66-F-294 M

WOOLNER BRIDGE

PEEL TWP.

e. m. peto associates ltd.

YOUR REFERENCE:-

OUR REFERENCE: 66354

1287 caledonia road,
TORONTO 19, ONTARIO
Telephone: 789-1128

December 22, 1966

The Township of Peel,
c/o Gamsby and Mannerow,
344 Woolwich Street,
Guelph, Ontario.

Attention: Mr. W.J. Mannerow, P.Eng.

Dear Sir:

Re: Soils Investigation,
Woolner Bridge,
Township of Peel.

We have pleasure in enclosing, herewith, our report on the soils investigation which was carried out in connection with the above project, and authorized by your letter of 9th November 1966.

The site of the investigation was at the Woolner Bridge, on the road between Lots 3 and 4 in Concession XVII, in the Township of Peel, where the road crosses the creek. It is proposed to reconstruct the existing bridge, and the purpose of the investigation was to establish the underlying stratigraphy, establish the bearing capacity characteristics, and to investigate the ground water conditions at this site.

Two testholes were put down at the locations shown on the enclosed site plan by a self propelled, 4½ inch diameter, flight auger during the latter part of November, 1966. The testholes were put down to a depth of 26 ft. 6 inches, and standard penetration tests were carried out at intervals of 2 ft. 6 inches during the first 15 ft., and thereafter at 5 ft. intervals. A careful check was kept on water conditions within the testholes during the period of the investigation.

A detailed description of the soils encountered is given on the appended borehole logs, together with the results of the standard penetration tests and moisture determination tests carried out. The enclosed site plan shows the location of the testholes relative to the existing bridge, and in order to illustrate the inferred stratigraphy between the testholes, a simplified soil profile has been included as part of the site plan. The elevations referred to on the borehole logs and profile are given relative to bench mark #1 on the enclosed site plan, which has an elevation of 100.00 ft.

A. SOIL CONDITIONS

Both testholes recorded an interlayered soil condition, where the strata were mainly of a granular nature. Underlying a layer of fill material, testhole 1 encountered a layer, 4 ft. thick, of mixed topsoil, organic peat, silt and some clay, which was dark brown in colour and very wet.

Underlying the fill in testhole 2, and the organic layer in testhole 1, was a layer of sandy gravel, which was light brown in colour and contained a fine to coarse sand and medium gravel. This layer, which was very wet and compact, had an average N-value of 22 blows/ft., at an average moisture content of 12%. The thickness of this layer, as proved in the testholes, was 3 ft.

Underlying the gravel, both testholes encountered a layer of silty fine light brown sand, which was in a dense and saturated condition. This stratum, which was approximately 13 ft. thick, had an average N-value of 40 blows/ft., at an average moisture content of 18%. Although the material, which made up this layer, was, generally, a fine sand, the odd seam of medium to coarse sand and the odd small stone was encountered throughout the depth investigated.

A.1 Sandy Gravel: Immediately below the fine sand, both testholes encountered, and terminated in, a layer of mixed sandy gravel and medium brown sand. In testhole 2, many more stones were encountered, and the layer, although similar to that encountered in testhole 1, contained a much higher percentage of gravel. The average N-value, from three standard penetration tests carried out in this material, was 57 blows/ft. and although the blow count may be exaggerated by the presence of the gravel, this layer is dense, although saturated.

A.2 Ground Water: Both testholes encountered a high water table at a depth of approximately 3 ft. 0 inches below grade elevation. Casing was used to a depth of 10 ft. 0 inches, but this failed to cut-off the water. The following table gives the water conditions:

B.H.#	Depth of Hole	Depth of Casing	Depth to Water
1	8' 6"	Nil	3' 6"
1	26' 6"	10' 0"	6' 4"
1	26' 6"	10' 0"	4' 2"
1	26' 6"	Nil	4' 2"
2	6' 6"	Nil	2' 9"
2	16' 6"	10' 0"	6' 0"
2	26' 6"	10' 0"	4' 0"
2	26' 6"	Nil	2' 9"

B. OBSERVATIONS AND RECOMMENDATIONS

The investigation has revealed that no problems arise at this site with regards to the allowable bearing capacity of the underlying strata. The bridge can be supported on spread footings at the proposed elevation of 84.5 and the allowable bearing capacity at this elevation can be taken as follows:

Width of Footing	Safe Allowable Bearing Capacity Kips/sq.ft.
4	7
6	6
8	5.5
10	5.25

As the material, in which the excavations will take place, is granular, and may be disturbed by the excavations; we would recommend the use of a plate vibrator within the trenches in order to impart an additional degree of compaction to the upper layers of the stratum in which the foundations are to be placed.

C. CONSTRUCTION

The major problem with the construction of this site will be caused by the presence of the high water table, and the granular nature of the underlying strata. There are three methods which could be used at this site to control or remove the water from the excavations. They are as follows:

1. Diverting the stream away from the excavations
2. Close sheeting
3. Well points

1. If the permeability of the underlying strata is found to be relatively low, it should be possible to construct an earth dam in order to force the flow of the river away from the excavations and thus provide dry conditions in which to carry out the necessary work. However, as the underlying strata are granular, and the examination of the samples indicates a high permeability, this operation is not considered a practical or an economical proposition.

2. Close sheeting would serve two purposes if used at this site. Firstly, it would supply sufficient support to the sides of the excavations to ensure that only the minimum amount of side excavation would be required. It could also be driven to sufficient depth to ensure that piping or bottom heave did not occur, and that the excavations could be pumped dry during the whole operation. The depth of penetration below the bottom of the trench will depend on the proposed width, but with a trench of 6 ft. in width the necessary depth of penetration will be approximately 8 ft. Further calculations can be done

once the design width of footing is known. Due to the denseness and stone content of the underlying material relatively hard driving can be expected with the sheet piling, which should be in steel.

3. The sand strata, on which the foundations of the proposed bridge will be set, is a suitable material in which to employ the well point dewatering system, although the close proximity of the river will necessitate a considerable volume of water being removed. But a properly designed well point system would enable the water table to be lowered sufficiently to ensure dry excavating conditions, and the material through which the excavations have to be taken, will be stable for near vertical cuts once the water table has been lowered. Safety regulations must be adhered to at all times, but the minimum amount of shattering only should be required.

Consideration has been given during this investigation to the use of pre-augered pressure piles, which would have eliminated the necessity of deep excavation through the saturated granular material. The depth required for these piles would not have been great, refusal would be reached on the gravelly sand layer. But it is considered, that it would still be necessary to excavate in the upper stratum to form the bottom of the abutment walls, which would require to be set at an elevation below the water level of the river, in order to prevent the scour of the fill material behind the abutment walls.

In conclusion we would recommend the use of close steel sheeting as being the most practical method of construction at this site. As these results are based on two diagonally opposite holes, there may be some variation in the strata, and these variations would condition the depths to which the piles have to be driven. Thus, it is possible that the individual piles may be driven to different depth. However, the variation is not expected to be great.

Whilst we believe that this report is complete within our terms of reference we would be pleased to discuss any further points you may wish to raise.

Yours very truly,

E. M. PETO ASSOCIATES LTD.,

E. M. Peto, P.Eng.

JH/hf

Report Prepared by:

J. Hunter,
Senior Soils Engineer.

4 c.c. Gamsby and Mannerow
1 c.c. File

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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RECORD OF BOREHOLE NO. 1

JOB NO. [illegible] JOB NAME [illegible] TECHNICIAN G.P.

BORING DATE [illegible] CLIENT [illegible] ENGINEER J.E.

GROUND ELEV 93.4± BOREHOLE TYPE [illegible] TYPED BY D.S.

DEPTH ELEV	SOIL PROFILE DESCRIPTION	GRAPHIC LOG	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS/FOOT	DYNAMIC CONE PENETRATION BLOWS/FOOT STANDARD PENETRATION TEST BLOWS/FOOT — SHEAR STRENGTH (LB/SQ FT)	LIQUID LIMIT w_L PLASTIC LIMIT w_P WATER CONTENT w — WATER CONTENT %	REMARKS
0'0"						10 20 30 40	w_P w w_L 10 20 30	
2'0"	FILL-Silty Sand [illegible] mixed brown.							
	TOPSOIL-Silt, organic peat, Dark brown.		1	SS	11			
6'0"			2	SS	24			
	SAND & GRAVEL-Silty brown, Wet, Compact		3	SS	34			
9'0"								
	SAND-Silty Fine, light brown, Saturated, Dense		4	SS	52			
			5	SS	51			
			6	SS	41			
			7	SS	52			
22'0"								
	SAND-[illegible] Gravel, Odd stone, Very Dense							
26'6"			8	SS	100/			
	Terminated at 26'6" At completion of hole water at 9'0" Cave at 22'0"							

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RECORD OF BOREHOLE NO. 2

JOB NO. 66354 JOB NAME Woolner Bridge TECHNICIAN D.S.

BORING DATE Dec. 9/66 CLIENT The Township of Sarl ENGINEER J.M.

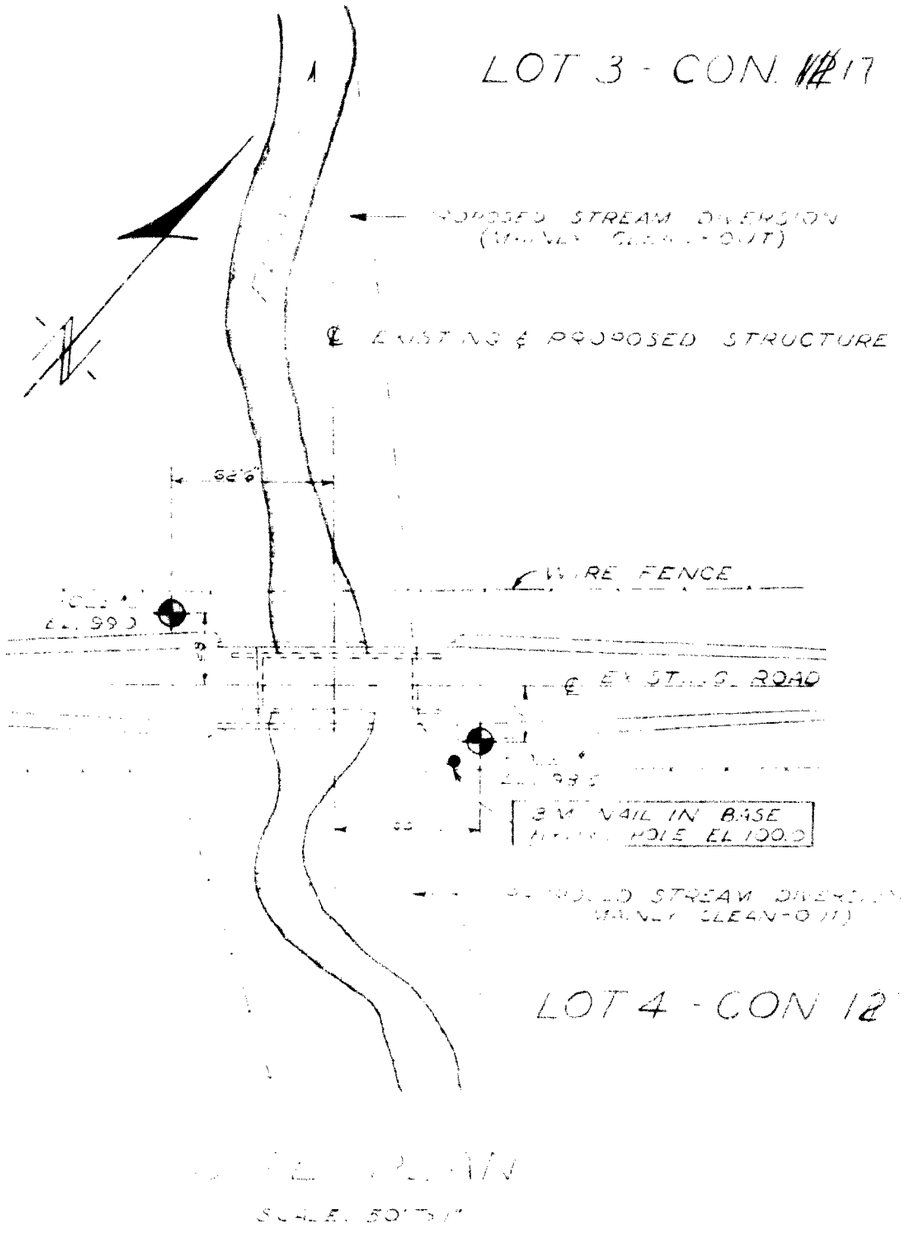
GROUND ELEV 99.01 BOREHOLE TYPE 3" Auger TYPED BY D.S.

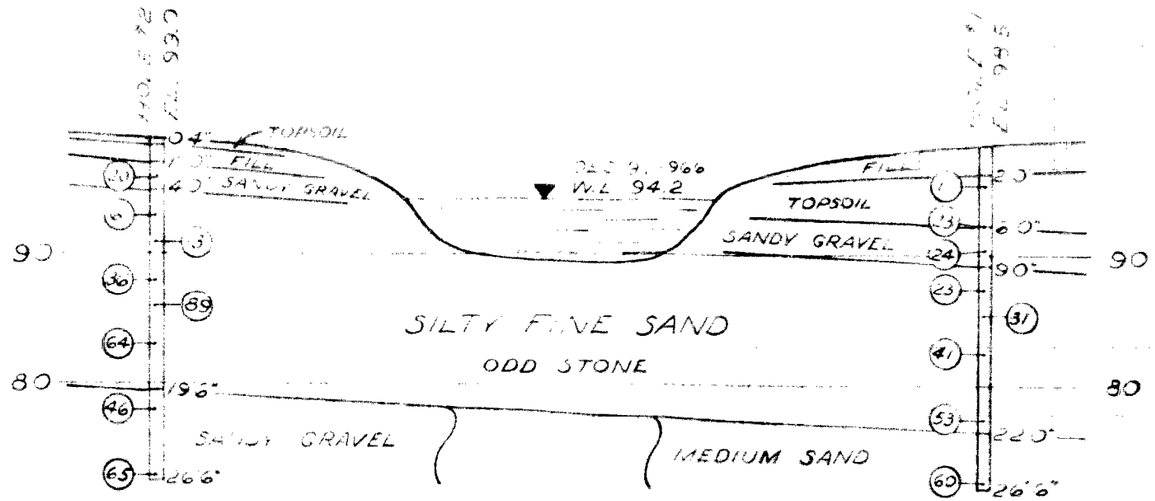
DEPTH ELEV.	DESCRIPTION	LEGEND	SAMPLES NUMBER	SAMPLES TYPE	BLOWS/FOOT
0'0"	4" Black Topsoil				
1'10"	FILL-Grey Silty Sandy Clay Fill Wet Loose		1	SS	20
4'0"	SANDY GRAVEL-Light Brown		2	SS	6
	SAND-Very Silty fine Light Brown, odd smallstone, odd seam of medium to coarse Sand.		3	SS	11
			4	SS	30
			5	SS	89
			6	SS	64
19'6"	SANDY GRAVEL-Light brown, Medium to coarse Sand and large Gravel, Saturated.		7	SS	40
			8	SS	45
26'6"	Terminated at 26'6" At completion of hole Water at 2'9" Cave at 4'0"				

DYNAMIC CONE PENETRATION BLOWS/FOOT
STANDARD PENETRATION TEST BLOWS/FOOT
10 20 30 40 50 60
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





SECTION THROUGH HOLES 2 & 1

SCALES: HOR. 20' TO 1"
VER. 10' TO 1"

LEGEND

- BOREHOLE
- (15) 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.

TOWNSHIP OF PEEL
% GAMSBY AND MANNEROW

WOOLNER BRIDGE

PREPARED BY
e.m.peto associates ltd.

JOB NO.	DATE	DRAWN BY	CHECKED BY
66354	DEC. 1966	D.N.	J.P.