ONTARIO
DEPARTMENT OF HIGHWAYS

Memo to Mr. A. M. Toye, Bridge Engineer. *Date* February 5, 1960.

From Materials & Research Section. *Subject* FOUNDATION INVESTIGATION - by E.M. Peto Associates, Ltd.

Attention: Mr. S. McCombie.

Re: Chedoke Expressway
at
C.N.R. & C.P.R. Tracks
District 4

This memo accompanies a report on the foundation conditions at the above proposed subway location submitted by E. M. Peto Associates, Ltd. The information contained in this report is primarily factual, and if the Design Group have any comments with respect to the information contained therein, or the interpretation of data presented, we would be pleased to discuss this with you.

As a result of a meeting held in C.C. Parker's Office, Hamilton, Thursday, February 4th, the alignment at the location of these two structures, as given in this report, was confirmed. Also, a result of this committee meeting was that the median width at the subway location would be reduced to 30 feet.

C.C. Parker have been handed their copy of this report and it will not be necessary for you to forward one to them.

L. G. Soderman

LGS/MdeF
Attach.

L. G. Soderman,
PRINCIPAL SOILS & FOUNDATIONS ENGINEER

cc: Messrs. A. M. Toye (2)
H. A. Tregaskes
D. G. Ramsay
I. Campbell
R. E. Richardson
P. F. Weber
Foundation Section
Gen. Files.

e. m. peto associates ltd.

YOUR REFERENCE:-

OUR REFERENCE:- 6002 and 6003

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

26 January 1960

The Soil and Foundation Engineering Dept.,
Department of Highways of Ontario,
c/o Parliament Buildings,
Toronto 2, Ontario.

60 - 3080

Attention: Mr. L. Soderman, P. Eng.

Re: Soil Investigation for Chedoke Expressway
at C.N.R. and C.P.R. tracks.

Gentlemen:

In accordance with a verbal request by Mr. L. Soderman, a soil investigation was carried out at the above site. We have pleasure in forwarding herewith ten copies of our final borehole logs and a covering letter. The covering letter includes:

1. Programme of Work
2. General information
3. Soil and water conditions
4. Observations and conclusions

PROGRAMME OF WORK

Jan. 5th 1960	The equipment and the drilling units were moved onto the site.
Jan. 6th 1960	The equipment and the machines were set up. Unit no. 4 drove a dutch cone adjacent to borehole 8.
Jan. 7th 1960	Unit no. 1 started borehole 10. Unit no. 4 started borehole 9. Unit no. 6 drove a dutch cone adjacent to borehole 7 and started borehole 7.
Jan. 8th 1960	Unit no. 1, advancing borehole 10, delayed by breakdown. Unit no. 4 advanced borehole 9. Unit no. 6 completed borehole 7.

PROGRAMME OF WORK (continued)

January 8 1960 — Machine no. 1 under repair; unit no. 4 completed work at borehole 9 and started at borehole 11. Unit no. 6 started work at borehole 6.

January 11 1960 — Unit no. 1 completed work at borehole 10. Unit no. 4 advanced borehole 11. Unit no. 6 completed borehole 6.

January 12 1960 — Unit no. 1 started work at borehole 2. Unit no. 4 advanced borehole 11. Unit no. 6 started borehole 8.

January 13 1960 — Unit no. 1 advanced borehole 2. Units 4 and 6 completed work at boreholes 11 and 8 respectively. Following instructions issued by Mr. K. Peaker all the work at this location was stopped and the equipment and the drilling units were moved to Mercer Glen site.

GENERAL INFORMATION

(a) The boreholes were put down in accordance with our standard procedure The attached borehole logs contain detailed descriptions of the recovered samples along with all the other pertinent data.

(b) The boreholes were put down at locations staked out by representatives of C.C. Parker and Parsons, Brinckerhoff Ltd. A 60^{0}-2 ins. diameter Standard Dutch cone was driven at four locations. These were:

P2 - 2 ft. north of borehole 2
P7 - 4 ft. east of borehole 7
P8 - 6 ft. east of borehole 8
P11 - 7 ft. west of borehole 11.

The results of these tests have been included in the Observations and Conclusions as Section (e).

(c) Details of the holes put down were:

Hole no.	Ground level elevation	Depth	Casing
2	339.65	16' +	BX (and AXT non-coring bit)
P 2	339.61	12'	
6	325.70	44'	BX (and AXT coring bit)
7	324.14	44'	BX (and AXT coring bit)
P 7	324.40	2'5"	
8	322.16	41'5"	BX (and AXT coring bit)
9	325.46	47'3"	BX (and BX coring bit)
P 8	325.62	5'3"	
10	322.17	38'9"	BX (and AXT coring bit)
11	343.38	69'	BX (and BX coring bit)
P 11	343.39	8'	

GENERAL INFORMATION (continued)

(d) The elevations given above are related to Bench Marks supplied by C.C. Parker and Parsons, Brinckerhoff Ltd. These were BM 338+98 (Elevation 341.69) top of north-east bolt on concrete base of C.P.R. light signal 100 ft. RT Sta. 338+98 E.B.L. and B.M. 337+60 (Elev. 325.39) top of north-east bolt on concrete base of C.N.R. light signal 62 ft. LT Sta. 337+60 E.B.L.

(e) Holes were put down without the use of wash water to virtual refusal, from this point downwards water was used to advance the holes with either a chopping bit, a non coring diamond bit or a coring diamond bit.

(f) The site is located at the C.N.R. and C.P.R. tracks about 1/4 mile west of Highway 2 and Highway 6 and just north-west of Mercer Glen in Hamilton.

Geologically the site is located on the east edge of the Niagara Escarpment just west of Hamilton. At this point the escarpment is made up of the Queenston shale which is Ordovician in age.

SOIL CONDITIONS

In general the material revealed by this investigation can be divided into two strata, an upper stratum of overburden and a lower stratum of soft to medium hard shale, reddish-brown in colour.

(a) Overburden

This stratum extended to the following depths in the borehole put down.

Borehole no.	
2	0' - 3'
6	0' - 2'
7	0' - 2'
8	0' - 1'
9	0' - 5'
10	0' - 4'
11	0' - 2'

The material in this stratum consisted of topsoil or fill underlain by silty clay with sand and gravel. Detailed investigation of the material in this stratum can be seen on the borehole logs.

(b) Soft to medium hard shale

The colour of this stratum was reddish-brown with green-grey bands and specks. The upper part of this stratum is soft turning medium hard at the following depths in the boreholes put down.

SOIL CONDITIONS (continued)

Borehole No.	
2	11 ft. 11 ins.
6	5 ft. 6 ins.
7	8 ft. 0 ins. approximately
8	3 ft. 0 ins.
9	7 ft. 0 ins.
10	7 ft. 1 in.
11	10 ft. 0 ins.

Lithologically the stratum is made up of a thinly bedded shale with sandy and possibly calcareous layers.

In addition to the upper soft part, the stratum contains several other soft layers of a minor nature. These were observed at:

Borehole no.	Depth	Thickness of layers
6	35 ft.	1 in.
	36 ft. 9 ins.	1 in.
	38 ft.	1 in.
	41 ft. 6 ins.	1 in.
7	38 ft. 10 ins.	2 ins.
8	16 ft. 6 ins.	3 ins.
	36 ft. 6 ins.	1/2 in.
	40 ft.	3 ins.
	41 ft. 10 ins.	3 ins.

Other soft layers may be present in the sections where the core recovery was poorer.

WATER CONDITIONS

The following is a table of water level readings taken at the time of the investigation:

WATER CONDITIONS (continued)

Borehole 6

Date (1960)	Time	Depth of Casing	Hole	Depth to water	Remarks
Jan. 9		nil	2'	1'1"	Seepage from ditch
11	2.52pm	5' 5"	44'	0	Hole filled up
	2.54pm	5' 5"	44'	7'8"	
	2.56pm	5' 5"	44'	15'1"	
	3.00pm	5' 5"	44'	28'8"	
	3.05pm	5' 5"	44'	32'6"	
	5.55pm	5' 5"	44'	36'2"	
	6.35pm	5' 5"	44'	36'5"	
12	7.43am	5' 5"	44'	36'8"	

Jan Borehole 7

Jan. 7	6.09pm	9'	10'	9'9"	Hole bailed out to 9'9"
Jan. 8	7.40am	9'	10'	9'9"	
	7.00pm	9'	44'	Water level in hole dropped after pump shut off.	
	7.15pm	9'	44'	35'6"	
Jan. 9	8.00am	9'	44'	36'3"	

After pulling casing water from ditch filled up hole.

Borehole 9

Jan. 12		nil	2'	9"	Seepage from ditch

At 37'5" depth only about half the wash water, pumped down returned to the surface; the other half was lost through permeable layers.

Jan. 8		6'	37'	Hole filled up with water	
9	7.30am	6'	37'	6'6"	
	1.00pm	nil	47'6"	6'6"	
11	7.30am	nil	47'6"	5'6"	
12	9.15am	nil	44'	4'10"	

Borehole 10

11	4.05pm	7'	38'10"	0	Hole filled up
	4.07pm	7'	38'10"	11'2"	
	4.09pm	7'	38'10"	15'11"	
	4.14pm	7'	38'10"	19'5"	
	4.24pm	7'	38'10"	21'1"	
	5.00pm	7'	38'10"	23'2"	
	5.20pm	7'	38'10"	23'2"	
12	8.00am	nil	38'10"	8'	Surface water entered hole.

WATER CONDITIONS (continued)

As a result of the above water level readings, the following conclusions can be drawn: water can be expected to arise from two sources (a) surface (b) permeable layers in the shale.

1. A considerable amount of water was flowing in the north ditch along the C.N.R. tracks during the period of our investigation. This water may not exist during the dry summer months.

2. Although at the time of our investigation wash-water was being lost through permeable layers in the shale, these permeable layers can be expected to be water-bearing during the wetter climatic periods. These layers were noted at the following approximate depths in the boreholes shown.

Borehole no.	Depth
6	36 ft. 6 ins. (290.2)
7	36 ft. 3 ins. (287.9)
8	37 ft. 6 ins. (284.7)
9	6-6 ft. (325.6 ?) (very minor seepage)
10	23 ft. 2 ins. (296.0)
11	10 - 13 ft (333.4 -330.4)
	16 ft (327.4)
	28 ft. (315.4)

OBSERVATIONS AND CONCLUSIONS

(a) The soil at this site consists of a stratum of overburden underlain by a stratum of shale bedrock. The upper portion of the shale is soft, changing to a medium hard shale with depth. Surface water seepage and possible water from permeable layers in the shale may have to be controlled.

(b) We are of the opinion that the overburden and the softer upper portion of the shale could be excavated by normal excavating equipment; whereas the medium hard shale may have to be drilled and blasted.

(c) Apart from the softer upper 10 ft. or so, the shale core was of relatively good quality. Shale is, of course, generally unsuitable as a bulk fill since it deteriorates and reverts to a clay on exposure to air.

In the absence of an adequate supply of superior fills, it may be used under very carefully controlled circumstances as a bulk fill, either as "rock" ballast under water, or as "core" embankment fill where the shale is to be well covered and protected from the atmosphere by superior fill material. Recent expreience in Hamilton has confirmed that the shale must be used in the dry summer months, since it will

OBSERVATIONS AND CONCLUSIONS (continued)

take up moisture readily and will roll and heave during compaction effort if it becomes too wet.

(d) Since we understand that this site is to be abandoned as the crossing for the expressway, we have not carried out any strength tests on the rock core. In the absence of such tests we would suggest an allowable bearing value for this shale of 6.0 tons per square foot. This figure is, in our opinion, quite conservative.

(e) As stated previously, Dutch cones were driven at boreholes 2, 7, 9 and 11. The following table gives the results:

P-2

Depth	Blows per foot
0 - 1'	13
1 - 2'	6
2 - 3'	17
3 - 4'	26
4 - 5'	40
5 - 6'	60
6 - 7'	67
7 - 8'	120
8 - 9'	100
9 -10'	133
10-11'	160
11'-11'11"	240
11'11"-12'	103

P-7

0 - 1'	1
1 - 2'	79
2'-2'8"	100
2'5"-2'5"	100

P - 9

0 - 1'	1
1 - 2'	1
2 - 3'	1
3 - 4'	23
4 - 5'	140
5'-5'2"	100
5'2"-5'3"	300

OBSERVATIONS AND CONCLUSIONS (continued)

P - 11

Depth	Blows per foot
0 - 1'	3
1 - 2'	1
2 - 3'	21
3 - 4'	41
4 - 5'	47
5 - 6'	50
6 - 7'	80
7 - 8'	300

We trust that the information supplied briefly herewith may be useful in review of conditions existing at any adjacent site now under examination. Should you require any supplementary information concerning this investigation, we shall be pleased to be of further service.

Yours very truly,

E. M. PETO ASSOCIATES LTD.

C. F. Freeman

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

UJV/jn

e. m. peto associates ltd.

SOIL ENGINEERING SERVICE – TORONTO, ONTARIO

BOREHOLE LOG

Job Name: Chedoke Expressway C.P.R. | Job No.: 6002 | Borehole No.: 2

Client: D.H.O. | Casing: BX | Boring Date: Jan.12th, &13th, 1960

Datum: Client's | Compiled By: S.B. | Checked By: U.J.V.

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"						Fill to 3'0"
Cinders 8", sandy clay grits and pebbles.	Mixed Grey Brown		339.65		1	C.S.			Moist to quite moist.
Siltyclay with pockets of sand	Mixed Grey Brown		3'0"		2	S.S.	17	22.8	Moist
Weathered shale (soft)	Red with grey green layers		5'0"		3	C.S.			Moist.
As above	Red				4	S.S.	58	11.0	Justmoist.
As above	Red				5	S.S.	60	10.1	Justmoist
			10'0"						
As above turning harder at 11'11"	Red with grey green layers				6	S.S.	200	9.1	Just moist.
~~12 ft. - 18 ft. hole~~ reamed down with a non coring bit.			15'0"						
		~~HOLE DISCONTINUED AT APPROXIMATELY 20 ft.~~							

e. m. peto associates ltd.

SOIL ENGINEERING SERVICE – TORONTO, ONTARIO

BOREHOLE LOG

Job Name: Chedoke Expressway, C.N.R Job No.: 6003 Borehole No.: 6

Client: Dept. of Highways, Ontario Casing: BX (AX core) Boring Date: Jan. 9 & 11 1960

Datum: Client's Compiled By: P.M.& A.M. Checked By: E.M.P.

SAMPLE CONDITION

- UNDISTURBED
- FAIR
- DISTURBED
- LOST

SAMPLE TYPE

- A.S. AUGER SAMPLE
- C.S. CASING SAMPLE
- S.S. 2" STANDARD SPLIT TUBE SAMPLE
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- 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
Ground surface			0'0"						
			320.70						
Gravelly silty clay, roots	Dk red-brown					C.S.			Sat.
Clay shale	Red-brn & grn-grey		2'0"			C.S.			Dry
Shale	Reddish-brn.					S.S.	127/1"	5.4	Dry
Transitional shale	Reddish-brn & band of grn-grey		5'5"			S.S.	~~100/8"~~ 100/2"	8.2	
Reamed hole from 5'5" to 25'0" with concave bit									
(No attempt to recover core)									
~~Axt~~ core recovered below 25'0"			25'0"						
Red-brown shale with 3 bands of grey shale ½" to 3" thick						R.C.			Longest piece 6-3/4" 38 fractures
			30'0"						4'8½" recovery 94%
Red-brown shale with 6 bands of grey shale 1/4" to 1½" thick						R.C.			Longest piece 3-1/4" 36 fractures
			34'0"						100% recovery (Core v. moist to wet from 34' to 35'8")
Red-brown shale with 3 bands of grey shale ½" to 7" thick						R.C.			Longest piece 2-3/4" Very badly fractured
			39'0"						100% recovery
Red-brown shale with 3 bands of grey shale 1/4" to 15" thick									(Wet seam 40'9" to 41'3" approx.) Longest piece 3-3/4". 47 fractures
			44'0"						4'9" Recovery 95%
Borehole terminated at 44'0"									Wash water returned during diamond drilling but W.L. dropped to 34' on completion.

e. m. peto associates ltd.

SOIL ENGINEERING SERVICE – TORONTO, ONTARIO

BOREHOLE LOG

Job Name: Chedoke Expressway C.N.R. Job No. 0003 Borehole No. 7

Client: Dept. of Highways, Ontario Casing: BX & AX Boring Date: Jan 7th and 8th, 1960

Datum: Client's Compiled By: J.N. Checked By: E.M.P.

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

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- 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
Ground surface			0'0" / 324.14			C.S.			
Silty clay, sme sand & gryl. Grey						C.S.			Much W.T.P.L.
Soft shale, gry. shale frag.	Reddish-brn.		2'0"			S.S.	200/3½"	8.8	Softening Wet by top water
Soft shale	" and grey								
Very soft shale	Reddish-brown					S.S.	200/3"		Wet
Soft shale	" "					S.S.	300/2½"	6.2	A. dry
			10'1"			S.S.	100/2/3"		
Ran casing from 10'1" to 24'									
using concave bit									
(No attempt to recover core)									
Axt core recovery below 24'0"			24'0"						
Red-brown shale with 2 bands of grey shale 3/4" and 2" thick						R.C.			Longest piece 4" 35 fractures
			29'0"						100% recovery but 6" of core dropped out & grd. over.
Red-brown shale, 3 bands of grey shale 1/4" to 1½" thick						R.C.			Longest piece 2½" 37 fractures
			34'0"						100% recovery
Red-brown shale, 4 bands of grey shale ½" to 13½" thick						R.C.			Longest piece 2½" 38 fractures
			39'0"						4'6" Recovery 90%
Red-brown shale, 6 bands of grey shale 1/4" to 1½" thick						R.C.			Longest piece 2½" 47 fractures. 4'10" recovery 97 %
			44'0"						
Borehole terminated at 44'0"									

e. m. peto associates ltd.

SOIL ENGINEERING SERVICE – TORONTO, ONTARIO

BOREHOLE LOG

Job Name: Chedoke Expressway C.N.R. | Job No.: 6003 | Borehole No.: 8

Client: D.H.O. | Casing: BX | Boring Date: Jan. 12 & 13th, 1960

Datum: Clients | Compiled By: S.W.B. | Checked By: U.J.V.

SAMPLE CONDITION

- UNDISTURBED
- FAIR
- DISTURBED
- LOST

SAMPLE TYPE

- A.S. AUGER SAMPLE
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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"						
Silty clay	Red		322.10' ± 1'0"			C.S.			Wet
Weathered shale (soft)	Red with grey					C.S.		5.1	Moist
as above	green layers Red		3'0"		1	S.S.	200/10"		Just moist
~~Reamed hole from 3 ft. – 20 ft. with a non coring bit.~~			5'0"						
			10'0"						
			15'0"						
A.X.T. core recovered	below 20 ft.		20'0"						20 – 25 ft.
Med. hard shale with ~~sandy~~ shale layers	Red with layers of grey-green					R.C.			Recovered 4'5" (88%) 21'4" to 22'8" grey-green layers. Longest unbroken piece 3". 25ft. – 29 ft.
			25'0"						Recovered 3'8" (75%)
As above	As above					R.C.			Longest unbroken piece 5"
			30'0"						29 ft. – 34 ft. Recovered 4'3" (88%)
As above	As above					R.C.			(lost 0" of core) Longest unbroken piece 4
			35'0"						34 ft. – 37'5" Recovered 1'7" (47%)
As above	As above					R.C.			Longest unbroken piece 2-1/2"
As above	As above					R.C.			37'5"-41'5" recovered 3'8" (94%)
			40'0"						Longest unbroken piece 4 inch.
			41'5"						
			HOLE TERMINATED AT 41'5"						

e. m. peto associates ltd.

SOIL ENGINEERING SERVICE – TORONTO, ONTARIO

BOREHOLE LOG

Job Name: Chedoke Expressway, C.N.R. Job No.: 6003 Borehole No.: 9

Client: Dept. of Highways, Ontario Casing: BX Boring Date: Jan. 7,- 9th, 1960

Datum: Client's Compiled By: P.M. & A.M. Checked By: E.M.P.

SAMPLE CONDITION

- UNDISTURBED
- FAIR
- DISTURBED
- LOST

SAMPLE TYPE

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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
Ground surface			0'0"						
Gravelly silty clay	Reddish-brown		325.46		1	C.S.			Saturated
Silty clay, shale frags. Blk & greenish grey grits	Reddish-brown				2	C.S.			D.T.P.L.
As above	As above	Firm			3	S.S.	7	16.5	D.T.P.L.
As above, Greenish-grey shale frags.	As above				4	C.S.			D.T.P.L.
As above	As above		5'0"		5	C.S.			Stiffening at 5' Moist D.T.P.L.
Clay shale(badly broken)	As above	Hard (soft shale)	7'0"		6	S.S.	100/8"	13.2	Wet
						S.S.	100/3"		Chopped with wtr.below, Longst.piece 12".7 fracs.
Red-brown shale with 4 seams of grey shale ½" to 3" thick			9'1"			R.C.			24½ recovery 98%
Approx. equal parts red-brown & grey shale ½" to 5" thick			12'0"			R.C.			Longest piece 5-1/4" 14 fractures 100% recovery.
Red-brown shale with 5 bands of grey shale ½" to 5" thick			17'3"			R.C.			Longest piece 18½",12 frac 100% recovery
Red-brown shale with 10 bands of grey shale ½" to 7" thick			22'6"			R.C.			Longest piece 16½" 12 fractures 100% recovery
Red-brown shale with 5 bands of grey shale ½" to 3" thick			27'9"			R.C.			Longest piece 7½,19 fracs 100% recovery
Red-brown shale, 8 bands of grey shale ½ to 3" thick			33'0"			R.C.			Longest piece 8½" 21 fracs 100% recovery
Red-brown shale, 4 bands of grey shale 3/4" to 4" thick			37'6"			R.C.			Longest piece 8",19 fracs 100% recovery
Approx. equal parts red-brown shale and grey shale interbedded			42'0"			R.C.			Longest piece 4½"27 fracs 100% recovery
Red-brown shale, 8 bands of grey shale ½" to 1-3/4" thick			47'3"			R.C.			Longest piece 5½"25 frac 100% recovery
			Borehole terminated at 47'3"						

e. m. peto associates ltd.

SOIL ENGINEERING SERVICE – TORONTO, ONTARIO

BOREHOLE LOG

Job Name: Chedoke Expressway, C.N.R. Job No.: 6003 Borehole No.: 10

Client: Department of Highways, Ont. Casing: BX Boring Date: January 7, 8th, 1960

Datum: Client's Compiled By: J.N. Checked By: E.M.P.

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
Ground surface			0'0"						
Silty clay, sand & gravel	Red-brwn.to blk.		322.17			C.S.			Sat.
						C.S.			
Coarse sand to grvl.some clay	Blk-gr to blk					S.S.	2	45.3	Sat.
content (Fill)			4'0"						
Shale	Red-brn.to grey					C.S.			Dry
Shale & frag.of grey shale	Red.-brn.					S.S.	180/6"	5.6	Dry
			7'1"			S.S.	200/1"		
Ran casing from 7'1" to 24'0"									
using concave bit									
(No attempt to recover core)									
Axt. core recovery below 24'0"			24'0"						
Red-brown shale with 4 bands of grey shale ½" to 4" thick						R.C.			Entire run unbroken at extraction
			29'0"						100% recovery
Red-brown shale, 3 bands of grey shale 1/4" to 1" thick						R.C			
			34'0"						100% recovery
Red-brown shale, 7 bands of grey shale 1/4" to 11"						R.C.			Longest piece 15½" 14 fractures
			38'9"						1" of core lost
Borehole terminated at 38'9"									

e. m. peto associates ltd.

SOIL ENGINEERING SERVICE – TORONTO, ONTARIO

BOREHOLE LOG

Job Name: Chedoke Expressway C.N.R. Job No. 6003 Borehole No. 11

Client: Dept. of Highways, Ont. Casing: BX Boring Date: Jan. 9, 11, 12 & 13 1960

Datum: Client's Compiled By: J.N. Checked By: U.J.V.

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

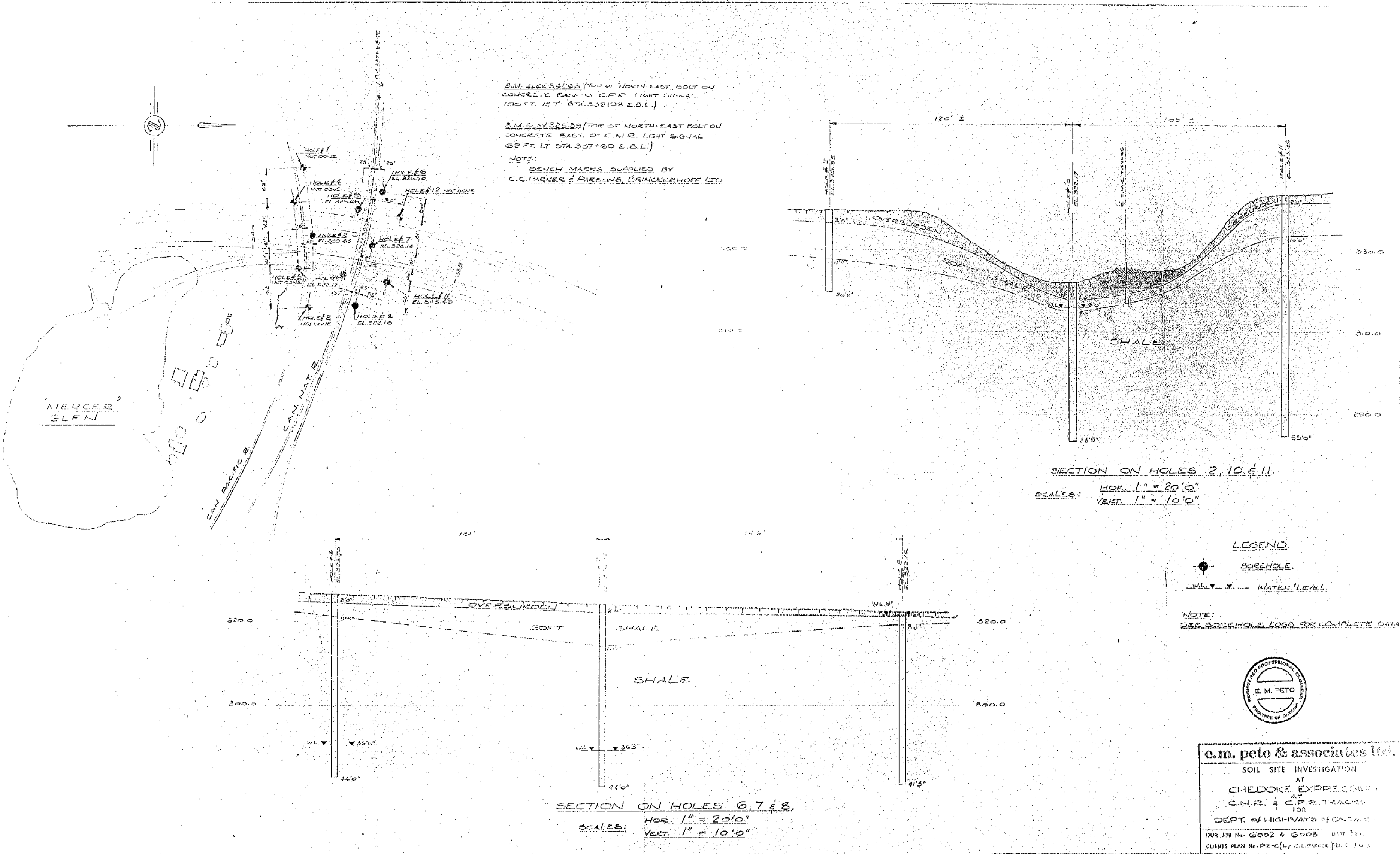
SOIL DESCRIPTION	COLOUR	Density or Consistency	Depth / Elevation	Legend	Sample No. and Condition	Sample Type	No. of Blows per Ft.	Natural Moisture Content	WATER LEVELS & REMARKS
Ground surface			0'0"						
Topsoil	Dk.brown		343.39			C.S.			3" frost Sat.
Clay shale, organic matter	reddish-brn								W.T.P.L.
Clay shale.frag.of gr shale	Reddish brn		2'0"			C.S.			D.T.P.L.
Soft shale	Lt.olive-grey					S.S.	24	4.6	S.moist
Soft shale	As above					C.S.			Dry
Soft shale	As above		5'0"			C.S.			Dry
Soft shale.frag.of gr.shale	Red-brown					S.S.	47	11.2	A.dry
As above	As above					S.S.	130	11.3	A.dry
As above	As above					R.C.	cone from 8'-9'7" (47% recovery)		Drilled & recovered 9" BX
Soft shale	As above		10'0"			S.S.	130/5"	7.7	Longest unbroken pc. 5" A.dry
Med.hard shale with	As above								Turns denser at 10'
layers of sandy shale	with gr-green layers								10-15' 4'4" recovery (87%)
(with holes in it 10-13')						R.C.			2 gr-green layers 2" thick
									longest unbroken pc.11"
			15'0"			S.S.	100/4"		No sample in S.S.
As above	Reddish-brown								15-20' 4'4" recovery (87%)
									Loosing wash water
						R.C.			at 16'
									Longest unbroken pc.12"
			20'0"			S.S.	100/4"		No sample in S.S.
As above	As above with								20-25' 4'7" recovery (92%)
	gr-green layers								2 gr-green layers 2" thck
						R.C.			Longest unbroken pce 9"
			25'0"						No sample in S.S.
As above	reddish-brown					S.S.	100/1"		25-26' 7½" recovery (67%)
As above	As above					R.C.			Longest unbroken pce.3"
						R.C.			26'-28'2" 2'2" recovery 100%
									Longest unbroken pc.4"
									28'2", 33'5", 5'3" recov. 100%
As above	As above with		30'0"						Poss. perm. layer at 28½'
	grey-green layers					R.C.			1 gr-green layer 1' thick
									30-31'
									Longest unbroken pce.6"
						S.S.	100/4"		No sample in S.S.
									33'5"-39' recovered
As above	As above		35'0"						4'11" (88%)
									Longest unbroken pc.5"
						R.C.	3 gr		3 gr-green layers 2"-6"
									thick
			40'0"						34'-44'3" Recovered 5'3" 100%
As above	As above								Longest unbroken pc.4"
						R.C.			3 gr-green layers 2"-4"
									thick
			45'0"						44'3"-49'6" recov. 5'3"
As above	As above								(100%)
						R.C.			Longest unbroken pce.6"
									2 grey-green layers
									2" thick
			50'0"						
As above	As above								49'6" - 54'0"
									Recovered 5'3" (100%)
						R.C.			Longest unbroken pc.5"
									3 grey-green layer 2" thck
			55'0"						
As above	As above								49'6" 59' recovered 2'4"
	56'-59' grey					R.C.			(55%)
	green								55'2" 2" layer grey-green shale
									Longest unbroken piece
			59'0"						is 3"
		Hole terminated at 59'0"							

60-F-308C

CHEDOKE

EXPRESSWAY

C.N.R. + C.P.R. TRACKS



B.M. ELEV. 341.63 (TOP OF NORTH-EAST BOLT ON CONCRETE BASE OF C.P.R. LIGHT SIGNAL 100 FT. RT. STA. 33+98 E.B.L.)
B.M. ELEV. 325.39 (TOP OF NORTH-EAST BOLT ON CONCRETE BASE OF C.N.R. LIGHT SIGNAL 62 FT. LT. STA. 337+60 E.B.L.)
NOTE:
BENCH MARKS SUPPLIED BY C.C. PARKER & PARSONS, BRINCKERHOFF LTD.
'MERCER' GLEN
CAN. PACIFIC R.
CAN. NAT. R.
OVERBURDEN
SOFT SHALE
SHALE
SECTION ON HOLES 2, 10 & 11.
SCALES: HOR. 1" = 20'0" VERT. 1" = 10'0"
SECTION ON HOLES 6, 7 & 8.
SCALES: HOR. 1" = 20'0" VERT. 1" = 10'0"
LEGEND.
BOREHOLE.
WATER LEVEL.
NOTE:
SEE BOREHOLE LOGS FOR COMPLETE DATA.
E. M. PETO
PROVINCE OF ONTARIO
e.m. peto & associates ltd.
SOIL SITE INVESTIGATION
AT
CHEDOKE EXPRESSWAY
AT
C.N.R. & C.P.R. TRACKS
FOR
DEPT. of HIGHWAYS of ONTARIO
OUR JOB No. 6002 & 6003