

63-F-269 m

BROCKLEY

BRIDGE OVER

DINGMANS CREEK.

WESTMINSTER

Twp.

MEMORANDUM

To: Mr. A. Stermac,
Principal Foundation Engineer,
Materials & Research Section.

FROM: Mr. G.C.E. Burkhardt,
Bridge Division.

DATE: February 27th, 1963.

OUR FILE REF.


IN REPLY TO

SUBJECT: Township of Westminster,
Brockley Bridge over Dingmans Creek,
Lot 13, Con. III/IV,
County of Middlesex,
Structure Site No. 20-363,
Our File No. B.A. 1599.

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

We would like to approve the plans as soon as possible and would appreciate it very much if we could have your comments at your earliest convenience.

GB:ap


G. C. E. Burkhardt,
for K. L. Kleinsteinber,
Municipal Bridge Liaison Engineer.

Comment:

1. Seismic possibility should be analysed and if it exists protective measures should be designed
2. During excavation piping could be created and sheet piling driven to depth below footing equal to distance of water above footing level is recommended. Open pump pumping as mentioned in the report could be detrimental

By phone

afternoon

March 4/6

MESSRS. FRED A. BELL AND ASSOCIATES
CONSULTING ENGINEERS
17 Hincks Street
ST. THOMAS ONTARIO

Report on
SOIL INVESTIGATION
for
BROKLEY BRIDGE
TOWNSHIP OF WESTMINSTER
COUNTY OF ELGIN

MIDDLESEX

65-1 251M

by
DOMINION SOIL INVESTIGATION LIMITED
363 Queens Avenue
LONDON ONTARIO

Reference No. 3-2-L4
February
1963

CONTENTS

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

In accordance with verbal authorization from Mr. R. Lemon, a soil investigation has been carried out at a site in the Township of Westminster where it is proposed to replace an existing road bridge with a new structure.

It is understood that the new bridge will be in approximately the same position as the existing one and will have a span of 50 feet. It is intended that the new structure will be a rigid-frame supported on spread footings.

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 PHYSIOGRAPHY

The site lies in a rural area 6 miles south of the City of London and immediately east of the London and Port Stanley railway. It is located in a wide shallow spillway valley formed between the ridges of the Ingersoll and Westminster Moraines.

The Dingman Creek, which the proposed structure will span, has cut a shallow bed through the fluvial sediments of the original glacial river and now forms the main drainage channel in the area.

Bedrock is believed to lie at a depth of 180 feet below the surrounding surface elevation.

II FIELD WORK

Field work was carried out on the 11th and 12th of February 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. Dynamic cone penetration tests were made adjacent to each borehole and at the two other locations shown on enclosure 2. Standard Penetration tests were made at frequent intervals of depth, to provide disturbed samples of the strata and give a measure of the relative density or consistency of the soil.

The results of the field tests are recorded on geotechnical data sheets comprising enclosures 3 and 4. Elevations have been referred to a benchmark at the west end of the existing bridge. (El. 58.11 feet).

III SUBSURFACE CONDITIONS

Details of the stratification at each borehole are shown on enclosures 3 and 4, and a general picture of the subsurface conditions is given by the profile on enclosure 2.

The sandy strata at the top of each borehole consist partly of backfill placed during construction of the existing bridge and partly of fluvial sediment from the original glacial river.

The very dense grey silt which was encountered at a shallow depth in both holes is a heavily precompressed material containing thin clay seams. Most of this stratum is cohesionless, but there are sufficient clay seams to make it relatively impervious at least in a vertical direction. Between 15 and 18 feet there is a gradual transition to a softer stratified clay layer. This material is also very silty but the clay fraction is predominant.

The results of cone penetration tests 3 and 4 indicate that the soil conditions at these locations are very similar to those at boreholes 1 and 2.

Groundwater was encountered at El. 47.3 feet in both boreholes.

IV FOUNDATIONS

The very dense silt stratum will provide an excellent base for spread footings. The elevation of the bed of the creek is approximately 47 feet, so that allowing for scour it is assumed that footings will be located at or about El. 42 feet. On the basis of the field penetration tests it is recommended that footings located between Els. 43 and 35 should be designed for a gross soil pressure (including the weight of backfill) not exceeding 10,000 p.s.f. Providing that the footings are poured on a clean undisturbed grade the total settlement associated with the recommended pressure is not expected to exceed one inch. In the unlikely event that footings are located below El. 35, the design pressure should be reduced because of the softening in the clay stratum below El. 30.

V CONSTRUCTION

The most effective dewatering procedure will be to drive sheet piles into the silt stratum, say one foot below the proposed footing level, and to excavate within the sheet pile enclosure. If the piling is not required for permanent scour protection, the piles can be recovered later. Seepage water should be removed by pumping from sumps dug below the footing grade. Because of the high permeability of the upper sand stratum, any alternative method such as the use of a diversion channel is unlikely to be effective unless the water table is very low at the time of construction.

The clay seams in the silt stratum occur at random so that the footing grade may or may not lie in cohesive material. At borehole 1 the floor of the excavation is likely to be in cohesionless silt. This material is very susceptible to disturbance from vibration so that special care should be taken in this respect. Any disturbed material should be removed and replaced with concrete. Compaction will only extend the area of disturbance.

A thin blanket of concrete spread on the footing grade as soon as it has been exposed and inspected will act as a useful protection during construction.

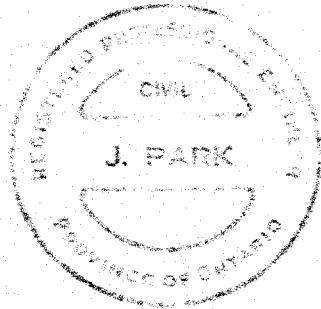
VI SUMMARY

1. The strata consist of approximately 6 feet of sandy fluvial sediments covering a very dense silt. At depths of 15 to 18 feet there is a gradual change to a softer clay stratum.
2. Footings located between Els. 43 and 35 should be designed for a soil pressure not exceeding 10,000 p.s.f.
3. The most effective dewatering procedure will be to drive sheet piles into the silt stratum and to excavate within the sheet-pile enclosure.

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).
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.

5. The Application of Theories of Elasticity and Plasticity to Foundation Problems, Leo Jurgenson, Sc.D., Boston Society of Civil Engineers, May, 1934.



Encl.
JP/mc



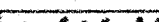
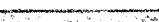
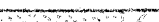
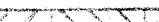
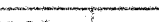
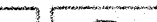


DOMINION SOIL INVESTIGATION LIMITED

A handwritten signature in cursive script, appearing to read "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
		COARSE	FINE	COARSE	MEDIUM	FINE						
Ø	> 8"	3"	3/4"	4.75mm	2.0	0.42	0.075	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.

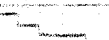
DYNAMIC PENETRATION RESISTANCE - to drive a 2" x 60° cone attached to the end of the drilling rods into the ground, expressed in blows per foot.

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



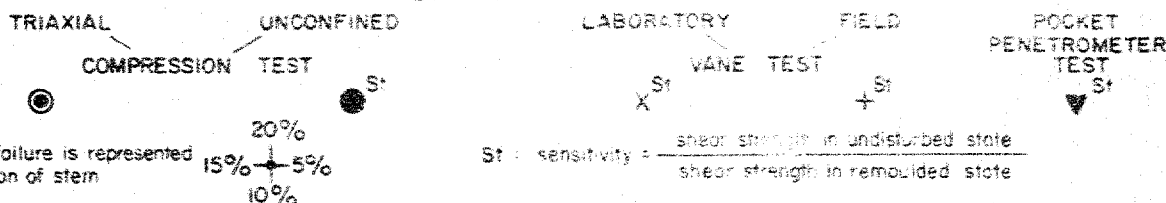
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SOIL PROPERTIES.

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 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

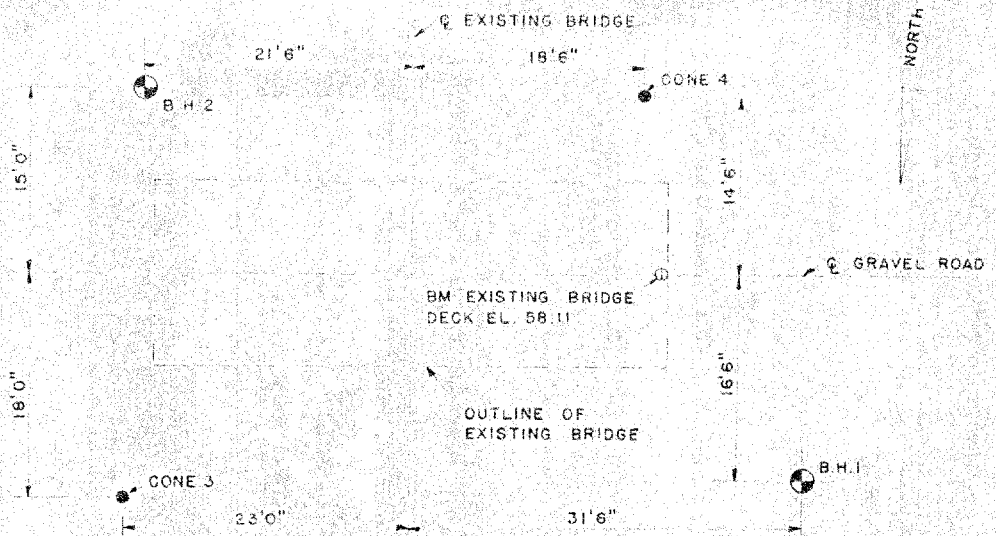
UNDRAINED SHEAR STRENGTH.

- DERIVED FROM -

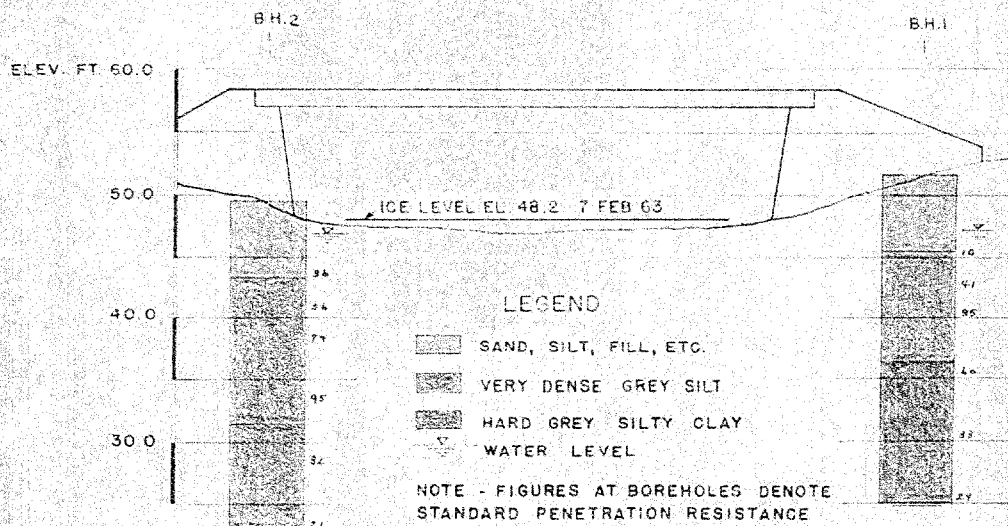


SOIL DESCRIPTION.

COHESIONLESS SOILS :	FC %	COHESIVE SOILS :	c lbs/sqft
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 SOUTH)
SCALE - 1 INCH TO 10 FEET

OUR REFERENCE NO. 3-2-14

GEOTECHNICAL DATA SHEET FOR BOREHOLE . . .

CLIENT Messrs. Fred A. Bell Associates

PROJECT Brookley Bridge

METHOD OF RECORDING Wash boring

DIAMETER OF BOREHOLE 8s (3-inch)

ENCLOSURE NO. 3

Borehole LOCATION See enclosure 2

DATE 11 Feb 63

BATHY ELEVATION See enclosure 2

ELEVATION ft.	DEPTH ft.	STRATIFICATION DESCRIPTION	STRATIFICATION SYMBOL	SAMPLES			PENETRATION RESISTANCE Lbf/in. sq. (psi)					CONSISTENCY Moisture content %	REMARKS
				NUMBER	TYPE	DEPTH ft.	20	40	60	80	100		
51.4	0	Ground surface											
49.1		clayey sandy silt fill, trace of organics											
46.9	5	Brown oxidized fine silty sand											
45.0		Gravelly clayey silt		1	SS	10							
42.0	10	clay seams		2	SS	41							
		Very dense grey silt		3	SS	85							
36.0	15	changing lt		4	SS	60							
30.0	20	Hard grey silty clay with silt seams		5	SS	33							
	25			6	SS	20							
25.1		End of borehole											

Penetration resistance graph showing Cone 1, Cone 2, and Cone 3. Cone 1 is at depth 10 ft, Cone 2 at 15 ft, and Cone 3 at 20 ft. The graph shows a sharp increase in resistance at 10 ft and 15 ft, indicating hard layers.

Remarks: Cone 3 driven from 41.47.5 to 45.0 ft. 12 Feb 63.

GEOTECHNICAL DATA SHEET FOR BOREHOLE

OUR REFERENCE NO. 3-2-14

CLIENT: Messrs. Fred A. Bell Associates

PROJECT: Arkley Bridge

Borehole LOCATION: See enclosure 2

DATUM ELEVATION: See enclosure 2

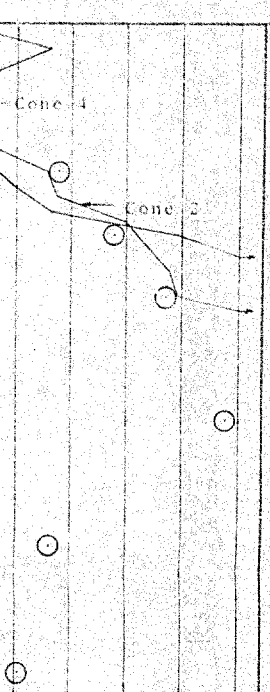
METHOD OF BORING: Washboring

DIAMETER OF BOREHOLE: 3x (3-inch)

DATE: 12 Feb 63

ENCLOSURE NO. 4

ELEVATION ft.	DEPTH ft.	STRATIFICATION DESCRIPTION	STRATIFICATION SYMBOL	SAMPLES			PENETRATION RESISTANCE blows per foot					CONSISTENCY water content %	REMARKS
				NUMBER	TYPE	TEST	20	40	60	80	100		
49.7	0	Ground surface											
45.7	5	Clayey sandy organics and seams of fine grey sand		1	SS	30							
40.0	10	Very dense grey silt with thin clay seams		2	SS	36							
35.0	15			3	SS	74							
31.7	20	changing to Very stiff to hard grey silty clay with silt seams		4	SS	65							
25.0	25			5	SS	52							
23.1		End of borehole		6	SS	21							



$\frac{1}{2}$ = 11.47.3
 12 Feb 63
 Cone 4 driven
 from ice level
 at 11.48.3