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G.I.-30 SEPT. 1976

GEOCRES No. 31G5-128

W.P. No.

CONT. No.

W. O. No.

STR. SITE No.

HWY. No. 17

LOCATION MONTREAL RD &
GREENS CREEK

OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT. NONE

REMARKS:

REPORT

ON

INVESTIGATION AT GREENS CREEK BRIDGE

OVER MONTREAL ROAD

AND

THE USE OF FRICTION PILES

TO

DE LEUW, CATHER & CO. OF CANADA LTD.

REPORT NO. SF-368

12 AUGUST 1958

McROSTIE & ASSOCIATES
CONSULTING ENGINEERS
OTTAWA CANANA

BA 686-A

McROSTIE & ASSOCIATES

CONSULTING ENGINEERS AND SURVEYORS

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3IG5-128
GEOCRES No.

TERMS OF REFERENCE

In your letter dated Jan 3, 1958, Mr. A. Harvey requested: 1) Two borings (subsequently changed to one boring with laboratory tests) of the existing Highway bridge on the Montreal Road at Greens Creek with sufficient samples to relate this soil to that at other projected bridge sites; 2) An opinion on the use of friction piles in the clays of the Greens Creek, Montreal Road, Highway 17 area.

CONCLUSIONS

1) The boring at the existing Highway bridge showed clay to a depth of at least 62.5 feet (the depth of the hole) of similar composition but fissured and stiffer than the clay at the bridge sites along the New Highway 17 at the Montreal Road and at Greens Creek.

2) Friction piles could be considered for any bridge abutments in this area with the understanding that;

a) representative load tests should be specified to verify design assumptions;

b) The time of strength regain after driving could not be predicted by analysis - it might be as little as a few days, particularly on timber piles, or it might be as much as several months, particularly on steel piles;

c) A tight construction schedule would require load tests before the contract to determine the time - strength regain for these clays and a particular pile type;

d) Friction piles would settle with any consolidation of the clay (due to an approach fill or an abutment load).

DISCUSSION

1) It was suggested and agreed to that for the purposes of correlation one boring with more testing be done than the two borings originally requested. The boring (see plate 2) showed that clay existed down to at least 62.5 feet below the ground surface adjacent to the West abutment of the existing highway bridge (see plate 1). The boring was not carried any deeper as its purpose was fulfilled at this depth. It was found that the clay was fissured and quite stiff. This was in contrast to the clay at the New Bridge site on the Montreal Road (see plate 3) and at the New Bridge site at Greens Creek (see plate 4), where the clay seemed to have only a fissured crust of 10 feet deep below which it was of medium soft strength.

As it is difficult to obtain an accurate measurement of the shear strength of a fissured clay some of the extra testing made possible by reducing the number of borings was done on strength tests. Besides an extensive program of 24 unconfined compression tests together with our small scale penetrometer tests, six field vane shear tests were run.

The vane tests showed the shear strength of the clay to be considerably higher than that indicated by the unconfined compression tests. It is to be expected particularly in a fissured sensitive clay that a confined in-situ test would give the higher results than an unconfined laboratory tests.

As the vane test is not yet as firmly established in soil engineering as the unconfined compression test we would not be inclined to use the full value of the high shear strengths indicated by it. However, the vane test does provide a good basis for using higher than average values obtained from a normal unconfined test program.

In addition to the strength test 8 mechanical analysis were run. These indicated that the composition of the clay was similar to the majority of silty clays found in the Ottawa area with 67% - 74% of the samples being clay (less than 0.002mm).

2) If the piles of the old Highway Bridge of Greens Creek are about 30 feet long then, in view of the boring results, they are friction piles. This together with our experience in other areas and the data we have been able to collect on friction piles in the immediately adjacent areas leads us now to the view that friction piles could be considered in the local clays. The successful use of such piles on any particular project would, however, require a thorough soil study.

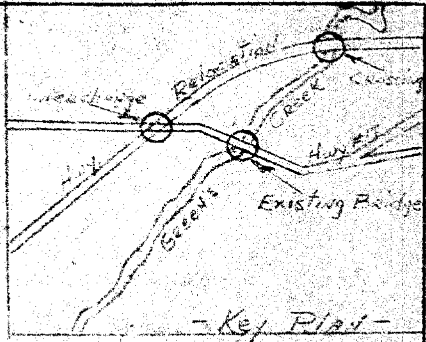
On a structure of any magnitude pile load tests should be specified so the assured design capacity would be verified. A minimum of two piles for each project should be tested.

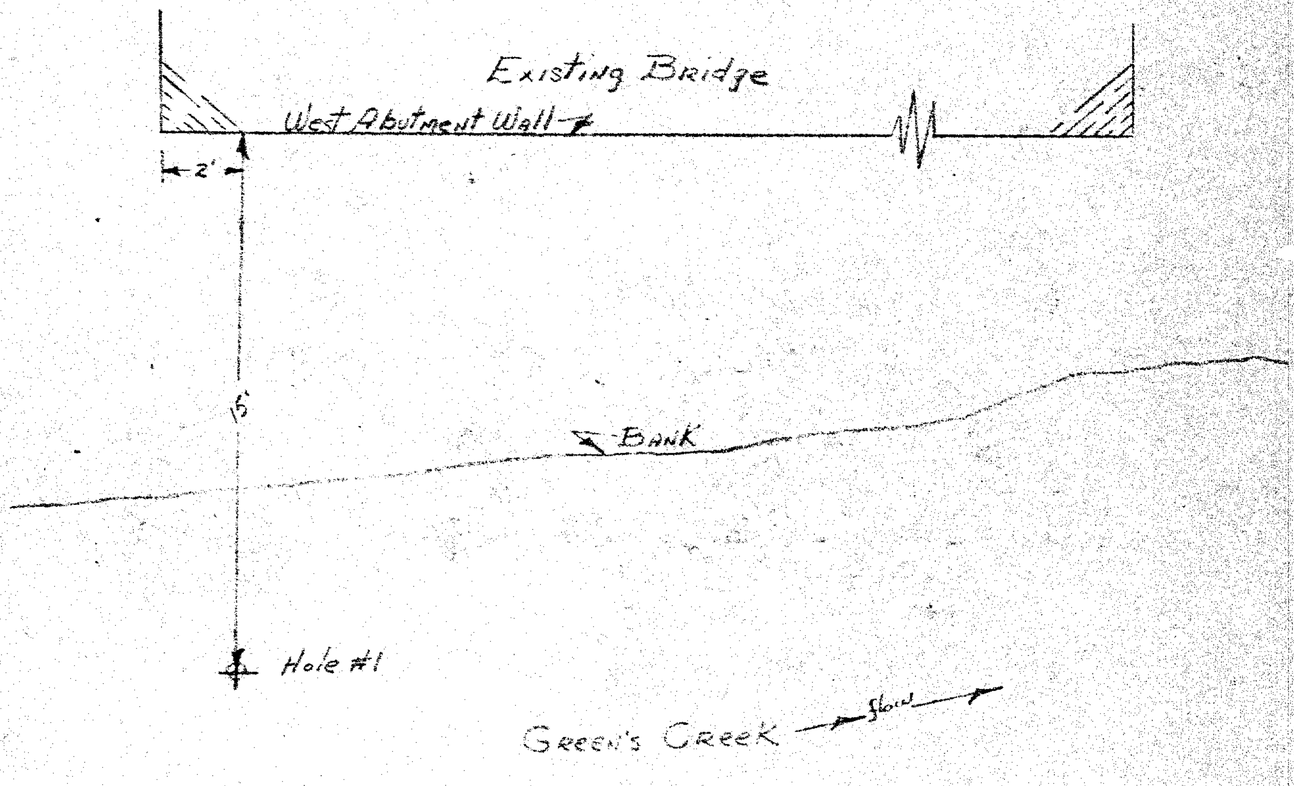
The time of strength regain of the clay after driving cannot be predicted by analysis. It is known that on many jobs the build up of adhesion of the clay to the piles occurs very quickly after driving, the piles having considerable capacity a few hours later and almost full capacity within a few weeks. It is felt that this is more likely to be so on timber piles than on steel piles. However, the build up can be very fast even on steel. On the other hand piles have been tested which showed that it took several months for an adhesive strength to be obtained on steel piles. Unfortunately the phenomenon does not seem to be related to the thixotropic strength regain of the clay as measured in the laboratory. In this case the regain of the major part of the clay's strength usually takes considerably longer.

For these reasons we feel if it is visualized that such piles would be feasible for a number of projects in the area then the cost of a program investigating this phenomenon would be warranted. A preliminary suggestion would be that three pile load tests could be run (at a cost of possibly $5,000.) to determine the time after driving that it would take to obtain certain pile capacities. The sites of such tests could be those where considerable soil test data has already been obtained. In these cases little or no additional expense would be required for soil exploration.

When considering whether friction piles might be feasible for any particular project it is important to bear in mind that consolidation of the supporting clay would cause settlement of the piles. An approach fill adjacent to a bridge abutment would be a typical site which could cause settlement of the abutment friction piles. Of course, if the load due to the fill were less than the preconsolidation load of the clay these would not be a significant factor. In any event such foundations require thorough engineering studies.

FORM S-11-2





McROSTIE & ASSOCIATES
CONSULTING ENGINEERS

BOREHOLE LOCATIONS
Green's Creek & Hwy #17

SCALE Sketch	PLATE 1

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OTTAWA CANADA

SOIL PROFILE AND SUMMARY OF LABORATORY TESTS

Green's Creek & Hwy #17

ELEVATION OF GROUND SURFACE (ZERO DEPTH) ____

REMARKS ____

DATE Mar. 3/58

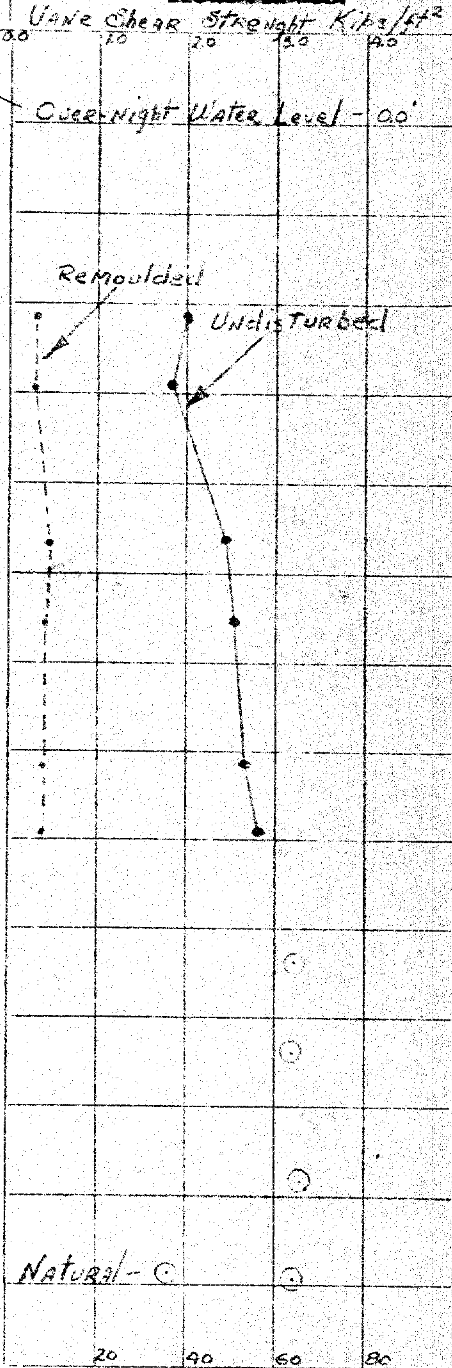
HOLE No. 1

Unconfined Compressive Strength Kips/Ft.^{2}	Small Scale Penetrometer Kips/Ft.^{2}	Standard Penetration Blows/Ft.	Sample Number	Description of Soil	Depth in Feet	Elevation
				Ground Surface	0.0'	
				Loose Sand, Silt, Clay & Stones		
					3.0'	
2.4	2.6, 3.2, 3.2, 3.0, 2.6		1-1	Stiff Fissured Gray Clay		
2.4	3.3, 2.6, 2.9, 3.2, 2.6		1-2		10.0'	
2.4	3.0, 2.5, 2.7, 3.8, 3.3		1-3		15.0'	
2.3	3.7, 3.3, 3.2, 3.2, 3.2		1-4		20.0'	
2.4	2.2, 3.6, 3.4, 3.3		1-5		25.0'	
2.4	3.9, 2.7, 2.6, 2.9		1-6		30.0'	
					35.0'	
2.4	2.5, 3.0, 3.6, 3.1		1-7	Stiff Gray Clay with some fissuring		
2.4	3.2, 3.6, 3.6, 3.5		1-8		40.0'	
2.4	2.9, 4.0, 3.2, 3.5		1-9		45.0'	
					50.0'	
2.4	2.9, 2.7, 2.9, 2.9		1-10	Stiff Fissured Gray Clay		
2.3	3.6, 3.7, 3.9, 3.3		1-11		55.0'	
2.3	3.5, 3.5, 4.0, 3.7		1-12			
				Bottom of Hole	62.5'	

PENETRATION TEST

.... LB. HAMMER — NO CASING

.... INCH DROP — .... INCH DIA. ROD



% WATER CONTENT

PLATE 2

G. C. McROSTIE
CONSULTING CIVIL ENGINEERS
OTTAWA CANADA

SOIL PROFILE AND SUMMARY OF LABORATORY TESTS

Trans-Canada East of Ottawa - Aviation? Road crossing

HOLE No. 2

ELEVATION OF GROUND SURFACE (ZERO DEPTH) 186.04

REMARKS Geodetic survey

BORINGS BY McRostie TESTING BY McRostie DATE 12 Jan 56

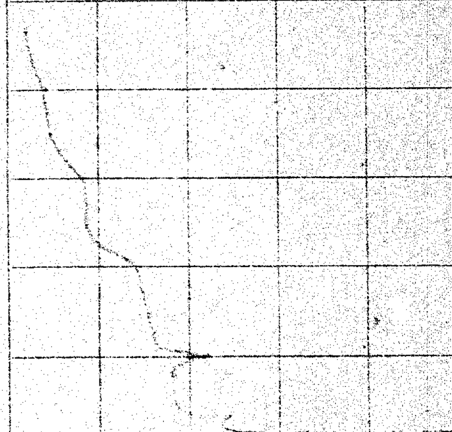
UNCONFINED COMPRESSIVE STRENGTH KIPS/FT²		STANDARD PENETRATION BLOWS/FT.	SAMPLE NUMBER	DESCRIPTION OF SOIL	DEPTH IN FEET	ELEVATION
				GROUND SURFACE	0	186.04
3.18			1.	Firm slightly fissured brownish grey clay		
2.56			2.	Firm slightly fissured brownish grey clay		
2.16			3.			
2.45			4.	Stiff to Medium soft grey clay	10	
2.39			5.			
2.16			6.			
1.8			7.			
1.94			8.		20	
2.59			9.			
2.59			10.			
2.59			11.			
2.55			12.		30	
1.37			13.			
2.09			14.		40	
1.75			15.			
2.16			16.		50	136.04
2.46			17.		60	
1.92			18.		70	
2.4			19.		80	
				84.0		
				Soft soil no samples see penetration tests	90	
					100	86.04
					110	
					120	
				Bottom of hole 126'		
					130	
					140	
					150	

PENETRATION TEST

........LB. HAMMER ....INCH DROP | NO CASING ....INCH DIA. ROD

BLOWS PER FOOT

Ground water at 0 ft



20 40 60 80

blows/ft no casing 140 lb hammer 30 in drop A rod

% WATER CONTENT

PLATE 3

G. C. McROSTIE

CONSULTING CIVIL ENGINEERS
OTTAWA CANADA

SOIL PROFILE AND SUMMARY OF LABORATORY TESTS

Trans Canada Highway – East of Ottawa
Green Creek Crossing

ELEVATION OF GROUND SURFACE (ZERO DEPTH) 157.48

REMARKS Geodetic datum

BORINGS BY Mc Rostie TESTING BY Mc Rostie DATE 25 Jan 56

HOLE NO. 2

PENETRATION TEST: 140 LB. HAMMER, 30 INCH DROP; NO CASING, 1.? INCH DIA. ROD; BLOWS PER FOOT (20, 40, 60, 80, 100)

UNCONFINED COMPRESSIVE STRENGTH KIPS/FT²	STANDARD PENETRATION BLOWS/FT.	SAMPLE NUMBER
1.3		1
1.2		
1.9		
1.6		4
1.7		5
2.1		6
2.6		7
1.4–2.6		8
2.0		9
2.5		10
2.6		11
2.6		12
2.6		13
2.3		14
2.3		15
2.6		16
2.5		17
2.5		18
2.6		19

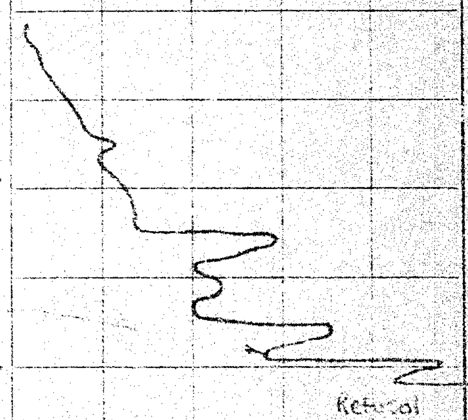
DESCRIPTION OF SOIL

GROUND SURFACE

- med. soft fissured brown-grey clay (to 2.6)
- Medium soft fissured grey clay
- Stiff, slightly fissured, grey clay
- Soil (no samples) Density increases with depth
- Bottom of hole (123)

DEPTH IN FEET	ELEVATION
0	157.48
10	[illegible]
20	[illegible]
30	[illegible]
40	[illegible]
50	107.48
60	
70	
80	
90	
100	57.48
110	
120	37.48

← Ground water level



% WATER CONTENT

PLATE 3