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BRIDGE 17

LOT 22 , CON. 2

E. WILLIAMS TWP.

A.M. SPRIET & ASSOCIATES LTD.,  
CONSULTING ENGINEERS  
LONDON ONTARIO.

Report on  
SOIL INVESTIGATION  
for  
PROPOSED BRIDGE 17  
LOT 22 CONCESSION 2  
TOWNSHIP OF E. WILLIAMS

by  
DOMINION SOIL INVESTIGATION LIMITED  
369 Queens Avenue  
LONDON ONTARIO  
Reference No.7-12-L1

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SUMMARY.

The soil profile below the creek bed consists of very stiff to hard silty clay and very dense silt strata which are suitable for the support of spread footing foundations.

It is recommended that the footing grade be established at or below El.77, using a maximum net soil pressure of 6000 p.s.f. Total settlement is estimated to be less than 1-inch.

No unusual construction problems are anticipated.

1. INTRODUCTION.

In accordance with verbal authorization from A.M. Spriet & Associates Limited, Consulting Engineers, a soil investigation has been carried out in the Township of East Williams where it is proposed to replace an existing road bridge with a new structure.

The existing steel truss structure is located on Lot 22, Concession 2 of the Township where the road crosses a tributary of the Ausable River, and it is understood that the proposed structure will be centered on the existing bridge.

The purpose of the investigation was to reveal the subsurface conditions at the site and to determine the relevant soil properties for the design and construction of the new foundations.

11. FIELD WORK.

The field work, consisting of 2 boreholes, was carried out on December 4 and 5, 1967, at the locations shown on Enclosure 1. The holes were advanced by washboring methods and were lined with Bx size casing.

Standard penetration tests were performed at frequent intervals of depth, as detailed in Appendix 'A', and the results are recorded on the borehole logs as 'N' values.

Dynamic cone penetration tests were performed adjacent to each borehole location to obtain an indication of soil density and strata changes with depth.

Elevations were referred to a benchmark which was established by the client. (Nail in tree stump, 72' E and 27' N of the centre of the existing bridge, El.100 feet).

111. SUBSURFACE CONDITIONS.

Detailed descriptions of the strata encountered in each borehole are given on the borehole logs comprising Enclosures 2 & 3, and a general picture of the soil stratigraphy is presented in the form of a Subsurface Profile on Enclosure 1. The following notes are intended only to amplify this data.

Silty Clay (Fill)

Both boreholes penetrated fill deposits which are associated with the construction of the approaches to the existing bridge.

Silty clay containing seams of silt.

This stratum was encountered immediately below the fill material and was found to be the predominant soil type in this area. Due to the clay content the soil exhibits plasticity and cohesion, and the consistency is described as 'very stiff' to 'hard' as indicated by 'N' values ranging from 16 to 96 blows per foot.

Atterberg Limit tests were performed on two samples as a means of classification and as a guide to the probable behaviour of the soil. These gave values of Liquid Limit of 24% and 35%, Plastic Limit of 14% and 16%, and Plasticity Index of 10 and 19 indicating that

the clay has a low plasticity and compressibility. The Liquidity Indices which relate the natural moisture contents to the Atterberg Limits were 0.1 and -0.1 confirming the 'very stiff' consistency obtained from visual and tactile examination.

Grey Silt.

This stratum was encountered within the silty clay stratum described previously and revealed a thickness of 3.5 and 5.5 feet.

The relative density of the material is described as 'very dense' as estimated from 'N' values of 72 and 117 blows per foot.

IV. GROUNDWATER CONDITIONS.

The water levels in the boreholes reached equilibrium at El.85.5 and El.86 in boreholes 1 and 2 respectively.

The water level in the creek at the time the field work was carried out stood at El.87.3.

V. DISCUSSION & RECOMMENDATIONS.

The natural soil profile below the creek bed consists of very stiff to hard silty clay and very dense silt strata which are suitable for the support of spread footing foundations.

The creek bed extends down to El.81.7 therefore, allowing 4 feet of cover for frost protection, consideration should be given to a footing grade at or below El.77. The final footing grade should be established after a hydrological study has been made to determine the maximum depth of scour.

On the basis of the borehole results a maximum net soil pressure of 6000 p.s.f. is appropriate for the design of footings at or below El.77. This soil pressure incorporates a factor of safety of 3 against shear failure of the underlying soil.

It is estimated that total settlement of footings mobilizing the above soil pressure will not exceed 1-inch, and in view of the similar conditions encountered in the two boreholes, no appreciable differential settlement is anticipated.

The adhesion between the footings and the silty clay stratum may be taken as 2000 p.s.f. and the factor of safety against horizontal sliding of the abutments should be at least 1.5.

Construction.

Dewatering of excavations should not be especially difficult once the creek has been diverted away from the site through some temporary channel. Seepage into excavations should be collected in sumps dug below the footing grade and removed by pumping.



Yours very truly,

DOMINION SOIL INVESTIGATION LIMITED.

*C.J.W. Atkinson*  
C.J.W. Atkinson, M.Sc., P.Eng.,  
Branch Manager.

CJWA/jb.,



## APPENDIX A.

### THE STANDARD PENETRATION TEST.

In order to determine the relative density of non-cohesive soils, such as sands and gravels, the standard penetration test has been adopted. The test also gives an indication of the consistency of cohesive soils.

A two inch external diameter thick-walled sample tube is driven into the ground at the bottom of the borehole by means of a 140 lb. hammer falling freely through 30 in. The tube is first driven an initial 6-inches to allow for the presence of disturbed material at the bottom of the borehole. The number of standard blows (N) required to drive the sampler a further 12 in. is recorded. The sample tube is one originally developed by Raymond Concrete Pile Company in the United States, where a sufficient number of tests have been made in conjunction with field investigations to show that the results, although essentially empirical, may be applied to foundation design.

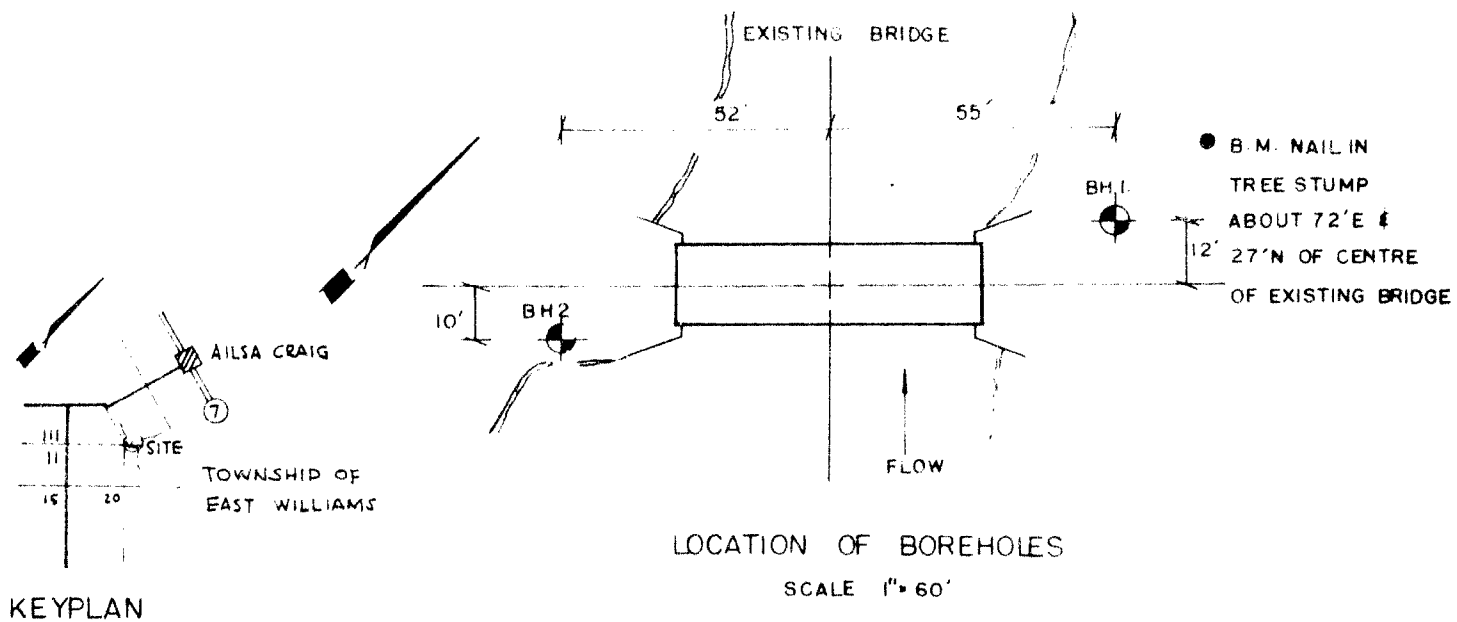
For Sands:-

Values of N	Density
Less than 10	Loose
Between 10 and 30	Compact
Between 30 and 50	Dense
Greater than 50	Very dense.




ADDENDUM.

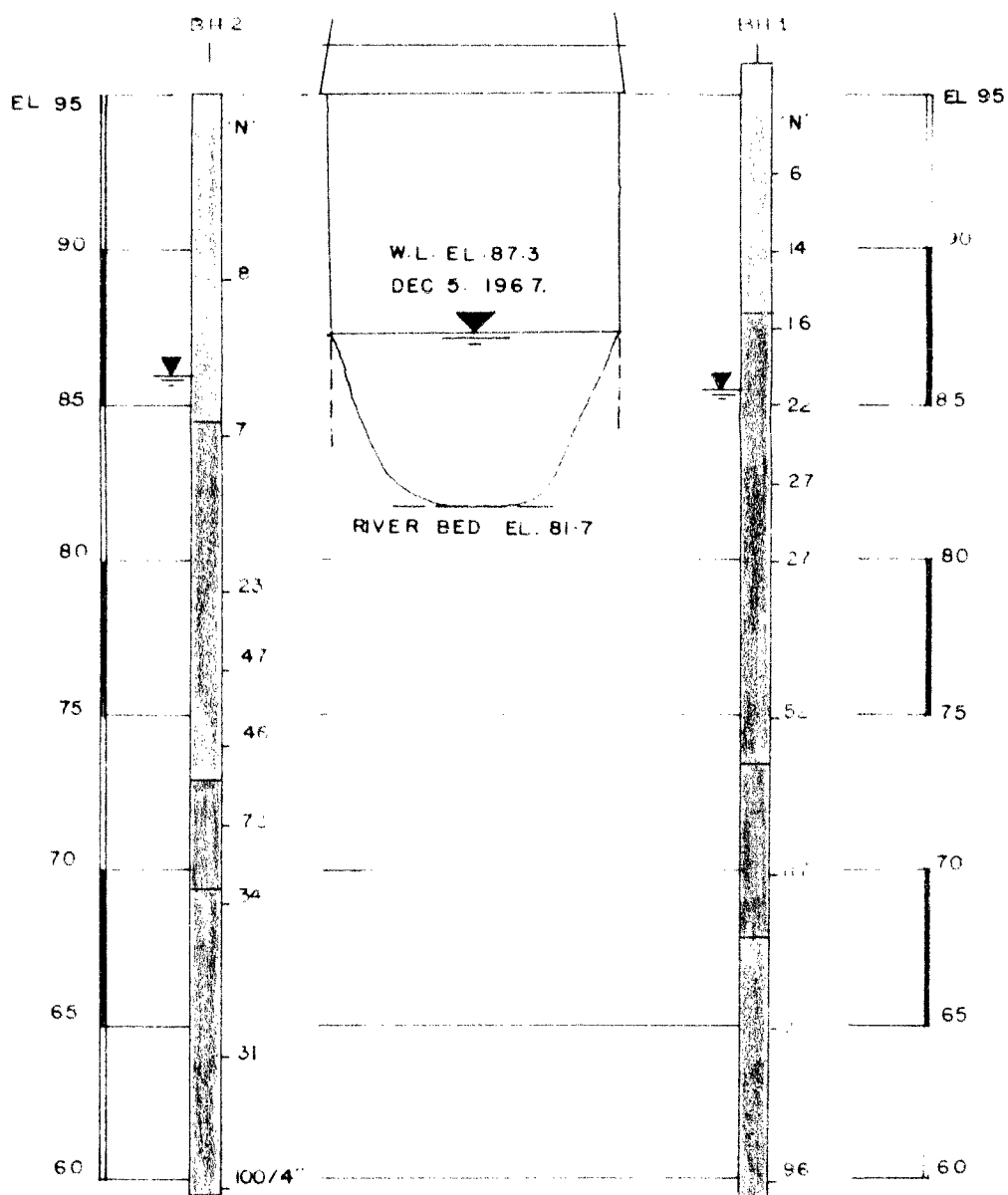
After completion of the drilling of the two boreholes described in this report, it was decided that the creek will be relocated to the west of the road and that a new bridge will be constructed to provide access to the farm property. Bridges 17 and 18 will then be replaced by smaller structures to allow a flow of water through the present waterway.

Due to the proximity of the two boreholes to the proposed structure it may be assumed that the design criteria recommended in this report for Bridge No.17, may be used for the design of the bridge into the farm property. When the excavation is carried out this conclusion can be confirmed by a visual inspection.



# LEGEND

-  SILTY CLAY FILL
-  VERY STIFF TO HARD SILTY CLAY, SEAMS OF SILT.
-  VERY DENSE SILT



# SUBSURFACE PROFILE

VERT. SCALE  
1" = 5'

# LOG OF BOREHOLE 1

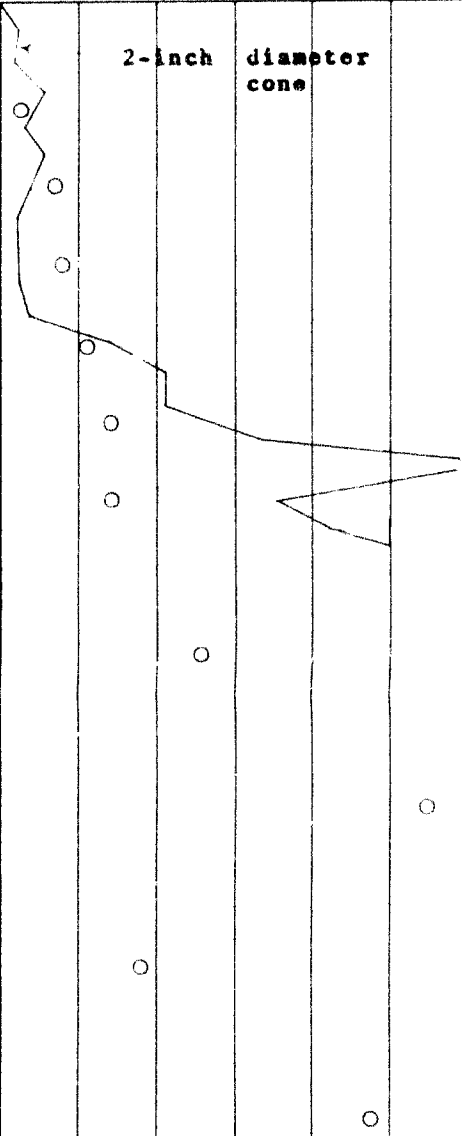
Our Reference No. 7-12-L1

Enclosure No. 2

CLIENT: A.M. Spriet & Associates Ltd  
PROJECT: Bridge No. 17  
LOCATION: Township of E. Williams  
DATUM ELEVATION: Nail in tree stump, El. 100 feet.

DRILLING DATA  
Method: Washboring  
Diameter: Bx(3-inch)  
Date: December 4, 1967

SUBSURFACE PROFILE				SAMPLES			PENETRATION RESISTANCE      Blows / Foot					WATER CONTENT %			REMARKS	
ELEVATION Ft.	DEPTH Ft.	DESCRIPTION	SYMBOL	GROUND WATER	NUMBER	TYPE	'N' Blows / Foot	20	40	60	80	100	PLASTIC LIMIT	NATURAL		LIQUID LIMIT
								UNDRAINED SHEAR STRENGTH      lbs/sq ft					WATER CONTENT %			
								+ FIELD VANE TEST      • COMPRESSION TEST					W <sub>p</sub>	W		W <sub>L</sub>
											10 20 30 40 50					

96.0 0.0 Ground Surface															
95	<div>Brown silty clay, trace of organics (Fill)</div> <div>Very stiff to hard brown grey silty clay, with seams of silt</div> <div>Very dense grey silt</div> <div>Hard grey silty clay, with seams of silt</div>		1	SS	6	<div>2-inch diameter cone</div>									
90			2	SS	14										
80			3	SS	16										
85			4	SS	22										
			5	SS	27										
80			6	SS	27										
75			7	SS	52										
225															
70			8	SS	117										
280															
65	9	SS	37												
60	10	SS	96												
365	End of Borehole														

VERTICAL SCALE: 1 inch to 5 feet

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MADE:

CHECKED:

# LOG OF BOREHOLE 2

Our Reference No. 7-12-L1

Enclosure No. 3

CLIENT: A.M. Spriet & Associates Ltd  
 PROJECT: Bridge No. 17  
 LOCATION: Township of E. Williams  
 DATUM ELEVATION: Nail in tree stump, El. 100 feet.

## DRILLING DATA

Method: Washboring  
 Diameter: 8x(3-inch)  
 Date: December 5, 1967

SUBSURFACE PROFILE				SAMPLES			PENETRATION RESISTANCE					WATER CONTENT			REMARKS				
ELEVATION Ft.	DEPTH Ft.	DESCRIPTION	SYMBOL	GROUND WATER	NUMBER	TYPE	IN' Blows / Foot	Blows / Foot					%						
								20	40	60	80	100	PLASTIC LIMIT	NATURAL		LIQUID LIMIT			
								UNDRAINED SHEAR STRENGTH									W <sub>p</sub> W      W <sub>L</sub>		
								+ FIELD VANE TEST									COMPRESSION TEST		

95.0	0.0	Ground Surface																	
90		Brown silty clay, trace of organics. (Fill)			1	SS	8												
85	10.5				2	SS	7												
80		Very stiff to hard silty clay, with seams of silt			3	SS	25												
75					4	SS	47												
70	22.0	Very dense grey silt			5	SS	46												
65					6	SS	72												
60	25.5	Hard grey silty clay, with seams of silt			7	SS	34												
					8	SS	31												
					9	SS	100	1/4"											
		End of Borehole																	

VERTICAL SCALE 1 inch to 5 feet

DOMINION SOIL INVESTIGATION LIMITED

MADE

CHECKED