66-F-267 M

BRIDGE # 389

N 1/2 LOTS 8/9

CONS. VII / VIII

MOSA TWP.

A. M. SPRIET & ASSOCIATES LIMITED
264 WELLINGTON STREET
LONDON ONTARIO

66-T-6779

Report on

SOIL INVESTIGATION

for

COUNTY OF MIDDLESEX BRIDGE NO 389

N 1/2 LOTS 8 AND 9, CONCESSIONS VII & VIII

TOWNSHIP OF MOSA

by

DOMINION SOIL INVESTIGATION LIMITED
369 Queens Avenue
LONDON ONTARIO

Reference No. 6-1-L4
January 24th, 1966

CONTENTS

ENCLOSURES

SUMMARY

The two borings showed the following ground succession:- firm clayey silt (9'-0"); stiff silty clay (5'-6" to 8'-0"); and very dense sandy silt (8'-6" maximum penetrated).

It is recommended that the structure be supported on spread footings at or below El. 35 using a maximum net soil pressure of 10,000 pounds per square foot. The estimated total settlement is less than 1-inch.

No unusual construction problems are anticipated.

I INTRODUCTION

Verbal authorization was received from A. M. Spriet & Associates, consulting engineers, to carry out a soil investigation at a site in the Township of Mosa where it is proposed to replace an existing road bridge with a new structure.

The existing structure is located on Lot 8, Concession 8 of the Township were the road crosses a Tributary of the Sydenham River.

It is understood that the structure will be relocated to allow for realignment of the road. The proposed structure was located on the site with the aid of a preliminary site plan which was supplied by the County of Middlesex and the boreholes were set out accordingly.

The purpose of this investigation was to reveal the subsurface conditions at the site and to determine the relevant soil properties for the design and construction of the new foundations.

II FIELD WORK

The field work, consisting of 2 boreholes, was carried out during the period January 12 - 14, 1966, at the locations shown on Enclosure 2. The holes were advanced by washboring methods, and were lined with Bx casing.

Standard Penetration Tests using a 2-inch outside diameter split-spoon sampler were performed at frequent intervals of depth, using a driving force of a 140 lb. hammer falling freely through 30-inches. The tube is first driven an initial 6-inches to allow for the presence of disturbed material at the bottom of the borehole. The number of standard blows required to drive the sampler a further 12-inches was recorded as the standard penetration resistance (or 'N' value). This test determines the relative density of granular strata and gives an indication of the consistency of cohesive strata. It also enables samples to be obtained for classification purposes.

Dynamic cone penetration tests were performed adjacent to each borehole location to obtain an indication of soil density changes with depth.

The results of the field tests are presented on the Geotechnical Data Sheet, Enclosure 3. Elevations were referred to a benchmark which was indicated on the clients preliminary site plan (Nail in tree stump, Sta. 17+60 left, El. 58.80 feet).

III SUBSURFACE CONDITIONS

Detailed descriptions of the strata encountered in each borehole are given on the Geotechnical Data Sheet, comprising Enclosure 3, and a general picture of the soil stratigraphy is given in the form of a Subsurface Profile on Enclosure 2.

The boreholes revealed the following general ground succession:-

		Thickness
(a)	Brown clayey silt, with a trace of fine sand. The consistency of this stratum is described as 'firm' as indicated by standard penetration test values of 7 blows per foot.	9'-0"
(b)	Brown/grey silty clay. This stratum consists of cohesive plastic material and the consistency is described as 'stiff' as indicated by standard penetration test results ranging from 7 to 14 blows per foot.	5'-6" to 8'-0"
(c)	Sandy silt with a trace of fine gravel. The relative density of this stratum is described as 'very dense' as estimated from standard penetration test results ranging from 48 blows per foot to refusal values of 100 blows for less than 1 foot penetration of the split-spoon sampler. Due to the very dense packing the soil exhibits some cementation.	penetrated 8'-6" in borehole 1.

IV GROUNDWATER CONDITIONS

The ice level in the creek at the time the field work was carried out was at El. 44.0.

Due to the impermeable nature of the subsoil, true groundwater levels were not recorded in the boreholes, however for practical purposes, it is anticipated that seepage into excavations will be small.

V DISCUSSION

The soil profile consists of firm clayey silt and stiff silty clay strata overlying very dense sandy silt. The top of the very dense sandy silt stratum was encountered between El. 35 and El. 36 in the two boreholes therefore it is recommended that the structure be supported on spread footings at or below El. 35. This footing elevation should provide sufficient depth of scour protection however, a hydrological study should be made to confirm this observation.

On the basis of the borehole results a maximum net soil pressure of 10,000 pounds per square foot is appropriate for the design of footings in the very dense sandy silt stratum. Furthermore the footings will have a factor of safety of at least 3 against shear failure of the underlying soil.

It is estimated that total settlement of the structure will not exceed 1-inch and in view of the similar conditions encountered in the two boreholes, no appreciable differential settlement is anticipated.

The coefficient of friction between the footings and the sandy silt till may be taken as 0.45 and the factor of safety against horizontal sliding of the abutments should be at least 1.5.

When the excavation for the footings is complete the footing grade should be inspected to see that all the overlying silty clay stratum has been removed. Any silty clay material found below the footing grade should be removed and replaced by lean concrete.

The subsoil is impervious and should cause no unusual construction problems. Seepage should be accumulated in sumps dug below the footing grade and removed by pumping. The soil on which the footings will bear is not unduly sensitive to the effects of water or mechanical disturbance. The faces of temporary excavations through the clayey silt stratum should be sloped at 1:1 and through the silty clay may be expected to stand vertically without support.

Yours very truly,

DOMINION SOIL INVESTIGATION LIMITED

C.J.W. Atkinson, M.Sc., P.Eng.,
Branch Manager

CJWA:jms

Enclosures

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"	¾"	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"ø, 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.

SYMBOL :

EXTRAPOLATED -N- VALUE 322

The energy for the penetration resistances is supplied by a 140 lb. hammer falling 30 inches.

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 —

TRIAXIAL COMPRESSION TEST ◉ ● St

UNCONFINED TEST

LABORATORY VANE TEST X St + St

FIELD

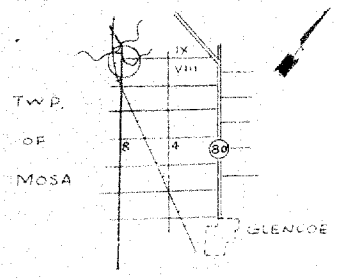
POCKET PENETROMETER TEST ▼ St

Strain at failure is represented by direction of stem: 20% / 15% — 5% / 10%

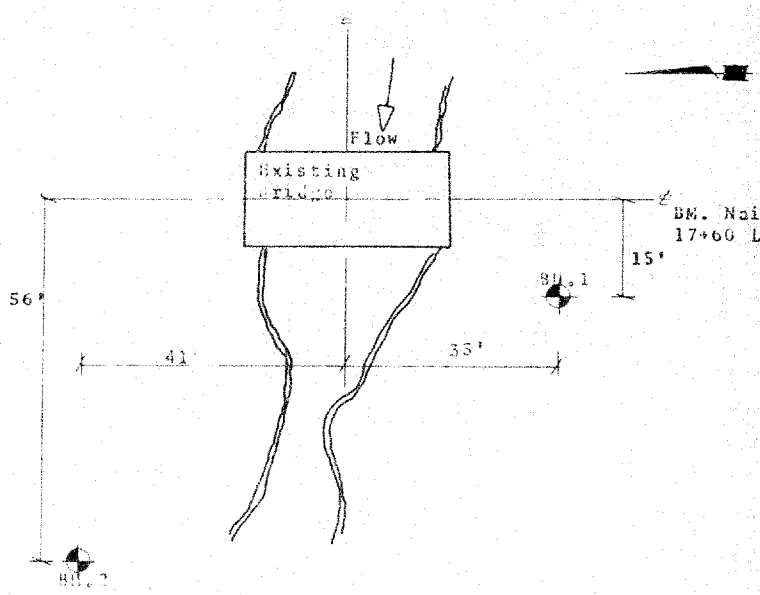
St : sensitivity = $\frac{\text{shear strength in undisturbed state}}{\text{shear strength in remoulded state}}$

SOIL DESCRIPTION.

COHESIONLESS SOILS :	RD :	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

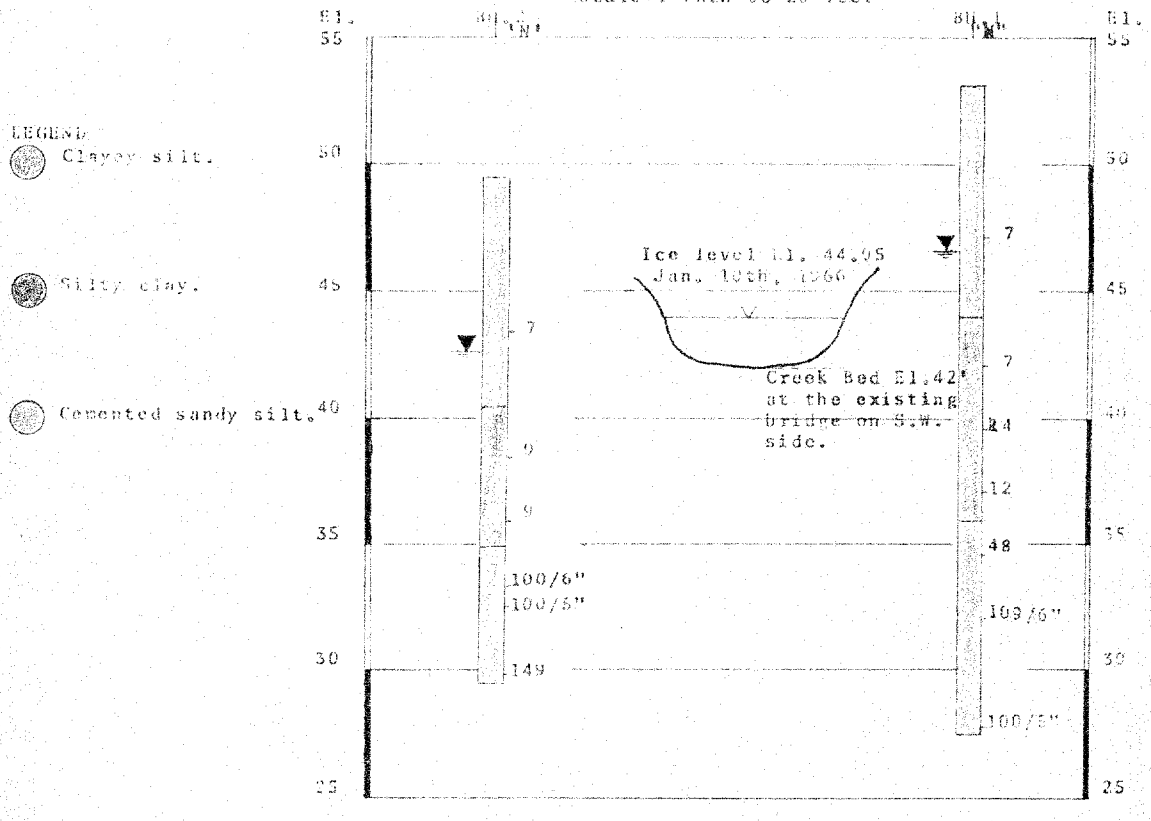


KEY PLAN



LOCATION OF BOREHOLES

Scale 1-inch to 20 feet



LEGEND

Clayey silt.

Silty clay.

Cemented sandy silt.

SUBSURFACE PROFILE

Vert. Scale 1-inch to 5 feet

DEFECTS IN NEGATIVE DUE TO CONDITION OF ORIGINAL DOCUMENT

GEOTECHNICAL DATA SHEET FOR BOREHOLES 1 & 2.

OUR REFERENCE NO. 6-1-L4

CLIENT A. M. Spriet & Associates
PROJECT Middlesex County Bridge No. 389
LOCATION Township of Ross
DATUM ELEVATION 58.80 feet

METHOD OF BORING Washboring
DIAMETER OF BOREHOLE Bx (3-inch)
DATE January 12 - 14, 1966

ENCLOSURE NO. 3

ELEVATION ft.	DEPTH ft.	STRATIFICATION DESCRIPTION	STRATIFICATION SYMBOL	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES N.S. PENETRATION RESISTANCE	PENETRATION RESISTANCE Blows per foot: 20 40 60 80 100 / SHEAR STRENGTH lbs/sq.ft.	CONSISTENCY Water Content %: P.L. W. L.L.	REMARKS
53.1	0.0	**Ground Surface**							**Borehole 1**
		Firm brown clayey silt, trace of fine sand.		1	SS	7			
45	9.0								
		Stiff brown silty grey clay.		2	SS	7			
				3	SS	14			
40				4	SS	12			
	17.0								
35		Very dense cemented sandy silt, trace of fine gravel. (Glacial Till).		5	SS	48			
				6	SS	109/6"			
30				7	SS	100/5"			
	25.5	End of Borehole							
49.5	0.0	**Ground Surface**							**Borehole 2**
		Firm brown clayey silt, trace of fine sand.		1	SS	7			
45	9.0								
		Stiff grey silty clay.		2	SS	9			
40				3	SS	9			
	14.5	Very dense cemented sandy silt, trace of fine gravel. (Glacial Till)		4	SS	100/6"			
35				5	SS	100/5"			
				6	SS	149			
30	20.0	End of Borehole							

VERTICAL SCALE, 1 IN. TO ft.

DOMINION SOIL INVESTIGATION LIMITED

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