

63-F-231M

BRIDGE No. B-55

COUNTY ROAD 13

MEMORANDUM

TO: Mr. A. Stermac,
Principal Foundation Engineer,
Materials and Research Section
Room 107, Lab. Bldg.

FROM: G. C. E. Burkhardt

DATE: January 21, 1964.

OUR FILE REF.

IN REPLY TO

SUBJECT: County of Huron
Bridge No. B-55 on County Road 13
Lots 40 and 55, Bayfield Con.
Township of Goderich,
Structure Site No. 13-191

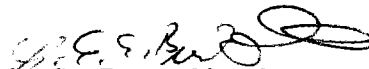
Attached please find one copy of the Foundation Report, by Dominion Soil Investigation Limited, for your comments.

It is proposed to place a 35 foot span concrete rigid frame at this site, founded on spread footings at El. 802.0₊.

We intend to approve the plans not later than Jan. 31st, 1964. We would appreciate it very much, if we could have your comments on/or before above mentioned date.

GCEB/es

cc. J. Walter


G. C. E. Burkhardt,
for K. L. Kleinstieber,
Mun. Bridge Liaison Engineer.

NO COMMENT
BY PHONE

JAN. 22. 1964 AGSTERMAC

BA. 1741

MR. J. W. BRITNELL
COUNTY ENGINEER
COUNTY OF HURON
COURT HOUSE
GODERICH ONTARIO

Report on
SOIL INVESTIGATION

for
ROAD BRIDGE
COUNTY ROAD NO. 13
COUNTY OF HURON

63-F-231M

by
DOMINION SOIL INVESTIGATION LIMITED
363 Queens Avenue
LONDON ONTARIO
Reference No. 3-12-L1
December 1963

CONTENTS

	<u>Page</u>
SUMMARY.....	1
I INTRODUCTION.....	2
II FIELD WORK.....	2
III SUBSURFACE CONDITIONS.....	2
IV FOUNDATIONS.....	3
V REFERENCES.....	4

ENCLOSURES

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

SUMMARY

The strata encountered consist of 5 to 6 feet of fill, gravel and sand extending to 10 to 11 feet, stiff to very stiff silty clay extending to about 20 feet, and thereafter a hard clayey silt till.

It is recommended that the structure should be supported on spread footings located at or below El.84 feet, using a gross soil pressure of 3500 p.s.f.

It will be necessary to divert the flow of groundwater from the gravel and sand layer, and particular attention should be given to the presence of cohesionless sand and silt seams within the clay stratum.

I INTRODUCTION

Verbal authorization was received from Mr. J. W. Britnell to carry out a soil investigation at a site on County Road No. 13, approximately 3 miles south-west of Clinton, where it is proposed to replace an existing road bridge with a new structure.

The new bridge will have a span of 40 feet (\pm) and may be of rigid-frame or freely-supported design. It will be in approximately the same position as the existing structure.

The purpose of this investigation has been to reveal the subsurface conditions and to determine the necessary soil properties for the design and construction of foundations.

II FIELD WORK

Field work was carried out on the 2nd and 3rd of December 1963, and consisted of 2 boreholes at the locations shown on enclosure 2. The holes were advanced by washboring and lined with Bx (3-inch) casing.

Standard Penetration tests were performed at frequent intervals of depth to determine the relative density or consistency of the soil and to recover disturbed samples. Dynamic cone penetration tests were performed adjacent to each borehole. These tests provide a continuous record of penetration resistance and give a qualitative indication of the resistance which may be encountered by piling.

The results of the field tests are recorded on geotechnical data sheets comprising enclosures 3 and 4. Elevations have been referred to the level of the concrete curb at the north-east corner of the existing bridge which is taken as El.100.0 feet.

III SUBSURFACE CONDITIONS

Details of the stratification at each borehole are shown in the data sheets and a general picture of the subsurface conditions is given by the profile on enclosure 2.

Five to 6 feet of fill was found at both boreholes. Below this a natural silty gravel and sand deposit extends to 10 to 11 feet. The consistency of this layer varies from loose to dense, and it is quite pervious.

Below the granular stratum a *stiff* to *very stiff* grey silty clay extends to approximately 20 feet. This layer contains occasional seams of cohesionless sand and silt up to 6 inches in thickness, but it is primarily a cohesive impervious material.

At a depth of 20 feet (\pm) there is a gradual change to a hard, impervious clayey silt till. This material contains 5 to 10% of granular particles generally of subangular shape and less than 1/4 inch in diameter.

IV FOUNDATIONS

The proposed footing depth is 6 feet (\pm) below the bottom of the stream, i.e. El.84 feet. This level lies within the stiff to very stiff grey silty clay stratum which has adequate strength for the support of spread footing foundations. At El.84 the Standard Penetration test showed an N-value of 11 increasing to 17 in borehole 1, and N=21 decreasing to 18 in borehole 2. On the basis of these values a gross* soil pressure of 3500 p.s.f. is recommended for the design of the footings.

Settlement due to consolidation of the clay under the dead load of the structure will take place for several months after completion. The magnitude of this settlement is unlikely to exceed one inch. Some differential settlement may occur because the soil is relatively softer at borehole 1, but it is unlikely to exceed the predicted one inch.

The excavation will encounter a free flow of water through the gravel and sand layer which extends to El.89 compared with a water level in the creek of El.92.5 feet. The diversion of the creek will probably remove most of the water, but if necessary, trenches dug into the clay can be used to cut off any remaining flow towards the excavation.

If the floor of the excavation happens to coincide with one of the cohesionless sand or silt seams, further excavation should be made until cohesive clay is encountered again. The former materials will be highly susceptible to disturbance.

Seepage into the excavation may be expected through the sand and silt layers. This should be collected in sumps dug below the footing grade level, and removed by pumping.

* Including the weight of backfill.

V

REFERENCES

1. The Physiography of Southern Ontario by L. J. Chapman and D. F. Putnam 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).
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.) London, 1957.
4. Terzaghi and Peck: Soil Mechanics in Engineering Practice. John Wiley and Sons, New York 1948.



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
$\phi > 8"$	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

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 :



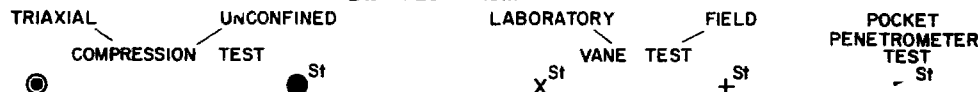
322

SOIL PROPERTIES.

W % Water content	γ 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 effective stress
PI % Plasticity index	C_v Coeff. of consolidation	C' Cohesion
LI Liquidity index	m_v Coeff. of volume compressibility	ϕ' Angle of int. friction

UNDRAINED SHEAR STRENGTH.

— DERIVED FROM —



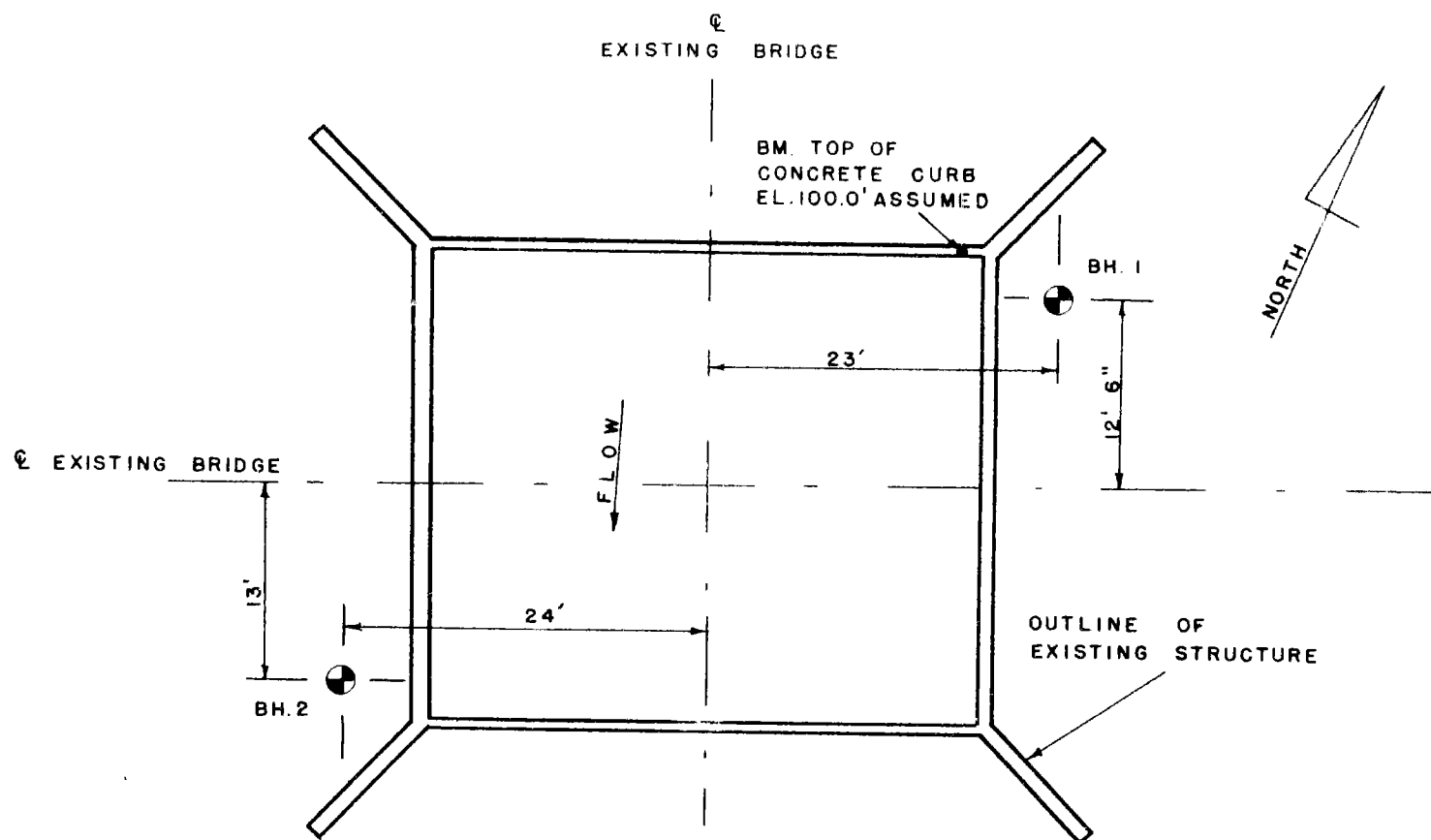
Strain at failure is represented by direction of stem

20%
15%
10%
5%

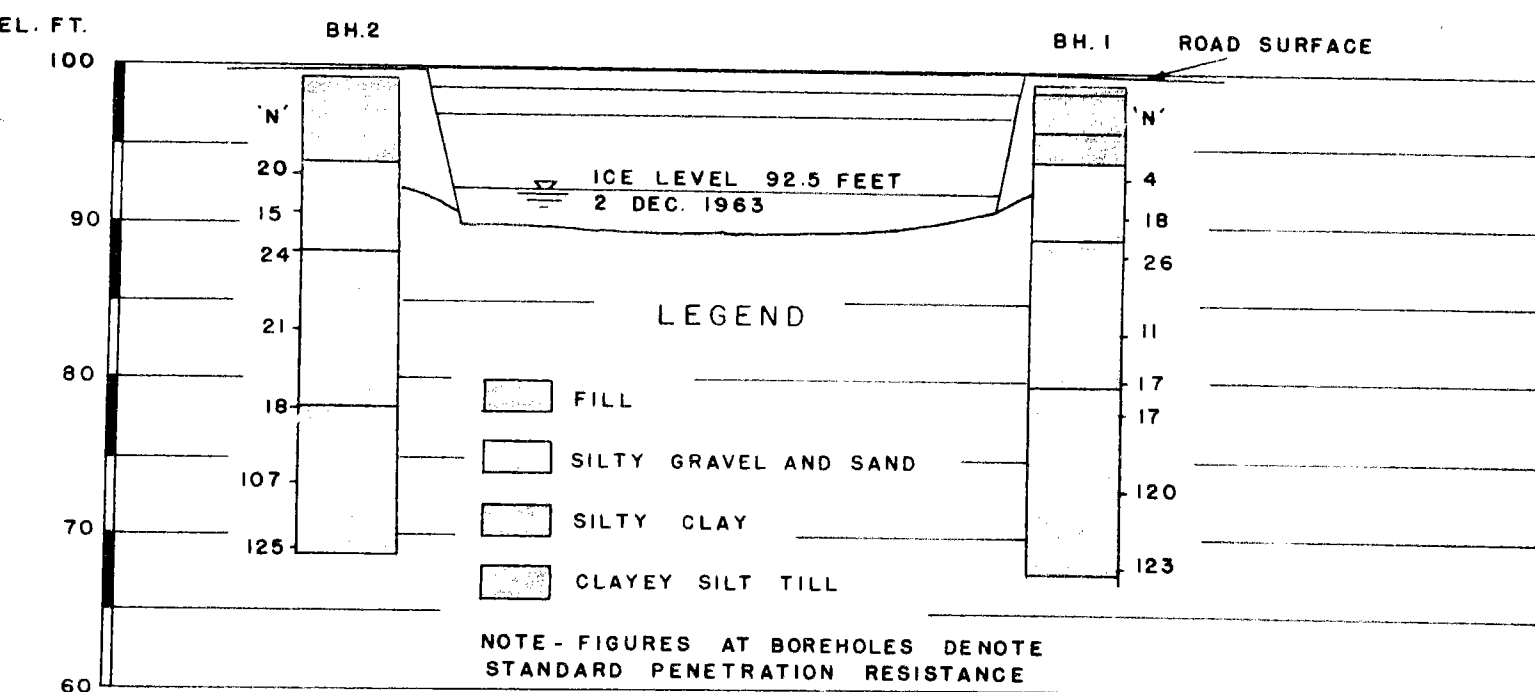
St : sensitivity = $\frac{\text{shear strength in undisturbed state}}{\text{shear strength in remoulded state}}$

SOIL DESCRIPTION.

COHESIONLESS SOILS :	RD :	COHESIVE SOILS :	C lbs/sq.ft.
Very loose	0 - 15 %	Very soft	less than 250
Loose	15 - 35 %	Soft	250 - 500
Compact	35 - 65 %	Firm	500 - 1000
Dense	65 - 85 %	Stiff	1000 - 2000
Very dense	85 - 100 %	Very stiff	2000 - 4000
		Hard	over 4000



LOCATION OF BOREHOLES
SCALE: 1 INCH TO 10 FEET



SUBSURFACE PROFILE
(LOOKING NORTH)
SCALE: 1 INCH TO 10 FEET

GEOTECHNICAL DATA SHEET FOR BOREHOLE

OUR REFERENCE NO. 3-12-11

CLIENT County of Huron
 PROJECT Road Bridge
 LOCATION County Road No. 15
 DATUM ELEVATION See encl. 2

METHOD OF BORING Washboring
 DIAMETER OF BOREHOLE 8 1/2 inch
 DATE December, 1965

ENCLOSURE NO. 3

ELEVATION ft.	DEPTH ft.	STRATIFICATION DESCRIPTION	STRATIFICATION SYMBOL	SAMPLES			PENETRATION RESISTANCE		CONSISTENCY water content %	REMARKS
				NUMBER	TYPE	N - 60 Adjustment of Standard	blows per foot	SHEAR STRENGTH lbs sq ft		
99.4	0	Ground Surface								
		Gravel.								
		Fine silty sand (fill).								
		Soft brown clay fill, traces of organics.								
95	5	Brown, clayey, loose compact and sand, moist.		1	SS	4				WL in creek at 92.5 feet 2 Dec. 1965
				2	SS	18				
90	10			3	SS	26				
		Very silty grey clay, occasional seams of sand or silt (0 to 6" thick), stiff to very stiff.		4	SS	11				
				5	TW	P				
		changing to		6	SS	17				
80	20			7	SS	17				
		Grey clayey silt till, very stiff to hard.		8	SS	120				
75	25			9	SS	123				
70	30									
		End of borehole								

VERTICAL SCALE: 1 IN. TO 5 FT.

DOMINION SOIL INVESTIGATION LIMITED

MADE: SB

CH'D: JP

COUNTY of Huron
 PROJECT Road Bridge
 LOCATION County Road No. 15
 DATUM ELEVATION See encl. 2

METHOD OF BORING Washboring
 DIAMETER OF BOREHOLE 5x (5-inches)
 DATE December, 1963.

ENCLOSURE NO 4

ELEVATION ft	DEPTH ft	STRATIFICATION DESCRIPTION	STRATIFICATION SYMBOL	SAMPLES			PENETRATION RESISTANCE		CONSISTENCY		REMARKS
				NUMBER	TYPE	N- Advancement of Sample	blows per foot	SHEAR STRENGTH lbs/sq ft	water content %	PL W LI	
99.4	0	Ground Surface									
		Dark clayey sandy organic fill.									
95	5			1	SS	20					
		Brown, silty gravel and sand, moist, compact to dense.		2	SS	15					
90	10	clayey		3	SS	24					
		Very silty grey clay, occasional seams of sand or silt (0 to 6" thick), stiff to very stiff.		4	SS	21					
85	15										
		changing to		5	SS	18					
80	20										
		Grey clayey silt till, very stiff to hard.		6	SS	107					
75	25										
70	30	End of borehole		7	SS	125					

2" Ø cone

WL in creek
 El. 92.5 feet
 2 Dec. 1963