

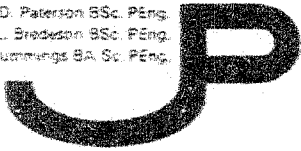
67-F-232M

CROW'S NEST BRIDGE

OSGOODE

OTTAWA-CARLETON

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Site 3-203

67-F-232M

REPORT OF SOIL INVESTIGATION

PROPOSED NEW CROW'S NEST BRIDGE

OSGOODE TOWNSHIP

No PLANS

OTTAWA - CARLETON

FOR

TOWNSHIP OF OSGOODE

GRAHAM, BERMAN & ASSOCIATES LTD.

CONSULTING DESIGN ENGINEERS

OTTAWA

(PROJECT NO. 1649)

REPORT NO. S578-67

MARCH 17, 1967.



INTRODUCTION

At the request of Graham, Berman & Associates Ltd., Consulting Civil Engineers, on behalf of the Municipality of the Township of Osgoode, a soil investigation was conducted at the site of the proposed replacement for the Crow's Nest Bridge which crosses the South Castor River on the road between Concessions VII and VIII at Lot 41, Osgoode Township, Carleton County.

A print of Dwg. No. 1649-1 was provided as a site plan and the location of four proposed test holes was shown on it as a guide to the Soils Consultants.

The new bridge is to be considerably larger and will accommodate a realignment of the road to the east.

FIELDWORK PROCEDURE

Three test holes were put down at the locations shown on the Test Boring Plan. The fieldwork program was reduced to three holes from four when the subsurface conditions were determined to be quite uniform at the site.

At each location, a cone probe was driven to refusal to determine the uniformity of the soils, the depth to bedrock and to help in planning a sampling program. In conjunction with cone probes driven at holes 1 and 2, casing was driven, the soils were sampled and bedrock was located.

A standard drilling rig, mounted on a trailer, was used for the fieldwork. A crew of two operated the equipment under the full-time supervision and direction of a Geologist from our staff.

SAMPLING AND TESTING

Samples of the soils were taken at Holes 1 and 2 by various means.

Casing samples of the miscellaneous fill were recovered by driving the BX casing into the ground two feet at a time and by withdrawing the casing and knocking out the sample.

Samples of the glacial till were recovered by means of a split spoon sampler. During the recovery of each split spoon sample, the Standard Penetration Test was conducted and the results are recorded as "N" values on the Soil Profile sheets.

The granular samples were examined in detail, classified and retained in plastic bags.

Thin-walled Shelby tube samples were recovered from the clay soils. Each tube was sealed air-tight in the field. At our laboratory, selected samples were extruded from the tubes and tested for unconfined compressive strength, water content, and unit weight. As well as determining clay strengths by conventional equipment, the strengths of several samples were determined by Hand Penetrometer.

A core sample of bedrock was recovered at Hole No. 1 as requested. The core was classified and retained in a core box.

OBSERVATIONS

(a) General Comments & Soil Types

The South Castor River has cut a U-shaped channel through the layer of clay that covers this area. The banks and river bottom are, therefore, exposed clay surfaces. Overlying the clay at the bridge approaches is a deposit of miscellaneous fill 2' to 5' thick and underlying the clay is a thin mantle of glacial till 1' to 2' thick resting on the bedrock. The bedrock surface is more or less a horizontal plane and the clay layer is uniformly thick except where it has been eroded away by stream action. The important properties of the clay are that it is soft and sensitive. Table I shows the low strengths determined in the clay layer.

In Hole No. 1, the following soil profile occurs:

0	- 2	Miscellaneous granular and clay fill.
2	- 4	Soft, grey (mottled brown) silty clay.
4	- 14	Soft, grey (slight pinkish tinge) silty clay. Includes an odd small white shell.
14	- 24	Soft, grey (pinkish) silty clay interbanded with very soft, grey, silty, fissured clay.
24	- 25.0	Medium dense, brownish grey glacial till.
25.0	- 30.3	Bedrock - interbanded brownish grey, porous dolomite and grey dense limestone.

The details of bore holes 1 and 2, and an interpretation of cone probe 3, based on cone blows per foot and the associated bore holes, are shown on the Soil Profile sheets.

(b) Groundwater

Water was observed flowing from Hole No. 1 (after its completion) under the influence of artesian pressure. The flow of water is small and not considered to be a problem. It is not known whether it originates from a source at the interface of the glacial till and bedrock, or from bedrock, but it is likely to be from the interface zone.

A groundwater level was established in Hole No. 2 at 3.4 feet.

(c) Test Results

The results of the tests conducted on selected samples of the clay are summarized below in Table I.

TABLE I

Summary of Results of Tests on Clay

Hole No.	Sample No.	Sample Elevation	Water Content in %	Unit Wt. in P.C.F.	Unconfined Comp. Stress in p.s.f.
1	TW 3	235.5 - 234	71.6	99.2	720 H.P.
1	TW 4	233.5 - 232	77.1	97.7	850
1	TW 5	231.5 - 230	84.3	95.6	640
1	TW 6	226.5 - 225	99.1	92.8	570
1	TW 8	220 - 218.5	49.5	105.9	550
2	TW 13	236.7 - 235.2	44.3	110.1	1550
	TW 15	233.7 - 232.2	72.7	97.5	660 H.P.
	TW 17	229.7 - 228.2	79.4	97.4	800 H.P.
	TW 19	222.7 - 221.2	65.9	103.4	1100 H.P.

CONCLUSIONS AND RECOMMENDATIONS

The clay is not a suitable material on which to place the foundation of the proposed bridge.

It is our recommendation that the bridge be supported by piles driven to refusal at the bedrock surface. Because of the softness of the clay, the thin mantle of glacial till, and the expected continuous submergence of piles below water level, timber piles are considered acceptable for the job.

After cut off, the piles at the abutments will be approximately twenty-two feet long and at the piers approximately ten feet long.

No problems with lateral stability of the piles is anticipated, but some batter piles should be driven to prevent possible eccentric loads from displacing piles. Adjacent piles should not be spaced closer than 2 feet because of the possibility of "boiling-up" of the clay due to displacement.

Stability Analysis

Using the details shown in Elevation A-A in the Project Drawing 1, by Raymond C. Gauthier, Consulting Engineer, a Factor of Safety with respect to height for the approaches has been calculated to be 1.66 using Stability Numbers established by D.W. Taylor.

We suggest, however, that a more comprehensive Stability Analysis be conducted if it is known that at High Water Levels there is a sudden draw down after Spring run-off.

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LB:bc

L. Bredeson, P. Eng.

JOHN D. PATERSON & ASSOCIATES LTD.

CONSULTING ENGINEERS

1479 Laperrriere Ave

Canada

SOIL PROFILE AND LABORATORY TESTS

Crow's Nest Bridge

LOCATION: Lot 41, Conc. VII & VIII

Osgoode Twp., Carleton County.

Elevation: Zero Depth: B.M. Nail in S.W. root of 1.0' elm.

Remarks: 69' LT. Sta 2+28, elevation 240.56 (Geodetic)

Cone probe to refusal.

Boring by F.E. Johnston Drilling Co. Date: March 6, 1967.

Sheet No: 3 of 3

Hole No: 3

Elev Feet	Soil Description	Sample Type	Depth in Feet	Elev	Moisture Content Per Cent.				
					30	40	50	60	70
	Deck of Bridge		0	247.4					
			3						
			6	241.4					
13	Ice Level	9.8	9						
144	Ice	11.0							
			12	235.4					
	Water		15						
	River Bottom	16.0	18	229.4					
1			21						
1	River Bottom		24	223.4					
1	Sediment & very soft		27						
1	and sensitive clay.		30	217.4					
1			33	214.4					
3									
3									
4		31							
35	Glacial Till	32.5							
35	Bedrock (inferred)								

for 6 1/2"

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SOIL PROFILE AND LABORATORY TESTS

Crow's Nest Bridge

LOCATION: Lot 41, Conc. VII & VIII
Osgoode Twp., Carleton County

Elevation 'Zero Depth' B.M. Nail in S.W. root of 1' elm.

Sheet No. 1 of 3

Remarks: 69' LT Sta 2+28, elevation 240.56 (Geodetic)

Test boring hole & cone probe. H.P. = Hand Penetrometer

Boring by P.E. Johnston Drilling Co. Date: Mar. 2 & 3, 1967.

Note No. 1

Depth per Foot	Soil Description	Sample Type	No.	HP	Depth in Feet	Elev.	Moisture Content Per Cent				
							30	40	50	60	70
	Ground Surface				0	240.5	Artesian Pressure				
-	Miscellaneous granular	BX	1								
-	and clay FILL.		2								
-	Soft, grey (mottled brown)				3						
9	silty clay.		4								
4		TW	2	Not tested							
4	Soft, sensitive grey	TW	3	0.36 HP	6	234.5					
3	(slight pinkish tinge)										
4	silty clay. Includes	TW	4	0.43	9						
4	an odd small white										
4	shell.	TW	5	0.32							
4					12	228.5					
3											
2											
2			14								
4	Soft, sensitive, grey	TW	6	0.29	15						
4	(pinkish) silty clay										
4	interbanded with very				18	222.5					
4	soft, grey, silty,										
4	fissured clay.	TW	7	Lost	21						
5		TW	8	0.28							
5											
5			24		24	216.5					
5	Brownish grey glacial till.		25								
7	Bedrock - Interbanded	SS	9		27						
23	brownish grey porous										
20	dolomite & grey dense										
for 1"	limestone.	Core	99%		30	210.5					
		Recovery									
			30.3								

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SOIL PROFILE AND LABORATORY TESTS

Crow's Nest Bridge

LOCATION: Lot 41, Conc. VII & VIII

Osgoode Twp., Carleton County

Location: Zero Depth: B.M. Nail in S.W. root of 1' elm.

Sheet No: 2 of 3

Remarks: 69' LT Sta 2+28, elevation 240.56 (Geodetic)

Test boring hole & cone probe. H.P.=Hand Penetrometer

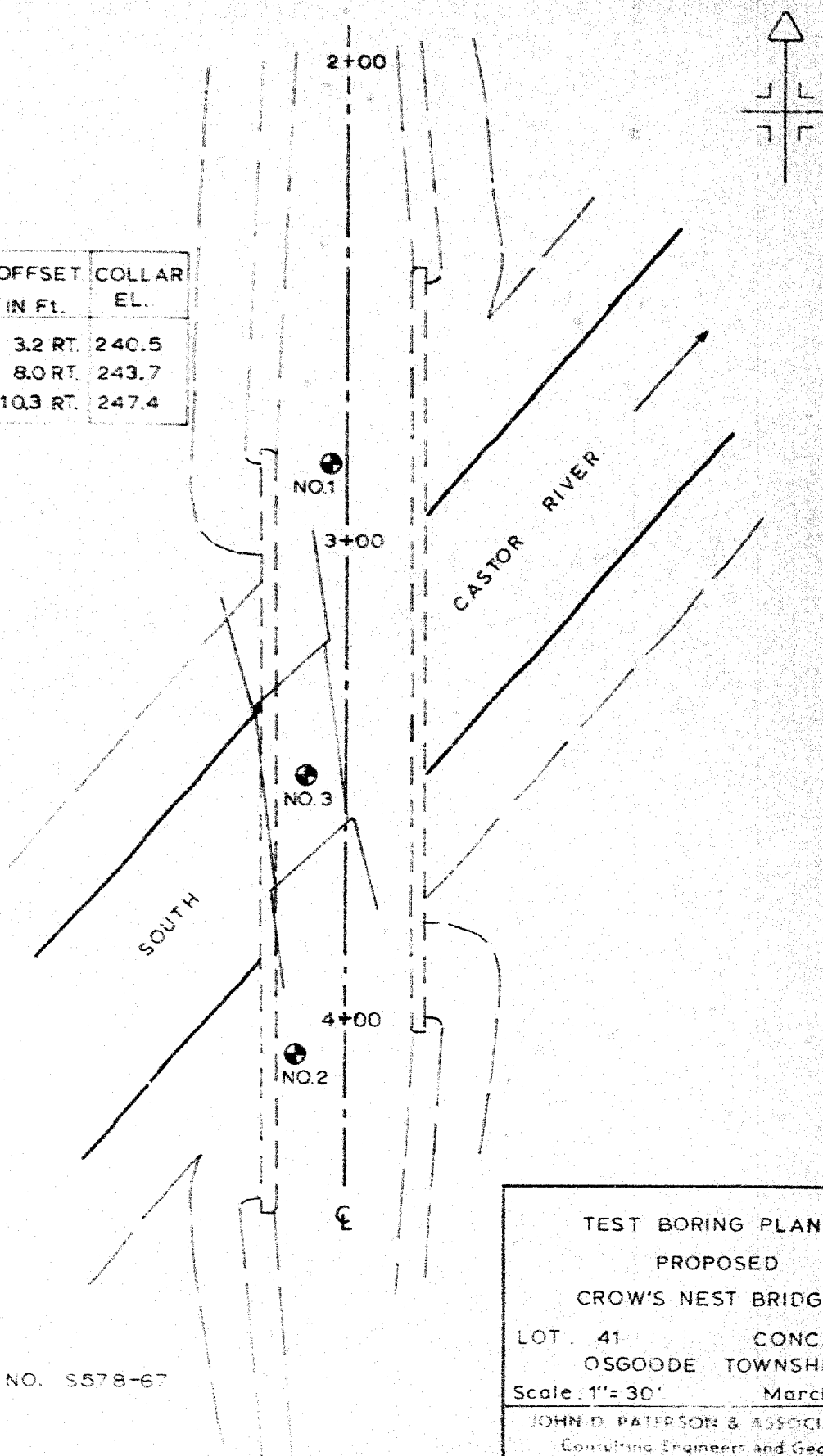
H.P. No: 2

Bored by: F.E. Johnston Drilling Co. Date: Mar. 3 & 6, 1967.

Depth Feet	Soil Description	Sample Type	Soil Temp °C	Depth in Feet	Elev	Moisture Content Per Cent				
						30	40	50	60	70
	Ground Surface			0	243.7					
-	Miscellaneous granular	BX 10								
12	and clay FILL.	BX 11		3						
10										
9	5.0	SS 12	Lost	13						
7	Medium stiff, slightly			6	237.7					
4	oxidized grey silty									
6	clay with fine roots.	TW 13	0.78							
7				9						
8		TW 14	Lost							
10		TW 15	0.33	HP						
9	Soft, sensitive, grey			12	231.7					
7	(in places banded pink,	TW 16	Not tested							
7	and black) silty clay.									
6		TW 17	0.40	HP	15					
6										
6		TW 18	Not tested							
7				18	225.7					
9										
9	20									
12				21						
13	Medium stiff, grey,	TW 19	0.55	HP						
11	(slight pinkish tinge)									
9	silty clay.			24	219.7					
12										
9										
12	27	SS 20		27						
72	Medium dense greyish									
29	brown clayey glacial									
87	till. 29.5									
for 9"	Bedrock (inferred)			30	213.7					
				33	210.7					

Groundwater
Level 3.4 feet
March 6, 1967.

HOLE NO.	STA	OFFSET IN Ft.	COLLAR EL.
1	2+84	3.2 RT.	240.5
2	4+75	8.0 RT.	243.7
3	3+49	10.3 RT.	247.4



REPORT NO. S578-67

TEST BORING PLAN
PROPOSED

CROW'S NEST BRIDGE

LOT 41 CONC. 7&8

OSGOODE TOWNSHIP

Scale: 1" = 30'

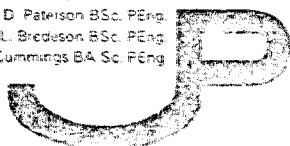
March 1967

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31G-90

GEOCRES No.

REPORT OF
ADDITIONAL SUBSURFACE INVESTIGATION
NEW PROPOSED SITE (STATION 5+00)
CROW'S NEST BRIDGE
TOWNSHIP OF OSGOODE, COUNTY OF CARLETON

FOR
TOWNSHIP OF OSGOODE

GRAHAM, BERMAN & ASSOCIATES LIMITED
CONSULTING ENGINEERS
OTTAWA

REPORT NO. S578-67/1

APRIL 3, 1967.



INTRODUCTION

At the request of Graham, Berman and Associates Ltd., two test holes, corresponding to the locations of the piers, were put down at the proposed site of the relocated Crow's Nest Bridge. The centre of the proposed bridge has been located tentatively at Station 5+00 on the relocated centre line of the road in order to accommodate a proposed realignment of the South Castor River.

The subsurface conditions at the existing bridge have already been reported in our Report No. S578-67. The additional test holes were requested because of the new location suggested by the Dept. of Highways.

FIELDWORK PROCEDURE

The test holes of this investigation (No's. 4 and 5) are shown located on the Test Boring Plan together with all the test holes put down in conjunction with the subsurface investigation at this bridge site.

At Hole No. 4, a cone probe was driven to refusal and in addition, a test hole was put down in which casing was driven, the soils were sampled and bedrock was located.

Because of the uniformity of the subsurface soils conditions, only a cone probe (in which the blows per foot were recorded) was driven to refusal at Hole No. 5.

A standard drilling rig was used as before, operated under the supervision and direction of a Geologist from our staff.

SAMPLING AND TESTING

Samples of the various soils were recovered by standard methods.

Samples of soils above a possible footing level were recovered for classification purposes by driving BX casing two feet at a time into the soil, and withdrawing the casing and knocking out the sample.

A sample of the glacial till (granular) was recovered by means of a split spoon sampler.

The BX casing and split spoon samples were classified and retained in plastic bags.

During the recovery of the split spoon sample, the Standard Penetration Test was conducted.

Shelby thin-walled tubes were used to recover samples of cohesive soils. The ends of each tube were sealed air-tight with plastic covers and tape in the field.

At our laboratory, the samples were extruded from the tubes and subjected to the routine tests to determine the unconfined compressive strength, the water content, and the unit weight.

Bedrock was not confirmed by diamond drilling, but the point of refusal of the cone probe to further penetration is considered to be the bedrock surface.

OBSERVATIONS

(a) General Comments & Soil Types

The subsurface soil profile established at the existing bridge continues to the south as revealed by this investigation. A thin layer of miscellaneous clayey fill overlies a thick layer of medium stiff to soft sensitive clay approximately 25 feet thick. Underlying the clay and resting on the bedrock is a thin layer of glacial till. The bedrock surface continues to slope gently to the south, but for all intents and purposes, it can be considered flat lying.

The excavation of a new river channel will be entirely in clay.

The soil profile of Hole No. 4 shown below is typical of the subsurface conditions at this site.

0	- 2	Miscellaneous clay (with roots) and granular fill.
2	- 4	Brownish grey silty clay with roots. Possibly fill.
4	- 8	Stiff to medium stiff brownish-grey (in places yellowish or pinkish) silty clay with a few small root holes.
8	- 11	Medium stiff grey sensitive silty clay with a trace of root holes.

- 11 - 22 Soft grey (in places pinkish) sensitive silty clay. Appears fissure-like in places.
- 22 - 28 Soft grey sensitive silty fissured clay inter-banded with soft pinkish grey sensitive silty clay and clayey silt.
- 28 - 31.2 Dense to very dense greyish brown (pinkish tinge) glacial till.
- 31.2 - Bedrock (inferred).

(b) Groundwater

At the completion of the fieldwork, the groundwater level in Hole No. 4 was 2.9 feet below ground surface. The water levels were also recorded in the holes put down previously. The observations are summarized in Table I.

TABLE I

Summary of Groundwater Levels

Hole No.	Date	Collar Elevation	Depth to Groundwater	Elevation of Groundwater
1	Mar. 6	240.5	Artesian pressure	
	Mar. 23	240.5	0.2'	240.3
2	Mar. 6	243.7	3.4'	240.3
	Mar. 23	243.7	3.9'	239.8
4	Mar. 23	242.8	2.9'	239.9

Test Results

The results of the laboratory tests conducted on the clay samples are summarized below in Table II.

TABLE II

Hole No.	Sample No.	Sample Elevation	Water Content in %	Unit Wt. in p.c.f.	Unconfined Comp. Stress in p.s.f.
4	TW 23	238.8 - 237.3	42.1	111.0	2460
	TW 24	236.8 - 235.3	52.2	107.8	1530
	TW 25	234.8 - 233.3	66.9	101.0	1610
	TW 26	229.8 - 228.3	75.6	95.5	830
	TW 27	224.8 - 223.8	81.8	95.0	760
	TW 28	219.8 - 218.3	49.8	110.4	650

CONCLUSIONS AND RECOMMENDATIONS

There is little change to be found in the physical characteristics of the clay at the proposed relocated bridge site and it is our recommendation as before that the bridge piers and abutments be supported by timber piles driven to refusal at the bedrock surface.

After cut off, the piles will be slightly longer than at the previous site investigated. At the abutments, they will be approximately 23' to 25' long and at the piers, approximately 13' to 14' long.

Although the piles will be imbedded in soft clay, no problem with lateral stability is anticipated. However, some batter piles should be driven to prevent possible eccentric loads from displacing piles.

Adjacent piles should not be spaced closer than two feet in order to prevent "boiling up" of clay due to displacement by piles.

Stability Analysis

A stability analysis, using the elevations shown in ProjectDwg. 1, by R. C. Gauthier, Consulting Engineer, has been computed as before with respect to height. The factor of safety has been computed to be 2.48, which is adequate.

We suggest, however, that a more comprehensive stability analysis be conducted, when the location of the structure is finalized, especially if high water levels during spring run-off are of short duration.

JOHN D. PATERSON & ASSOCIATES LTD.

L. Bredeson

LB:bc

L. Bredeson, P. Eng.

JOHN D. PATERSON & ASSOCIATES LTD.

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SOIL PROFILE AND TEST DATA

Crow's Nest Bridge

Lot 41, Concession VII & VIII

Osgoode Twp., Carleton County

Datum B.M. Nail in S.W. root of 1' elm, 69' LT Sta 2+ 28

Remarks el. 240.56 (Geodetic).

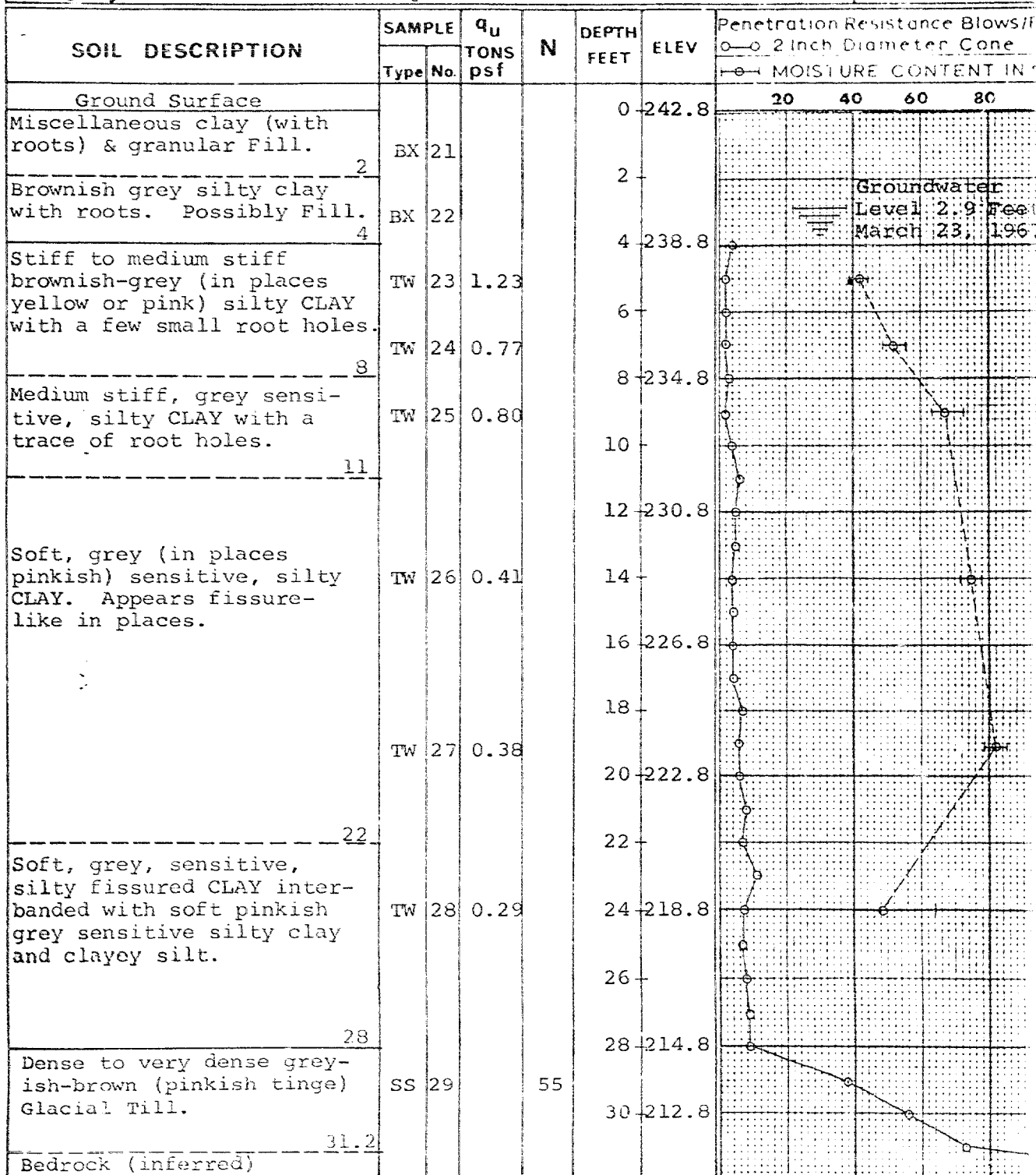
Test boring hole & cone probe.

Borings By F.E. Johnston Drilling Co.

Date March 23, 1967.

Sheet No 1 of 2

Hole No 4



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SOIL PROFILE AND TEST DATA

Crow's Nest Bridge

Lot 41, Concession VII & VIII

Osgoode Twp., Carleton County

Datum B.M. Nail in S.W. root of 1' elm, 69' LT Sta 2+28

Remarks el. 240.56 (Geodetic).

Cone probe to refusal. Interpretation based on cone blows per foot

Borings By F.E. Johnston Drilling Co.

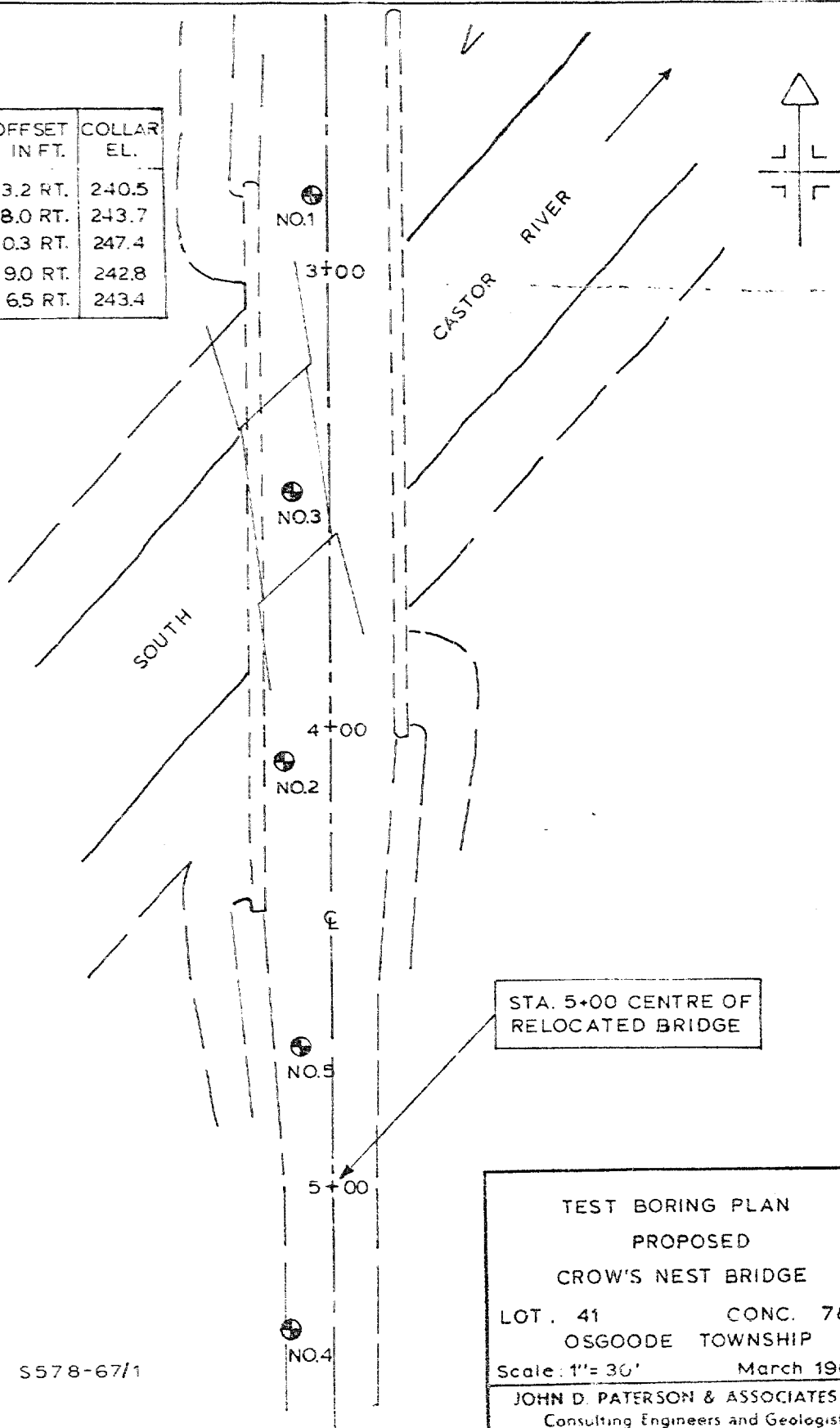
Date March 23, 1967.

Sheet No 2 of 2

Plot Hole No 5

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HOLE NO	STA	OFFSET IN FT.	COLLAR EL.
1	2+84	3.2 RT.	240.5
2	4+75	8.0 RT.	243.7
3	3+49	10.3 RT.	247.4
4	5+30	9.0 RT.	242.8
5	4+70	6.5 RT.	243.4



REPORT NO. S578-67/1

TEST BORING PLAN
PROPOSED
CROW'S NEST BRIDGE
LOT. 41 CONC. 7&8
OSGOODE TOWNSHIP
Scale: 1"= 30' March 1967
JOHN D. PATERSON & ASSOCIATES LTD.
Consulting Engineers and Geologists
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