

#62 - F - 315 M

BOOMER CREEK

BRIDGE

LOT 1, CON. XI/XII

WELLESLEY TWP.

WATERLOO CTY.

MESSRS. McCARGAR, FILER AND HACHBORN
CONSULTING ENGINEERS
30 Francis Street South
KITCHENER ONTARIO

Report on
SOIL INVESTIGATION
for
BOOMER CREEK BRIDGE
LOT 1, CONCESSIONS XI AND XII
TOWNSHIP OF WELLESLEY
COUNTY OF WATERLOO

by
DOMINION SOIL INVESTIGATION LIMITED
363 Queens Avenue
LONDON ONTARIO

Reference No. 2-9-L5

September 1962

CONTENTS

	<u>Page</u>
INTRODUCTION	1
I DESCRIPTION OF SITE AND GEOLOGY	2
II FIELD WORK	2
III SUBSURFACE CONDITIONS	2
IV BEARING CAPACITY AND SETTLEMENT	3
V CONSTRUCTION	3
VI SUMMARY	3
VII REFERENCES	4

ENCLOSURES

	<u>No.</u>
SYMBOLS, ABBREVIATIONS AND NOMENCLATURE	1
LOCATION OF BOREHOLES AND SUBSURFACE PROFILE	2
GEOTECHNICAL DATA SHEETS	3 & 4

INTRODUCTION

Verbal authorization was received from Mr E G Hachborn on the 21st of September 1962 to carry out a soil investigation at a site in Wellesley Township where it is proposed to replace a temporary culvert, carrying a gravel road across Boomer Creek, with a new rigid-frame single-span bridge. 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 this investigation was to reveal the subsurface conditions and to determine the necessary soil properties for the design and construction of the new bridge.

I DESCRIPTION OF SITE AND GEOLOGY

The site is located in a shallow valley to the south of the Village of Hawkesville. The gravel road crossing Boomer Creek is carried at present by a 6-foot diameter steel pipe which replaces an earlier structure now demolished. The creek is a tributary stream of the Conestoga River which can be seen from the north of the village.

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 from close to the surface are evidence of considerable ice pressure.

II FIELD WORK

Field work was carried out on the 26th and 27th of September 1962 and consisted of 2 boreholes at the locations shown on enclosure 2. The holes were partly lined with Bx casing and advanced by a combination of washboring and diamond drilling using a Bxt core barrel. This latter 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

Details of the stratification appear on the data sheets and a general picture is provided by the subsurface profile shown on enclosure 2.

Above El. 90 to 91 the soil is a loose to compact fill which provides the approaches to the present culvert. The material is the local till, and some of it may have been in place since the construction of the original bridge.

Below the fill, near El. 91, the natural strata are very dense throughout the depth explored. A brown gravelly silt till containing cobble or boulder fragments extends to 27'6" at each

borehole. Pieces of core up to 6 inches in length were recovered from the larger particles. The material possesses slight cohesion and the content of granular material ranges from 20 per cent upwards.

A 12-inch clay layer was encountered near El. 70 in borehole 1 and the holes were terminated in a stratum of very dense silty sand.

The level of water in the boreholes at the termination of the field work corresponded approximately to that in the creek.

IV BEARING CAPACITY AND SETTLEMENT

The bed of the creek lies between Els. 90 and 91 which corresponds to the surface of the natural strata. It is assumed that footings for the new bridge will be located at or near El. 86 feet. Although the Standard Penetration results in this stratum 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 at any level within the natural till layer. 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 will be necessary to divert the surface water and it may also be necessary to lower the groundwater 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 may be required. Pumping from the excavation itself should be avoided because this may tend to loosen the grade.

VI SUMMARY

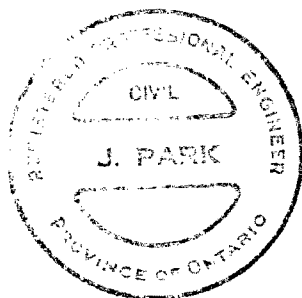
1. The strata consist of 7 to 10 feet of silt fill and below

this a very dense gravelly, silt till with cobbles or boulders, extending to 27'6". Layers of clay and dense sand were explored for a further 4 feet.

2. A gross soil pressure of 10,000 p.s.f. is recommended for the design of spread footings at or near El. 86.0 feet.
3. 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.



Encl.
JP/mc

DOMINION SOIL INVESTIGATION LIMITED

A handwritten signature in cursive script that reads "James Park".

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

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
$\emptyset > 8"$	$3" \text{ to } 8"$	COARSE FINE	COARSE MEDIUM FINE	$0.075 \text{ to } 0.002$	$0.002 \text{ to } 0.0002$	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

Washwater returns
 Washwater lost

PENETRATION RESISTANCES.

DYNAMIC PENETRATION RESISTANCE : to drive a 2" ϕ , 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 :



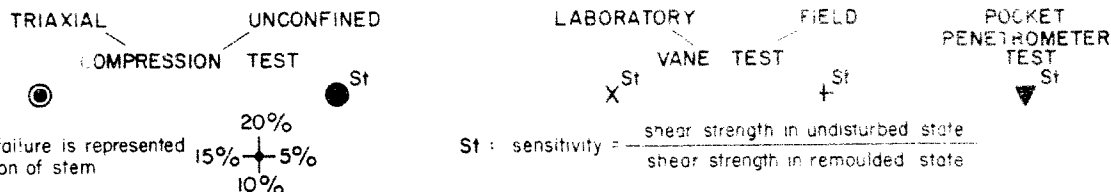
322

SOIL PROPERTIES.

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

UNDRAINED SHEAR STRENGTH.

— DERIVED FROM —



SOIL DESCRIPTION.

COHESIONLESS SOILS :

RD :

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

COHESIVE SOILS :

C lbs./sq ft

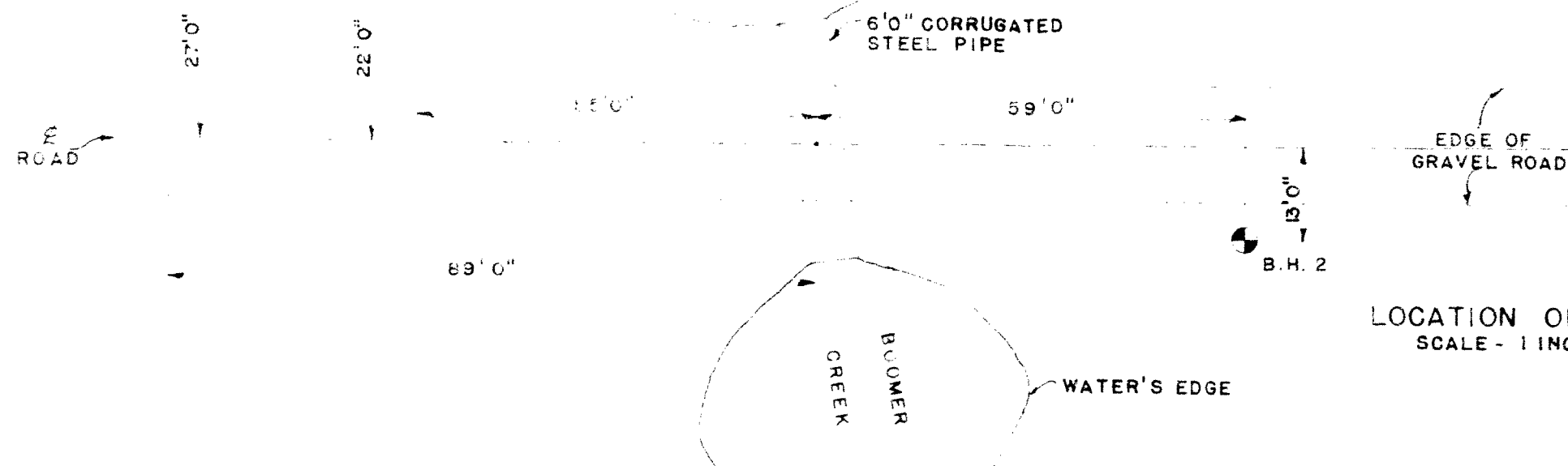
Very soft	less than 250
Soft	250 - 500
Firm	500 - 1000
Stiff	1000 - 2000
Very stiff	2000 - 4000
Hard	over 4000

JOB NO. 2-9-L5

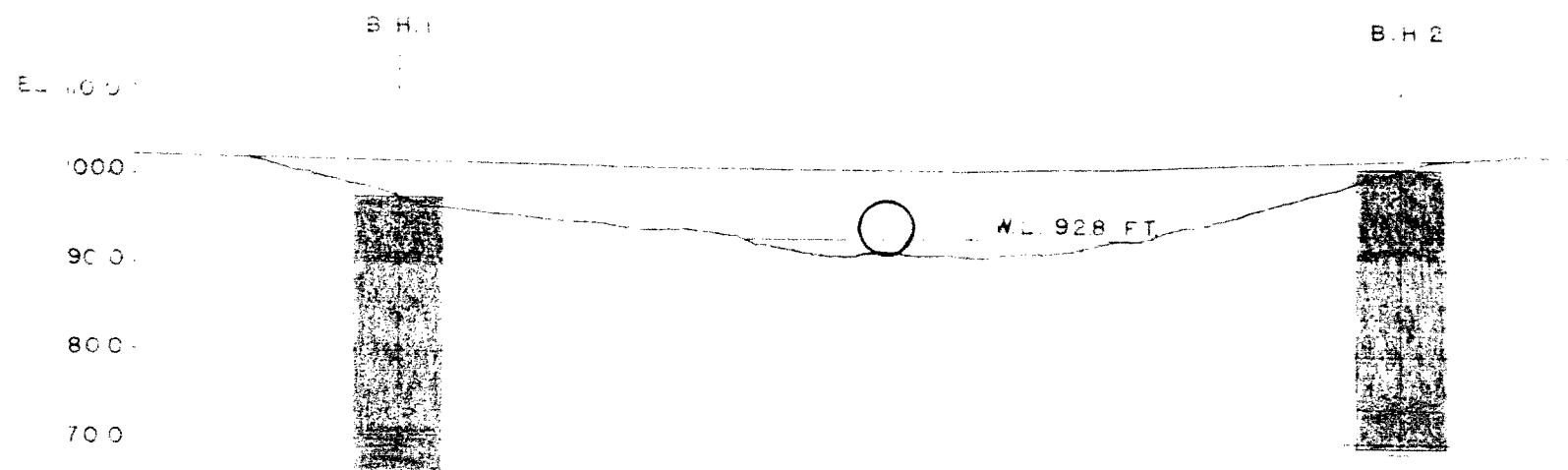
PREP. BY M. G.

ENCLOSURE 2

B.M. NAIL IN
TELEPHONE POLE
EL. 100.0 FEET



LOCATION OF BOREHOLES
SCALE - 1 INCH TO 20 FEET



SUBSURFACE PROFILE
(LOOKING NORTH)
SCALE - 1 INCH TO 20 FEET

LEGEND

- FILL
- VERY DENSE GREY-BROWN GRAVELLY SILT TILL, WITH COBBLES OR BOULDERS
- BROWN SILTY CLAY
- GREY-BROWN FINE TO COARSE SILTY SAND

GEOTECHNICAL DATA SHEET FOR BOREHOLE

OUR REFERENCE NO. 10-5-1-1

CLIENT: McArthur, Miller and Bachhorn Limited
PROJECT: Roeder (road) bridge
LOCATION: Hattersville, Township of Collesier
DATUM ELEVATION: 100.0 feet (See enclosure 2)

METHOD OF BORING: See Remarks
DIAMETER OF BOREHOLE: 4 inches

DATE: 26 September 1962

ENCLOSURE NO. 3

ELEVATION H	DEPTH H	STRATIFICATION DESCRIPTION	STRATIFICATION SYMBOL	SAMPLES			PENETRATION RESISTANCE Blows per foot					CONSISTENCY Water content %			REMARKS
				NUMBER	TYPE	No. of Adjustment of Sample	20	40	60	80	100	PI	W	LI	
100.0	0	Ground surface													
		ORGANICS													
	5	Brown gravelly silt fill		1	SS	31									0' dry 7.6' EXT. CORAL BARREL
99.5	10			2	SS	99									20' washing
	10			3	SS	300									30'
				4A	Bxt										
				4B	SS	142									
				5A	Bxt										
15		Very dense grey-brown gravelly silt fill, with cobbles or boulders		5B	SS	143									
				6A	Bxt										
20				6B	SS	180									
				7A	Bxt										
25				7B	SS	107									
27.5		Brown silty clay													
28.5		Grey-brown fine to coarse silty sand		8	SS	120									
30		End of borehole													

GEOTECHNICAL DATA SHEET FOR BOREHOLE ... 2 ...

OUR REFERENCE NO. 2-9-15

CLIENT McCargher, Piler and Bachhorn Limited
PROJECT Basher Creek Bridge
LOCATION Hawkesville, Township of Wellesley
DATUM ELEVATION 100.0 feet (see enclosure 20)

METHOD OF BORING See Remarks
DIAMETER OF BOREHOLE

DATE 27 September 1962

ENCLOSURE NO. 4

ELEVATION ft	DEPTH ft	STRATIFICATION DESCRIPTION	STRATIFICATION SYMBOL	SAMPLES			PENETRATION RESISTANCE					CONSISTENCY water content % PL W LI	REMARKS
				NUMBER	TYPE	2' or Advancement of sampler	20	40	60	80	100		
101.2	0	Ground surface											
		Brown gravelly silt fill		1	SS	10							dry
103.7	2.5	Fine silty sand fill, traces of clay & organics		2	SS	4							1st core retrieved
101.2	10			3	SS	54							
				4	SS	150							
	15	Very dense grey brown gravelly silt till, with cobbles or boulders		5	SS	200							
				6A	Ext								
	20			6B	SS	200							
	25			7	SS	300							
				8A	Ext								
100.7	30	Grey-brown fine to coarse silty sand		8B	SS	108							
		End of borehole											