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57-F-207C

W.P. # 753-56

Hwy # 401

WILMOT CREEK

**e. m. peto associates ltd.**

YOUR REFERENCE:-

OUR REFERENCE:-

5739

850 Roselawn Avenue,  
TORONTO, ONTARIO.  
RUssel 1 - 4955.

May 13th, 1957.

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

Attention: Mr. J. C. McAllister

Re: Soil Site Investigation,  
Wilmot Creek Bridge  
Your Project No. WP-752-56

Dear Sir:

Enclosed herewith are the usual four copies of our report for the above mentioned project. We believe the report to be complete and to contain all the information that you require.

We have not specified any specific type of piles since we feel that almost any pile type would be suitable, with the possible exception of timber piles.

Field work on the next set of proposed bridge sites for Highway No. 401 will commence this week, following the order recommended in your letter of May 10th, 1957.

Yours very truly,

E. M. PETO ASSOCIATES LTD.,



E. M. Peto, P. Eng.

MM:sb

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850 roselawn avenue,  
TORONTO, ONTARIO.  
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### REPORT ON SOIL SITE INVESTIGATION

at

PROPOSED WILMOT CREEK-HWY. NO. 401 BRIDGE SITE

for

DEPARTMENT OF HIGHWAYS OF ONTARIO

BRIDGE DEPARTMENT

#### TERMS OF REFERENCE:

We were retained, by a letter from Mr. J. C. McAllister dated April 2nd, 1957, to perform a complete soil investigation for the above mentioned structure. We were required to drive four test holes at or near the locations indicated on your site plan No. E-3234-1. Test holes were initially to be driven with BX casing, sampling ahead in our standard manner at 5 ft. intervals or less. Holes were to be driven to a depth of 25 or 30 ft., depending on the soil conditions. It was required that a minimum of 15 ft. of good bearing soil be proved, using standard penetration test results as a guide. Shelby tube samples for strength tests were to be taken where necessary. At least one of the holes was to be deep enough to prove continuity of soil conditions.

Water table levels were to be carefully noted during the performance of the work.

#### METHOD OF OPERATIONS:

The equipment was trucked to the site from Toronto on April 24th, 1957. Work was commenced on April 25th and was completed on May 4th, 1957, being hampered throughout by bad weather.

The four holes were located as shown on the site plan attached to the rear of this report. As at the Graham Creek Bridge site, extremely dense soil conditions prevailed, and the deepest hole only went a distance of 23 ft. Soil conditions did not warrant the taking of undisturbed Shelby tube samples.

METHOD OF OPERATIONS: (Cont'd)

All samples obtained 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.

All elevations mentioned in this report are referred to Geodetic datum, and were obtained from your bench mark which was a nail and washer in the South root of a 1'0" Cedar stump, 150 ft. left of station 794 + 40.

SITE AND GEOLOGY:

The proposed bridge site lies in the general physiographic area known as the Iroquois Plain, and was formed in late Pleistocene times. The topography at the site is undulating to gently rolling. The stream meanders considerably and runs through a young valley, which is fairly heavily wooded along both banks. There are sand flats bordering the stream, and there is a gravel stream bed with numerous gravel bars. Severe bank erosion was noted at some points, although the banks are not very high. The stream has a high velocity of flow, and is up to 3 ft. deep. At one point a hard clay bottom was noted.

Soil conditions are characterized by stream-deposited fine sands and silts of glacial origin.

SOIL CONDITIONS:

Although the adjacent holes showed some similarity of soil conditions in the upper 15 ft., there was no general continuity over the site in the upper strata.

Beneath the relatively recent deposits of fine to medium to coarse sand and gravel, the major soil type encountered was a dense, grey, silty very fine sand with grits and gravel up to 2" size. The gravel throughout consisted of angular fragments of dolomitic limestone. A thin stratum of silty clay with grits, ranging in thickness from 1 foot to 5-1/2 feet was interbedded with the silty very fine sand. This silty clay was generally wetter than the Plastic Limit and was soft, with standard penetration test results in the order of 9 to 10 blows. This material is liable to consolidate with time when loaded.

No bedrock was encountered on this site although extremely dense conditions were reached in all the test holes. A rock core sample was attempted in hole 3 starting at the 16 ft. depth and going down to 22 ft. depth. However, the material brought up in the core barrel and washed up consisted only of a fine sand and gravel, which did contain apparently large sized boulders.

In the vicinity of holes 2 and 4, excellent soil bearing capacities can be obtained below the approximate elevation 248.0; and in the vicinity of holes 1 and 3, good soil bearing capacities can be obtained below approximately elevation 246.0.

WATER CONDITIONS:

The water table at the site, due to the permeable nature of the surface strata, is the same as the stream level. Rain falling in the evening of the same day that the field levels were taken by our Field Engineer, brought about a rise in the stream level of approximately 2 to 3 ft. The stream is apparently prone to flooding and to fluctuations with weather.

RECOMMENDATIONS AND CONCLUSIONS:

1. It is our opinion that the loose sand and gravel and the generally soft silty clay should be by-passed when placing the foundations for the proposed bridge structure. There would then be very little danger of potential settlement.
2. Because there would be considerable difficulty with any excavation on this site due to the ingress of water, the use of relatively short end-bearing piles driven to refusal might be the best alternative on this site. In the vicinity of holes 2 and 4 the piles would probably be about 12 ft. long, reaching generally to an elevation between 245 and 248. In the vicinity of holes 1 and 3, refusal would probably be reached at elevation 245, which means that the piles would probably not be longer than 12 ft.
3. It would be possible to construct the bridge on footings based roughly at elevation 245 to 246, but seepage cutoff sheeting would then be required, possibly making this uneconomical. The dense silty very fine sand at or below the above stated elevations can safely tolerate loadings in the order of 3.2 tons per sq. ft. for footings 7 feet wide or less.
4. We do not believe that a large reinforced boxed concrete culvert would be a practical alternative for this stream crossing because of the following factors;
  - a) The length of the culvert and the span requirements in particular would make a single arched structure very expensive.
  - b) The soil conditions in the top 12 to 15 ft. on this site are not consistent and the variation in the thickness of soft clay stratum could well lead to differential settlement and cracking of a long boxed culvert.
  - c) The presently proposed road grade would involve placing at least a 15 ft. depth of fill above the culvert and this additional loading would add considerably to the potential differential settlement.

RECOMMENDATIONS AND CONCLUSIONS: (Cont'd)

4. d) It would be possible to construct a reinforced concrete boxed culvert on a pile foundation providing cutoff sheeting was driven at the upstream end of the culvert (as would be required in any case), but for the number of piles required it would probably make this structure more expensive than a short open bridge.

E. M. FETO ASSOCIATES INC.,



E. M. Feto, E. Eng.

LM:sc

May 13th, 1957.

# BOREHOLE LOG

Checked By ..... E.M. Petro

R. C. ROCK CORE

[illegible]

# BOREHOLE LOG

Checked By E. A. JACO

### ABBREVIATIONS

R. C. ROCK CORE

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
MEDIUM TO COARSE SAND AND GRAVEL.	BROWN	LOOSE	0' 6" 258.4	[Symbol]				▽ W.T. = STREAM W.L. AT THIS POINT.
			5' 0" 253.4	[Symbol]	1 ⊗ S.S.		8	SATURATED.
			9' 2" 249.2	[Symbol]				
SILTY VERY FINE SAND WITH GRITS AND GRAVEL UP TO 1" SIZE.	GREY	DENSE	12' 0" 246.4	[Symbol]	2 ⊗ S.S.		43	WET.
		DENSE	15' 0" 243.4	[Symbol]	3 ⊗ S.S.  W.S.		50	WET.
		EXTREMELY DENSE	20' 0" 238.4	[Symbol]				
	GREY		22' 0" 236.4	[Symbol]	4 ⊗ S.S.		150	WET.
			HOLE TERMINATED.					



# BOREHOLE LOG

Checked By .....                    

W. T. GROUND WATER TABLE IN SOIL

SOIL DESCRIPTION	COLOR	Density or Consistency	Depth Elevation	Legend	Sample No. and Condition	Sample Type	No. of Blows per Ft.	WATER LEVELS, SOIL MOISTURE & REMARKS
			0' 0" 260.6					
ORGANIC SANDY SILT TOPSOIL	DARK BROWN	SOFT						
			5' 8" 254.9		1 X	S.S.	5	WT. = STREAM W.L.
FINE TO COARSE SAND. SOME GRAVEL.	BROWNISH GREY	PROBABLY LOOSE TO COMPACT	9' 6" 251.1		2 X	S.S.	10	WETTER THAN PLASTIC LIMIT.
SILTY CLAY WITH GRITS. STRATA OF MEDIUM SAND.	LIGHT GREY	STIFF	15' 0" 245.6		3 X	S.S.	63	BOULDER AT 16'. CONSISTS OF DOLOMITIC LIMESTONE
SILTY VERY FINE SAND.	GREY	VERY DENSE.				R.C. & W.S.		15% RECOVERY.
FINE SAND WITH GRAVEL AND BOULDERS	GREY	VERY DENSE.	22' 0" 238.6					
				HOLE TERMINATED.				

# BOREHOLE LOG

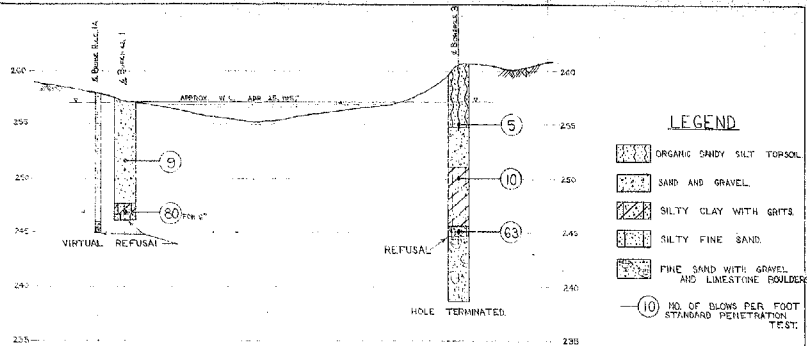
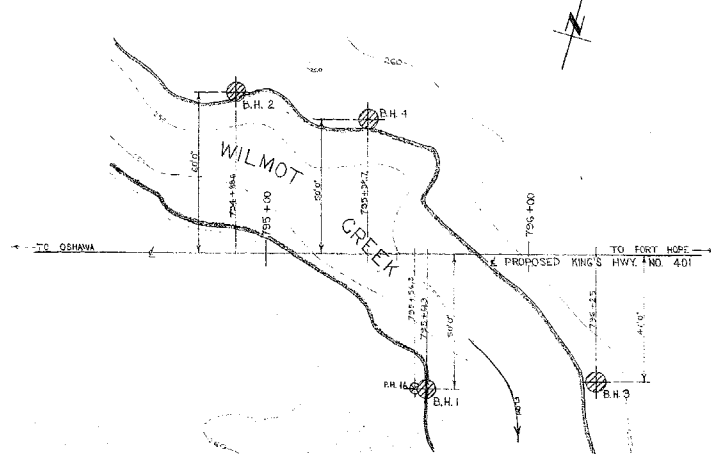
Checked By E. M. Peto

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	COLOR	Density or Consistency	Depth Elevation	Legend	Sample No. and Condition	Sample Time	No. of Blows per Ft	WATER LEVELS, SOIL MOISTURE & REMARKS
FINE TO COARSE SAND AND GRAVEL	BROWN	PROBABLY LOOSE	0'0" 257.1					W. L. AT SURFACE. WATER FLOWING OVER TOP OF CASING. SATURATED.
SILTY CLAY WITH GRITS AND GRAVEL	GREY	STIFF	5'0" 252.1		1	⊗ S.S.	9	WETTER THAN PLASTIC LIMIT.
SILTY VERY FINE SAND, GRITS AND GRAVEL UP TO 2" SIZE.	GREY	COMPACT TO DENSE	10'0" 247.1		2	⊗ S.S.	25	WET.
			15'0" 242.1		3	⊗ S.S.	30	LENSES OF MEDIUM SAND. FRAGMENTS OF DARK BROWN DOLOMITE.
			19'0" 238.1		4	⊗ W.S.		
MEDIUM TO COARSE SAND AND FINE GRAVEL	BROWNISH-GREY	VERY DENSE.	23'2" 233.9		5	⊗ S.S.	54	PROBABLY SLIGHT ARTESIAN HEAD AT 20'.
			23'2" 233.9		6	— S.S.	110 1/2"	
				REFUSAL.				

# PLAN SHOWING LOCATION OF TEST HOLES

SCALE: 1" = 20'



## SECTION THROUGH B.H. 1, B.H. 3 AND B.H. 4

SCALE: HOR. 1" = 10'  
VERT. 1" = 5'

**e.m. peto & associates ltd.**

SOIL SITE INVESTIGATION

AT  
WILMOT CREEK—HWY 401 BRIDGE  
NEAR NEWCASTLE, ONTARIO

FOR  
DEPARTMENT OF HIGHWAYS OF ONTARIO  
BRIDGE DEPARTMENT

OUR JOB No. 5739

DATE: MAY 10, 1957

CLIENTS PLAN No. E 3234-1

PER: M.M.

