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G.II-30 SEPT. 1976

GEOCRES No. 40 P15-24

DIST. 3 REGION southwestern

W.P. No. _____

CONT. No. _____

W. O. No. _____

STR. SITE No. _____

HWY. No. _____

LOCATION LOT 1 CONCESSION 4 & 5

ARTHUR TWP

OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT. _____

REMARKS: DOCUMENTS TO BE UNFOLDED

BEFORE MICROFILMED

B.A. 2008

MR. B. M. ROSS
CONSULTING ENGINEER
GÖDERICH ONTARIO

40 P15-24
FIGURES No.

Report on
SOIL INVESTIGATION
for
BRIDGE BR 129
LOT 1, CONCESSIONS IV & V
TOWNSHIP OF ARTHUR

by
DOMINION SOIL INVESTIGATION LIMITED
363 Queens Avenue
LONDON ONTARIO
Reference No. 4-11-L8
December 11th, 1964

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SUMMARY

The strata consist of about 9 feet of sandy silt fill overlying a very dense glacial till deposit.

It is recommended that the structure should be supported on spread footings at or below El. 1474.0 using a maximum net soil pressure of 10,000 pounds per square foot. The estimated consolidation settlement is less than 1.0 inch.

No unusual construction problems are anticipated.

I INTRODUCTION

A letter of authorization was received from Mr. B. M. Ross's office on November 10th, 1964, to carry out a soil investigation at a site in the Township of Arthur, where it is proposed to replace an existing road bridge with a new structure.

It is understood that the new bridge will probably be a concrete rigid frame with a span of 40 feet and the south abutment will be located approximately 10 feet south of the existing south abutment.

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 was done during the period November the 13th to 18th, 1964, and consisted of two boreholes to a depth of 21 feet. The locations of the boreholes are shown on enclosure 2.

The progress of the drilling was expedited by the use of diamond coring techniques to penetrate very dense glacial deposits below El. 1473. Standard penetration tests were performed at frequent intervals of depth to determine the relative density or consistency of the soil and to recover representative samples. Dynamic cone penetration tests were performed adjacent to each borehole.

The results of the field tests are recorded on enclosure 3. Elevations have been referred to a Geodetic Bench Mark established by the client. (Low steel of existing bridge El. 1487.4).

III SUBSURFACE CONDITIONS

Details of the stratification at each borehole are shown on enclosure 3, and a general picture of the soil stratigraphy is given in the form of a subsurface profile on enclosure 2.

Both boreholes encountered a deposit of fill which is associated with the construction of the existing bridge. This material extends to a depth of about 9 feet and consists of a sandy silt containing traces of organics and gravel.

Natural soil was encountered at an average elevation of 1480 feet. This stratum is a sandy silt containing gravel, cobbles and boulders and increases in relative density from compact to very dense with depth.

IV GROUNDWATER CONDITIONS

Due to the impervious nature of the fill and the till a free standing water table was not disclosed. The water table may be assumed to be the same level as the water in the stream. (El. 1483.6 at the time of the field work).

V DISCUSSION

The general soil profile consists of about 9 feet of sandy silt fill overlying a stratum of sandy and clayey silt till which increases in relative density from compact to very dense with depth.

The bed of the stream extends to El. 1478.4 and allowing for scour it is recommended that the footing should bear at or below, El. 1474. This level lies within the very dense till stratum and on the basis of the field observations a maximum net soil pressure of 10,000 pounds per square foot is recommended for the design of footings. It is estimated that the settlement due to consolidation of the soil below a footing 4 feet wide loaded to 10,000 pounds per square foot will be less than 1 inch. In view of the very similar conditions at the two boreholes, no appreciable differential settlement is anticipated.

The coefficient of friction between the footings and the till should be taken as 0.35 and the factor of safety against horizontal sliding of the abutments should be at least 1.5.

Excavations into the upper layers of fill should be cut back at a slope at 1:1. The sides of excavation into the till stratum will stand almost vertically without support.

The permeability of the fill and till strata is very low and seepage into the excavation will easily be controlled by pumping from a sump.

Yours very truly

DOMINION SOIL INVESTIGATION LIMITED



C. J. W. Atkinson, M. Sc.
Project Engineer

CA/sg

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.

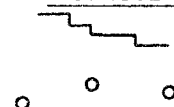
DYNAMIC PENETRATION RESISTANCE : to drive a 2" ϕ , 60° cone attached to the end of the drilling rods into the ground, expressed in blows per foot.

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 :



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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 consolidation
 m_v Coeff. of volume compressibility

k Coeff. of permeability
 C Shear strength
 ϕ Angle of int. friction
 C' Cohesion
 ϕ' Angle of int. friction

in terms of total stress
in terms of effective stress

UNDRAINED SHEAR STRENGTH.

— DERIVED FROM —

TRIAXIAL COMPRESSION TEST



UNCONFINED TEST



LABORATORY

VANE TEST



FIELD



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 :

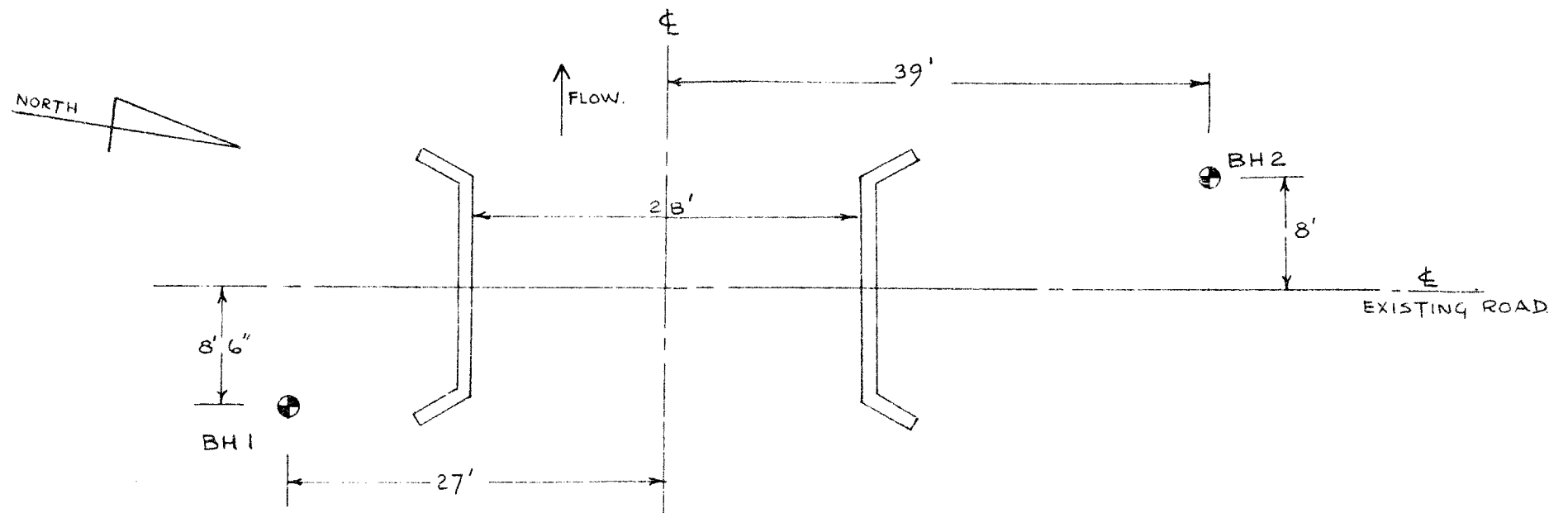
RD :

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

COHESIVE SOILS :

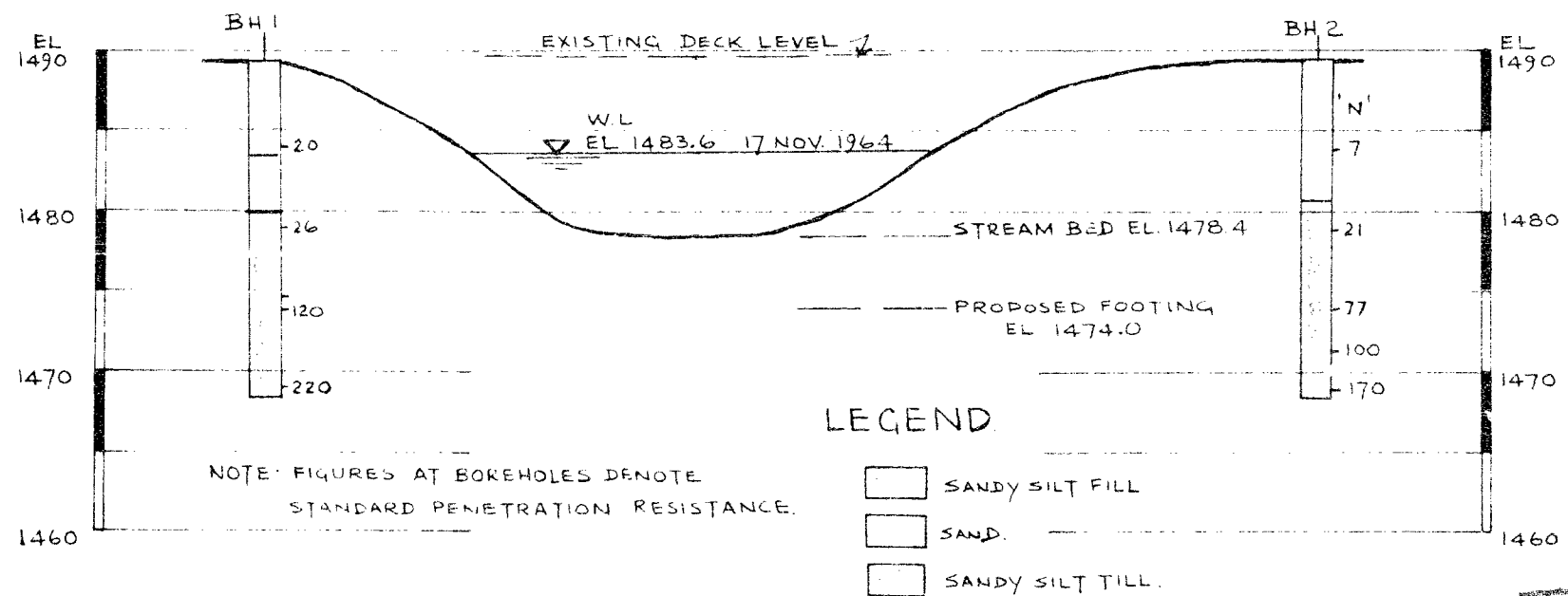
C lbs/sq ft.

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



LEGEND

- SANDY SILT FILL
- SAND
- SANDY SILT TILL

NOTE: FIGURES AT BOREHOLES DENOTE
STANDARD PENETRATION RESISTANCE.

SUBSURFACE PROFILE.

SCALE: 1 INCH TO 10 FEET

40P15-24
EXHIBIT No.

GEOTECHNICAL DATA SHEET FOR BOREHOLES 1 & 2.

QU. REFERENCE NO. 4-11-18

CLIENT: R. M. Ross

PROJECT: Bridge BR 120

LOCATION: Township of Arthur

DATUM ELEVATION: 1487.4 (low steel)

METHOD OF BORING: Washboring

DIAMETER OF BOREHOLE: 6-inches

DATE: 17th to 18th, November, 1964

ENCLOSURE NO. 3

ELEVATION ft	DEPTH ft	STRATIFICATION DESCRIPTION	STRATIFICATION SYMBOL	SAMPLES			PENETRATION RESISTANCE blows per foot		CONSISTENCY water content % PL W LI	REMARKS
				NUMBER	TYPE	N or Advancement of Sampler	SHEAR STRENGTH lbs. sq ft			
1489.3	0.0	Ground Surface								
1485	0.0	Brown sandy silt with cobbles & boulders (Fill)		1	SS	20				<u>Remarks</u> Extrapolated 'N' values: Sa #3 36/6" 60/6" Sa #5 45/6" 110/6"
1480	9.6	Compact gravelly sand								
1475	12.0	Grey sandy and clayey silt with some gravel (Fill)		2	SS	26				
1470	21.0	Very dense sandy silt with gravel cobbles and boulders (Fill)		3	SS	120				
1470	21.0	Very dense sandy silt with gravel cobbles and boulders (Fill)		4	Bxt					
		End of Borehole		5	SS	220				
1489.4	0.0	Ground Surface								
1485	0.6	Road Fill								<u>Remarks</u> Extrapolated 'N' values: Sa #4 50/6" 50/6" Sa #6 40/6" 85/6"
1480	9.0	Brown sandy & clayey silt with gravel & trace of organics (Fill)		1	SS	7				
1475	15.0	compact very dense		2	SS	21				
1470	21.0	Very dense sandy & clayey silt with gravel, cobbles & boulders (Fill)		3	SS	77				
1470	21.0	Very dense sandy & clayey silt with gravel, cobbles & boulders (Fill)		4	SS	100				
1470	21.0	Very dense sandy & clayey silt with gravel, cobbles & boulders (Fill)		5	Bxt					
		End of Borehole		6	SS	170				

VERTICAL SCALE: 1 IN. TO 5 FT

DOMINION SOIL INVESTIGATION LIMITED

MADE:

CH'D:

40P15-24
GEOCRE No.