

63-F-240M

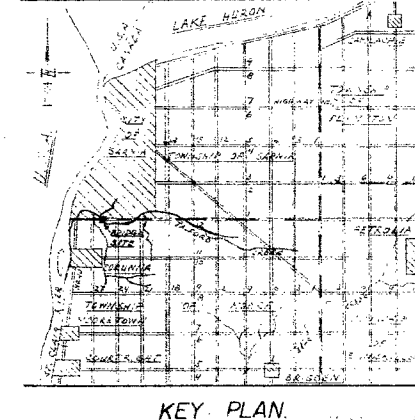
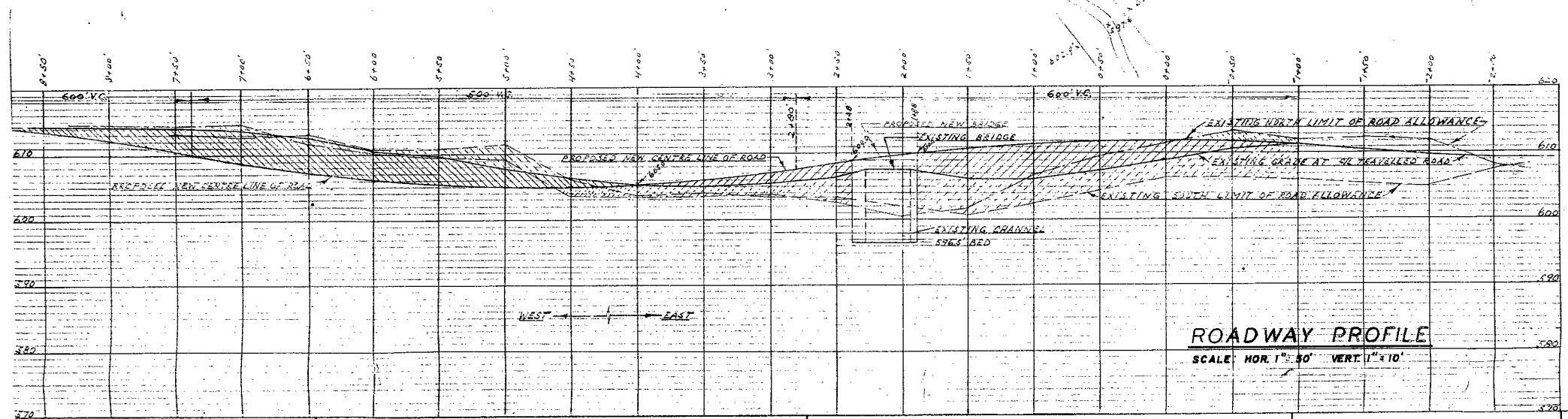
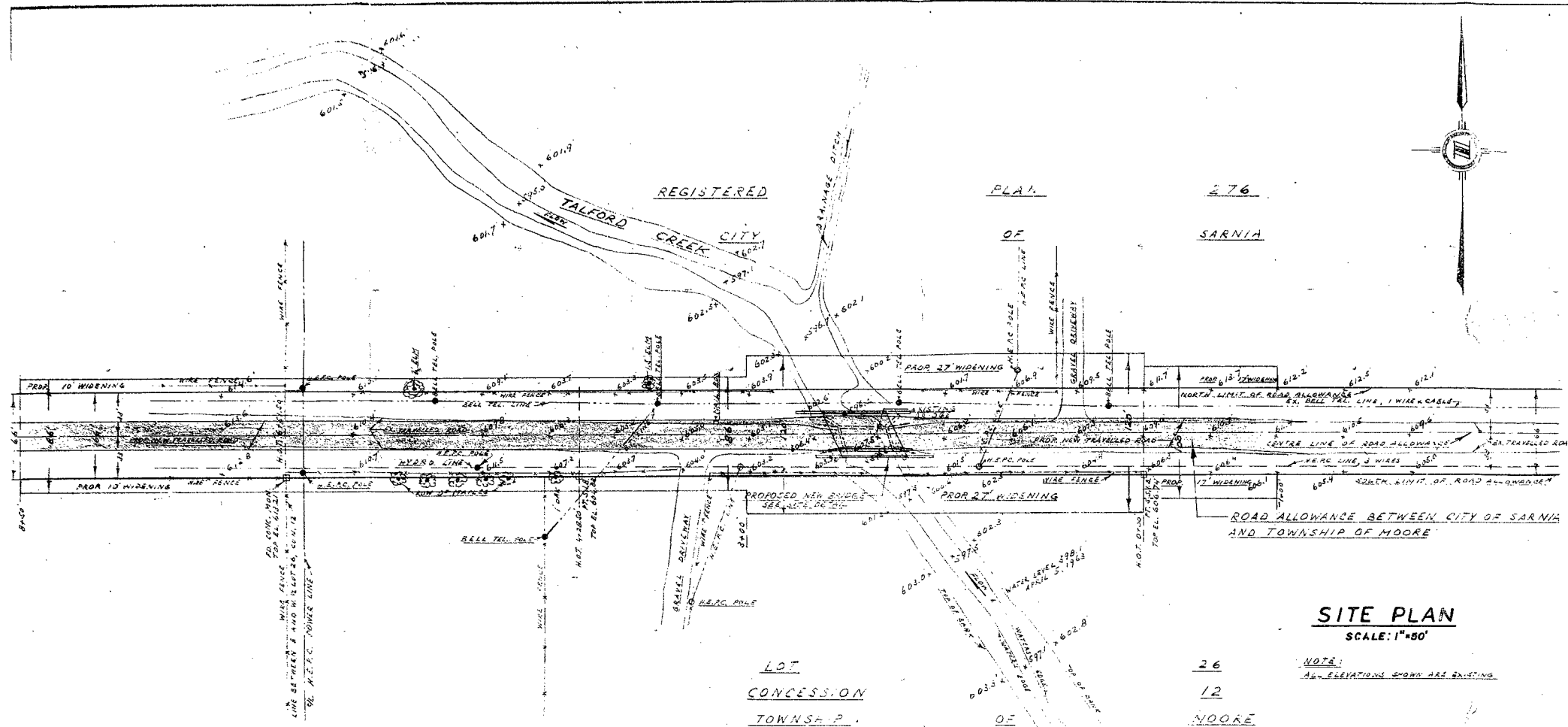
MOORE AT SARINIA

CITY LINE

TALFOURD

CREEK

LOT 26, CON. 12



FOLLOW SEPARATE INSTRUCTIONS FOR PREPARATION OF BRIDGE SITE PLAN WHEN MAKING BRIDGE SURVEY.

DATA

1. SPECIAL FEATURES, WATERFALLS, DAMS, EXCEPTIONAL FLOODS, ICE, DRIFTWOOD, SLIDING BANKS, ETC. NONE

2. UPSTREAM & DOWNSTREAM BRIDGES (GIVE LOCATION, LENGTH, HEIGHT ABOVE N.H.W.L., NET CROSS-SECTIONAL AREA AT HIGH WATER & ESTIMATED AGE) NO BRIDGE ON ROAD BETWEEN LOTS 25 & 26. CONJ. 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100, 101, 102, 103, 104, 105, 106, 107, 108, 109, 110, 111, 112, 113, 114, 115, 116, 117, 118, 119, 120, 121, 122, 123, 124, 125, 126, 127, 128, 129, 130, 131, 132, 133, 134, 135, 136, 137, 138, 139, 140, 141, 142, 143, 144, 145, 146, 147, 148, 149, 150, 151, 152, 153, 154, 155, 156, 157, 158, 159, 160, 161, 162, 163, 164, 165, 166, 167, 168, 169, 170, 171, 172, 173, 174, 175, 176, 177, 178, 179, 180, 181, 182, 183, 184, 185, 186, 187, 188, 189, 190, 191, 192, 193, 194, 195, 196, 197, 198, 199, 200, 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213, 214, 215, 216, 217, 218, 219, 220, 221, 222, 223, 224, 225, 226, 227, 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SARNIA ONTARIO

File No. E-63-21

Report on
SOIL INVESTIGATION
for
TALFOURD CREEK BRIDGE TWP 14
LOT 26, CONCESSION 12
TOWNSHIP OF MOORE AT
SARNIA CITY LINE

E-63-21-24021

Conf. Confidential

by
DOMINION SOIL INVESTIGATION LIMITED
363 Queens Avenue
LONDON ONTARIO

Reference No. 3-3-L3
March 1963

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SUMMARY

The strata resemble closely the typical clay tills found in that part of the St. Clair Clay Plains near and to the east of Sarnia.

It is proposed that the structure should be supported on spread footings at El. 588 feet, designed for a gross soil pressure not greater than 4450 p.s.f. The resulting settlement will be small and differential settlement will be negligible.

No unusual construction problems are anticipated.

I INTRODUCTION

Verbal authorization was received from Mr. R. Letham to carry out a soil investigation at a site on the Township of Moore - City of Sarnia Line where it is proposed to replace an existing road bridge with a new structure. A visit was made to the site by Mr. Letham and the writer on the 12th of March 1963 when the scope and requirements of the project were discussed.

It is understood that the new bridge will be of approximately the same span (about 35 feet) and in the same position as the existing one and, if suitable soil conditions prevail, will be a rigid-frame design.

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 PHYSIOGRAPHY

The site lies 2 to 3 miles northwest of the Town of Corunna, and 1-1/2 miles east of the St. Clair River, at one of several locations where the LaSalle Road crosses the Talfourd Creek. It lies within the physiographic region known as the St. Clair Clay Plains which, characteristically, has little surface relief. The soils are typically deep clay deposits of the glacial lakes Whittlesey and Warren which covered the area in successive periods during the recession of the Wisconsin Glacier. The upper strata generally show some degree of over-consolidation as a result of dessication and weathering.

III FIELD AND LABORATORY WORK

Field work was carried out during the period 18th to 20th March 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 using a 2-inch O.D. split spoon. This test provides a measure of the consistency of the soil and enables

disturbed samples to be recovered. Undisturbed samples were recovered in 2-inch diameter thin-walled tubes, and insitu vane shear tests were performed using a 4-bladed vane 2 inches in diameter and 4 inches in length.

Unconfined compression tests were performed in the laboratory on two samples and one consolidation test was performed to provide data for settlement calculations. In addition, the moisture content for a number of samples has been determined.

The results of the field and laboratory tests are recorded on enclosures 3, 4 and 5 and the latter are summarized on enclosure 6. Elevations have been referred to the benchmark shown on the client's survey drawing (concrete monument at chainage 6 + 51.5 feet, El. 613.21 feet).

IV 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 upper layer of brown silty clay till extending to a depth of approximately 8 feet is in a very stiff to hard condition with a moisture content near the plastic limit. This is a very impervious material and contains only 3 or 4% of fine granular particles.

Below the brown till the holes were terminated in a stratum of grey silty clay of low to intermediate plasticity showing a sensitivity of approximately 2. The liquidity index of the material lies between 0.1 and 0.2. The moisture content of this layer shows little variation within the depth explored, but a definite and characteristic trend of decreasing shear strength with increasing depth is illustrated on enclosures 3 and 4. The field test results at the two boreholes show the soil properties to be fairly consistent with depth.

The properties of the soil at this site are notably different from those at other sites to the west and south near Corunna which have been the subject of earlier investigations.*

* References 8, 9 and 10.

These have shown normally or slightly over-consolidated lake clays with a high liquidity index. Although the method of determining the preconsolidation load from the shape of the e-p curve is crude, in this case the value is clearly of a much higher magnitude. The liquidity index is low and the soil more nearly resembles the 'tills' found to the north and east. In this latitude, therefore, the soft lake clay deposit must be confined to a narrow strip along the river.

V

FOUNDATIONS

(a) Bearing Capacity

The level of the bed of the creek was found to be El. 595.5 feet. For some distance below this level the soil is a very stiff grey silty clay possessing adequate shear strength to support spread footings. The proposed footing level, allowing for scour, is El. 588 feet, and the average shear strength of the soil at this level is taken to be 2500 p.s.f.* ** Using Meyerhof's theory, the ultimate bearing capacity of a footing with dimensions 5.5' x 35' at El. 588, is 13,350 p.s.f. Thus, applying the common safety factor of 3, the recommended maximum gross soil pressure for design is 4450 p.s.f.

(b) Settlement

The long-term consolidation settlement has been calculated for a dead load of 3500 p.s.f. on a footing 5.5 feet wide. The settlement is estimated to be 0.63 inches. The calculated time periods for 50% and 90% consolidation are 87 days and

* Considering the laboratory unconfined compression and field vane shear test results (enclosures 3 and 4) between Els. 588 and 580, the low result from borehole 1, sample 4 is ignored as being out of keeping with the remaining values and attributable to sample disturbance.

** At lower elevations the reduction in the magnitude of the applied ~~stress~~ caused by spreading of the stress pattern compensates adequately for the reduction in shear ~~strength~~ of the soil.

609 days respectively.

In view of the similarity of the measured soil properties at the two boreholes, it is concluded that differential settlement between the two abutments will be negligible.

(c) Construction

The soil is cohesive and impervious so that no difficulty should be experienced in forming the shallow excavations required for the footing. Once the surface water has been diverted away from the site, the amount of seepage entering the excavation will be small and can be removed by pumping. After the footing grade has been inspected and approved, it is recommended that it should be covered with a thin concrete blanket as a protection against disturbance.

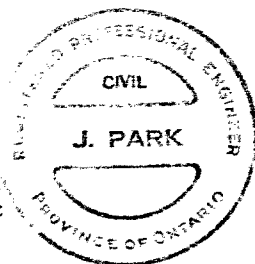
VI

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8. Geotechnical Properties of Glacial Clays in Lake St. Clair Region of Ontario, by Soderman, Kenny and Loh, Proceedings of the Fourteenth Canadian Soil Mechanics Conference, 13 and 14 October, 1960.
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10. Dominion Soil Investigation Limited Report No. 2-4-L2, to Mr. James D. Nisbet, April 1962.

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
		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

CS Sample from casing

ChS Chunk sample

RC Rock core

% Recovery

SS Split spoon sample

TP Piston, thin walled tube sample

TW Open, thin walled tube 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.

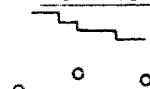
DYNAMIC PENETRATION RESISTANCE : to drive a 2" ϕ , 60° cone attached to the end of the drilling rods into the ground, expressed in blows per foot.

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

LL % Liquid limit

PL % Plastic limit

PI % Plasticity index

LI Liquidity index

 γ Natural bulk density (unit weight)

e Void ratio

RD Relative density

C_v Coeff. of consolidationm_v Coeff. of volume compressibility

k Coeff. of permeability

C Shear strength in terms of total stress

 ϕ Angle of int. friction

C' Cohesion in terms of effective stress

 ϕ' Angle of int. friction

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% + 5%
10%

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

SOIL DESCRIPTION.

COHESIONLESS SOILS :

RD :

Very loose

Loose

Compact

Dense

Very dense

0 - 15 %

15 - 35 %

35 - 65 %

65 - 85 %

85 - 100 %

COHESIVE SOILS :

Very soft

Soft

Firm

Stiff

Very stiff

Hard

C lbs/sq.ft

less than 250

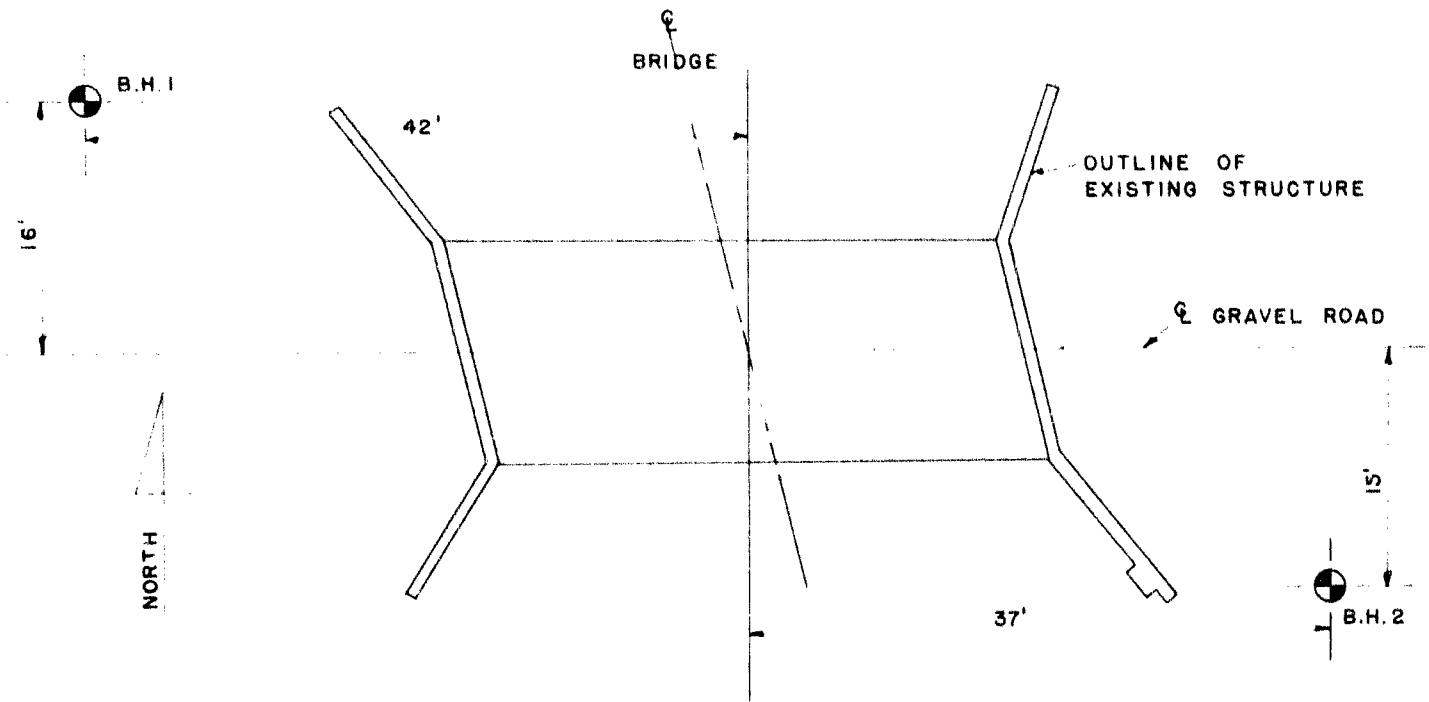
250 - 500

500 - 1000

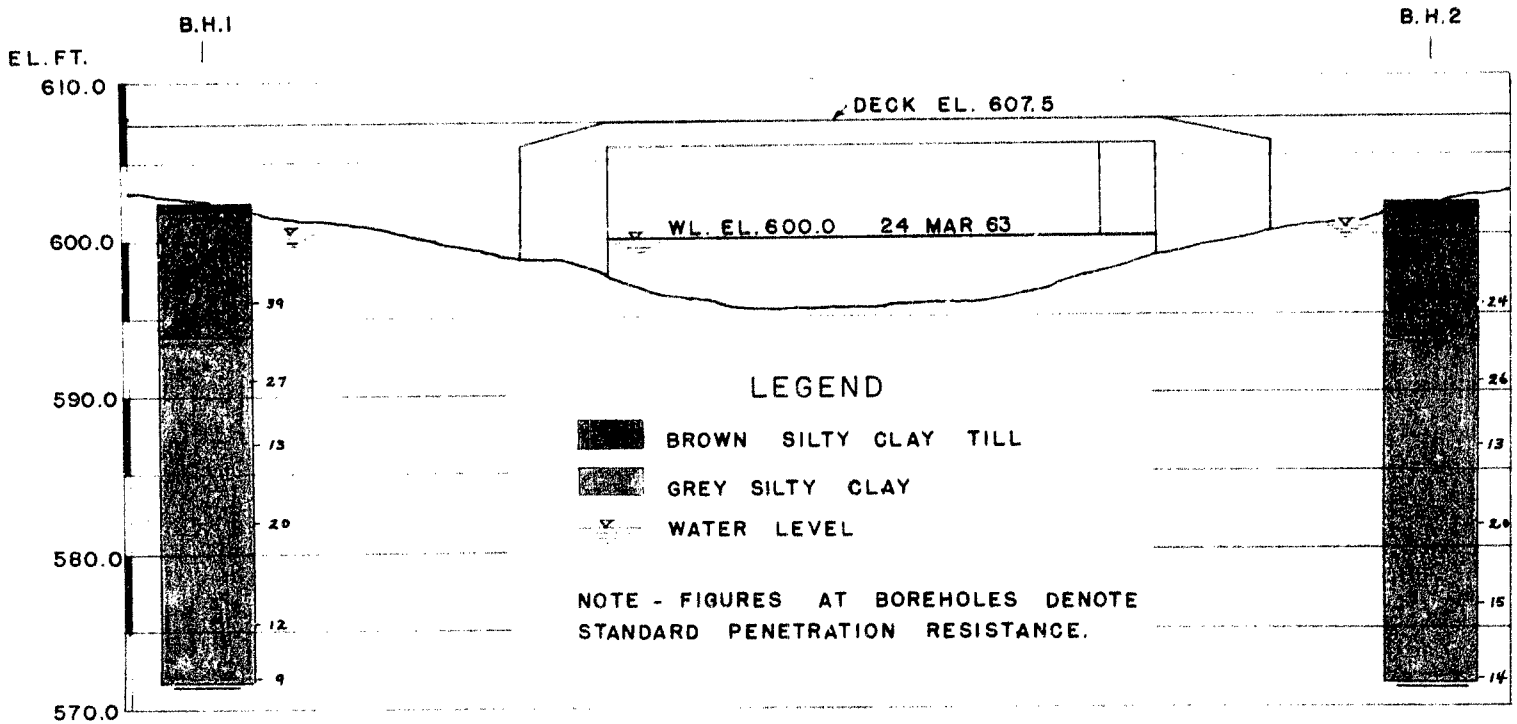
1000 - 2000

2000 - 4000

over 4000



LOCATION OF BOREHOLES
SCALE - 1 INCH TO 10 FEET



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

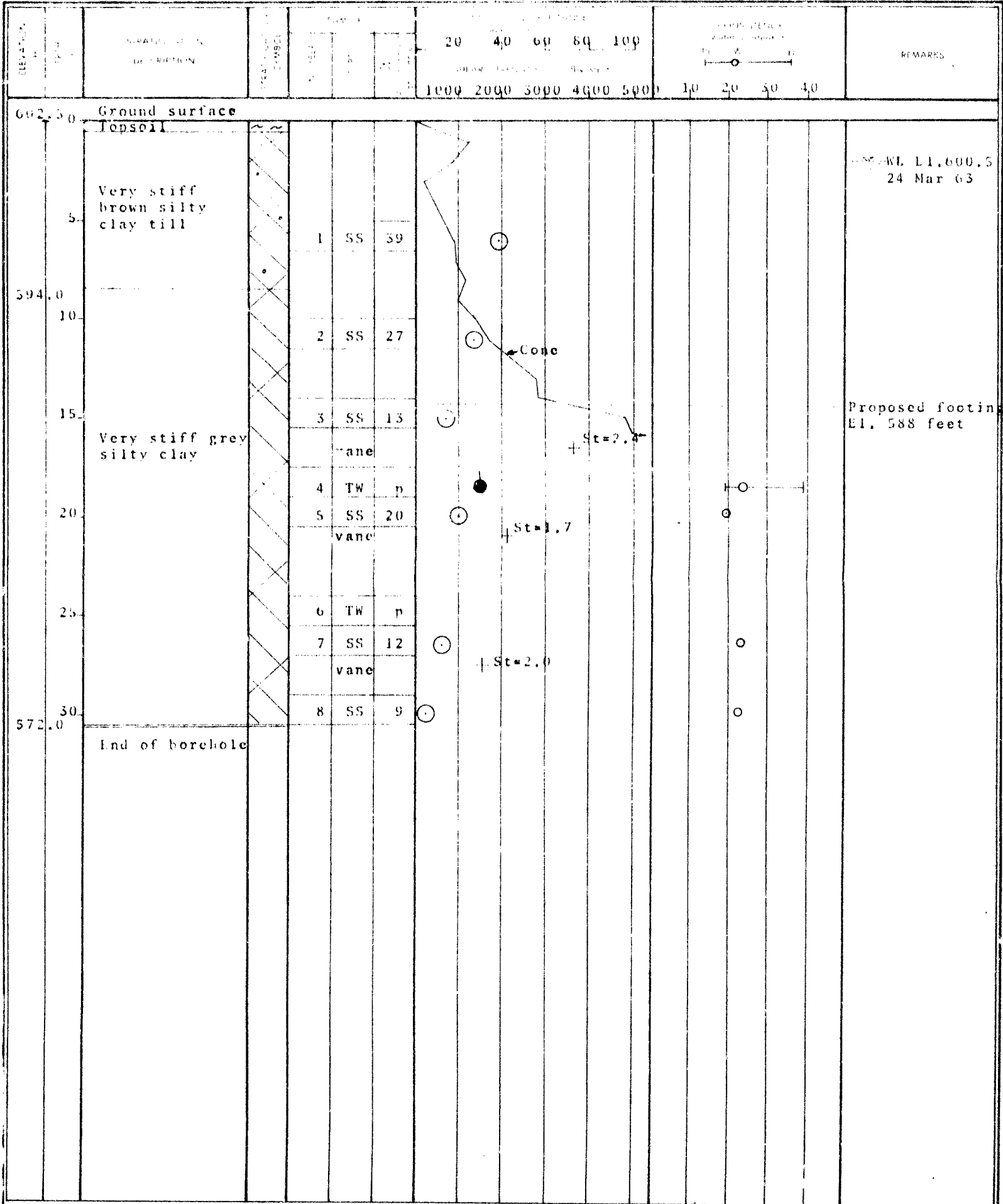
GEOTECHNICAL DATA SHEET FOR BOREHOLE

3-3-1.5

Mr. J.D. Nisbet
Tallourd Creek Bridge
City of Sarnia - Moore Twp. line
Geodetic

Washbering
Bx (3-inch)
18/19 Mar 63

3



GEOTECHNICAL DATA SHEET FOR BOREHOLE 3-3-L3

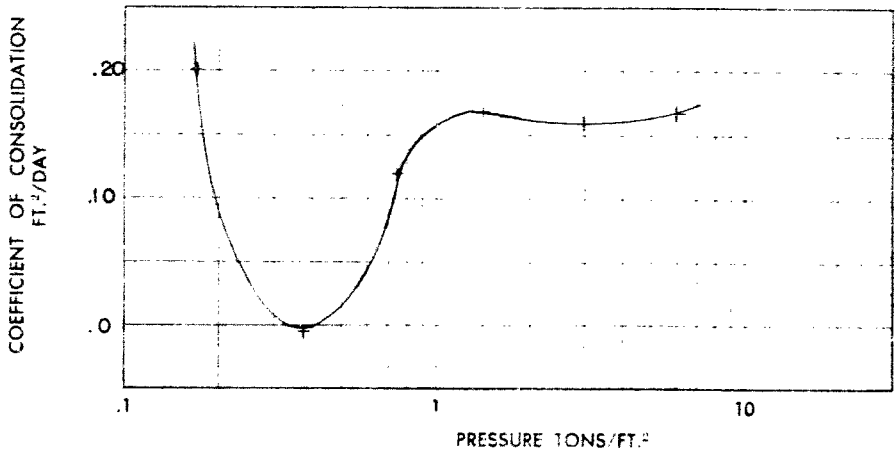
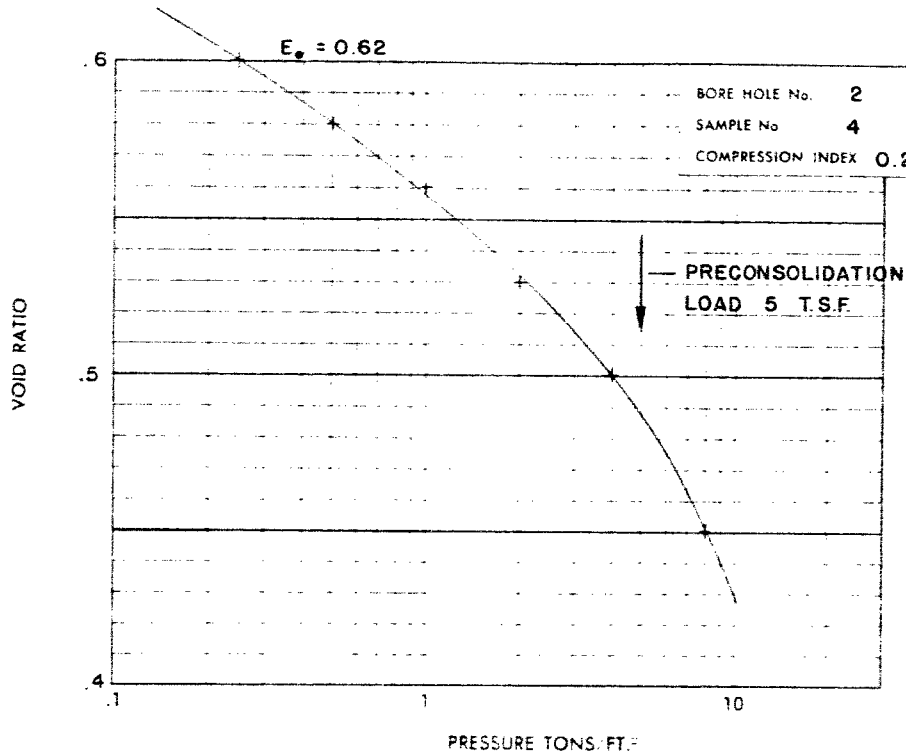
3-3-L3
 Mr. J.D. Nisbet
 Telfourd Creek Bridge
 City of Sarnia - Moore Exp. Line
 Datum Elevation: Geodetic

Washboring
 Bx (3-inch)
 19/20 Mar 63

SHEET NO. 4

ELEVATION + DEPTH -	SITE LOCATION DESCRIPTION	TESTED SAMPLER	SAMPLE				UNIFORMITY COEFFICIENT					CONSISTENCY Water content, %				REMARKS
			NO.	TYPE	DEPTH Feet	DEPTH Meters	20	40	60	80	100	10	20	30	40	
602.0	Ground surface															
0	Topsoil															WL E1.600.5 24 Mar 63
5	Very stiff brown silty clay till		1	SS	24											
993.3			2	SS	26											
10			3	SS	13											Proposed footing E1.588 feet
15	Very stiff grey silty clay		* 4	TW	n											*Consolidation test sample, see enclosure 5.
20			5	SS	20											
25			6	TW	p											
30			7	SS	15											
571.5	End of borehole		8	SS	14											

Dominion Soil Investigation Ltd.
CONSOLIDATION TEST



SUMMARY OF LABORATORY TEST DATA

Borehole No.	1	2
Sample No.	4	4
Liquid limit (%)	38.6	31.2
Plastic limit (%)	19.5	18.2
Plasticity index (%)	19.1	13.7
Liquidity index	0.2	0.1
Natural moisture (%)	23.2	19.1
Void ratio	0.58	0.62
Bulk density (p.c.f.)	125.5	129.2
Cohesion (from unconfined compression test) p.s.f.	1465	2500
Compression index	-	0.2
Coefficient of consolidation (square feet per day)	-	0.26
Group Symbol	CI	CL

Borehole	Sample	Natural Moisture (%)
1	4	23.2
	5	19.9
	7	22.9
	8	22.4
2	3	20.1
	4	19.1
	5	20.1
	7	22.2
	8	21.8

MEMORANDUM

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

FROM: G.C.E. Burkhardt

DATE: February 21, 1964.

OUR FILE REF.

IN REPLY TO

SUBJECT: County of Lambton,
Bridge over Telford Creek,
Twp. of Moore, Lot 26, Con. XII
Structure Site # 15-78
Our File # BA 1757

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

We would appreciate it very much, if we could have your
comments on or before February 28th, 1964.

GCEB/kd


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

No comment.
By phone Feb 25, 1964
WJS