

#64-F-267 M

BRIDGE #412

(STRATHBURN)

LOT #24, RANGE #1

SOUTH

*B.A. 1873*  
*1944*

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COUNTY OFFICES  
LONDON ONTARIO

*6-4* *10/1/14*

Report on  
SOIL INVESTIGATION  
for  
BRIDGE #412 (STRATHBURN)  
LOT 24, RANGE I SOUTH  
TOWNSHIP OF EKFRID

by  
DOMINION SOIL INVESTIGATION LIMITED  
363 Queens Avenue  
LONDON ONTARIO  
Reference No. 4-4-L10  
19th May, 1964

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### SUMMARY

The soil is a silty clay till with a small granular content. Its stiffness increases with depth. Very similar conditions were encountered in both boreholes.

It is recommended that the structure should be supported on spread footings at El. 48 feet, using a gross soil pressure of 4500 pounds per square foot. It is anticipated that the total and differential settlements of the footings will be within tolerable limits for a rigid frame structure.

No unusual construction problems are anticipated.

## I INTRODUCTION

In accordance with a letter of authorization from Mr. J. P. McIntyre, Assistant County Engineer, a soil investigation has been carried out at a site in the Township of Ekfrid where it is proposed to replace an existing road bridge with a new structure. The existing bridge carries the gravel road dividing Ekfrid and Mosa Townships across a tributary of the River Thames near Strathburn. The project includes a re-alignment of both the road and the stream with the result that the new structure will lie approximately 400 feet to the northeast of the existing one. It is understood that the new bridge will have a span of approximately 40 feet and will probably be a rigid frame.

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 the new foundations.

## II FIELD WORK

Field work was carried out on the 12th and 13th of May, 1964 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.

A dynamic cone penetration test was performed adjacent to borehole 1 only. This test, by providing a continuous record of driving resistance, enables the detection of abrupt changes in stratification and gives a qualitative indication of the resistance which might be encountered in the driving of piles. Because the strata in borehole 1 were found to be stiff and cohesive throughout the depth explored, no further cone tests were performed.

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 the client's survey drawing (nail in tree 59 feet right of Sta. 10+36, El. 60.52).

## III SUBSURFACE CONDITIONS

Details of the stratification at each borehole are shown on the data sheets and a general picture of the subsurface conditions is given by the profile on enclosure 2. The following notes are intended only to augment these data.

Under a 6-inch layer of organic clayey topsoil the borehole encountered a silty clay till throughout the depth of exploration. This material is of glacial origin and contains 2 or 3% of fine granular particles, generally less than 1/4-inch in diameter, embedded in a matrix of silty clay. The upper 5 to 6 feet has a brown weathered appearance, and below this depth the soil is grey. The consistency of the deposit stiffens progressively with depth. In the upper 5 feet it is termed *firm* and gradually stiffens to a *hard* consistency below about 20 feet.

Within the relatively short duration of the field work the water level in the boreholes reached a level 3 to 4 feet higher than the water level in the nearby creek. These observations are consistent with the fairly steep profile of the sides of the valley in which the bridge site is located.

The site lies within the Ekfrid clay plain and the strata encountered appear to belong to that physiographic formation.

#### IV FOUNDATIONS

The elevation of the bed in the nearby stream was found to be El. 52.7 feet and it is assumed that the realigned stream bed will be at approximately the same level. The soil formation is not especially susceptible to erosion and it is adequately stiff for the support of spread footing foundations. It is therefore proposed that the footings should bear at El. 43.0 feet. The soil at this level gave blow counts of  $N = 20$  and  $21$  in borehole 1 and  $N = 27$  and  $24$  in borehole 2. The minimum  $N$  value below the proposed footing level is 18 at El. 43.5 in borehole 1. On the basis of the foregoing values a gross soil pressure of 4500 pounds per square foot is recommended for the design of the footings.

It is estimated that the settlement of a 5 feet wide footing under the proposed loading, due to consolidation of the soil, will be 1.0 inch. Because of the very similar soil conditions at the 2 boreholes, no appreciable differential settlement is anticipated.

The soil is generally stiff and impervious and in these conditions no unusual construction problems are anticipated. The sides of shallow temporary excavations will stand vertically without support and the amount of seepage entering the excavation should be easily controllable by pumping.

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. Terzaghi and Peck: Soil Mechanics in Engineering Practice. John Wiley and Sons, New York 1948.



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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 76mm	2.0	0.42	0.074	0.002	>			
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  
 pressure

Washwater returns  
 Washwater loss

## PENETRATION RESISTANCES.

**DYNAMIC PENETRATION RESISTANCE** : to drive a 2", 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	$\gamma_s$ 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	$\phi$ Angle of internal friction - total stress
PI % Plasticity index	$C_v$ Coeff. of consolidation	$C'$ Cohesion in terms of
LI Liquidity index	$m_v$ Coeff. of volume compressibility	$\phi'$ Angle of internal friction - effective stress

## UNDRAINED SHEAR STRENGTH.

— DERIVED FROM —

TRIAXIAL COMPRESSION TEST

UNCONFINED TEST

LABORATORY

FIELD

VANE TEST

POCKET PENETROMETER TEST

Strain at failure is represented by direction of stem

20%  
15%  
10%  
5%

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

## SOIL DESCRIPTION.

COHESIONLESS SOILS :

RD :

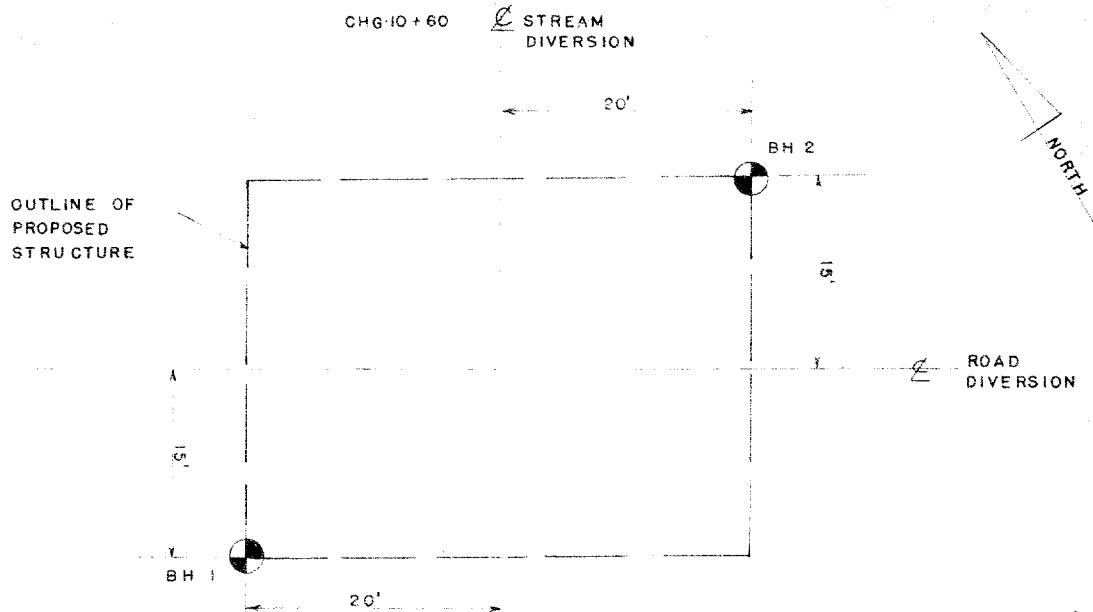
COHESIVE SOILS :

C lbs./sq ft

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

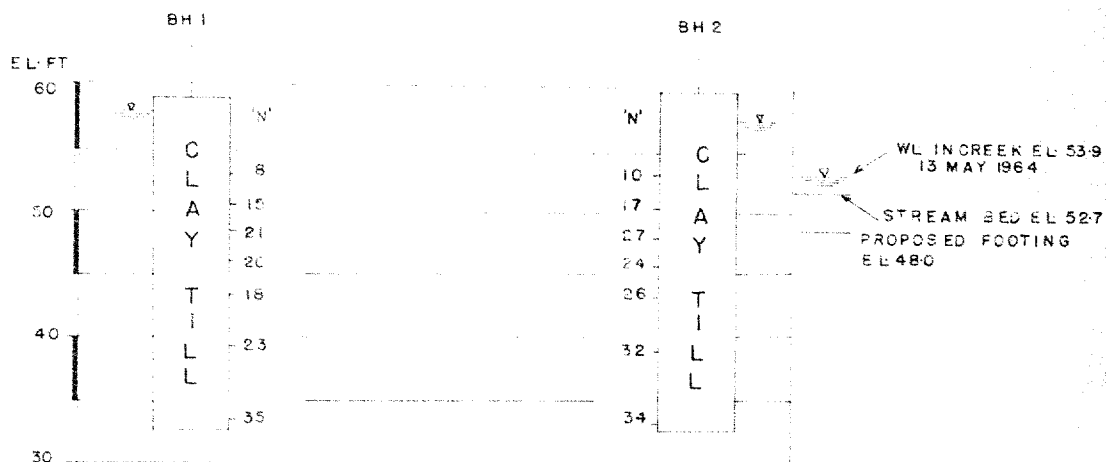
Very soft	less than 250
Soft	250 - 500
Firm	500 - 1000
Stiff	1000 - 2000
Very stiff	2000 - 4000
Hard	over 4000





### LOCATION OF BOREHOLES

SCALE: 1 INCH TO 10 FEET



NOTE: FIGURES AT BOREHOLES DENOTE  
STANDARD PENETRATION RESISTANCE

### SUBSURFACE PROFILE

SCALE: 1 INCH TO 10 FEET

# GEOTECHNICAL DATA SHEET FOR BOREHOLE . . . . .

OUR REFERENCE NO. 4-4-L10

CLIENT: County of Middlesex

PROJECT: Road Bridge

LOCATION: Township of Ekfrid

DATUM ELEVATION: 60.52 feet (Nail in root of tree 59' Rt Stn 10+36)

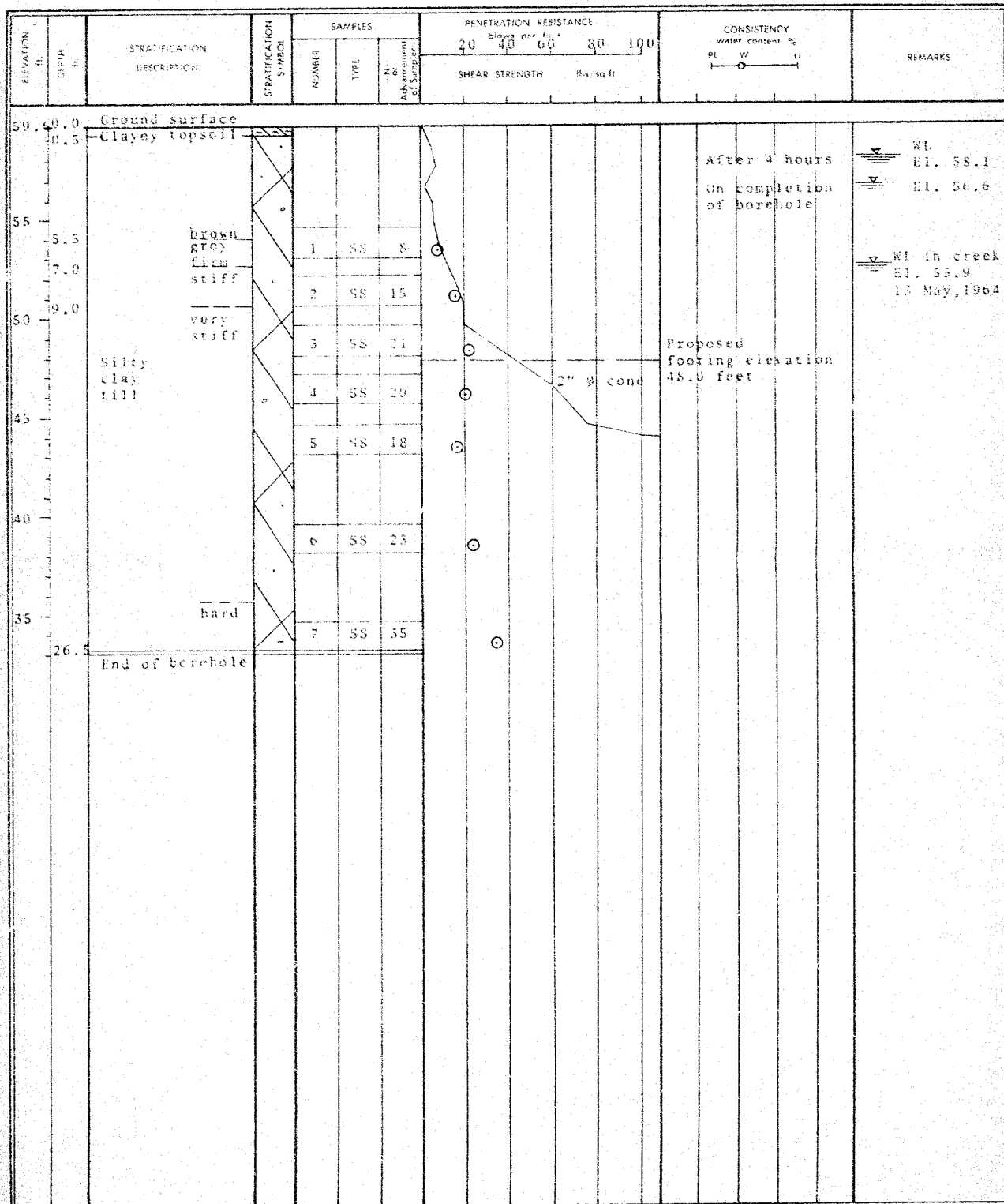
METHOD OF BORING: Washboring

DIAMETER OF BOREHOLE: Bx (3-inch)

DATE

May 12th, 1964

ENCLOSURE NO. 5



# GEOTECHNICAL DATA SHEET FOR BOREHOLE 2

OUR REFERENCE NO. 4-4-110

CLIENT County of Middlesex  
PROJECT Road Bridge  
LOCATION Township of Etobicoke  
DATUM ELEVATION 60.52 feet (Nail in root of tree 59' Et Sta 10+36)

METHOD OF BORING Washboring  
DIAMETER OF BOREHOLE Bx (3-1/2")  
DATE May 13th, 1964  
ENCLOSURE NO. 4

ELEVATION ft.	DEPTH ft.	STRATIFICATION DESCRIPTION	STRATIFICATION SYMBOL	SAMPLES			PENETRATION RESISTANCE blows per foot					CONSISTENCY Water content %			REMARKS
				NUMBER	TYPE	NO. Adj. per ft. of sampler	SHEAR STRENGTH					PS W LI			
							10	20	30	40	50				
59.0	0.0	Ground surface													
58.5	0.5	Clayey topsoil													
55.0	5.5	light brown grey stiff		1	SS	10	○								On completion of borehole
50.0	10.0	very stiff		2	SS	17	○								WL in creek
45.0	15.0	Silty clay till		3	SS	23		○							El. 53.9
40.0	20.0	hard		4	SS	24	○								13 May, 1964
35.0	25.0			5	SS	25	○								
26.0	34.0	End of borehole		7	SS	34	○								

VERTICAL SCALE: 1 IN. TO 5 FT.

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MADE M&P CHD JP