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GEOCRES No. 31G-117

W.P. No. _____

CONT. No. _____

W. O. No. _____

STR. SITE No. 3-119

HWY. No. _____

LOCATION NEW BR. OVER JOCK
RIV., NEPEAN-GOULBOURN
TOWN LINE,

=====

OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT. NONE

REMARKS: _____

JOHN D. PATERSON, B.Sc., P.ENG.

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31G-117

GEOCRE No.

STRUCTURE CRE No. 3-119

REPORT

OF

SOIL INVESTIGATION

FOR

NEW BRIDGE OVER JOCK RIVER

NEPEAN-GOULBOURN TOWN LINE

FOR

COUNTY OF CARLETON

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1. Introduction
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4. Observations
5. Conclusions and Recommendations

Report No. S 120-59.

Ottawa, November 25th, 1959.

1. Introduction:

At the request of Mr. A. J. Graham, P. Eng., Carleton County Engineer, a soil investigation was conducted at the site of a proposed new bridge over the Jock River on the Nepean-Goulbourn Township Line. The site is approximately one mile east of the town of Richmond and one-quarter of a mile south of the Richmond Road.

The present bridge occupying the site, which was built sixty years ago, is a narrow, light, steel truss supported on cut limestone abutments. The span is 105 feet.

2. Field Work Procedure:

Five test borings were put down at the locations shown on the Borings Plan included in this report.

At Holes Nos. 1 and 2 a cone probe was driven initially after which the soils and bedrock were sampled and drilled.

After the soil profile was determined from these two holes the soil sampling was discontinued and Holes Nos. 3, 4 and 5 consisted of driving casing to bedrock and core drilling the rock. A standard diamond drilling rig fully equipped for soil testing and supplied by the F. E. Johnston Drilling Company was used in this work. All the field work and sampling was supervised by an engineer member of our staff.

A bench mark was established in the root of a large tree near the northwest corner of the bridge. The elevation was assumed to be 100.0 and all test hole elevations refer to this bench mark.

3. Sampling and Testing:

As mentioned above, samples of the soil were obtained in Holes Nos. 1 and 2 by means of the Shelby thin-walled sample tube (cohesive soils), the split spoon sampler (non-cohesive soils) and core drilling the bedrock.

The samples in the Shelby tubes were taken to the laboratory and were tested for unconfined compressive strength and moisture content. Split spoon samples were retained in glass jars and classified. Rock core samples were placed in core boxes and logged for classification.

4. Observations:

(a) Soil Types

The soil and rock profile at this site was found to be relatively uniform as determined by the five test holes. Briefly, the profile is as follows: There is a stiff, fissured, grey-brown clay and sandy clay to a depth of about 11 feet. This is followed by a sensitive, grey, silty clay, softer with increasing depth, which extends to 25 feet. Underlying the clay is a layer of boulder till ranging from 1 to 4 feet in thickness. Bedrock underlies the till and this is an

interbedded

interbedded limestone and dolomite, somewhat altered by calcite replacement. The geological age is "Ordovician" -- probably near the base of the Black River formation.

(b) Ground Water:

The ground water level in the four test holes put down near the abutments was found to be within a few inches of the level of the water in the river at the time of the investigation. The water depth in the middle of the river was judged to be 9' 2" when the drill rod was lowered into the river and came to rest. However, there may be one or two feet of very soft muck above this.

(c) Test Results:

The unconfined compressive strength test results on the clayey samples confirm the thickness of the stiff, fissured clay with values up to 2.4 tons per square foot.

However, below the fissured zone the strength is very low. A gradual increase in moisture content is noted with increasing depth until more silty material is reached. The moisture content then drops sharply.

5. Conclusions and Recommendations:

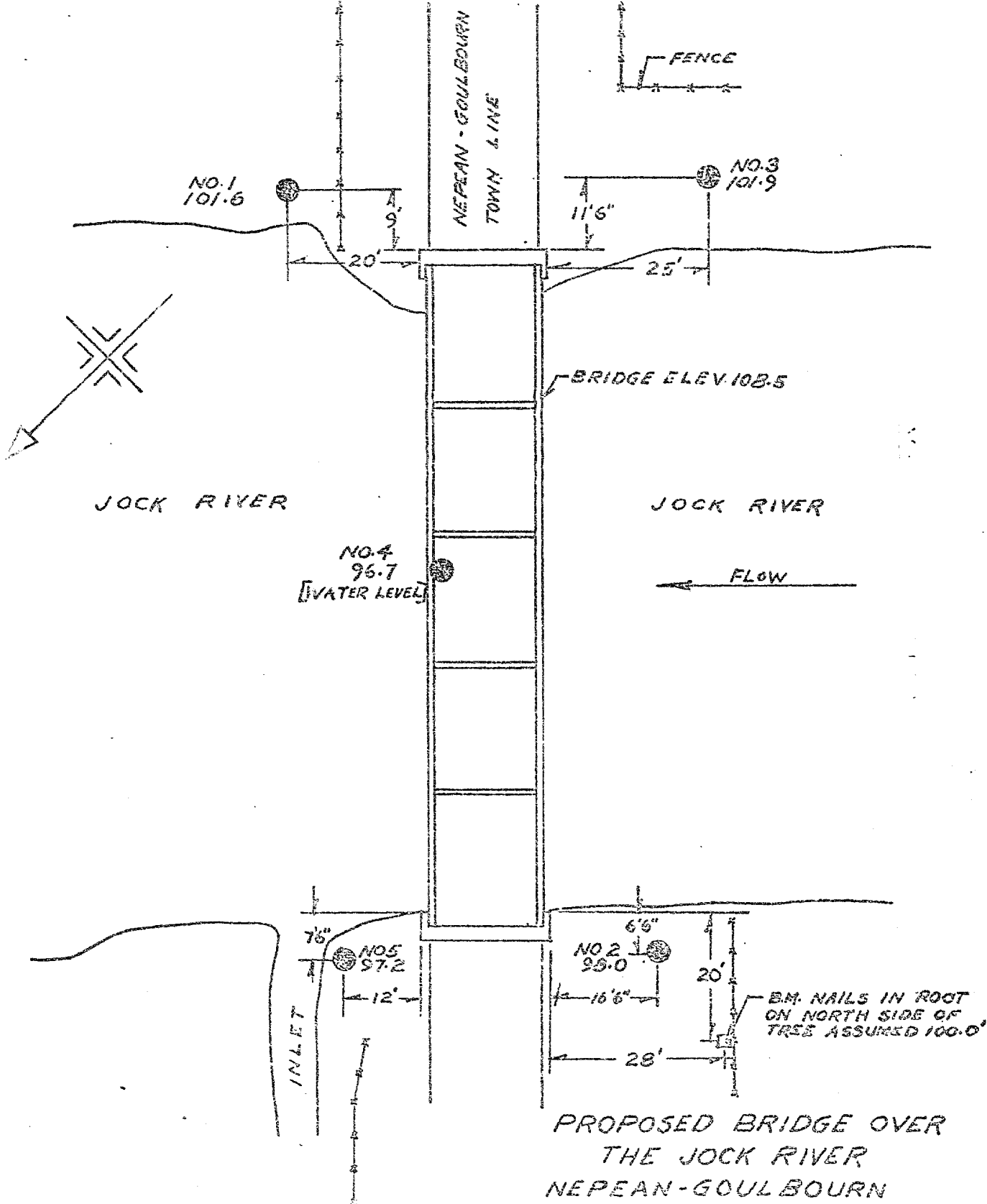
The soil at this site is not considered to be suitable on which to place new bridge abutments. While the stiff clay is capable of sustaining fairly heavy loads there is not sufficient thickness of it and the existence of much softer, sensitive clay below would cause fairly substantial settlement. We think it is extremely likely that the present bridge abutments are founded either on piles or a large timber mat, as there appears to have been very little movement over the past sixty years.

It is, therefore, our recommendation that this new bridge structure be founded on end-bearing piles driven to bedrock.


J. D. Paterson, P. Eng.

JDP/PMC.





PROPOSED BRIDGE OVER
THE JOCK RIVER
NEPEAN-GOULBOURN
TOWN LINE
CARLETON COUNTY

SCALE 1"=20'

NOV. 1959

JOHN D. PATERSON
CONSULTING ENGINEER
OTTAWA CANADA

SOIL PROFILE
&
LABORATORY TESTS

Location: Bridge over ~~Camp~~ River on Nepean-Goulbourn
Township Line, Carleton County.

ELEVATION (Zero Depth): 101.6

Remarks: Cone Test and Test Boring

Sheet No. 1 of 5

Hole No. 51

Borings by: F.E. Johnston Drilling Co., Ltd. Date: Nov. 10 & 11, 1959

BLOWS PER FOOT	SOIL DESCRIPTION	Samples		Unconf. Strength Ton/Sq. Ft.	Depth in Feet	ELEV.	MOISTURE CONTENT PER CENT.				
		Type	No.				30	40	50	60	70
	Ground Surface		0								
5	Black Top Soil		1		0-	101.6					
4											
5											
7	Stiff										
8	Fissured Grey-Brown Clay										
8		TW	1	1.8	5-	96.6					
11											
13											
14											
18											
20		TW	2	2.4	10-	91.6					
20	11'6"										
20	Sensitive										
19	Grey Silty Clay										
20	becoming softer with depth										
17		TW	3	0.6	15-	86.6					
13											
13											
12											
10											
12		TW	4	0.7	20-	81.6					
11											
11											
13											
12											
12	25	TW	5	0.2	25-	76.6					
15	Grey Silty Clay										
13	with silt layers										
13	up to 2 inches thick										
14											
26	30	TW	6	Lost Sample	30-	71.6					
39	Boulder Till										
58											
Refusal	33'11"										
33'6"	Bedrock, Limestone	Core									
	with minor shale lenses	(86% Recovery)			35-	66.6					
	and calcite fissures.										
	Bottom of Hole - 38'9".										

Ground Water
Level 4'10"

(Rock)

[illegible]

SOIL PROFILE & LABORATORY TESTS

Hole No. _____

BLOWS PER FOOT	SOIL DESCRIPTION	Samples		Unconf. Strength Tons/Sq Ft.	Depth in Feet	ELEV.	MOISTURE CONTENT PER CENT.				
		Type	No.				30	40	50	60	70
	Ground Surface		0		0	101.9					
	Black Top Soil		1								
	Probably Fissured Grey-Brown Clay				5	96.9					
				Note: Drove Casing to Bedrock then drilled.							
			10		10	91.9					
	Probably Grey Silty Clay										
					15	86.9					
					20	81.9					
					25	76.9					
			29								
	Probably Boulder Till		30'6"		30	71.9 71.4					
	Bedrock, Limestone with calcite replacement including vugs of calcite crystals, grad- ing to dolomite with minor sand inclusions.		35'5"	Core (82% Recovery)	35	66.9					

SOIL PROFILE & LABORATORY TESTS

Date: Nov. 13 & 16, 1959.

Core
(63% Recovery)

JOHN D. PATERSON
CONSULTING ENGINEER
OTTAWA CANADA

SOIL PROFILE
&
LABORATORY TESTS

Location: Bridge over ~~Sand~~ River on Nepean-Goulbourn
Township Line, Carleton County.

ELEVATION (Zero Depth): 97.2

Remarks: Test Boring

Sheet No.
5 of 5

Hole No.
5

Borings by: F. E. Johnston Drilling Company

Date: Nov. 16 & 17, 1959.

BLOWS PER FOOT	SOIL DESCRIPTION	Samples, Unconsolidated		Depth in Feet	ELEV.	MOISTURE CONTENT PER CENT.				
		Type	No.			30	40	50	60	70
	Ground Surface			0	97.2					
	Probably Sandy Clay									
				5	92.2					
				10	87.2					
				15	82.2					
				20	77.2					
				25	72.2					
					70.5	(Rock)				
				30	67.2					
				35	62.2					

Note:

Casing
driven
to
Bedrock
then
drilled.

Core.
(90% Recovery)

Bedrock, Limestone with
considerable calcite replace-
ment followed by a 2' Band of
Liney Dolomite with Sand
Grain inclusions followed by
Limestone with minor Green
Shale.

33'9"

STRUCTURE SITE No. 3-119

ENGINEERING REPORT

FOR

JOCK RIVER BRIDGE

FOR

COUNTY OF CARLETON

31G-117

GEOCRE No.

A SCOPE

This report includes a discussion of general design features of the Jock River Bridge to be constructed for the County of Carleton. Preliminary plans are included as part of this report.

B OWNER

The County of Carleton assumes responsibility for this bridge due to its location on a road which forms the boundary between two Townships.

C LOCATION AND USE

The bridge is located on the mainline between Nepean and Goulbourn Townships and carries traffic using this road over the Jock River - Exact location is described as Lot 27, Concession III, Goulbourn Township and Lot 7, Concession VI, Nepean Township.

D GENERAL DESIGN DATA

1. Hydrology

No gauging stations are kept on the river in the vicinity. The drainage area to the bridge site is 182 square miles and, using a discharge coefficient of 29 c.f.s., it is estimated that a

1. Hydrology - Continued

reasonable design flow for this river would be 5,300 cubic feet per second. It has been assumed from previous floods that this discharge will cause an increase in river stage, from normal water level, of 10 feet.

2. Hydraulics

A section through a typical cross section of the flood plain indicates an area of approximately 11,000 sq. ft. to the high water elevation of 106.0. Under present conditions of flow over the road, this area is contracted to approximately 4,000 sq. ft. including 1,300 sq. ft. at the bridge. The backwater under this condition is negligible and though a barn immediately upstream is often flooded, causes no complaints from local residents.

If the road is graded above H. W. L. and all flow forced through the bridge, it is believed that an excessive backwater condition will be caused due to the considerable contraction required. This, no doubt, would cause difficulties to the farmers living upstream and possibly flooding over Richmond Road.

Should this road at some future date be graded above elevation 106.0, it is recommended that substantial culvert capacity be installed in the grade.

3. Soil Conditions

A soil investigation of the site was performed by John D.

Paterson, Consulting Engineer and Geologist of Ottawa.

This has revealed the presence of a stiff fissured grey-brown clay and sandy clay to a depth of about 11 ft. This is followed by a sensitive, silty clay, softer with increasing depth, which extends to 25 feet. Underlying the clay is a layer of boulder till ranging from 1 to 4 feet in thickness. An interbedded limestone and dolomite bedrock underlies the till.

Though the top stiff clay layer has substantial bearing capacity, the weakness and compressibility of the underlying sensitive clay makes the use of spread footings undesirable. The bedrock at a depth of about 35 ft. should make excellent foundation for bearing piles.

4. Skew Angle

No suitable monuments or fence lines could be located in the field to properly establish the correct right-of-way line. However, field checks showed that the existing bridge is located properly with respect to the existing road and the stream bed. The existing bridge has its substructure units set at right angles to the road.

5. Geometric Standards

The existing road has a very low traffic count at present, though this will probably increase with the improved bridge.

A design traffic volume of 0 - 200 vehicles per day is recommended for the site.

E EXISTING BRIDGE

The existing bridge is a 105 foot through truss span having a clear roadway of 15 feet. The timber deck and stringers are in very poor condition. The steel truss, built in 1900, is extremely light and, in fact, shows failures in the portal bracing and in the end post. The substructure is in good condition, being limestone masonry, though no satisfactory wing walls could be observed; rock rip-rap being used to attempt to retain the fills. This latter condition has caused sloughing of these fills at the sides so that the roadway immediately adjacent to the bridge is no more than 12 ft. in width.

The structure is located approximately in the centre of a flood plain having a width of approximately 2,300 ft. Under normal spring break-up, water flows over the grade on each side. This flood lasts for about two weeks and causes little damage to the existing road. This condition, for the short period, is not considered serious by local residents as alternate roads are available.

F. PROPOSED BRIDGE

(a) General

The new structure will provide approximately the same waterway at the site as exists at present. The deck elevation will be raised two feet to prevent ice jamming or damage to the bridge. Though the overflow capacity of the roadway will be slightly reduced due to the required vision curve, it is not believed the amount of this reduction will increase upstream water levels during flooding.

It is proposed that the roadway immediately adjacent to the bridge be regraded to provide a stopping sight distance of 275 ft.

(b) Substructure

The incorporation of the existing stone abutments into a new structure was given consideration. Due to the lack of information about these, it was felt a new structure would have to be supported on separate new units, though the existing units could be used to retain the fill, as they are now doing. However, studies showed that this procedure would not be economical and, in fact, would produce problems during construction. Excavation adjacent to these may destroy their present stability and no economical method is apparent

(b) Substructure - Continued

f or tying these in to new foundations. It was therefore decided to abandon this plan and demolish these structures for use as rip-rap.

The new bridge will have steel H piles driven to bed rock to provide suitable foundations. In comparison with timber piles it is felt that these will be more economical.

The substructure units will be set at right angles to the road, i. e. zero skew angle and centred on the river bed as is the existing bridge.

(c) Superstructure

At current costs, a two span composite steel-concrete structure would usually be most economical for this crossing. However, the site lends itself to a two span rigid frame. End bearing piles on rock eliminate the possibility of settlement. During the summer, the water level in the river is very low and the top clay material provides good bearing material for falsework. The leg height to span ratio is also well suited for a frame.

Cost comparisons were therefore made between these two types of structures. These showed that the rigid frame would cost approximately \$2,000 more than the simple beam span.

(c) Superstructure

However, it was considered that the increased maintenance costs of the structural steel and the necessary bearings and expansion joints of the simple spans would more than offset this saving. This factor may be of more importance since the structure is not on a County Road and subject to the routine inspection of County maintenance forces.

It is therefore recommended that a two span rigid frame be constructed at the site as shown on the attached preliminary drawing.

- (d) It is estimated that the bridge project would cost approximately \$65,000.

M. M. DILLON & COMPANY LIMITED
CONSULTING ENGINEERS
LONDON - TORONTO - OTTAWA

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