fill material is laid, and will thereafter cease. Due to the sandy nature of the soil in the vicinity of the old earth dam and up to chainage 421 + 50, we anticipate little or no settlement in this section. However, from this point on to the West bridge abutment settlement of the native soil will take place, with the maximum soil compression occurring closest to the river. Most of the settlement on the West approach should occur during and almost immediately after the placement of the fill.

The profile indicates that a relatively thick stratum of soft, compressible clay starts at the Eastern extremity of the Genaraska River flood plain where the ground rises sharply. This material is liable not only to considerable settlements but also to plastic shear failure, since it has a very low ultimate shear strength.

On the fairly level Eastern approach to the river from the riverbank itself to station 426 + 90 there does not appear to be sufficient of this soft clay to cause a major plastic shear failure. As on the West bank, the soil in the East approach will settle during the placement of the fill. The sand strata occurring throughout the organic silt, and the silty sand strata occurring elsewhere should preclude the build-up in the soil of excessive pore water pressures which encourage sudden shear failure.

We recommend that thought should be given to the placement of about 5 feet of fairly dry, good quality fill over the whole width of the proposed embankment, to provide a reasonably dry working surface before heavy compaction commences. This will reduce to a minimum the heaving usually associated with the compaction of very moist silty soils.

E. M. PETO ASSOCIATES LTD.,

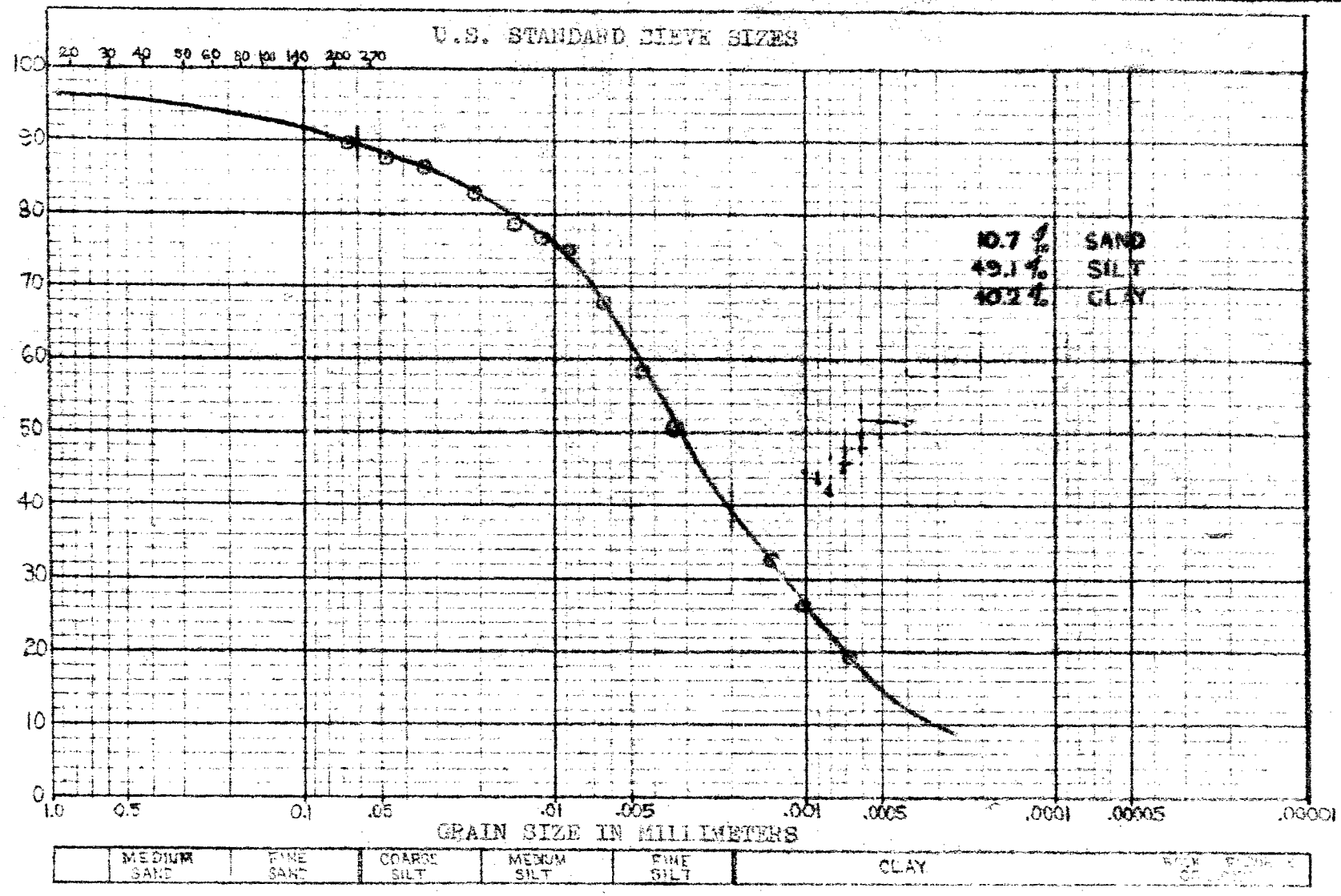
E. M. Peto, P. Eng.

MM:sb

July 23rd, 1957.

E. M. PETO ASSOCIATES LTD.

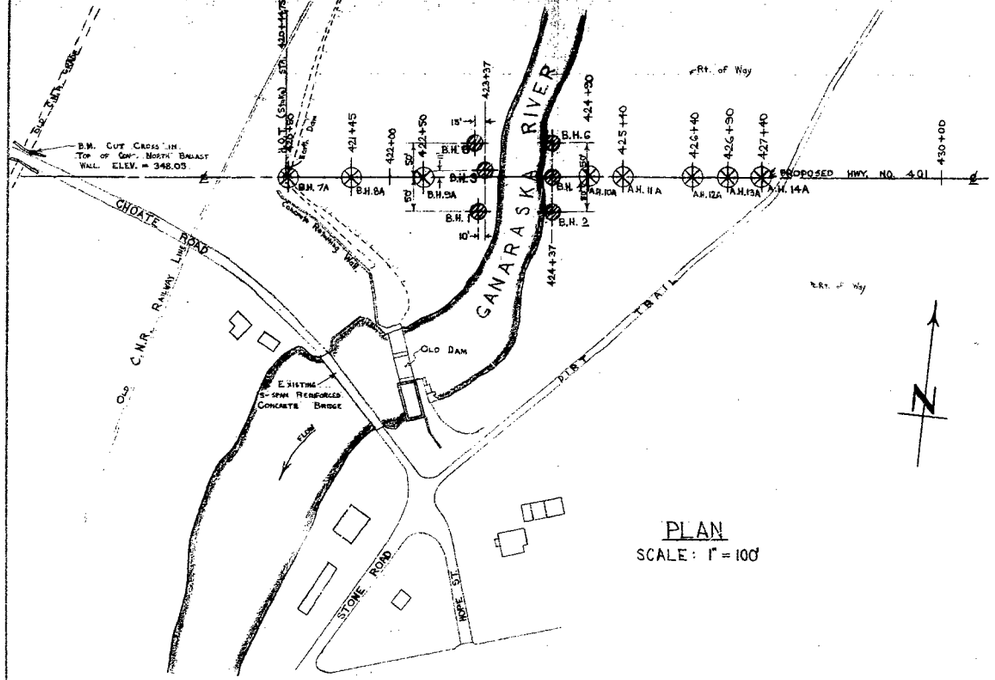
HYDROMETER GRAIN SIZE DISTRIBUTION DIAGRAM



M.I.T. CLASSIFICATION

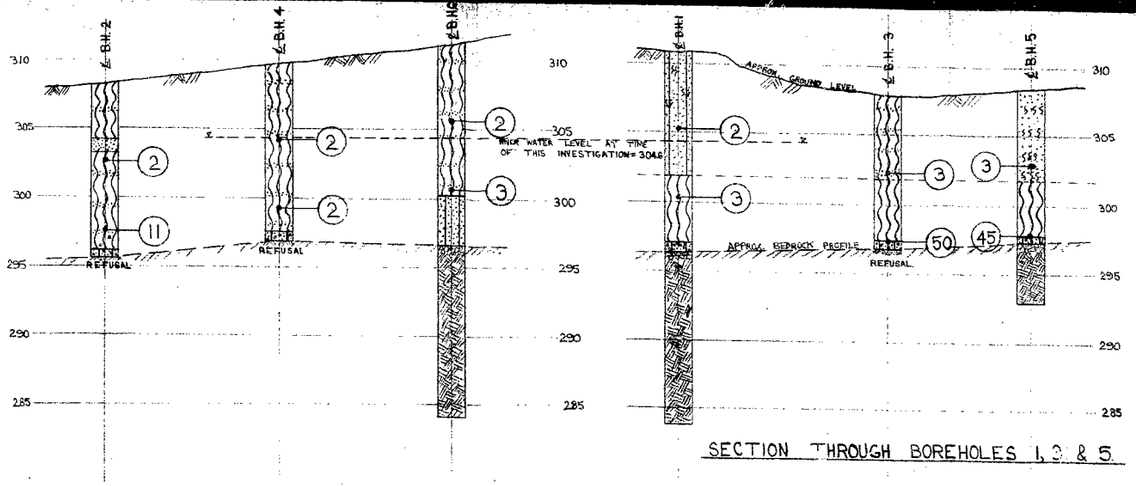
Job Name APPROACHES: CANARASIA P Job. No. 5765 A. Borehole No. A.H. 14 Sample No. —

Depth 5'-6" Elevation ——— Remarks MAX. PARTICLE SIZE = 3/8" 96.6% FINER THAN #10 SIEVE



PLAN

SCALE: 1" = 100'



SECTION THROUGH BOREHOLES 2, 4 & 6

SECTION THROUGH BOREHOLES 1, 3 & 5

PROFILES

SCALE: HOR. 1" = 20'
VERT. 1" = 5'

LEGEND

- FINE SAND, SOME SILT CONTENT
- MILDLY ORGANIC SILT, LAYERS OF FINE SAND
- SILTY VERY COARSE SAND AND ROCK FRAGMENTS
- LIMESTONE BEDROCK
- (3) STANDARD PENETRATION TEST RESISTANCE. BLOWS/FT.
- SUPPLEMENTARY BOREHOLES AND AUGER HOLES TO INVESTIGATE THE RIVERBANK MATERIAL.

NO.	REVISIONS	DATE	BY	CHK'D
1	SUPPLEMENTARY BOREHOLES AND AUGER HOLES	15-7-57	W.M.	A.M.P.

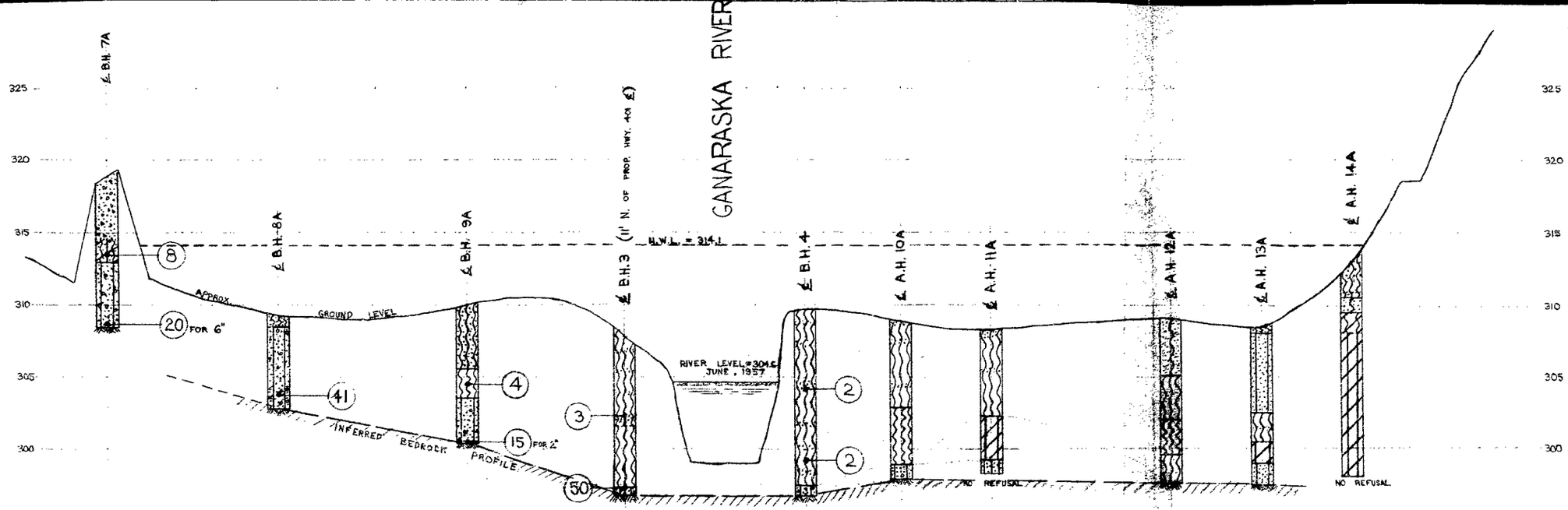
REGISTERED PROFESSIONAL ENGINEER — E. M. PETO — PROVINCE OF ONTARIO

e.m. peto & associates ltd.

SOIL SITE INVESTIGATION
AT
HWY. 401—CANARASKA RIVER BRIDGE
FOR
DEPT. OF HIGHWAYS OF ONTARIO.

OUR JOB No. 5765 DATE JULY 10, 1957

CLIENTS PLAN No. E-2866-1 ; E-2869-1 PER W.M.



PROFILE ALONG ℄ PROP. HWY. 401

SCALE: HOR. 1"=40'
VERT. 1"=5'

LEGEND

AS SHOWN ON SITE PLAN

HIGHLY ORGANIC SILT.

SILTY CLAY. GENERALLY SOFT AND MUCH WETTER THAN PLASTIC LIMIT

REGISTERED PROFESSIONAL ENGINEER
E. M. PETO
PROVINCE OF ONTARIO

e.m. peto & associates ltd.

SOIL SITE INVESTIGATION
AT
APPROACHES TO GANARASKA RIVER BRIDGE
FOR
DEPT. OF HIGHWAYS OF ONTARIO

OUR JOB No.- 5765 A — DATE- JULY 16, 1957
CLIENTS PLAN No.- F 2131-1 — PER- W. M.

BA 618

AN INDEPENDENT ORGANIZATION PROVIDING A COMPLETE SOIL ENGINEERING & INVESTIGATION SERVICE

e. m. peto associates ltd.

YOUR REFERENCE:-

OUR REFERENCE:- 5765

850 roselawn avenue,
TORONTO, ONTARIO.
RUssell 1 - 4955.

REPORT ON

SOIL & FOUNDATION CONDITIONS

HWY. 401 - GANARASKA RIVER CROSSING

HOPE TWP. #16 W. P. 757 - 56

for

DEPARTMENT OF HIGHWAYS OF ONTARIO

TERMS OF REFERENCE:

We were retained by a letter from Mr. J. C. McAllister dated May 10th, 1957 to carry out a complete soil site investigation at the above river crossing.

The work was to be performed in our standard manner, as on the other Highway 401 bridge sites. We were required to drive 6 test holes at locations as shown on the D.H.O. site plan E.2866-1. In addition, 2 other test holes were to be performed on the bank at the discretion of our Field Engineer in order to see whether the material on the bank could tolerate the load imposed by 30 to 40 ft. of surcharge.

All test holes were to be driven initially using BX casing and sampling in the standard manner at 5 ft. intervals or less. Standard penetration test results were to be recorded throughout the work. If cohesive soil with results of 15 blows or less was encountered, Shelby tube samples for strength tests were to be taken. If early refusal was encountered, bedrock was to be proven by coring for a distance of at least 10 ft. with a diamond drill bit.

Water table levels were to be noted, both during the performance of the work and after the casing had been pulled.

METHOD OF OPERATIONS:

The work was performed using a skid-mounted Longyear Junior Straightline drill rig with A-frame, which was trucked to the site from the Highway 401 - Wooler Road Crossing on June 6th, 1957. The work commenced on this date and was completed on June 14th, but the equipment was trucked back to Toronto on June 17th. The 6 test holes for the bridge were performed as shown on the site attached at the rear of this report. After the original field work had been completed, and subsequent to a discussion of the preliminary results with D.H.O. bridge department officials, it was decided to send a crew back to the site to perform a number of test holes along the centre line on either side of the river. The purpose of these holes was to delineate the bedrock profile along the centre line and to obtain samples for density tests of the material on the banks. At the time that this report is being written, this supplementary field work is in progress and the report on that phase of the work will follow at a later date, and will form an addendum to this report.

All samples obtained on the site were carefully checked in our laboratory and complete borehole logs were drawn up. These are included at the rear of this report. The samples will be retained for a period of at least 30 days, after which they will be discarded unless we are otherwise notified.

The ground water levels were noted wherever possible during the performance of the work, but could not be obtained after the casing had been pulled because the very loose silty material caved in immediately.

All elevations shown on the site plan and mentioned in this report are referred to Geodetic datum, which was obtained from a D.H.O. bench mark on the site. This bench mark is a cut cross in the top of the concrete ballast wall abutment of an old C.N.R. grade left of Station 416 + 60, and the elevation was taken to be 348.05.

SITE AND GEOLOGY:

Although its main branch is only 22 miles long, the Ganaraska River drains an area of over 100 sq. miles since it has a large number of tributaries. A large part of its drainage basin lies in the Iroquois plain. Its average gradient is 30 ft. per mile. Floods occur every year, and during the past 100 years at least 20 major floods have inundated Port Hope.

The banks immediately adjacent to the proposed bridge site are fairly level for a distance of approximately 300 - 400 ft. on each side of the river, but the general topography in the area is hilly due to the presence of many drumlins. The soil type encountered at the site were muck and bottom-land soils, which are developed on flood lands along stream courses. These soils are characterized by a blackish layer ranging in depth from 1 ft. to several feet composed of organic material fairly well decomposed. This is frequently underlain by till or limestone bedrock.

SITE AND GEOLOGY: (Cont'd)

Frequently some form of layering appears that marksthe yearly depositions. In this particular case the layering was in the form of thin bands of fine brown sand. The water table in the soils is generally high.

Bedrock consists of limestone of Paleozoic origin.

SOIL CONDITIONS:

Soil conditions on the site are uniform, and the bedrock surface was found to be quite level, although it tends to follow the gradient of the river.

The top 10-1/2 to 14-1/2 ft. of the site consists basically of a mildly organic silt, dark blackish brown in colour and of spongy texture, which is interbedded with thin seams of fine brown sand. This material is soft to very loose with standard penetration test results of only 2 or 3 blows. It is generally very wet or saturated. At some of the test holes, particularly holes 1 and 5 on the West bank of the river, the fine sand predominated and had layers of organic silt.

At each of the 6 test holes, a thin stratum no more than 1 foot in thickness of silt, fine to very coarse sand with limestone fragments was encountered. This material, which is very dense, immediately overlies the bedrock and underlies the organic silt and fine sand. At 3 of the holes, rock cores were taken to assess the soundness of the bedrock. Although the first 0" to 1 ft. of the bedrock is fragmented and faulted it was found to be sound and of excellent quality below this. Bedrock consists of limestone, although some dolomite, occasional fossils and feldsper cyrstals were noted.

WATER CONDITIONS:

The sandy and silty material at the bridge site is readily permeable to water, and the ground water level was found to generally coincide with the stream water level. This latter was at elevation 304.6, to your datum.

RECOMMENDATIONS AND CONCLUSIONS:

1. There is no doubt that the bridge should be founded directly on bedrock.

2. Because of the shallow depth to bedrock it will probably be preferable to drive sheeting and then excavate down directly to the bedrock. The abutments can then be well keyed into the solid rock below the fractured upper portion, enabling them to resist any lateral thrust from the large amounts of surcharge to be placed on the banks. There will also then be no danger of scour under the bridge foundations.

RECOMMENDATIONS AND CONCLUSIONS:

3. Due to the comparatively wide and level flood plains on either side of the river immediately adjacent to the bridge crossing and due to the limited depth of soil overlying bedrock, bank slippage or slope failure need not be considered.

4. We expect that the existing soil on the banks will consolidate considerably under the load from the 30 to 40 foot of surcharge, and heaving of the existing soil beyond the toe of the fill may occur. In order to better assess this, a series of test holes are now being put down along the centre-line as stated previously, and a supplementery report concerning this will follow very shortly.

5. We would recommend that the existing materials adjacent to the abutments be completely stripped to bedrock for a distance of some 15 ft. back so that good granular fill material can be placed and properly compacted, to avoid unnecessary settlement adjacent to the structure.

E. L. PETO ASSOCIATES LTD.,

M.L.P.:sb

M. L. Peto, P. Eng.

July 12th, 1957.

e. m. peto associates ltd.

SOIL ENGINEERING SERVICE – TORONTO, ONTARIO

BOREHOLE LOG

Job Name Hwy. 401-Genereaske River Br Job No. 5765 Borehole No. 1

Client Dept. of Highways of Ontario Casing BX & AX Boring Date June 7 - 11, 1957.

Datum D.H.O. Compiled By M. Mindess Checked By E. M. Peto

SAMPLE CONDITION

- UNDISTURBED
- FAIR
- DISTURBED
- LOST

SAMPLE TYPE

- 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
- Q/u UNCONFINED COMPRESSIVE STRENGTH
- W.L. WATER LEVEL IN CASING
- W.T. GROUND WATER TABLE IN SOIL

SOIL DESCRIPTION	COLOUR	Density or Consistency	Depth / Elevation	Legend	Sample No and Condition	Sample Type	No. of Blows per Ft	WATER LEVELS, SOIL MOISTURE & REMARKS
			0'0" 310.8					
FINE SAND TRACES OF ORGANIC MATTER	GREY-BROWN							MOIST.
			▽ 5'0" 305.8			▽ W.L.		
FINE SAND SOME SILT CONTENT	BROWN	VERY LOOSE			1	S.S.	2	MOIST.
			9'0" 301.8					
MILDLY ORGANIC SILT	DARK BROWNISH-BLACK	SOFT			2	S.S.	3	WET. SPONGY TEXTURE.
SILTY FINE TO VERY COARSE SAND. GRAVEL.	GREY	VERY DENSE	13'9" 297.0					VIRTUAL REFUSAL AT 14'6".
			296.3					
LIMESTONE, SOME DOLOMITE. OCCASIONAL FOSSILS AND SOME FELDSPAR CRYSTALS.	VERY DARK BROWN, GREY-BROWN & GREY-BLACK	EXCELLENT QUALITY BELOW 15'.			3	R.C.		DRILLED AX CASING DOWN TO 15'. CORED WITH AXT CORE BARREL AND BIT FROM 15' TO 27'. 100% CORE RECOVERY
			20'0" 290.8					
						R.C.		
						R.C.		
			27'0" 283.8					
			HOLE TERMINATED.					

e. m. peto associates ltd.

SOIL ENGINEERING SERVICE – TORONTO, ONTARIO

BOREHOLE LOG

Job Name Hwy. 401-Genaraska River Bridge | Job No. 5765 | Borehole No. 3 & 5

Client Dept. of Highways of Ontario | Casing BX | Boring Date June 6 & 7, 1957.

Datum D.H.O. | Compiled By M. Mindess | Checked By E. M. Peto

SAMPLE CONDITION

- UNDISTURBED
- FAIR
- DISTURBED
- LOST

SAMPLE TYPE

- S. S. 2" STANDARD SPLIT TUBE SAMPLE
- S. L. SPLIT BARREL WITH LINERS
- S. T. THIN-WALLED SHELBY TUBE SAMPLE
- W. S. WASH SAMPLE
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- V. T. IN SITU VANE SHEAR TEST
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- W. L. WATER LEVEL IN CASING
- W. T. GROUND WATER TABLE IN SOIL

SOIL DESCRIPTION	COLOUR	Density or Consistency	Depth Elevation	Legend	Sample No. and Condition	Sample Type	No. of Blows per Ft	WATER LEVELS, SOIL MOISTURE & REMARKS
			BOREHOLE 3					
			0' 0" 307.8					
MILDLY ORGANIC SILT, SEAMS OF FINE SAND.	DARK BLACKISH-BROWN SAND: BROWN	SOFT						▽ W.L
			5' 0" 302.8					
MILDLY ORGANIC SILT	DARK BROWN-BLACK	SOFT			1	S.S.	3	SATURATED SILT: SPONGY
SILTY FINE TO COARSE SAND AND LIMESTONE FRAGMENTS	GREY	VERY DENSE	10' 6" 297.3 / 296.8		2	S.S.	50	WET
			REFUSAL. PROBABLY BEDROCK.					
			BOREHOLE 5					
			0' 0" 308.4					
FINE SAND LAYERS OF ORGANIC SILT	BROWN.							HOLE WET BELOW 3'.
			5' 0" 303.4					
FINE TO MEDIUM SAND. MINOR SILT CONTENT	BROWN	VERY LOOSE			1	S.S.	3	WET
MILDLY ORGANIC SILT	DARK BROWNISH-GREY	SOFT						SILT: SPONGY
SILTY FINE TO MEDIUM SAND AND LIMESTONE FRAGMENTS.	GREY	VERY DENSE	10' 8" 297.7		2	S.S.	45 REFUSAL	WET AT 11' 2"
FAULTED AND FRAGMENTED LIMESTONE	DARK GREY				3	R.C.		
					4	R.C		50% CORE RECOVERY
			15' 6" 292.5					
			HOLE TERMINATED.					

e. m. peto associates ltd.

SOIL ENGINEERING SERVICE – TORONTO, ONTARIO

BOREHOLE LOG

Job Name Hwy. 401-Genareska River Bridge | Job No. 5765 | Borehole No. 2 & 4

Client Dept. of Highways of Ontario | Casing BX | Boring Date June 12 & 13, 1957.

Datum D.H.O. | Compiled By M. Mindess | Checked By E. M. Peto

SAMPLE CONDITION

- UNDISTURBED
- FAIR
- DISTURBED
- LOST

SAMPLE TYPE

- 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
- Q/u UNCONFINED COMPRESSIVE STRENGTH
- W.L. WATER LEVEL IN CASING
- W.T. GROUND WATER TABLE IN SOIL

SOIL DESCRIPTION	COLOUR	Density or Consistency	Depth Elevation	Legend	Sample No. and Condition	Sample Type	No. of Blows per Ft	WATER LEVELS, SOIL MOISTURE & REMARKS
			BOREHOLE 2					
			0' 0"					
MILDLY ORGANIC SILT AND DECAYED VEGETABLE MATTER	DARK BROWNISH-BLACK		308.2					MOIST
			4' 0"					
FINE SAND LAYER	BROWN		5' 0"					HOLE WET BELOW 5'
AS ABOVE		SOFT	303.2		1 ☒	S.S.	2	WET SPONGY
SEAMS OF FINE SAND								
	DARK							
MILDLY ORGANIC SILT	BROWNISH-BLACK.	FIRM			2 ☒	S.S.	11	WET
			12' 0"					
SILTY FINE TO VERY COARSE SAND, AND ROCK FRAGMENTS.	GREY	VERY DENSE	291.2 / 290.6		3 ☒		60/3"	ON OPEN END A-ROD.
		HOLE TERMINATED.					REFUSAL AT 12'7"	
			BOREHOLE 4					
			0' 0"					
MILDLY ORGANIC SILT SEAMS OF FINE SAND	DARK BROWNISH-BLACK SAND: BROWN	SOFT	309.7					MOIST
AS ABOVE, BUT SAND PREDOMINATES.	"	VERY LOOSE			1 ☒	S.S.	2	QUITE MOIST
AS ABOVE	"	SOFT			2 ☒	S.S.	2	WET SPONGY
SILTY FINE TO COARSE SAND, LIMESTONE FRAGMENTS.	GREY	VERY DENSE	12' 2" 297.5 / 296.9		3 ☒			SATURATED.
		REFUSAL PROBABLY BEDROCK						

e. m. peto associates ltd.

SOIL ENGINEERING SERVICE – TORONTO, ONTARIO

BOREHOLE LOG

Job Name: Hwy. 401-Genaraska River Bridge | Job No.: 5765 | Borehole No.: 6

Client: Dept. of Highways of Ontario | Casing: BX & AX | Boring Date: June 13-14, 1957.

Datum: D.H.O. | Compiled By: M. Mindess | Checked By: E. M. Peto

SAMPLE CONDITION

- UNDISTURBED
- FAIR
- DISTURBED
- LOST

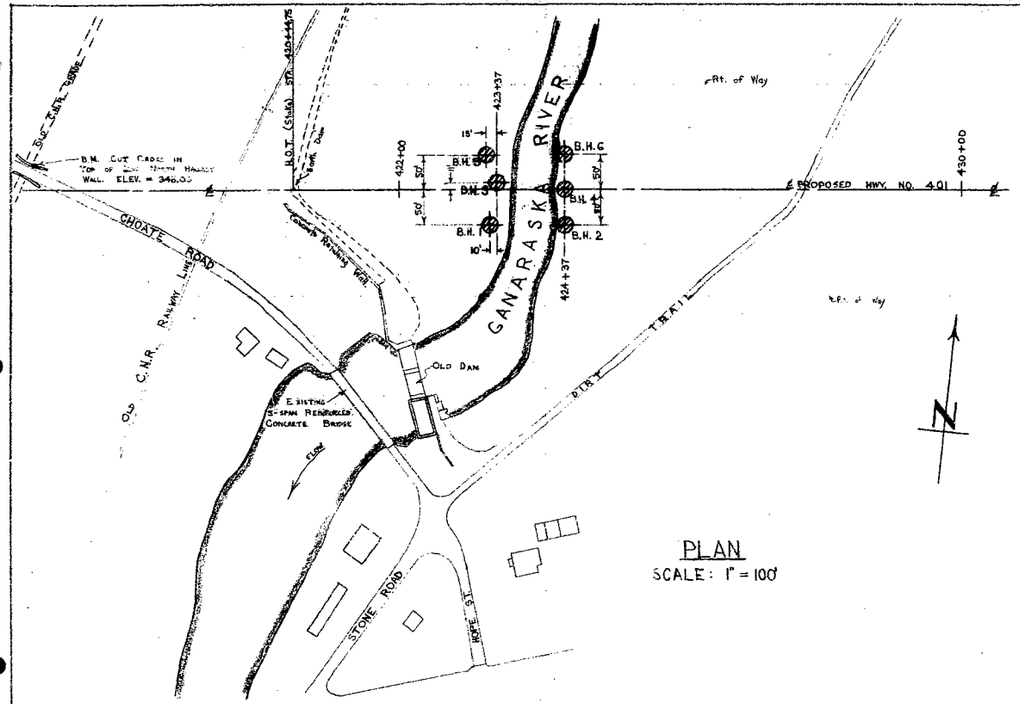
SAMPLE TYPE

- 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

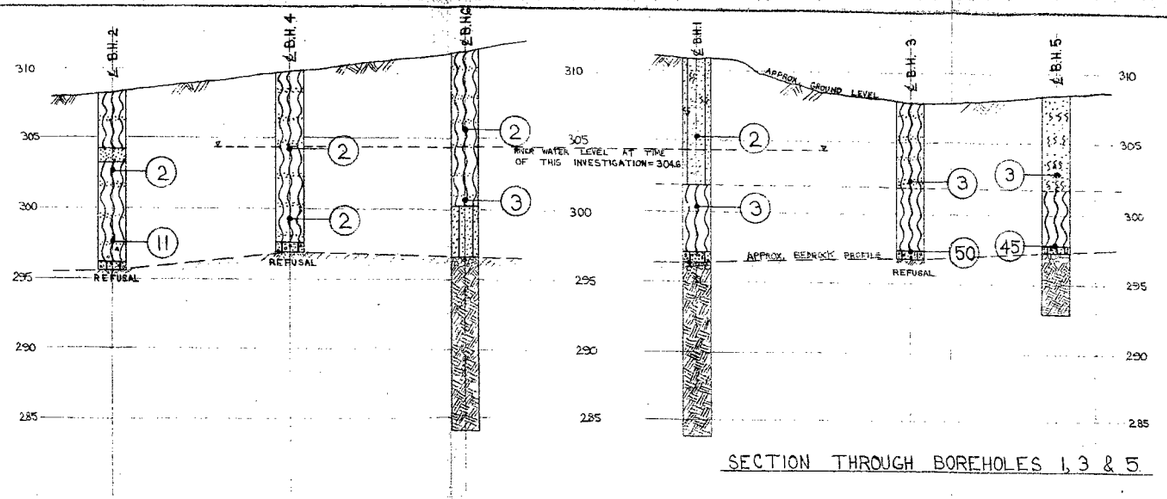
- V.T. IN SITU VANE SHEAR TEST
- Q/u UNCONFINED COMPRESSIVE STRENGTH
- W.L. WATER LEVEL IN CASING
- W.T. GROUND WATER TABLE IN SOIL

SOIL DESCRIPTION	COLOUR	Density or Consistency	Depth / Elevation	Legend	Sample No. and Condition	Sample Type	No. of Blows per Ft	WATER LEVELS, SOIL MOISTURE & REMARKS
			0' 0" / 311.1					
MILDLY ORGANIC SILT SEAMS OF FINE SAND.	DARK BROWNISH-BLACK. SAND: BROWN		5' 0" / 306.1		1	S.S.	2	WET. SPONGY TEXTURE.
AS ABOVE	GREY-BLACK.		11' 0" / 300.1		2	S.S.	3	"
SILTY FINE TO VERY COARSE SAND.	GREY		14' 6" / 296.6		3	W.S.		WET. REFUSAL AT 14' 6". DRILLED AX CASING DOWN TO 15'. THEN USED AXT CORE BARREL AND BR
LIMESTONE, SOME FOSSILS.	DARK GREY	SOUND BELOW 15½'.	17' 0" / 294.1		4	R.C.		15'-17' : 75 % CORE RECOVER
					5	R.C.		17'-27' : 100 % " "
			22' 0" / 289.1					
AS ABOVE	"				6	R.C.		
	"		27' 0" / 284.1					
			HOLE TERMINATED					



PLAN

SCALE: 1" = 100'



SECTION THROUGH BOREHOLES 2, 4 & 6

SECTION THROUGH BOREHOLES 1, 3 & 5

PROFILES

SCALE: HOR. 1" = 20'
VERT. 1" = 5'

REGISTERED PROFESSIONAL ENGINEER E. M. PETO PROVINCE OF ONTARIO

e.m. peto & associates ltd.

SOIL SITE INVESTIGATION
AT
HWY. 401—GANARASKA RIVER BRIDGE
FOR
DEPT. OF HIGHWAYS OF ONTARIO.

OUR JOB No.- 5765 DATE- JULY 10, 1957

CLIENTS PLAN No.- E-2866-1 ; E-2869-PER- M.M.

include with 30M16-7 BA697.

AN INDEPENDENT ORGANIZATION PROVIDING A COMPLETE SOIL ENGINEERING & INVESTIGATION SERVICE

e. m. peto associates ltd.

YOUR REFERENCE:-

OUR REFERENCE:- 57144

850 roselawn avenue,
TORONTO, ONTARIO.
RUssell 1 - 4955.

December 24th, 1957.

30M16-7
GEOCRES No.

Department of Highways of Ontario,
c/o M. M. Dillon and Company Limited,
141 Maple Street,
London, Ontario.

Attention: Mr. R. M. Dillon, P. Eng.

Re: [redacted] Hope Township Bridge No. 15
Soil Investigation.

Dear Sirs:

We refer to your letter of November 22nd, 1957, in which you requested us to carry out a soils investigation at the proposed overpass for Hope Township Bridge Number 15. Our terms of reference required that we should drive three test holes and three probe holes at locations as indicated on your site plan 928-42 P-1.

In view of the initial test results from the first three test holes, it was decided to extend the investigation by performing the additional three holes as soil test holes in lieu of probing. Our report has now been completed and is submitted based on the soil test results obtained from these six test holes.

In summation of the field test work and laboratory examination and analysis of the sampling work, we submit the following recommendations and conclusions for your consideration:

1. The proposed overpass structure should be founded on the limestone bedrock, and all footings or column pads should be keyed well into the rock. This will enable them to resist any lateral thrust from the high approach embankments.

2. If the footings or pads are placed on poorer quality rock, then the recommended safe loading is only 5.0 tons per sq. ft.

3. If the foundations rest on sound limestone, the safe allowable loading is 15.0 tons per sq. ft. However, we recommend that before using this higher figure, a pneumatic star-drill hole should be driven at the bottom of the individual excavations, as a positive check on the soundness of the rock.

4. Because of the high perched water table, and the relatively permeable sands and silty sands, it will in all likelihood be necessary to use some form of sheeting around the excavations, particulary those on the Easterly side of the abandoned railway tracks.

5. Before placing any of the fill for the approach embankments to the overpass structure, all of the loose soil with organic content should be removed and replaced with clean granular fill.

6. It is apparent that the sort silty clay stratum on the West side of the bridge site will fail, or approach failure, under the superimposed load of the approach embankment behind the abutment. We now understand that this embankment fill will be of the order of 30 to 35 ft. in height. Providing the bridge abutments are well keyed into the bedrock and designed to withstand the lateral thrust from the embankment, failure of the softer silty clay stratum should not affect the bridge structure.

7. If the poor subsoil condition is limited to only a short length of roadway West of the bridge, it might be expedient to consider excavating this stratum to avoid ultimate settlement of the embankment. However, we understand from supplementary information from the Department of Highways Soils staff, that poor soil conditions also exist some 400 ft. West of the bridge site. This alternative therefore appears of use only if it should be uneconomical or otherwise undesirable to key the bridge abutment to the bedrock.

8. If the soft silty clay stratum is not excavated behind the West abutment, and if relatively small diameter pier caissons are used to carry the abutment load to bedrock, then there will be some upward displacement of the proposed gravel road bed under the bridges as the embankment fill behind the abutment reaches its maximum height of 30 to 35 feet. This displacement will be reduced and may be negligible if the design incorporates a number of piers under the abutment. Failure will then be apparent principally along the toe of the embankment slope.

We would be most pleased to assist you with any further interpretation of the test results where you deem necessary. As we have discussed earlier, the question of bank stability has not been examined in detail in this report since the Department of Highways presently have other information from prior investigations with respect to the approach embankments.

Yours very truly,

E. M. PETO ASSOCIATES LTD.,

E. M. Peto, P. Eng.

MM:sb

e. m. peto associates ltd., 850 roselawn avenue, Toronto 10, Ontario

Job No. 57144 Client's Ref. No. 928-42-1 Date December 23/57

Report on

SOIL SITE INVESTIGATION

at

HOPE TWP. BRIDGE NUMBER 15

HIGHWAY 401 over CHOATE ROAD

for

M. M. DILLON AND COMPANY LTD.

TERMS OF REFERENCE:

On November 25th, 1957, we received a letter from Mr. R. M. Dillon authorizing us to proceed with the soil investigation for the above project, which was considered to be urgent. The enclosed Client's site plan number 928-42 P-1 showed six required boreholes, three on each side parallelling the new alignment on Choate Road.

Only three of the holes were to be regular soil test holes, and the other three were to be holes in which only percussion tests were carried out. However, from previous experience we had gained on this site, we knew that bedrock was at a fairly shallow depth, and that the overlying soil has very poor engineering properties. These facts were corroborated by the first two soil test holes. Therefore a decision was made on site by our Field Engineer to drive all six test holes in the standard manner, and to check the soundness of the underlying bedrock in three of the test holes. This measure yielded much more information, at very little additional cost, since it took little extra time to drive and sample the holes properly.

METHOD OF OPERATIONS:

On December 3rd, 1957, a reconnaissance of the site was made by our Field Engineers, the holes were staked out, and the ground elevations were taken. Our field crew and equipment arrived on the site in the morning of December 5th, 1957, on which date the work commenced.

This investigation was carried out by our number 4 crew, using a skid-mounted Sullivan "12" drill rig with A-frame. The field work was completed and the equipment returned to the yard in Toronto on December 11th, 1957.

METHOD OF OPERATIONS: (Cont'd)

In all six test holes, soil samples were obtained at 3 ft. intervals or less, using a 2" standard split spoon sampler, and recording the standard penetration test results throughout. A number of natural moisture content samples of the overlying poor soil were also taken. In test holes 1, 2 and 4, 10 ft. of rock coring was done in order to be able to assess the soundness of the bedrock. The soil consistency was such that it was extremely difficult to obtain undisturbed samples for triaxial tests.

The ground water levels in uncased holes were all carefully measured on the final day at the site.

All samples obtained were carefully examined in our laboratory in Toronto, and such laboratory testing as was deemed necessary was performed. Detailed borehole logs were drawn up. These are included at the rear of this report, along with the hydrometer grain size distribution diagram and the Atterberg Limit tests for the silty clay stratum. A site plan and soil profile is also attached.

For your additional information, the soil profile of the Ganaraska River crossing is also included.

The soil samples will be retained for a period of at least 30 days from date of issuance of this report, after which they will be discarded unless we are otherwise notified.

All elevations mentioned in this report and shown on the borehole logs and site plan, were obtained using the Client's temporary bench mark on this site, which was the base of the North-West rail at the centre line of Highway 401 at chainage 419 + 23.70. The elevation of this bench mark was taken to be 316.6 (D.H.O. datum).

SITE AND GEOLOGY:

The area surrounding the site has been drumlinized in the past, and as a result, the topography in the area is rolling to hilly. The site of the Highway 401 - Choate Road overpass lies at the extreme Western edge of the old Ganaraska River flood plain. The fluvial deposited soil types encountered, and the tendency for stratification, bear out this fact.

Bedrock in the area consists of limestone of Palaeozoic origin.

SOIL CONDITIONS:

Soil conditions on the site are fairly uniform, and the bedrock surface was found to be quite level.

The site of the proposed overpass is covered by up to 3'6" of organic topsoil. On the East side of the railway tracks this topsoil is of a sandy nature, and on the West side of the tracks it consists mainly of dark brown organic clayey silt up to 1'2" thick. Below the surface layers at test holes 1, 2, 3 and 6, is a stratum of pale brown silty clay, which tends to be stratified. At some locations the material becomes much more silty and has been classified as a clayey silt. The annual river deposits are marked in some cases by thin, brown, fine sand strata interbedded with the silty clay or clayey silt. This stratum is generally firm to stiff in consistency, and the unconfined compressive strength is in the order of 1000 pounds per square foot. Natural moisture contents range from 23.6% to 34.1%, well in excess of the plastic limit, which is 19.2%.

Underlying this relatively cohesive soil stratum, and directly overlying the limestone bedrock, is a stratum ranging in thickness from 5 ft. to 8 ft. of grey-brown fine to medium sand and grey silty fine sand. This sand contains many grits and limestone fragments, and in some cases even has very thin layers of limestone. Natural moisture contents range from 7.4% to 18.4%, and the material is loose to verydense.

The parent material on this site is grey fine-grained, dolomitic limestone, with an upper boundary limit between elevations 306.9 and 304.2. Occasional small marine fossils are contained in the limestone. The limestone has minor horizontal fissures throughout. The upper three or four feet are generally not of good quality , because there are thin layers from 1" up to 6" of grey silty sand and gravel interbedded with the upper part of the limestone. The soundness, however, is excellent below an elevation of approximately 300.0

WATER CONDITIONS:

The water table on this site is very high, due to a number of factors. The soil mantle overlying the bedrock is relatively permeable and generally not very dense. The bedrock itself obviously acts as an impervious layer on which the ground water is perched. There is considerable run-off in this area due to the hilly topography.

WATER CONDITIONS: (Cont'd)

Drainage on this site appears to occur in a South by South-Westerly direction, and there is some water in the ditch adjacent to borehole number 1. This is shown on the attached profile through boreholes 1, 2 and 3.

ENGINEERING CONSIDERATIONS:

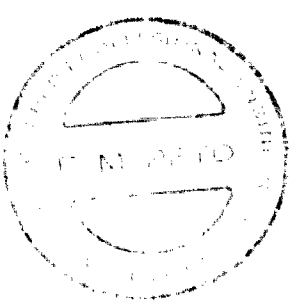
1. As one of the unexpected oddities to this site, the stratified silty clay and clayey silt stratum was encountered only in the three boreholes on the Westerly side of the abandoned railway tracks.

   This is the only soil type that is liable to actually fail under the expected high approach embankments, although the loose sandy material will settle during the placement of the fill.

2. The organic sandy topsoil and organic silty loam found only on the Easterly side of the old railway tracks to depths as great as 4 feet below existing grade, is an undesirable sub-base material, due to its very low densities, organic content, and high moisture content.

3. Because of the perched high water table on this site, some dewatering of the pier excavations will be necessary. It may be advisable to sheet pile the excavation to bedrock to minimize the water problem and to limit the volume of material to be excavated.

4. The upper 3 or 4 feet of the bedrock is interbedded with the silty sand and gravel strata. Due to the minor fissures and layered nature of even the more solid limestone bedrock below, blasting should not be resorted to if it should be decided to remove the top 3 ft. or 4 ft. of the weaker bedrock in order to obtain the higher bearing values from the sounder limestone below.



e. m. peto associates ltd.

SOIL ENGINEERING SERVICE – TORONTO, ONTARIO

BOREHOLE LOG

Job Name: Hope Twp. Bridge No. 15 | Job No. 57144 | Borehole No. 1

Client: M. M. Dillon & Co. Ltd. | Casing: BX (2-1/2" diam.) | Boring Date: Dec. 11th, 1957

Datum: D.H.O. | Compiled By: M.M. | Checked By: E.M.P.

SAMPLE CONDITION

- UNDISTURBED
- FAIR
- DISTURBED
- LOST

SAMPLE TYPE

- 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
- Q/u UNCONFINED COMPRESSIVE STRENGTH
- W.L. WATER LEVEL IN CASING
- W.T. GROUND WATER TABLE IN SOIL

SOIL DESCRIPTION	COLOUR	Density or Consistency	Depth / Elevation	Legend	Sample No. and Condition	Sample Type	No. of Blows per Ft.	WATER LEVELS, SOIL MOISTURE & REMARKS
			0' 0"					
ORGANIC CLAYEY SILT	DARK BROWN		314.5 1' 2"					▽ W.L. = 0' 4", DEC. 11, 1957
SILTY CLAY, LAYERS OF CLAYEY SILT.	MIXED LIGHT BROWN AND GREY	FIRM			1	S.S.	5	WETTER THAN PLASTIC LIMIT. NAT. M.C. = 31.3%
			5' 0"					
VERY CLAYEY SILT, LAYERS OF LT. BROWN FINE TO MED. SAND.	LIGHT GREY	COMPACT TO STIFF DENSE.	8' 4" 306.2		2	S.S.	13	VERY MOIST. SLIGHTLY WETTER THAN PLASTIC LIMIT. NAT. M.C. = 16.6%
FINE-GRAINED DOLOMITIC LIMESTONE. SOME SMALL FOSSILS.	GREY	TENDS TO BE FAULTED AND FISSURED	13' 4"		3	AXT R.C.		100% CORE RECOVERY
AS ABOVE.			18' 4" 296.2		4	AXT R.C.		75% RECOVERY
		HOLE TERMINATED.						

e. m. peto associates ltd.

SOIL ENGINEERING SERVICE - TORONTO, ONTARIO

BOREHOLE LOG

Job Name: Hope Twp. Bridge No. 15 | Job No.: 57144 | Borehole No.: 1

Client: M. M. Dillon & Co. Ltd. | Casing: BX (2-1/2" diam.) | Boring Date: Dec. 11th, 1957

Datum: D.H.O. | Compiled By: M.M. | Checked By: E.M.P.

SAMPLE CONDITION

- UNDISTURBED
- FAIR
- DISTURBED
- LOST

SAMPLE TYPE

- 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
- Q/u UNCONFINED COMPRESSIVE STRENGTH
- W.L. WATER LEVEL IN CASING
- W.T. GROUND WATER TABLE IN SOIL

SOIL DESCRIPTION	COLOUR	Density or Consistency	Depth / Elevation	Legend	Sample No. and Condition	Sample Type	No. of Blows per Ft.	WATER LEVELS, SOIL MOISTURE & REMARKS
			0' 0"					
ORGANIC CLAYEY SILT	DARK BROWN		314.5					▽ W.L. = 0'4", DEC. 11, 1957
SILTY CLAY, LAYERS OF CLAYEY SILT.	MIXED LIGHT BROWN AND GREY	FIRM	5' 0"		1	S.S.	5	WETTER THAN PLASTIC LIMIT. NAT. M.C. = 31.3%
VERY CLAYEY SILT, LAYERS OF LT. BROWN FINE TO MED. SAND.	LIGHT GREY	COMPACT TO STIFF DENSE	8' 4" 306.2		2	S.S.	13	VERY MOIST. SLIGHTLY WETTER THAN PLASTIC LIMIT. NAT. M.C. = 16.6%
FINE-GRAINED DOLOMITIC LIMESTONE. SOME SMALL FOSSILS.	GREY	TENDS TO BE FAULTED AND FISSURED	13' 4"		3	AXT R.C.		100% CORE RECOVERY
AS ABOVE.			18' 4" 296.2		4	AXT R.C.		75% RECOVERY
		HOLE TERMINATED.						

e. m. peto associates ltd.

SOIL ENGINEERING SERVICE – TORONTO, ONTARIO

BOREHOLE LOG

Job Name: Hope Twp. Bridge No. 15 | Job No.: 57144 | Borehole No.: 2

Client: D. M. Dillon & Co. Ltd. | Casing: BX (2½" diam.) | Boring Date: December 5th, 1957.

Datum: D.H.O. | Compiled By: M.I. | Checked By: E.M.P.

SAMPLE CONDITION

- UNDISTURBED
- FAIR
- DISTURBED
- LOST

SAMPLE TYPE

- 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
- Q/u UNCONFINED COMPRESSIVE STRENGTH
- W.L. WATER LEVEL IN CASING
- W.T. GROUND WATER TABLE IN SOIL

SOIL DESCRIPTION	COLOUR	Density or Consistency	Depth Elevation	Legend	Sample No. and Condition	Sample Type	No. of Blows per Ft.	WATER LEVELS, SOIL MOISTURE & REMARKS
			0' 0"					
ORGANIC CLAYEY SILT.	DARK BROWN		319.9					
SILTY CLAY, LAYERED	PALE BROWN WITH RUST LENSES.	FIRM			1	S.S.	5	WETTER THAN PLASTIC LIMIT. NAT. M.C. = 24.4%. Qu = APPROX. 1.4 T.S.F. W.L. = 5'6", DEC. 11, 1957.
			5' 0"					
AS ABOVE, LAYERS OF SAND AND OF ORGANIC CLAYEY SILT.	PALE BROWN	STIFF			2	S.S.	10	NAT. M.C. = 29.6%
		STIFF TO COMPACT	8' 6" 311.4		3	S.S.	12	Qu = APPROX. 1.3 T.S.F. NAT. M.C. = 27.4%
SILTY FINE SAND, SOME GRAVEL	LT. BROWNISH GREY	COMPACT			4	S.S.	18	MOIST NAT. M.C. = 7.4%
			12' 4" 307.6					
GRAVEL WITH GREY SILTY SAND	GREY	"						GRAVEL CONSISTS OF LIMESTONE FRAGMENTS.
1" LAYER OF LIMESTONE.			14' 9"					
			15' 8" 304.2					
THIN LAYERS OF LIMESTONE FROM ½" TO 8" INTERBEDDED WITH THIN LAYERS OF GREY SILTY SAND AND GRAVEL.	GREY				5	AXT R.C.		DIAMOND DRILLED 9'4". 3'10" BROKEN CORE RECOVERED, AND SOME OF THE CORE WAS GROUND UP BY THE BIT. THE SAND LAYERS BECOME MORE INFREQUENT WITH DEPTH.
			24' 0" 295.9					
		HOLE TERMINATED.						

e. m. peto associates ltd.

SOIL ENGINEERING SERVICE – TORONTO, ONTARIO

BOREHOLE LOG

Job Name: Hope Twp. Bridge No. 15 | Job No.: 57144 | Borehole No.: 3

Client: M.M. Dillon & Co. Ltd. | Casing: BX (2-1/2" diam.) | Boring Date: December 6th, 1957.

Datum: D.M.O. | Compiled By: M.M. | Checked By: E.M.P.

SAMPLE CONDITION

- UNDISTURBED
- FAIR
- DISTURBED
- LOST

SAMPLE TYPE

- 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
- Q_u UNCONFINED COMPRESSIVE STRENGTH
- W.L. WATER LEVEL IN CASING
- W.T. GROUND WATER TABLE IN SOIL

SOIL DESCRIPTION	COLOUR	Density or Consistency	Depth / Elevation	Legend	Sample No. and Condition	Sample Type	No. of Blows per Ft.	WATER LEVELS, SOIL MOISTURE & REMARKS
			0' 0"					
ORGANIC SANDY TOPSOIL	BROWN		321.9					MOIST
FINE TO MEDIUM SAND	"		1' 10"					
STRATIFIED CLAYEY SILT, SOME ORGANIC CONTENT	" PALE	COMPACT	3' 7" 318.3		1	S.S.	11	NOT QUITE PLASTIC. NATURAL M.C. = 24.6% — W.L. = 5'10" DEC. 11.1957
SILTY CLAY, LAYERS OF BROWN CLAY	BROWN	STIFF			2	S.S.	14	Q_u = 864 P.S.F @ 20% DEFORMTN. M.C. CLAY = 27.3% M.C. SILTY CLAY = 23.8%
AS ABOVE.	"	"	8' 2" 313.7		3	S.S.	16	Q_u = APPROX. 1.2 T.S.F. NAT. M.C. = 25.2%
FINE TO MED. SAND	MIXED GREY AND BROWN	LOOSE	9' 6"					
SILTY FINE SAND WITH GRAVEL UP TO 1¼" SIZE	GREY-BROWN	VERY DENSE			4	S.S.	72	MOIST. NAT. M.C. = 7.4%
AS ABOVE, WITH VERY THIN LAYERS OF LIMESTONE.		EXTREMELY DENSE	16' 5" 305.5					SOIL TOO HARD TO TAKE SPLIT SPOON SAMPLE AT 15'.
								REFUSAL. LIMESTONE BEDROCK.

e. m. peto associates ltd.

SOIL ENGINEERING SERVICE – TORONTO, ONTARIO

BOREHOLE LOG

Job Name: Hope Twp. Bridge No. 18 | Job No.: 57144 | Borehole No.: 4

Client: M. M. Dillon & Co. Ltd. | Casing: BX (2-1/2" diam.) | Boring Date: December 9th, 1957

Datum: D.H.O. | Compiled By: M.M. | Checked By: E.M.P.

SAMPLE CONDITION

- UNDISTURBED
- FAIR
- DISTURBED
- LOST

SAMPLE TYPE

- 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
- Q/u UNCONFINED COMPRESSIVE STRENGTH
- W.L. WATER LEVEL IN CASING
- W.T. GROUND WATER TABLE IN SOIL

SOIL DESCRIPTION	COLOUR	Density or Consistency	Depth Elevation	Legend	Sample No and Condition	Sample Type	No. of Blows per Ft	WATER LEVELS, SOIL MOISTURE & REMARKS
			0' 0"					
ORGANIC SANDY TOPSOIL	DARK BROWN		315.3					
			1' 8"					▽ W.L. = 1'7" DEC. 11, 1957
SILTY FINE TO MEDIUM SAND	MIXED GREY AND BROWN	COMPACT	3' 4"		1	S.S.	11	VERY MOIST
FINE TO MED. SAND	BROWN	"			2	S.S.	13	WET NAT. M.C. = 18.4%
			7' 0"					
SAND WITH GRITS AND LIMESTONE FRAGMENTS.	GREY	"	8' 6"					
		GENERALLY	308.8			AXT		
FINE-GRAINED DOLOMITIC LIMESTONE, OCCASIONAL SMALL MARINE FOSSILS.	GREY	SOUND, BUT SOME FISSURES.			3	R.C.		60% RECOVERY.
			13' 6"					
		EXCELLENT				AXT		
AS ABOVE.	"	QUALITY			4	R.C.		100% RECOVERY.
			18' 6"					
			298.8					
								Note: When bailing hole upon completion, ingress of water prevented the hole from being bailed below the 7'8" depth.
			HOLE TERMINATED					

e. m. peto associates ltd.

SOIL ENGINEERING SERVICE – TORONTO, ONTARIO

BOREHOLE LOG

Job Name: Hope Twp. Bridge No. 15 | Job No.: 57144 | Borehole No.: 5

Client: M.M. Dillon & Co. Ltd. | Casing: BX (2-1/2" diam.) | Boring Date: December 10th, 1957.

Datum: D.H.O. | Compiled By: M.M. | Checked By: E.M.P.

SAMPLE CONDITION

- UNDISTURBED
- FAIR
- DISTURBED
- LOST

SAMPLE TYPE

- 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
- Q/u UNCONFINED COMPRESSIVE STRENGTH
- W.L. WATER LEVEL IN CASING
- W.T. GROUND WATER TABLE IN SOIL

SOIL DESCRIPTION	COLOUR	Density or Consistency	Depth / Elevation	Legend	Sample No. and Condition	Sample Type	No. of Blows per Ft.	WATER LEVELS, SOIL MOISTURE & REMARKS
			0' 0" / 316.1					
SLIGHTLY ORGANIC SANDY LOAM	DARK BROWN	LOOSE	3' 5" / 312.6		1 ☒	S.S.	4½	MOIST
SILTY FINE SAND, MINOR ORGANIC TRACES	DARK YELLOWISH-BROWN	LOOSE			2 ☒	S.S.	7	QUITE MOIST
		COMPACT	7' 9"		3 ☒	S.S.	14	WET.
FINE TO MEDIUM SAND.	GREY-BROWN		9' 3" / 306.9					
		REFUSAL LIMESTONE BEDROCK.						Note: Hole caved in upon completion. Water level not obtainable.

e. m. peto associates ltd.

SOIL ENGINEERING SERVICE – TORONTO, ONTARIO

BOREHOLE LOG

Job Name: Hope Twp. Bridge No. 15 | Job No.: 57144 | Borehole No.: 6

Client: M.M. Dillon & Co. Ltd. | Casing: BX (2-1/2" diam.) | Boring Date: December 10th, 1957

Datum: D.H.O. | Compiled By: M.M. | Checked By: E.M.P.

SAMPLE CONDITION

- UNDISTURBED
- FAIR
- DISTURBED
- LOST

SAMPLE TYPE

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- S.L. SPLIT BARREL WITH LINERS
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SOIL DESCRIPTION	COLOUR	Density or Consistency	Depth Elevation	Legend	Sample No. and Condition	Sample Type	No. of Blows per ft.	WATER LEVELS, SOIL MOISTURE & REMARKS
			0' 0"					
CINDER FILL, PIECES OF BRICK, ROOTS, ETC.			316.7 1' 3"					
MIXED ORGANIC SILT AND BROWN SILTY FINE SAND.	DARK BROWN	LOOSE.	4' 0"		1	S.S.	5	MOIST
FINE SAND.	BROWN	"	4' 10"					WET
CLAYEY SILT, SOME SAND.	"	COMPACT	6' 4"		2	S.S.	11	NAT. M.C. = 34.1%
MEDIUM SAND.	"	"	5' 7"		3	S.S.	13	WET. NAT. M.C. = 20.0%
FINE TO MEDIUM SAND.	GREY	COMPACT TO DENSE	9' 11" 305.8					MOIST
			REFUSAL. LIMESTONE BEDROCK.					Note: Hole caved in upon completion. Water level not obtained.

e. m. peto associates ltd.

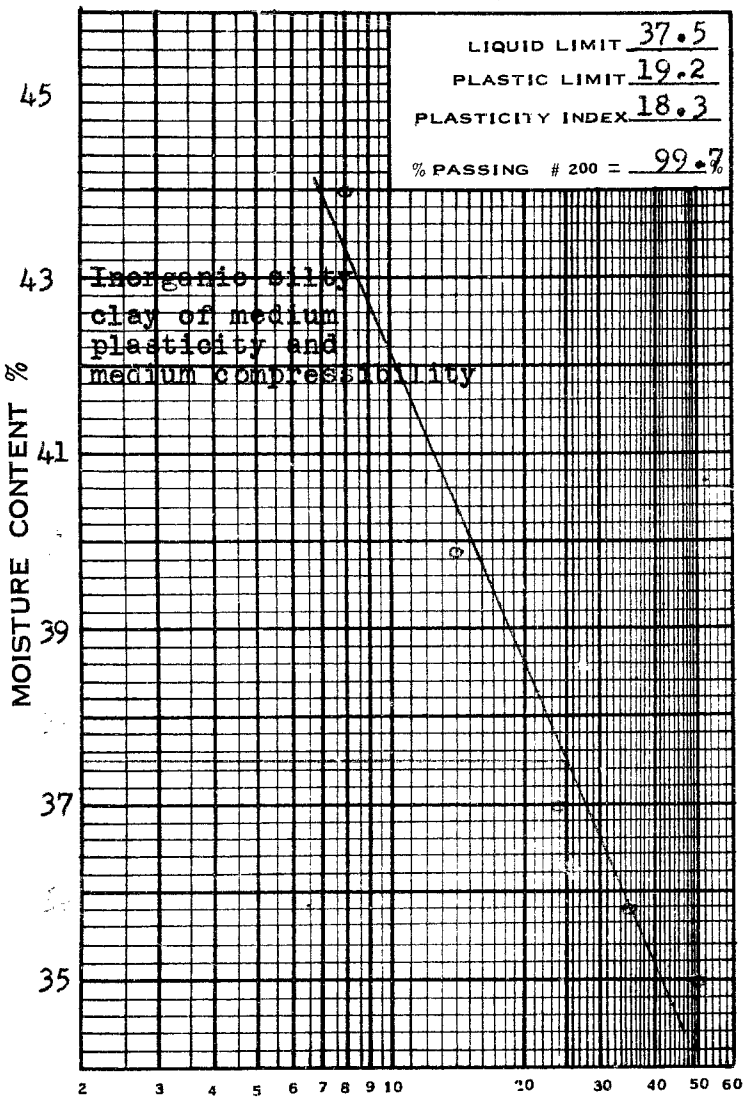
SOIL TESTING LABORATORY

LIQUID LIMIT TEST — FLOW LINE CHARTS

Job No. 57144 Project M. M. Dillon and Co. Ltd.

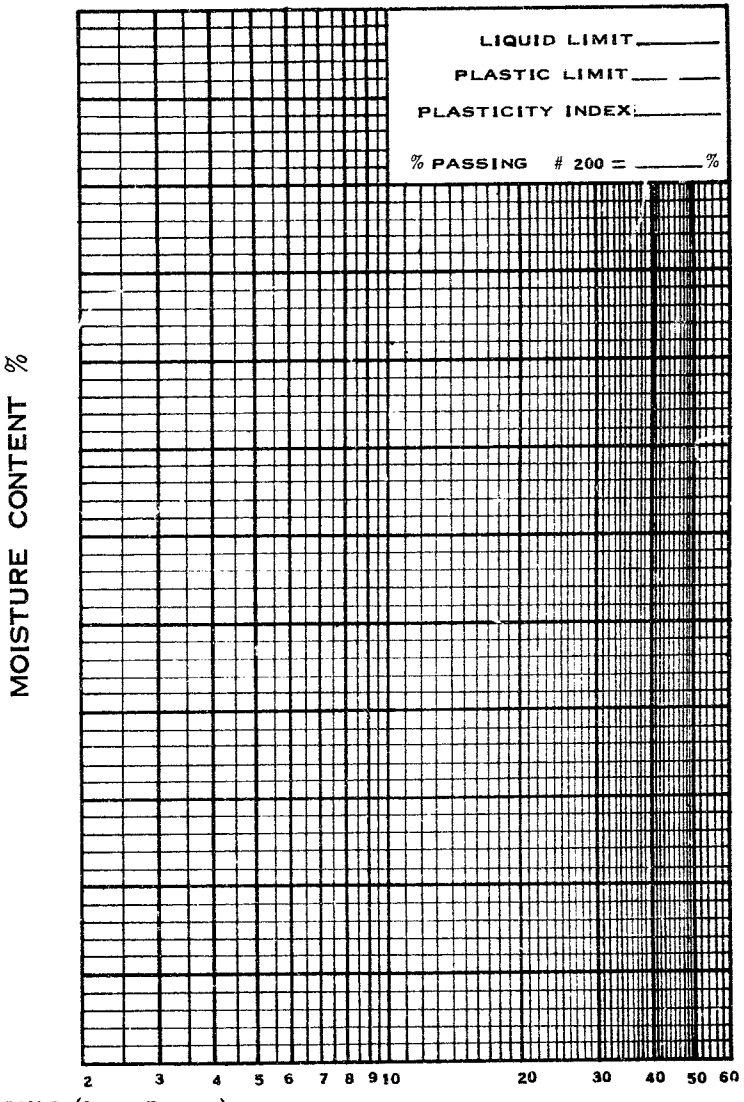
Sample From B.H. 3 sample 2

Depth 5' - 6'



Sample From _____

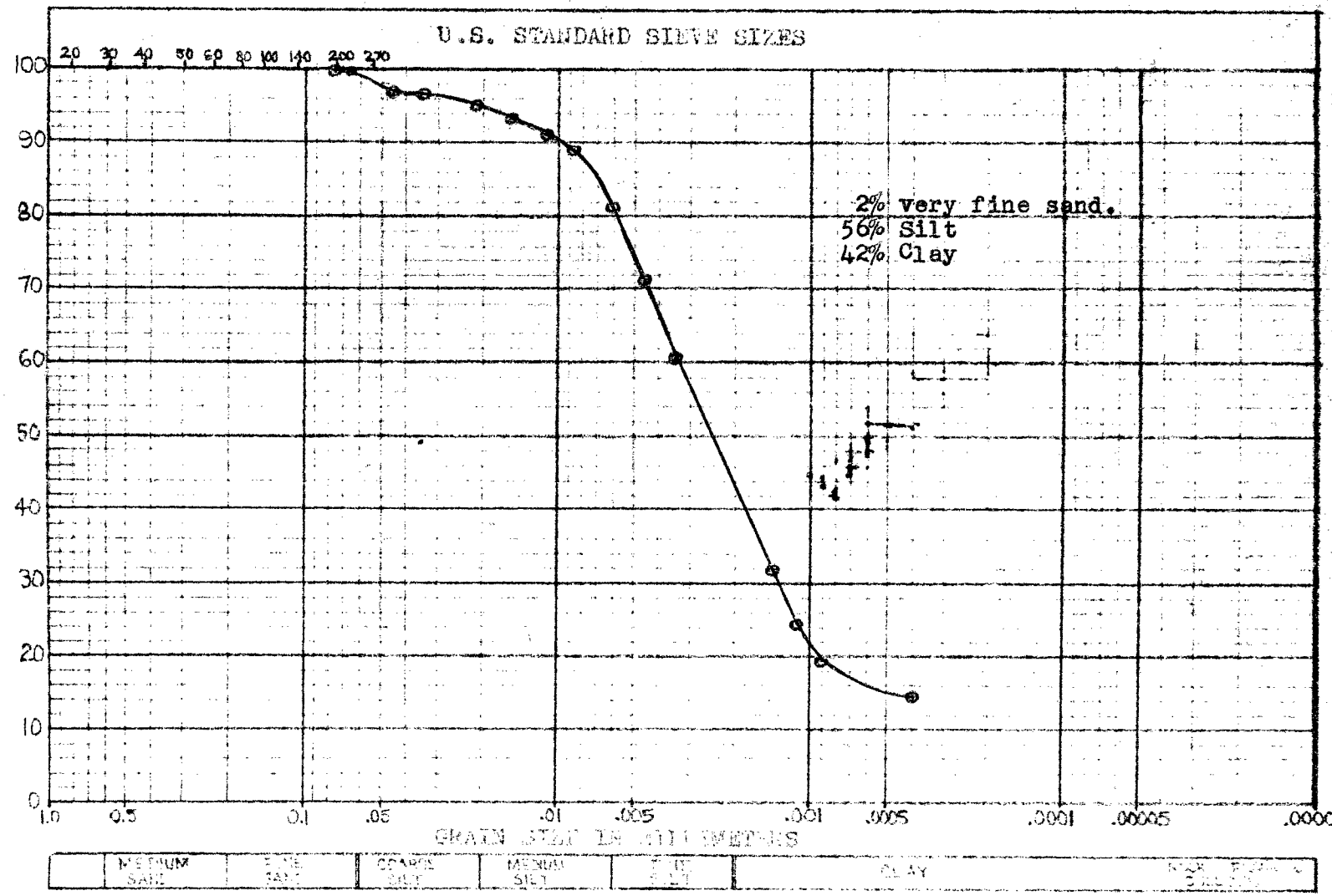
Depth _____



NO. OF BLOWS (Log Scale)

E. M. PETO ASSOCIATES LTD.

HYDROMETER GRAIN SIZE DISTRIBUTION DIAGRAM



Job Name Hope Twp. Bridge No. 15 Job No. 57144 Borehole No. 3 Sample No. 3

Depth 7' - 8' Elevation 314 Remarks Specific Gravity of this sample = 2.71