67-F-234M

ELGIN COUNTY BRIDGE #34

COUNTY ROAD #37

DOMINION SOIL INVESTIGATION LIMITED
77 CROCKFORD BOULEVARD - SCARBOROUGH ONTARIO CANADA - TELEPHONE 421-2567

BRANCH
369 QUEENS AVENUE
LONDON, ONTARIO
TELEPHONE GE. 3-3851

FOUNDATION ENGINEERS

ASSOCIATED COMPANY
SOIL TESTING AND ENGINEERING LTD.
34 BRENTFORD ROAD,
KINGSTON 5, JAMAICA, WEST INDIES
TELEPHONE: 62989

A.M. SPRIET AND ASSOCIATES LIMITED
CONSULTING ENGINEER'S
LONDON ONTARIO

67-F-234M

Report on

SOIL INVESTIGATION

for

ELGIN COUNTY BRIDGE NO. 34

COUNTY ROAD NO. 37

by
DOMINION SOIL INVESTIGATION LIMITED
369 Queens Avenue
LONDON ONTARIO

Reference No. 7-7-L11
August 29th, 1967.

CONTENTS. PAGE

ENCLOSURES NO.

SUMMARY

The two boreholes revealed the following general ground succession:- silt fill (9'-0" to 10'-0" thick); compact to dense silt (9'-0" to 11'-0" thick); and very stiff to hard clayey silt (maximum penetrated 17'-6").

It is recommended that the structure be supported on spread footing foundations at or below El. 48, using a maximum net soil pressure of 5000 p.s.f. Total settlement is estimated to be less than 1-inch.

Dewatering procedures are discussed in the report.

1 INTRODUCTION

In accordance with verbal authorization from A.M.Spriet & Associates, Consulting Engineers, a soil investigation has been carried out at a site in the County of Elgin where it is proposed to replace an existing road bridge with a new structure.

The existing structure is located on County Road No. 37, immediately to the east of the Town of Belmont, where the road crossed Kettle Creek.

It is understood that the new bridge will be relocated, and the proposed centre line is about 75 feet to the west of the centre line of the existing bridge. The requirements of the project were discussed with Mr. A.M. Spriet, P. Eng., who supplied the foregoing information.

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.

11 FIELD WORK

The field work, consisting of 2 boreholes, was carried out on August 4 & 8, 1967, at the locations shown on Enclosure 1. The holes were advanced to the sampling depths by washboring methods and were lined with Bx size casing.

Standard penetration tests were performed at frequent intervals of depth as detailed in Appendix 'A', and the results are recorded on the Geotechnical Data Sheets as 'N' values.

Dynamic cone penetration tests were performed adjacent to each borehole location to obtain an indication of soil density changes with depth. The same source of energy was used to drive the cone as was used for the standard penetration test.

Elevations were referred to a benchmark which was indicated by the client. (Nail in root of tree stump, 43' right of Sta. 15+65, El. 66.33 feet).

SUBSURFACE CONDITIONS.

Detailed descriptions of the strata encountered in each borehole are given on the Geotechnical Data Sheets, comprising Enclosures 2 and 3, and a general picture of the soil stratigraphy is presented in the form of a Subsurface Profile on Enclosure 1. The following notes are intended only to amplify this data.

Silt Fill

This material is associated with the construction of the existing road embankment. The relative density of the fill is described as 'loose' as estimated from 'N' values of 6 and 8 blows per foot.

Silt with traces of clay and fine sand.

This stratum was encountered at El. 53 in both boreholes and revealed a thickness of 11 and 9 feet at borehole 1 & 2 locations respectively. The relative density of the stratum is described as 'compact' to 'dense' as estimated from 'N' values ranging from 11 to 49 blows per foot.

A grain size analysis of the material is presented in the form of a distribution curve on Enclosure 4. This shows that the material contains 83% silt, 10% clay and 7% fine sand size particles.

Clayey silt containing layers of silty clay.

This stratum exhibits some cohesion therefore it should be regarded as a plastic material. The consistency is described as 'very stiff' to 'hard' as indicated by 'N' values ranging from 23 to 79 blows per foot.

GROUNDWATER CONDITIONS.

The water levels in the boreholes reached equilibrium at El. 52.3 and El. 49.9, which were lower than the prevailing water level in the adjacent creek. (El. 52.9).

For construction purposes it may be assumed that the groundwater table is the same as the water level in the creek at any particular time.

DISCUSSION.

The natural soil profile below the creek bed consists of a

compact to dense silt stratum overlying very stiff to hard clayey silt. Both strata are inherently capable of supporting spread footing foundations however special precautions must be taken to control the groundwater and to prevent disturbance during excavation for the footings.

The creek bed extends to El. 52.5, therefore allowing 4 feet of cover for frost protection, footings will be placed at or below El. 48. The material at this level is considered highly susceptible to scour therefore a hydrological study should be made before the final footing grade is established.

The recommended maximum net soil pressure for the design of footings placed at or below El. 48 is 5000 p.s.f. The settlement of footings mobilizing this pressure is estimated to be less than 1-inch.

The coefficient of friction between the footings and the silt material may be taken as 0.35 and the factor of safety against horizontal sliding of the abutment should be at least 1.5.

As mentioned above the major problem in constructing footings will be to control the groundwater and to prevent the silt material below the footing from being disturbed. This can be done by carrying out the excavation inside a sheet pile enclosure

which should penetrate to at least El. 40 to seal the bottom of the excavation. It is unlikely that timber sheeting can be driven to the required depth therefore steel sheet piling will be required. This may be left in place after completion of the footings as a positive method of scour protection.

Yours very truly,

DOMINION SOIL INVESTIGATION LIMITED.

C.J.W. Atkinson

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

REGISTERED PROFESSIONAL ENGINEER
C.J.W. ATKINSON
PROVINCE OF ONTARIO

CJWA:/jc

APPENDIX A

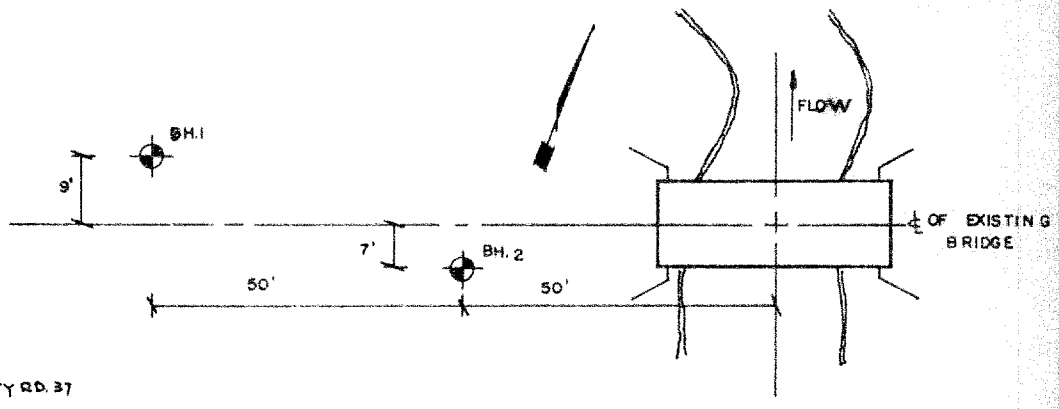
STANDARD PENETRATION TESTS

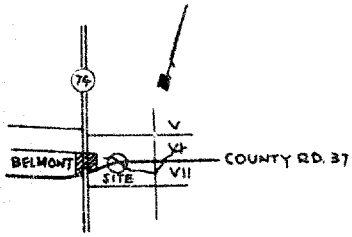
In order to determine the relative density of non-cohesive soils, such as sands and gravels, the standard penetration test has been adopted. The test also gives an indication of the consistency of cohesive soils.

A two-inch external diameter thick-walled sample tube is driven into the ground at the bottom of the borehole by means of a 140 lb. hammer falling freely through 30 in. The tube is first driven an initial 6 in. to allow for the presence of disturbed material at the bottom of the borehole. The number of standard blows (N) required to drive the sampler a further 12 in. is recorded. The sample tube used is one originally developed by the Raymond Concrete Pile Company in the United States, where a sufficient number of tests have been made in conjunction with field investigations to show that the results, although essentially empirical, may be applied to foundation design.

For sands:

Values of N	Density
Less than 10	Loose
Between 10 and 30	Compact
Between 30 and 50	Dense
Greater than 50	Very dense



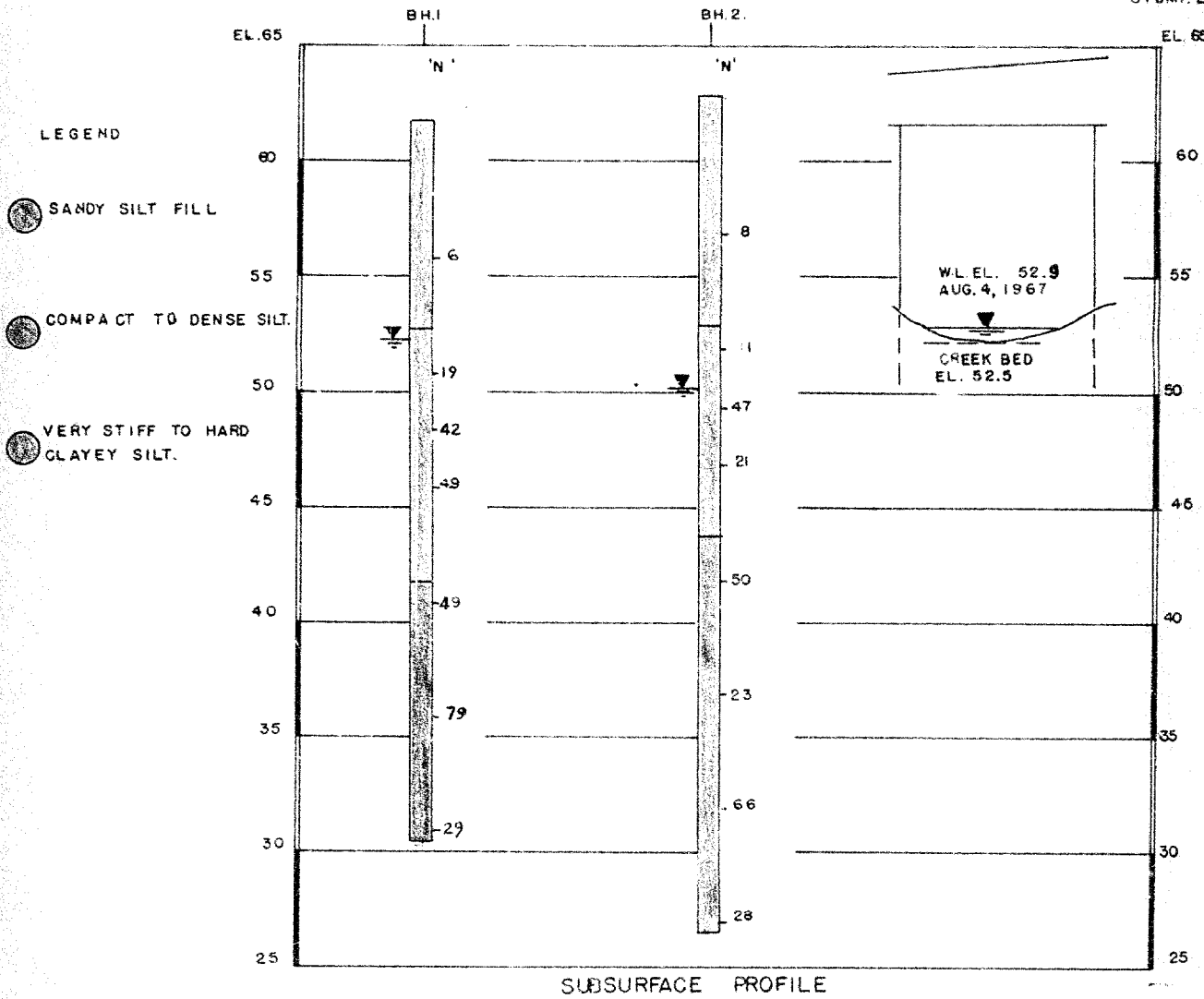


KEYPLAN

LOCATION OF BOREHOLES

SCALE 1" - 50'

●B.M. NAIL IN ROOT OF TREE STUMP. EL. 663.3



SUBSURFACE PROFILE

VERT. SCALE 1"- 5'

GEOTECHNICAL DATA SHEET FOR BOREHOLE 1

OUR REFERENCE NO. 7-7-L11

CLIENT: A.M. Spriet & Associates.
PROJECT: Bridge 34, County of Elgin,
LOCATION: Belmont.
DATUM ELEVATION: Nail in root of tree stump, El. 56.33 feet.

METHOD OF BORING: Washboring
DIAMETER OF BOREHOLE: Bx (3-inch)
DATE: August 4, 1967.

ENCLOSURE NO. 2

ELEVATION ft	DEPTH ft	STRATIFICATION DESCRIPTION	STRATIFICATION SYMBOL	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" Resistance to Penetration of Sampler	PENETRATION RESISTANCE Blows per foot 20 40 60 80 100	CONSISTENCY Water content % PL W LL	REMARKS
61.8	0.0	Ground Surface.							
60		Loose brown sandy silt (Fill)		1	SS	6	2" diameter cone.		
55	9.0	Compact to dense grey silt, traces of clay and fine sand.		2	SS	19			W.L. El. 52.3
50				3	SS	42			
45				4	SS	49			
40	20.0	Very stiff to hard grey clayey silt, layers of silty clay.		5	SS	49			
35				6	SS	79			
30	31.5			7	SS	29			

VERTICAL SCALE: 1 IN. TO 5 FT

DOMINION SOIL INVESTIGATION LIMITED

MADE CHD

GEOTECHNICAL DATA SHEET FOR BOREHOLE 2

OUR REFERENCE NO. 7-7-L11

CLIENT: A.M. Spriet & Associates.
PROJECT: Bridge 34, County of Elgin,
LOCATION: Belmont.
DATUM ELEVATION: Nail in root of tree stump, El. 66.33 feet.

METHOD OF BORING: Washboring
DIAMETER OF BOREHOLE: Bx (3-inch)
DATE: August 8, 1967.

ENCLOSURE NO. 3

ELEVATION ft.	DEPTH ft.	STRATIFICATION DESCRIPTION	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES N or Advancement of Sampler	REMARKS
62.9	0.0	Ground Surface.				
		Loose brown silt (Fill)	1	SS	8	2" diameter cone
	10.0	compact brown to grey dense silt, traces of clay and fine sand.	2	SS	11	
			3	SS	47	W.L. El. 49.9
			4	SS	21	
	19.0	Very stiff to hard grey clayey silt, layers of silty clay.	5	SS	50	
			6	SS	23	
			7	SS	66	
	36.5		8	SS	28	

PENETRATION RESISTANCE blows per foot: 20 40 60 80 100
SHEAR STRENGTH lbs. sq. ft.

CONSISTENCY water content %: PL W LL

VERTICAL SCALE: 1 IN. TO 5 FT.

DOMINION SOIL INVESTIGATION LIMITED

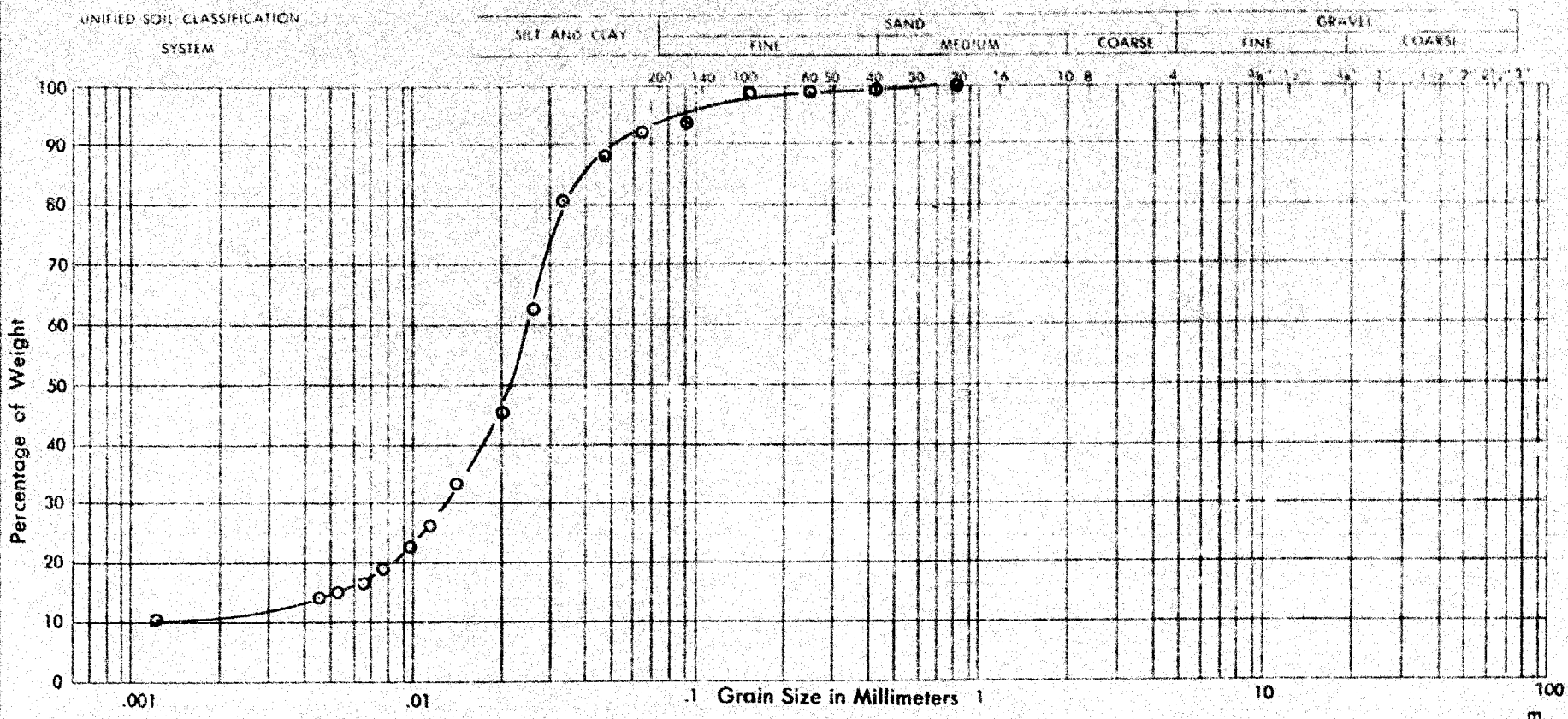
MADE

CH'D

DOMINION SOIL INVESTIGATION LIMITED

GRAIN SIZE DISTRIBUTION

OUR REFERENCE NO. 2-7-111



PROJECT: Bridge 34,
LOCATION: Belmont,
BOREHOLE NO.: 1
SAMPLE NO.: 4
DEPTH OF SAMPLE: 15 feet,
ELEVATION OF SAMPLE: 46 feet.

COEFFICIENT OF UNIFORMITY
COEFFICIENT OF CURVATURE

Classification of Sample and Group Symbol:
Silt with traces of clay
and fine sand.

PLASTIC PROPERTIES.

LIQUID LIMIT % =
PLASTIC LIMIT % =
PLASTICITY INDEX % =
MOISTURE CONTENT % =
ACTIVITY =

Enclosure No. 4