65-F-289 M

BRIDGE

LOT 36, CON. IV

WEST ZORRA TWP.

LOT 10, CON. X

DOWNIE TWP.

BA 2013
25-209

MR. T.B. COLLINGS, P. ENG.
PERTH COUNTY ENGINEER
COUNTY BUILDINGS
STRATFORD ONTARIO

Report on

SOIL INVESTIGATION

for a

BRIDGE

LOT 36, CONCESSION IV

TOWNSHIP OF WEST ZORRA

&

LOT 10, CONCESSION X

TOWNSHIP OF DOWNIE

63-5-289M

by

DOMINION SOIL INVESTIGATION LIMITED
363 Queens Avenue
LONDON ONTARIO

Reference No. 5-1-L13
February 24th, 1965

CONTENTS

ENCLOSURES

SUMMARY

The strata consist of 4 feet 6 inches to 5 feet of fill and 3 feet 6 inches to 5 feet of flood-plain deposits overlying fine sand which increases in relative density from 'compact' to 'dense' with depth.

It is recommended that the structure should be supported on spread footings at or below El. 90.0 using a maximum net soil pressure of 6000 pounds per square foot. The total settlement will not exceed 1 inch and will occur immediately upon application of the load.

It will be necessary to control the ground water in excavations below the existing ground water table by means of well-point dewatering system.

I INTRODUCTION

Verbal authorization was received from Mr. T.B. Collings, P. Eng., Perth County Engineer, to carry out a soil investigation at a site where it is proposed to replace an existing road bridge with a new structure. The location of the site is bordered by Lot 36 Concession IV of the Township of West Zorra to the north, and by Lot 10 Concession X of the Township of Downie to the south.

The existing steel-beam structure has a span of 50 feet and it is understood that the new bridge will be a rigid frame structure with a span of about 45 feet. The centre of the new bridge will be located about 160 feet east of the existing bridge centre line.

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

Two boreholes were put down to a maximum depth of 26 feet 6 inches during the period February 10th and 11th, 1965. The holes were advanced by washboring methods and were lined with Bx casing.

Standard Penetration Tests using a 2" O.D. split-spoon sampler were performed at frequent intervals of depth to determine the relative density or consistency of the soil and to recover representative samples. The results are plotted as 'N' values on the Geotechnical Data Sheets for each borehole and are also recorded on the Subsurface Profile, Enclosure 2.

The locations of the boreholes are shown on the site plan Enclosure 2, and elevations have been referred to a Bench Mark established by the client, El. 99.16 (Nail in hydro pole at ch. 11 + 00, south side of road).

III SUBSURFACE CONDITIONS

Detailed descriptions of the strata encountered in each borehole are given on the data sheets comprising Enclosures 3 and 4, 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)	Fill, consisting of gravelly sand road sub-base overlying sand, gravel and silty clay.	4'6" to 5'-0"
(b)	Flood-plain deposits consisting of organic silt, fine sand and sandy gravel containing wood and organic material.	3'6" to 5'-0"
(c)	Fluvio-glacial deposits consisting of fine sand containing layers of gravel and cobbles. The relative density of these deposits increases from 'compact' to 'dense' with depth as estimated from Standard Penetration Test Results ranging from 19 to an extrapolated value of 132 blows per foot.	Penetrated 18'-0" in borehole 1

IV GROUNDWATER CONDITIONS

The level of the water in the river at the time of the field work was very high and was recorded at El. 100.9 feet. The water levels recorded in the boreholes after the drilling was completed were slightly lower and it can be assumed that these did not reach equilibrium.

Because of the 'medium' to 'high' permeability of the substrata it can be assumed that the ground water table is the same as the water level in the river at any particular time.

V DISCUSSION

The soil profile at the location of each abutment is generally similar and consists of 4 feet 6 inches to 5 feet of fill overlying compressible flood-plain deposits, 3 feet 6 inches to 5 feet in thickness. Underlying these deposits there is a stratum of compact to dense fine sand containing a layer of gravel and cobbles.

The bed of the stream extends to about El. 94.4 and allowing for scour it is recommended that footings should bear at El. 90.0 or lower depending on the results of hydrologic studies. This level lies within the stratum

of compact gravel and cobbles and on the basis of the borehole results a maximum net soil pressure of 6000 pounds per square foot would be appropriate for the design of the footings. It is estimated that the total settlement will not exceed 1 inch and in view of the very similar conditions at the two boreholes no appre ciable differential settlement is anticipated.

Construction of the footings will entail excavation below the ground water table in the sand stratum and to prevent 'sloughing in' of the sides and disturbance of the bottom of the excavation it will be necessary to lower the water table below El. 90 for this operation.

It is suggested that the well-point system be employed and that the lines of wells are spaced to allow for a 1 to 1 slope for the sides of the excavation.

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

Yours very truly,

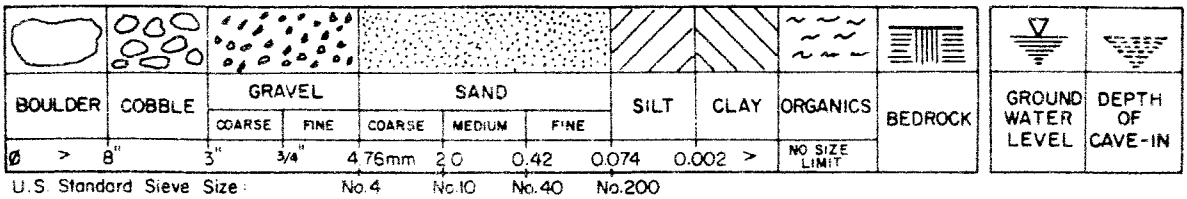
DOMINION SOIL INVESTIGATION LIMITED

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

CA/sg

LIST OF SYMBOLS, ABBREVIATIONS AND NOMENCLATURE.

SOIL COMPONENTS AND GROUND WATER CONDITIONS.



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.

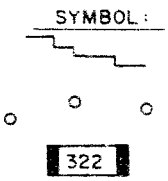
DYNAMIC PENETRATION RESISTANCE : to drive a 2"ϕ, 60° cone attached to the end of the drilling rods into the ground, expressed in blows per foot.

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 :



SOIL PROPERTIES.

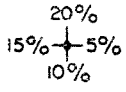
W %	Water content	γ	Natural bulk density (unit weight)	k	Coeff. of permeability
LL %	Liquid limit	e	Void ratio	C	Shear strength — in terms of total stress
PL %	Plastic limit	RD	Relative density	ϕ	Angle of int. friction — in terms of total stress
PI %	Plasticity index	C_v	Coeff. of consolidation	C'	Cohesion — 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 — UNCONFINED — LABORATORY VANE TEST — FIELD — POCKET PENETROMETER TEST

Strain at failure is represented by direction of stem



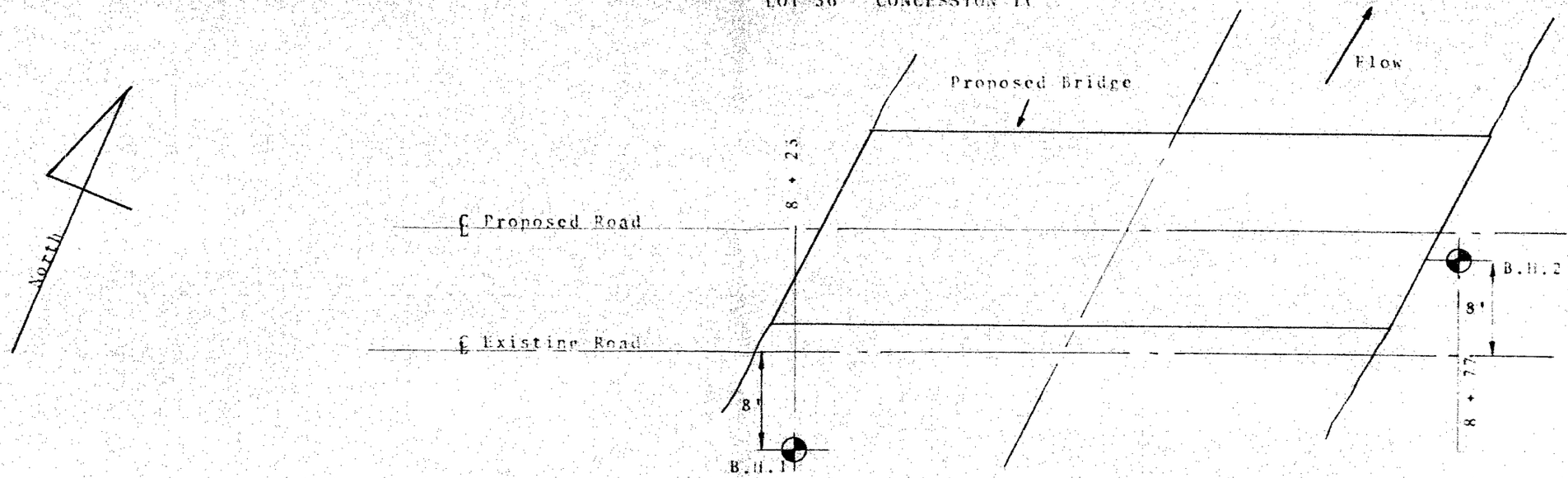
St : sensitivity = $\frac{\text{shear strength in undisturbed state}}{\text{shear strength in remoulded state}}$

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

TOWNSHIP OF WEST ZORRA

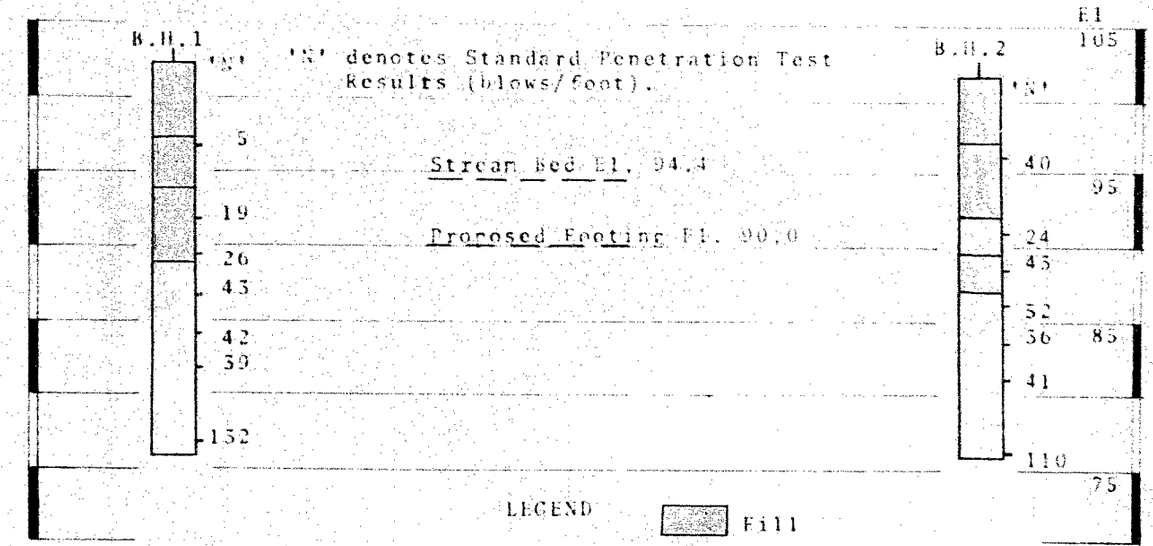
LOT 36 CONCESSION IV



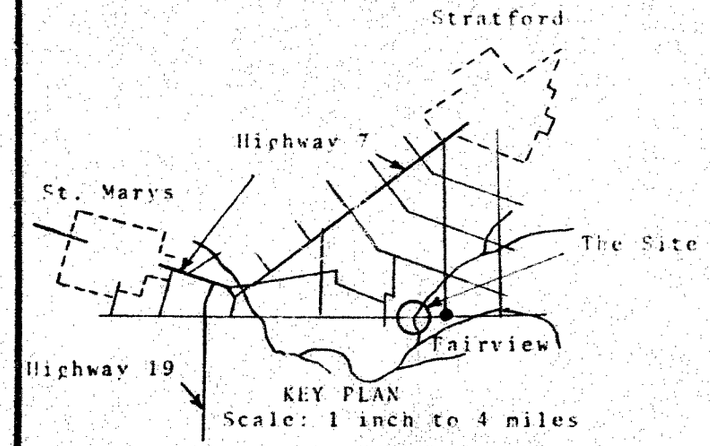
TOWNSHIP OF DOWNIE

LOT 10 CONCESSION 10

BOREHOLE LOCATION PLAN
Scale: 1 inch to 10 feet



SUBSURFACE PROFILE
Scale: 1 inch to 10 feet



DEFECTS IN NEGATIVE DUE TO
CONDITION OF ORIGINAL DOCUMENT

GEOTECHNICAL DATA SHEET FOR BOREHOLE . . 1 . . .

OUR REFERENCE NO. 5-1-113

CLIENT: Perth County
PROJECT: Bridge
LOCATION: Fairview, nr. Stratford
DATUM ELEVATION: 99.16 feet

METHOD OF BORING: Washboring
DIAMETER OF BOREHOLE: Bx (3-inch)
DATE: February 10th, 1965

ENCL. SOIL NO. 5

ELEVATION ft.	DEPTH ft.	STRATIFICATION DESCRIPTION	STRATIFICATION SYMBOL	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: N = No. of Advancements of Sampler	PENETRATION RESISTANCE: blows per foot (20 40 60 80 100) / SHEAR STRENGTH lbs/sq ft.	CONSISTENCY: Water content % (PL W LL)	REMARKS
102.4	0.0	Ground Surface							
	1.5	Gravel Fill							
100		Sand and silty clay Fill							
	5.0	Loose grey organic silt		1	SS	5			W.L. El. 98.4 0900 hours February 11th
	6.5	Grey fine sand							
95	7.3	Wood							
	8.5	Compact gravel & cobbles in matrix of brown sandy silt		2	SS	19			
90	13.5			3	SS	26			
				4	SS	43			Extrapolated 'N' Value
85		Dense grey fine sand, trace of silt and fine gravel		5	SS	42			Sa#7 42/6" 60/4"
				6	SS	39			
80									
	26.5			7	SS	132			
75		End of Borehole							

VERTICAL SCALE: 1 IN. TO 5 FT.

DOMINION SOIL INVESTIGATION LIMITED

MADE CHKD.

GEOTECHNICAL DATA SHEET FOR BOREHOLE 2

OUR REFERENCE NO. 5-1-113

CLIENT: Perth County
PROJECT: Bridge
LOCATION: Fairview, nr. Stratford
DATUM ELEVATION: 99.16 feet

METHOD OF BORING: Washboring
DIAMETER OF BOREHOLE: Bx (3-inch)
DATE: February 11th, 1965

ENCLOSURE NO. 4

ELEVATION ft.	DEPTH ft.	STRATIFICATION DESCRIPTION	STRATIFICATION SYMBOL	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES N — Blows per foot for Advancement of Sampler	PENETRATION RESISTANCE blows per foot 20 40 60 80 100 / SHEAR STRENGTH lbs/sq ft	CONSISTENCY water content % PL W LL	REMARKS
101.8	0.0	Ground Surface							
100		Gravelly sand Fill							
	2.8	Sand, gravel and silty clay Fill							
	4.5	organics		1	SS	40			
95	6.0	Sandy gravel with trace of silt							W.L., El. 94.6 1430 hours February 11th
	9.5	Compact brown fine sand, trace of silt		2	SS	24			
90	12.0	Dense gravel and cobbles with some brown silty sand		3	SS	43			
	14.5	Dense grey/brown well-graded sand some silt & gravel		4	SS	52			
85	17.0			5	SS	36			Extrapolated 'N' Values
		Dense grey/brown fine sand, trace of silt & fine gravel		6	SS	41			Sa #1 20/6" 100/1" (cobble)
80									Sa #7 55/6"
	26.0			7	SS	110			
75		End of Borehole							

VERTICAL SCALE: 1 IN. TO 5 FT.

DOMINION SOIL INVESTIGATION LIMITED

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