#67-F-286 M

SITE INVESTIGATION

MARY HILL BRIDGE

B.A. 2621
Site 33-106

E. M. PETO ASSOCIATES LTD.

67-F-286M

SITE INVESTIGATION REPORT

MARYHILL BRIDGE

FOR

McCARGAR & MACHBORN LTD.

KITCHENER, ONTARIO

DISTRIBUTION:

4 c.c. Addressee
1 " File

JOB NO. 67 P103

MAY, 1967.

e. m. peto associates ltd.

YOUR REFERENCE

OUR REFERENCE 67 P103

1287 caledonia road,
TORONTO 19, ONTARIO
Telephone: 789-1126

May 17, 1967.

McCargar & Hachborn Ltd.,
546 Belmount Avenue West,
Kitchener, Ontario.

Attention: Mr. B. N. Medicky

Dear Sirs:

Re: Site Investigation
Maryhill Bridge

Enclosed are four copies of our report of the findings encountered at the above mentioned site. Two soils testholes have been performed to determine the soil stratigraphy, the apparent bearing capacities (based on the standard penetration test) and water levels and/or water seepage zones.

The bridge crossing is on Waterloo Country Road No. 36 over Hopewell Creek, approximately 1 mile south of Maryhill, northeast of Kitchener. Testholes are located approximately 10 ft. behind the corners of the existing abutments at upstream side of the bridge, as indicated on the attached sketch.

A. SOIL DESCRIPTION

From ground level to ±5 ft. there is a loose bouldery fill used in the construction of the original bridge. Beneath this abutment backfill, the original river bottom deposits of layered brown plastic clay and loose peat exist to depths of 8 or 9 ft. from surface. Below the original loose river bottom

deposits, the soil is a grey brown layered silty fine sand, extending to about 18 ft. and 14 ft. from surface at holes 1 and 2 respectively. This sand is variably compact with "N" values ranging from 11 to 24 blows/ft., the more compact condition being found at the upper portion of the stratum at hole 1 only. The sand was considered to be saturated, with natural moisture contents ranging from 10 to 17%.

The terminal stratum underlying the "just compact" sand is a grey silty sand till which is dense to very dense, with "N" values ranging from 36 to more than 80. This till is only moist with natural moisture contents consistently only 7 or 8%. Testhole 1 was terminated at 31 ft. from surface and hole 2 was terminated at 21 ft. 6 inches from surface after encountering difficulties with a boulder interference with further sampling. The till appeared to be slightly more clayey at hole 2.

B. WATER CONDITIONS

The elevation of the water in the creek is 94.82. Depth of water found in hole 1 was at 5 ft. 6 inches or elevation 94.71. Hole 2 caved at 6 ft. 6 inches suggesting water at that level which is 93.42. Also, these figures reflect a water level approximately that of the creek.

C. CONCLUSIONS AND RECOMMENDATIONS

The abutments to the new bridge could be supported on spread footings placed into the upper surface of the grey brown silty fine sand at depths of about 10 ft. below existing grade. The footing bearing value should be limited to 1.0 tons/sq.ft.; the theoretical maximum settlement with this load application is 1 inch.

With a spread footing foundation design, it may be necessary to provide scour protection to the face of the abutments, since the sand stratum is regarded as easily disturbed or eroded if the creek velocity should increase sharply during spring flood. Any cut-off sheeting should preferably penetrate to the underlying dense till; alternatively, rip rap placed on the creek bottom in front of the abutments may provide adequate protection against scour developing under the front edge of the abutments.

As an alternative foundation design, we recommend consideration to the use of a piled foundation, with the piles founded into the upper surface of the dense silty sand till stratum at depths of 14 ft. to 18 ft. below existing surface, i.e. at elevations ranging from 86.0 to 82.2. Bored caissons will encounter some difficulty in maintaining "open hole" through the sand stratum. Either driven tube piles, or Franki type displacement piles are considered most suitable. You may also wish to consider the use of timber piles, preferably creosoted or otherwise protected against eventual deterioration due to variation of water levels. Steel "H" piles may also be considered; such piles may extend somewhat further into the dense silty sand till before achieving an adequate set.

A water condition will develop in any excavation below approximately the existing creek water level, i.e. elevation 94.8 at the time of the field work. Thus, some dewatering will be necessary if spread footings, founded at elevation 90±, are adopted as the foundation design. Dewatering by pumping from the excavation bottom is likely to result in bottom disturbance and possibly "quicking" of the sand, and thus any dewatering must be carried out by pumping from outside the foundation area.

Yours very truly,

E. M. PETO ASSOCIATES LTD.

EMP/jw

E. M. Peto, P.Eng.

LIST OF ABBREVIATIONS

PENETRATION RESISTANCE

STANDARD PENETRATION RESISTANCE 'N' :- THE NUMBER OF BLOWS REQUIRED TO ADVANCE A STANDARD SPLIT SPOON SAMPLER 12 INCHES INTO THE SUBSOIL, DRIVEN BY MEANS OF A 140 POUND HAMMER FALLING FREELY A DISTANCE OF 30 INCHES.

DYNAMIC PENETRATION RESISTANCE :- THE NUMBER OF BLOWS REQUIRED TO ADVANCE A 2 INCH, 60 DEGREE CONE, FITTED TO THE END OF DRILL RODS, 12 INCHES INTO THE SUBSOIL, THE DRIVING ENERGY BEING 350 FOOT POUNDS PER BLOW.

DESCRIPTION OF SOIL

THE CONSISTENCY OF COHESIVE SOILS AND THE RELATIVE DENSITY OR DENSENESS OF COHESIONLESS SOILS ARE DESCRIBED IN THE FOLLOWING TERMS :-

CONSISTENCY	'N' BLOWS / FT.	c LB. / SQ. FT.	DENSENESS	'N' BLOWS / FT.
VERY SOFT	0 - 2	0 - 250	VERY LOOSE	0 - 4
SOFT	2 - 4	250 - 500	LOOSE	4 - 10
FIRM	4 - 8	500 - 1000	COMPACT	10 - 30
STIFF	8 - 15	1000 - 2000	DENSE	30 - 50
VERY STIFF	15 - 30	2000 - 4000	VERY DENSE	> 50
HARD	> 30	> 4000		

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

A.P.L. ABOUT PLASTIC LIMIT

TYPE OF SAMPLE

S.S	SPLIT SPOON	T W	THINWALL OPEN
W S	WASHED SAMPLE	T P	THINWALL PISTON
S B	SCRAPER BUCKET SAMPLE	O S	OESTERBERG SAMPLE
A S	AUGER SAMPLE	F S	FOIL SAMPLE
C S	CHUNK SAMPLE	R C	ROCK CORE
S T	SLOTTED TUBE SAMPLE		

P H SAMPLE ADVANCED HYDRAULICALLY

P M SAMPLE ADVANCED MANUALLY

SOIL TESTS

Qu	UNCONFINED COMPRESSION	L V	LABORATORY VANE
Q	UNDRAINED TRIAXIAL	F V	FIELD VANE
Qcu	CONSOLIDATED UNDRAINED TRIAXIAL	C	CONSOLIDATION
Qd	DRAINED TRIAXIAL		

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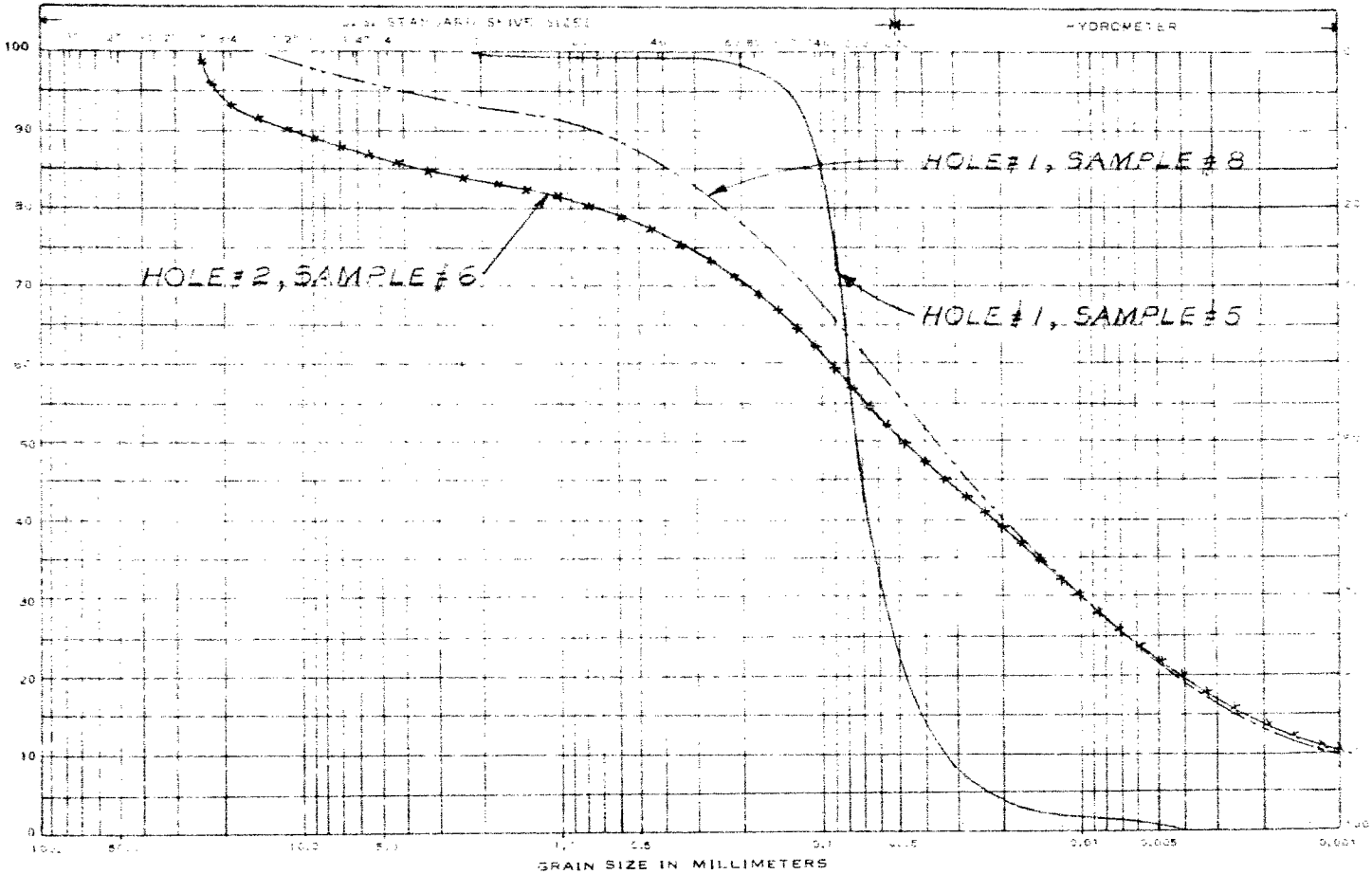
Toronto 19, Ontario



JOB NAME Maryhill Bridge JOB NO. 67 F103 HOLE NO. _____ SAMPLE NO. _____

DEPTH _____ ELEVATION _____ REMARKS _____

GRAIN SIZE DISTRIBUTION

DEFECTS IN NEGATIVE DUE TO CONDITION OF ORIGINAL DOCUMENT

e. m. peto associates ltd.

Consulting soil engineers

RECORD OF BOREHOLE NO. 1

JOB NO. 67 F103 JOB NAME Maryhill Bridge TECHNICIAN H.K.

BORING DATE April 24/67 CLIENT McCargar & Hachborn Ltd. ENGINEER E.M.P.

GROUND ELEV. 100.2 BOREHOLE TYPE 3" Auger TYPED BY J.W.

SOIL PROFILE			SAMPLES			DYNAMIC CONE PENETRATION BLOWS/FOOT STANDARD PENETRATION TEST BLOWS/FOOT 10 20 30 40 50 SHEAR STRENGTH C_u LB/SQ. FT	LIQUID LIMIT w_L PLASTIC LIMIT w_p WATER CONTENT w w_p w w_L WATER CONTENT % 10 20 30	REMARKS
DEPTH ELEV	DESCRIPTION	LEGEND	NUMBER	TYPE	BLOWS/FOOT			
0'0"	FILL, brown gravel, sandy fill, many boulders Moist		1	SS	14			
6'0"			2	SS	7			
7'6"	Top soil with stones Very silty, dk. brown							
8'3"	Clayey sand, br, v. moist		3	SS	8			
	SAND, grey and brown layered, silty fine SAND. Saturated, Compact.		4	SS	23			After 10' sa. water at 7'6"
			5	SS	24			
	Few boulders at 17'		6	SS	13			
	TILL, silty sand. Grey. Moist Very dense		7	SS	68	70		After 20' sa. water 7'3" Hole open to 20'6"
			8	SS	70	83		
31'0"			9	SS	83			
	Terminated at 31'0" Water at 5'6" Cave at 11'2"							

e.m.peto associates ltd. Consulting soil engineers

RECORD OF BOREHOLE NO. 2

JOB NO. 67 F103 JOB NAME Maryhill Bridge TECHNICIAN H.K.

BORING DATE April 24/67 CLIENT McCarmar & Hachborn Ltd. ENGINEER E.M.P.

GROUND ELEV. 99.9 BOREHOLE TYPE 3" Auger TYPED BY J.W.

SOIL PROFILE DEPTH ELEV.	DESCRIPTION	LEGEND	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS/FOOT
0'0"	FILL, brown gravelly sand. Wet below 4'6"		1	SS	12
5'8"	TILL, clayey brown. M.W.T.P.L.		2	SS	5
9'±	PEAT, dark brown to black peat, with grey seams of sand.		3	SS	7
	SAND, fine sand, brown wet, Loose to compact.		4	SS	11
14'3"			5	SS	12
16'0"	TILL, silty clay.		6	SS	36
	TILL, silty sand. Grey, Moist, Very dense				
21'6"	Terminated at 21'6" Hole caved at 6' No casing was used on this hole				

DYNAMIC CONE PENETRATION BLOWS/FOOT
STANDARD PENETRATION TEST BLOWS/FOOT
10 20 30 40
SHEAR STRENGTH C_u LB/SQ.FT.

LIQUID LIMIT ——— W_L
PLASTIC LIMIT ——— W_p
WATER CONTENT ——— W

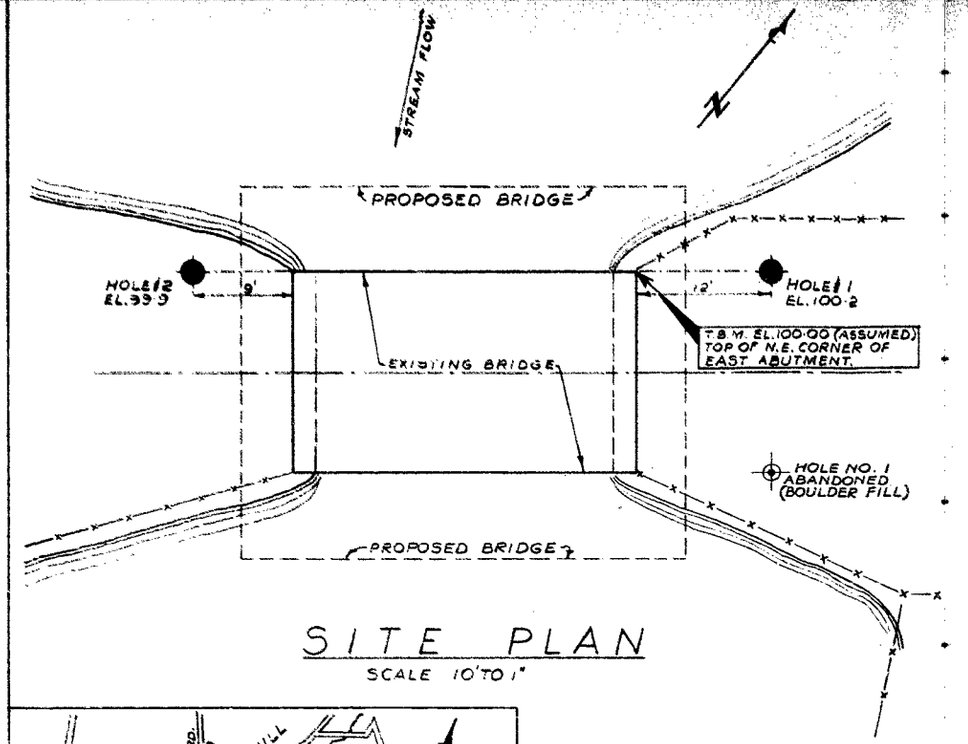
W_p W W_L
WATER CONTENT %
10 20 30

55

REMARKS

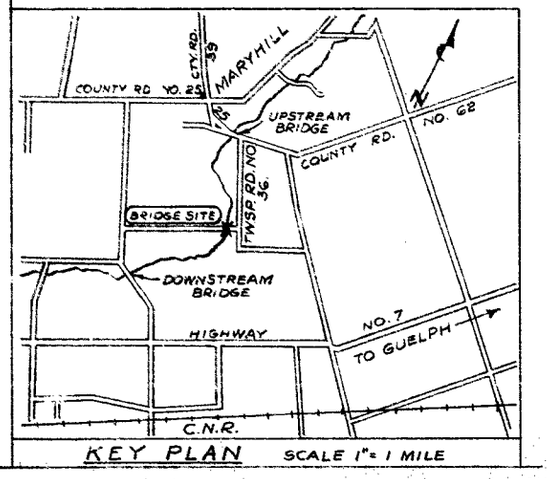
Wet below 4'6" after every sa... water 4'

Hole keeps caving at 6'6"

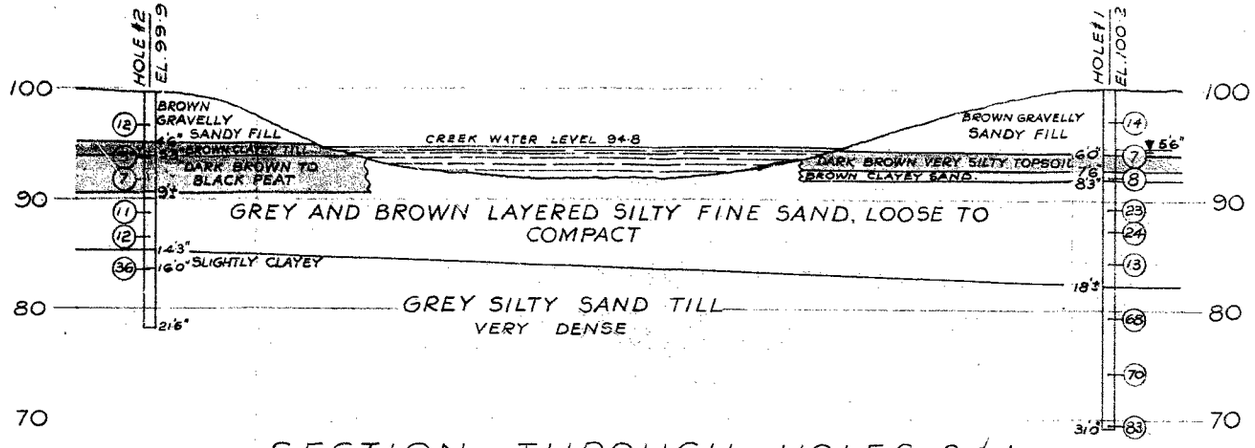


SITE PLAN

SCALE 10'TO 1"



KEY PLAN SCALE 1"= 1 MILE



SECTION THROUGH HOLES 2 & 1

SCALES; HOR. 6'TO 1", VERT. 10'TO 1"

LEGEND

- BOREHOLE
- (10) BLOWS/FT.
- WATER LEVEL

NOTE

SEE BOREHOLE LOGS FOR COMPLETE SOIL DETAILS

NOTE: The actual soil stratification has been verified from data obtained at the borehole locations only. The inferred contacts shown are based on geological evidence and these may vary from those shown between borings.

REGISTERED PROFESSIONAL ENGINEER
E. M. PETO
PROVINCE OF ONTARIO

McCARGAR AND HACHBORN
CONSULTING ENGINEERS

MARYHILL BRIDGE

MARYHILL, ONTARIO

PREPARED BY

e.m. peto associates ltd.

JOB NO.	DATE	DWN BY	CHECKED BY;
67-F103	MAY 1967	K.	EMP