

#62-F-316 M

HAWKESVILLE BRIDGE

LOT 2, CON. XII

WELLESLEY TWP.

STRUCTURE SITE No. 34-197

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Report on
SOIL INVESTIGATION
for
HAWKESVILLE BRIDGE
LOT 2, CONCESSION XII,
TOWNSHIP OF WELLESLEY
COUNTY OF WATERLOO

34-197

by
DOMINION SOIL INVESTIGATION LIMITED
363 Queens Avenue
LONDON ONTARIO

Reference No. 2-9-L4

September 1962

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INTRODUCTION

Verbal authorization was received from Mr. E. G. Hachborn on the 21st of September 1962 to carry out a soil investigation at the site of an existing masonry arch bridge in Wellesley Township. The number and location of the holes were agreed during a visit to the site made by the writer and Mr. Hachborn on September 21st.

The purpose of the investigation was to reveal the subsurface conditions and to determine the necessary soil properties for the design and construction of a new bridge which will replace the existing structure.

I DESCRIPTION OF SITE AND GEOLOGY

The site is located in a shallow valley to the south of the Village of Hawkesville. The bridge carries a tarmac road across the Donald Creek which is a tributary stream of the Conestoga River. At the time of this investigation the bed of the creek was dry in the immediate vicinity of the bridge.

The area is part of the heavily glaciated Stratford Till Plain which borders the Waterloo Hills area at this point. The very dense strata which were encountered almost from surface are evidence of considerable ice pressure.

II FIELD WORK

Field work was carried out during the period 21st to 25th September 1962 and consisted of 2 boreholes at the locations shown on enclosure 2. The holes were partly lined with Bx casing and advanced mainly by diamond drilling using a Bxt core barrel. This procedure was necessitated by the large number of cobble or boulder size fragments encountered. Standard Penetration tests were made at frequent intervals using a 2-inch O.D. split spoon. This test provided disturbed samples of the strata and gave a measure of their relative density or consistency.

The results of the field tests are recorded on geotechnical data sheets comprising enclosures 3 and 4. Elevations have been referred to a local benchmark shown on enclosure 2.

III SUBSURFACE CONDITIONS

Apart from 4 feet of brown silty sand in borehole 2, the strata consist of a very dense gravelly silt till throughout the depth explored. The silt possesses only slight cohesion and is mixed with varying amounts of sand, fine and coarse gravel, and cobbles or boulders. The largest pieces of core recovered were 6 inches long so that it has not been established whether boulder size particles (greater than 8 inches) are present. The content of granular material in the till ranges from 20 per cent upwards.

The water level in the two boreholes varied by almost 2 feet at the termination of the field work. The average elevation is 84.5 feet or just below the bed of the creek.

IV BEARING CAPACITY AND SETTLEMENT

The lowest point on the bed of the creek is approximately El. 85 feet and it is assumed that footings will be located near El. 80 feet. This level is well into the dense till at both boreholes. Although the Standard Penetration results are high and erratic, partly because of the large particle sizes encountered, they provide sufficient evidence that the soil has a high load bearing capacity. Accordingly, a gross soil pressure of 10,000 p.s.f. is proposed for the design of spread footings. Provided that the footings are poured on an undisturbed grade, the resulting settlement is expected to be negligible.

V CONSTRUCTION

The footing grade should be carefully examined for local weaknesses, although these are unlikely to be found in such strata. Any loose pockets should be removed and replaced with concrete. Mechanical compaction should be avoided because this is likely to disturb the silt matrix.

It may be necessary to lower the water table at the time of construction. It is recommended that this be done by pumping from sumps or trenches dug adjacent to the excavation, at as many points as required. Pumping from the excavation itself should be avoided because this may tend to loosen the grade.

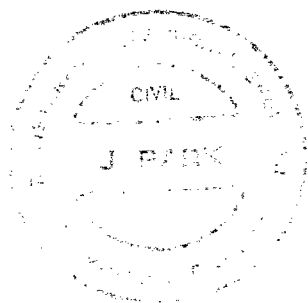
VI SUMMARY

1. The strata consist of a very dense sandy, gravelly, silt till with cobbles or boulders.
2. A gross soil pressure of 10,000 p.s.f. is recommended for the design of spread footings.
3. At the time of this investigation the water table was located at El. 84.5 approximately. It is proposed that dewatering should be carried out by pumping from sumps or trenches adjacent to the excavation.

VII REFERENCES

1. The Physiography of Southern Ontario by L.J. Chapman and D.F. Putman of the Ontario Research Foundation - University of Toronto Press 1951.

2. Procedures for Testing Soils, ASTM, April 1958, pp. 186 to 198 (Unified Soil Classification System, by A.A. Wagner) London.
3. Proceedings of the 4th International Conference on Soil Mechanics and Foundation Engineering (Research on Determining the Density of Sands by Spoon Penetration Testing, by H.J. Gibbs and W.G. Holtz of the United States Bureau of Reclamation).
4. Terzaghi and Peck: Soil Mechanics in Engineering Practice. John Wiley and Sons, New York 1948.



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A handwritten signature in dark ink, appearing to read "James Park".

James Park, M.Sc., P.Eng.

Encl.
JP/mc

LIST OF SYMBOLS, ABBREVIATIONS AND NOMENCLATURE.

SOIL COMPONENTS AND GROUND WATER CONDITIONS.

BOULDER	COBBLE	GRAVEL		SAND			SILT	CLAY	ORGANICS	BEDROCK	GROUND WATER LEVEL	DEPTH OF CAVE-IN
		COARSE	FINE	COARSE	MEDIUM	FINE						
Ø > 8"	3"	3/4"	4.76mm	2.0	0.42	0.074	0.002	>	NO SIZE LIMIT			
U.S. Standard Sieve Size		No. 4		No. 10	No. 40	No. 200						

SAMPLE TYPES.

AS	Auger sample	RC	Rock core	TP	Piston, thin walled tube sample
CS	Sample from casing	%	Recovery	TW	Open, thin walled tube sample
ChS	Chunk sample	SS	Split spoon sample	WS	Wash sample

SAMPLER	ADVANCED BY	static weight	w
"	"	pressure	p
"	"	tapping	t

OBSERVATIONS
MADE WHILE
CORING

	Steady pressure
	No pressure
	Intermittent pressure

	Wash water retained
	Wash water lost

PENETRATION RESISTANCES.

DYNAMIC PENETRATION RESISTANCE : to drive a 2" \emptyset , 60° cone attached to the end of the drilling rods into the ground, expressed in blows per foot

STANDARD PENETRATION RESISTANCE, -N- : to drive a 2" outside dia, split spoon sampler 1 foot into the ground, expressed in blows per foot.

EXTRAPOLATED -N- VALUE

The energy for the penetration resistances is supplied by a 140 lb. hammer falling 30 inches

SYMBOL



322

SOIL PROPERTIES.

W %	Water content	γ	Natural bulk density (unit weight)	k	Coeff. of permeability
LL %	Liquid limit	e	Void ratio	C	Shear strength in terms of
PL %	Plastic limit	RD	Relative density	ϕ	Angle of int. friction - total stress
PI %	Plasticity index	C _v	Coeff. of consolidation	C _i	Cohesion in terms of
LI	Liquidity index	m _v	Coeff. of volume compressibility	ϕ'	Angle of int. friction - effective stress

UNDRAINED SHEAR STRENGTH.

— DERIVED FROM —

TRIAXIAL
COMPRESSION TEST

UNCONFINED

LABORATORY

FIELD

VANE TEST

POCKET
PENETROMETER
TEST

Strain of failure is represented by direction of stem

20%
15% + 5%
10%

$$St : \text{sensitivity} = \frac{\text{shear strength in undisturbed state}}{\text{shear strength in remoulded state}}$$

SOIL DESCRIPTION.

COHESIONLESS SOILS :

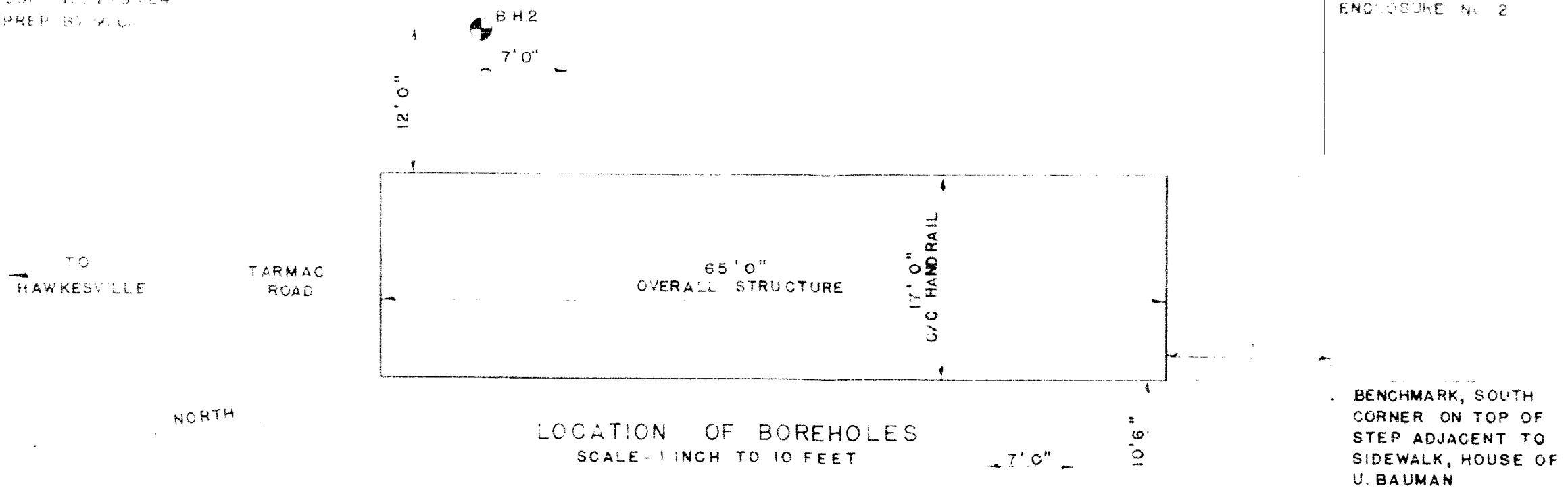
RD :

COHESIVE SOILS :

c lbs/sq ft

Very loose	0 - 15 %
Loose	15 - 35 %
Compact	35 - 65 %
Dense	65 - 85 %
Very dense	85 - 100 %

Very soft	less than 250
Soft	250 - 500
Firm	500 - 1000
Stiff	1000 - 2000
Very stiff	2000 - 4000
Hard	over 4000



EL. 100.0

90.0

80.0

70.0

60.0


B.H.2

B.H.1

DRY BED
(DONALD CREEK)

LEGEND

 SILTY SAND

 DENSE GRAVELLY SILT
TILL WITH COBBLES
OR BOULDERS

SUBSURFACE PROFILE
(LOOKING EAST)
SCALE - 1 INCH TO 10 FEET

GEOTECHNICAL DATA SHEET FOR BOREHOLE

OUR REFERENCE NO. 2-9-1-1

CLIENT: McCaig, Taylor and Macpherson Limited
 PROJECT: Hawkesville Bridge
 LOCATION: Donald Creek, Township of Wellesley
 DATUM ELEVATION: 100.0 feet

METHOD OF BORING: *See Remarks*
 DIAMETER OF BOREHOLE:
 DATE: 25 September 1962

ENCLOSURE NO.

5

ELEVATION ft.	DEPTH ft.	STRATIFICATION DESCRIPTION	STRATIFICATION SYMBOL	SAMPLES			PENETRATION RESISTANCE blows per foot				CONSISTENCY water content %		REMARKS
				NUMBER	TYPE	28 Days	40	40	60	50	100	Pl	
89.2	0	Ground surface											
		Organics											
	5	85.4 20/7/62		1	SS	137							
				2	SS	140							
	10	Very dense gravelly, sandy silt till, with cobbles or boulders		3	SS	125							
				4A	Bxt								
				4B	SS	126							
	15			5	SS	130							
				6A	Bxt								
	20			6B	SS	202							
	25			7	SS	100							
82.7		End of borehole											

VERTICAL SCALE: 1 IN. TO 7 FT.

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MADE: MC

CHD: JH



GEOTECHNICAL DATA SHEET FOR BOREHOLE 3

OUR REFERENCE NO. 2-1-14

CLIENT McCarper, Filer and Hachborn Limited
 PROJECT Haslesville Bridge
 LOCATION Donald Creek, Township of Wellestree
 DATUM ELEVATION 100.0 feet

METHOD OF BORING See Remarks
 DIAMETER OF BOREHOLE
 DATE 24 September 1962

ENCLOSURE NO. 4

ELEVATION ft	DEPTH ft	STRATIFICATION DESCRIPTION	STRATIFICATION SYMBOL	SAMPLES			PENETRATION RESISTANCE blows per foot					CONSISTENCY water content %		REMARKS
				NUMBER	TYPE	N or Advancement of Sample	20	30	60	80	100	W	U	
89.5	0	Ground surface												
		Gravelly silty sand												
85.5	5	85.7 25/20/62		1	SS	49								The hole was inspired to 10 feet and lined with Bx casing to 15 feet. Advance- ment below 10 feet using Bxt core barrel.
				2	SS	166								
	10			3	SS	300								
				4	Bxt									
				5	SS	136								
	15	Very dense gravelly, sandy silt till, with cobbles or boulders		6	SS	300								
				7A	Bxt									
	20			7B	SS	170								
				8A	Bxt									
	25			8B	SS	107								
83.5		End of borehole												