

DOCUMENT MICROFILMING IDENTIFICATION

GEOCRES No. 40P9-25

DIST. 3 REGION Southwestern

W.P. No. _____

CONT. No. _____

W. O. No. _____

STR. SITE No. _____

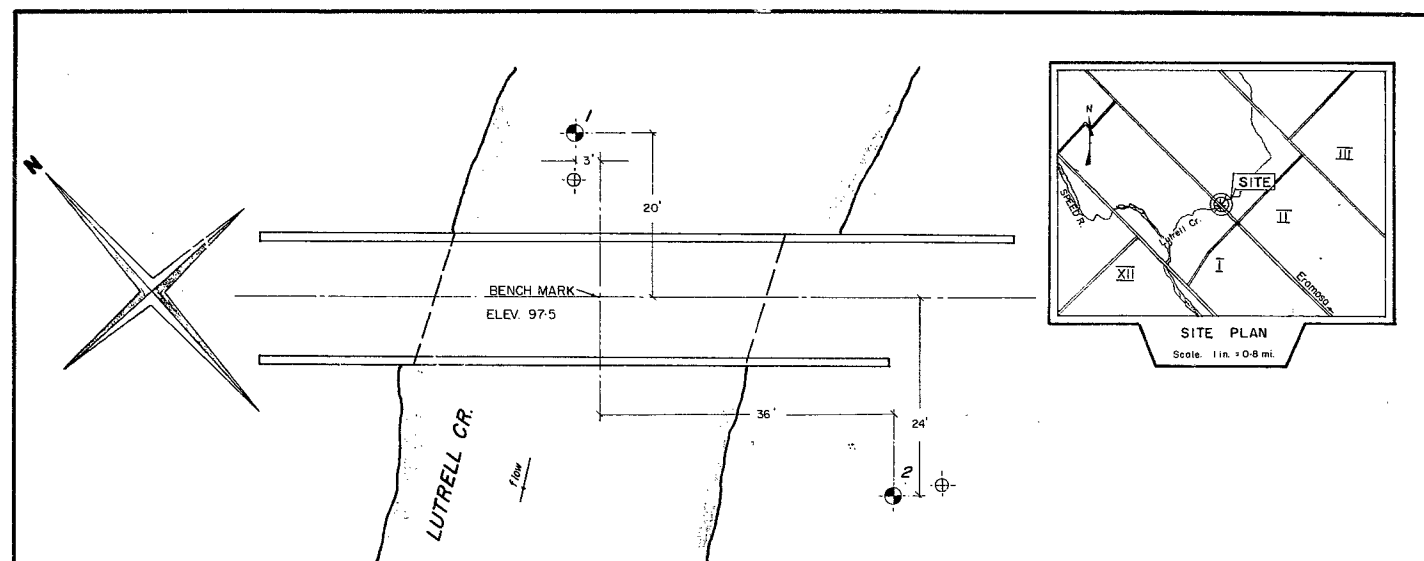
HWY. No. _____

LOCATION BARRIE HILL BRIDGE

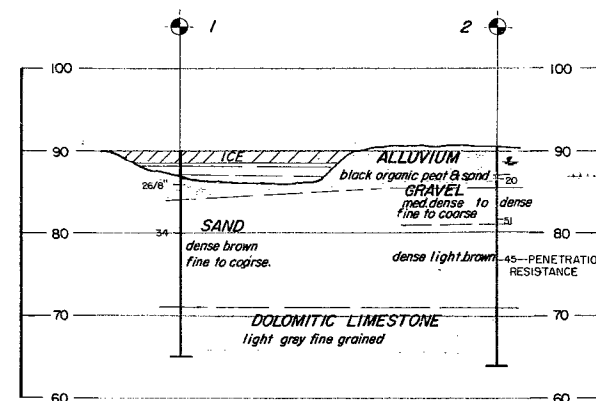
LUTRELL CREEK (NORTH OF RAMOSA)

OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT. 1

REMARKS: _____



PLAN
SCALE: 1 IN. = 10 FT.



LEGEND

- BOREHOLE
- ⊕ CONE

INTERPRETED SUBSOIL STRATIGRAPHY
SCALE: HOR. & VERT. 1 IN. = 10 FT.

40 P7-25
GEOLOGICAL No.

WILLIAM A. TROW AND ASSOCIATES LIMITED		
FOUNDATION INVESTIGATION		
BARRIE HILL BRIDGE		
OVER LUTRELL CREEK		
TWP. ERAMOSA	ONTARIO	
PROJ. 1331	DATE FEB. 1964	DWG. No. 1

40P9 map

WILLIAM A. TROW AND ASSOCIATES LTD.

SITE INVESTIGATIONS
LABORATORY TESTING
SOIL MECHANICS CONSULTATION

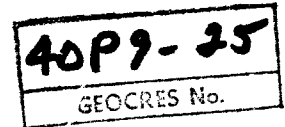
W. A. TROW, M.A.Sc., M.E.I.C., P.ENG.

1850 JANE ST.,
WESTON, ONT.
CH. 1-4644

Project: J1331

March 4, 1964.

Mr. V.R. Astrop, P. Eng.,
Consulting Engineer,
4 Hugason Street South,
Hamilton, Ontario.



Re: Soil Conditions
Barrie Hill Bridge Over Lutrell Creek
Wellington County, Ontario

Dear Sirs:

In conformance with your authorization of January 17th, 1964, we have carried out a soil investigation at Barrie Hill Bridge over Lutrell Creek in Wellington County, Ontario. This work consisted of borings taken to depths of 22 and 26 feet. Briefly the findings of this report are as follows:

- (1) Dolomitic limestone was intersected by both boreholes at El 71, about 16 feet below stream bed level. A silt till stratum overlies the limestone bedrock in borehole 2 at the south end of the bridge while sandy gravel extends to bedrock at borehole 1. The top 3 feet of this gravel is loose and may be classed as relatively recent river alluvium. Gravel also overlies the till in borehole 2 and is in turn blanketed by an alluvium and topsoil cover.
- (2) It is recommended that either wooden piles driven to refusal on bedrock or in the dense soil above or a spread footing with sheet pile wall protection be used to carry the abutment loads. The permissible loading of a pile driven to refusal will be limited

to its safe structural capacity when considered as a short column. Spread footings founded 4 feet below stream bed level may be safely loaded to 4 ksf. The protective sheet pile wall should be driven 10 feet below stream bed level.

(3) The abutment and wing walls should be designed for an earth pressure given by the coefficient $K = 0.35$, allowance being made for surcharge loads.

Descriptions of the site, details of the field work carried out and brief comments on the soil and field conditions as they affect foundation design and construction are given in the following sections.

THE SITE

Barrie Hill Bridge spans Lutrell Creek about 3 miles north west of Eramosa. It is located between concessions I and II, in the Township of Eramosa, Wellington County (Key Plan, Dwg. 1)

The existing bridge consists of a simply supported reinforced concrete beam structure and spans approximately 40 feet. It appeared to be structurally sound but a close examination was not possible since the stream was frozen at the time of the investigation.

At the bridge crossing the stream flows in an almost east to west direction. The ground upstream and downstream of the bridge supports a shrub and small tree cover. The road embankment rises about 4 feet above existing ground on the west sides of the bridge and about 7 feet on the east side.

FIELD WORK AND SUBSOIL

Two boreholes, preceded by dynamic cone tests, were put down at the positions indicated on the site plan, Dwg. 1. Borehole 1 was drilled from the ice cover at the north east side of the bridge while boring 2 was drilled from the bank at the south west side of the bridge.

The elevations of the boreholes are referred to a temporary bench mark on the centre of the top of the bridge deck (Dwg. 1.) The elevation of the mark has been given as 97.5 ft.

Dolomite bedrock was encountered at El 71 in both boreholes. AX coring produced samples up to 3 inches long. The dolomite effervesced on addition of dilute hydrochloric acid. It is cream white in colour probably due to weathering action. It is believed that the dolomitic limestone belongs to the Guelph - Lockport formation.

A 10 ft. thick dense silt-till layer overlies bedrock to stream bed at the borehole 1 location. The top 3 feet of this deposit is in a loose state, probably due to scour action during periods of heavy flood. A thin topsoil cover followed by granular alluvium and medium dense to dense sandy gravel overlies the silt in borehole 2.

Borehole records, which include the depths drilled, soils encountered, samples recovered and field measurements made are compiled in Dwgs. 2 and 3.

FOUNDATION CONSIDERATIONS

It is believed that the most satisfactory foundation solution is to support this bridge replacement structure on piles driven to refusal either in the dolomite bedrock or in the dense gravel or silt till strata overlying bedrock.

An alternative method would be to incorporate steel sheet piling around each abutment and place the footing at about El 84 in the

medium dense gravel. Both methods of founding are considered below:

(1) Piled Foundation - It is expected that refusal of timber piles to penetration will occur near the bottom of the sand and gravel stratum. Some piles may penetrate through the sand and gravel to the dolomite bedrock.

The permissible loading of a pile driven to refusal in such a stratum will be limited to its safe structural capacity when considered as a short column.

Refusal to penetration of timber piles should be taken as 6 blows per inch under a driving energy of 8750 ft.lbs. per blow. Overdriving or the use of a heavy hammer should be avoided.

Since the soils are in a relatively uniform condition at the proposed founding level, differential settlements will be of a small order, and will take place during the construction of the bridge.

The abutment wall should be taken down at least to stream bed level and a protective sheeting driven along the face of the wall. Interlocking steel sheet piles driven about 5 feet below stream bed level and anchored to the abutment and wing walls should be satisfactory.

(2) Strip Footing - If the abutment is founded directly on the sandy gravel stratum it must be located below the depth of maximum scour. Reference to the borehole logs shows that the alluvium extends to about 3 feet below river bed level. This is believed to be maximum scour depth. It will be necessary to drive sheeting around the abutment in advance of excavation. This sheeting can be incorporated in the abutment structure and will provide protection against scour. For this arrangement footings founded at El 83 may be safely loaded to 4 ksf. The sheet piling should be driven to El 77 to prevent heave

of the excavation bottom during construction.

EARTH RETAINING WALLS

For both footing arrangements suggested above, well compacted free-draining granular fill should be placed behind the abutment and wing walls. In order to allow for the rigidity of the walls it is recommended that an earth pressure coefficient $K = 0.35$ be assumed for design purposes. The earth pressure acting at any depth, h , below the top of the fill will be given by:

$$P = K \{ \gamma (h-h) + \gamma^1 h^1 + q \}$$

where: γ and γ^1 are the bulk and submerged densities of the backfill soil (assumed 130 and 70 pcf)

h^1 is the height of the water table above the point being considered.

q is the surcharge, if any, acting at the top of the wall.

In the above expression it is assumed that the ground water will be drained, by weepers through the wall, down to the level of the water in the stream.

Since the soils overlying the dolomitic limestone are relatively pervious, construction of embankments for the approach roads will present no stability or settlement problem.

If you have any queries after you have examined the results of this investigation we shall be pleased to discuss them with you.

Yours very truly,

T.H. Hanna

T.H. Hanna, P. Eng.

THH/bs.
Encls.
J1331.

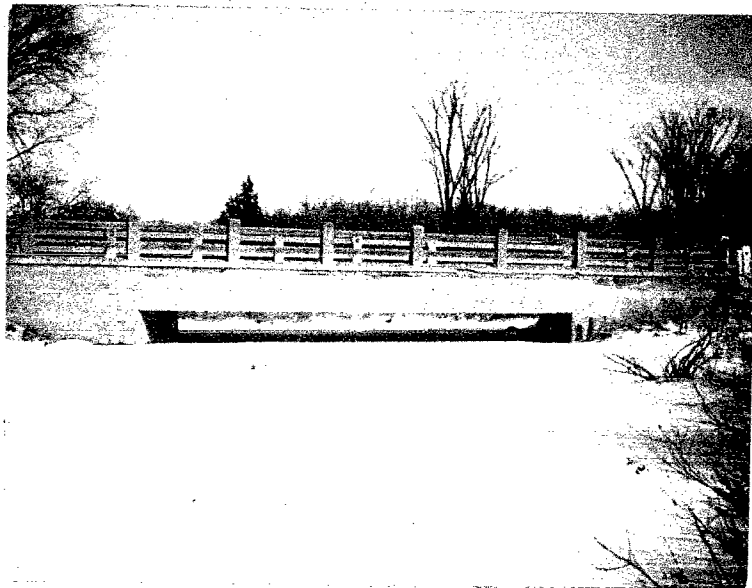


View Looking North East



View Looking South West

View Looking North





View Looking East



View Looking West

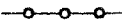
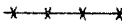

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SITE INVESTIGATIONS SOIL MECHANICS CONSULTATION




DRAWING No. 2
PROJECT No. J1331.

LEGEND

PENETRATION RESISTANCE



2" O.D. SPLIT TUBE 
2" I.D. SHELBY TUBE 
2" DIA. CONE 

SHEAR STRENGTH




UNDRAINED TRIAXIAL AT OVERBURDEN PRESSURE 
UNCONFINED COMPRESSION 
VANE TEST AND SENSITIVITY (S) 

NATURAL MOISTURE CONTENT AND LIQUIDITY INDEX




ATTERBERG LIMITS

LIQUID LIMIT 
PLASTIC LIMIT 

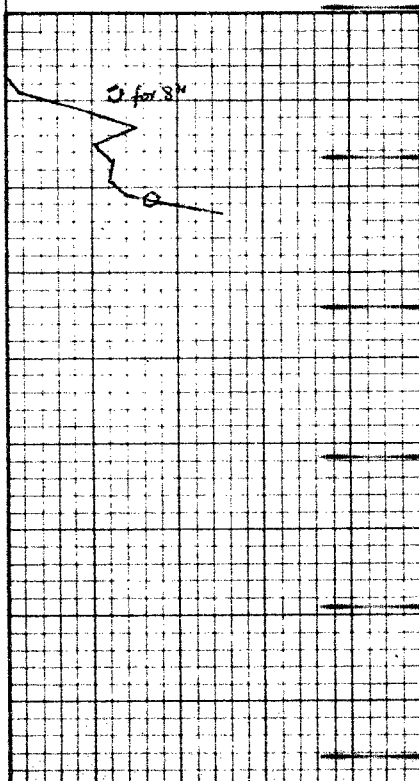
SAMPLE TYPE

2" O.D. SPLIT TUBE 
2" I.D. SHELBY TUBE 
3" O.D. SHELBY TUBE 

BOREHOLE No. 1
PROJECT Barrie Hill Bridge Over Luttrell Creek.
LOCATION Township of Eramosa, Wellington County, Ont.
HOLE LOCATION See Dwg. 1.
HOLE ELEVATION 90.5 ft.
DATUM See Dwg. 1.

SYMBOL	SOIL DESCRIPTION	ELEV FEET	DEPTH FEET	PENETRATION RESISTANCE 350 FT. LB BLOWS/FT		NATURAL MOISTURE CONTENT AND ATTERBERG LIMITS % DRY WEIGHT	SAMPLE TYPE AND NO	NATURAL UNIT WEIGHT P.C.F.
				20	40			
	Top of Ice	90.5	0					
	Stream Bed	88.5						
	ALLUVIUM-loose to medium dense brown fine to coarse gravel with coarse sand.	87.0						
	GRAVEL-medium dense becoming dense brown fine to coarse with coarse sand sizes and limestone cobbles.	84.0						
	DOLOMITE-light grey, fine, grained, calcareous. No loss of pressure during coring.	71.0	20					
	End of Bore	65.0						
Notes: 1) Hole augered by continuous flight methods to 95 ft. Hole completed using wash boring and rotary core drilling methods. 2) Dynamic cone driven about 6 ft. south west of borehole. 3) Hole caved at 7 ft.								

PENETRATION RESISTANCE 350 FT. LB
BLOWS/FT
SHEAR STRENGTH PSF



NATURAL MOISTURE CONTENT AND ATTERBERG LIMITS % DRY WEIGHT		SAMPLE TYPE AND NO	NATURAL UNIT WEIGHT P.C.F.
		Recovery	
		SS1	
		SS2	
		AX Core	
		88%	

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
SITE INVESTIGATIONS · SOIL MECHANICS CONSULTATION

LEGEND

DRAWING No. 3
PROJECT No. J1331.

BOREHOLE No. 2
PROJECT Barrie Hill Bridge Over Luttrell Creek.
LOCATION Township of Eramosa, Wellington County, Ont.
HOLE LOCATION See Dwg. 1.
HOLE ELEVATION 90.5 ft.
DATUM See Dwg. 1.

PENETRATION RESISTANCE

2" O.D. SPLIT TUBE 
2" I.D. SHELBY TUBE 
2" DIA. CONE 
SHEAR STRENGTH
UNDRAINED TRIAXIAL AT OVERBURDEN PRESSURE 
UNCONFINED COMPRESSION 
VANE TEST AND SENSITIVITY (S) 

NATURAL MOISTURE CONTENT AND LIQUIDITY INDEX

ATTERBERG LIMITS

LIQUID LIMIT

PLASTIC LIMIT

SAMPLE TYPE

2" O.D. SPLIT TUBE

2" I.D. SHELBY TUBE

3" O.D. SHELBY TUBE

SYMBOL	SOIL DESCRIPTION	ELEV FEET	DEPTH FEET	PENETRATION RESISTANCE		350 FT LB BLOWS/FT 80	NATURAL MOISTURE CONTENT AND ATTERBERG LIMITS % DRY WEIGHT	SAMPLE TYPE AND NO	NATURAL UNIT WEIGHT P.C.F.	
				20	40					60
				SHEAR STRENGTH						PSF
	TOPSOIL-black, organic.	90.5	0							
	ALLUVIUM-black organic sand, peat, and gravel.	88.5								
	GRAVEL-medium dense to dense fine to coarse with some coarse sand.	85.5								
	SILT TILL-dense light brown with occasional sand partings. Some pebbles and sand below 15 feet.	81.0	10							
	DOLOMITE-light grey, fine grained calcareous. No loss of pressure during coring.	71.0	20							
	End of Bore	64.0								
Notes:	1) Hole augered by continuous flight methods to 19.5 ft. and uncased. BX casing then installed to 19.5 ft. Bedrock proved using rotary core drilling methods.									
	2) Dynamic cone driven before boring was sunk and about 6 feet east, of borehole.									

Recovery.	
	SS1
	SS2
	SS3
	Ax Core 81%.

Recovery.

SS1

SS2

SS3

Ar Core

81%