

DOCUMENT MICROFILMING IDENTIFICATION

GEOCRES No. 41 A - 127

W.P. No. _____

CONT. No. _____

W. O. No. _____

STR. SITE No. 2 - 394

HWY. No. _____

LOCATION Bf. 241

LOT 31, CON'S. 9 & 10

HURON TWP.

OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT. NONE

REMARKS: _____



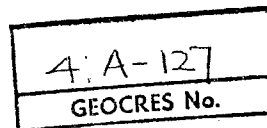
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KINGSTON 5, JAMAICA
WEST INDIES



Report on
SOIL INVESTIGATION
for
BRIDGE BR-241
LOT 31, CONCESSIONS 9 & 10
TOWNSHIP OF HURON.

by
DOMINION SOIL INVESTIGATION LIMITED
369 Queens Avenue
LONDON ONTARIO
Ref. No. 8-8-L7.

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SUMMARY

The two boreholes revealed a soil profile consisting of stiff to hard silty clay till which extends to a depth of at least 60 feet below the stream bed.

It is recommended that the structure be supported on a spread footing foundation at El. 702 using an allowable soil pressure of 2500 p.s.f., or alternatively, a timber pile foundation which will develop a working load of 20 tons per pile with an embedded length of 30 feet. Both types of structure are suitable to the soil conditions and the choice will depend on economy of construction and availability of materials.

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1. INTRODUCTION.

In accordance with verbal authorization from B. M. Ross & Associates Limited, Consulting Engineers, a soil investigation has been carried out in the Township of Huron where it is proposed to replace an existing road bridge with a new structure.

The existing steel-beam structure is located at Lot 31, Concessions 9 & 10 of the Township, where the road allowance crosses Oak Creek.

It is understood that the proposed structure has a span of 40 feet on a 30 degree skew, and that the centre line will be moved 21 feet to the east of the centre line of the existing bridge. The requirements of the project were discussed with Mr. K.G. Dunn, P. Eng., who supplied the foregoing information.

The purpose of the 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 15 and 16, 1968, at the locations shown on Enclosure 1. The holes were advanced 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 borehole logs as 'N' values.

Insitu vane shear tests were performed in cohesive strata to determine the undrained shear strength of the soil. The procedure followed in this test is outlined in Appendix 'B'.

Elevations were referred to the low steel of the existing bridge, which was indicated on the client's site plan as having a Geodetic Elevation 716.82 feet.

111. SUBSURFACE CONDITION.

Detailed descriptions of the strata encountered in each borehole are given on the borehole logs, 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.

Both boreholes penetrated a glacial silty clay stratum which contains less than 10 per cent of sand and gravel size particles. This stratum is the predominant soil type in the area and is commonly referred to as 'Glacial Till'. The vane shear tests gave values of the undrained shear

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strength ranging from 980 to 3300 p.s.f., indicating that the consistency varies from 'stiff' to 'hard'. These values were confirmed by 'N' values ranging from 9 to 133 blows per foot.

Atterberg Limit tests were performed on 3 samples of the clay till and moisture content tests on 11 samples as a means of classification and as a guide to the probable behaviour of the soil. These gave values of Liquid Limit ranging from 26% to 27%, Plastic Limit from 12% to 15%, and Plasticity Index from 12 to 14 indicating that the soil has a low plasticity and compressibility. The Liquidity Indices which relate the natural moisture content to the Atterberg Limits ranged from zero to 0.36, indicating a stiff to very stiff consistency.

IV. GROUNDWATER CONDITIONS.

Due to the impervious nature of the subsoil, it was not possible to obtain a true level of the groundwater table in an open borehole. However, from a visual inspection of the soil samples, it may be assumed that the groundwater table approaches close to the ground surface during the wet season and reaches a lower level at El. 705 during summer periods.

V. DISCUSSION & RECOMMENDATIONS.

The natural soil profile consists of silty clay which extends to the limit of the boreholes at a depth of about 60 feet below the stream bed. The shear strength of the till generally increases with depth and the consistency is described as 'stiff' to 'hard'.

The stream bed extends down to El.706.54, therefore the footing grade normally would be established at about El.702. At borehole 2 location, the undrained shear strength of the soil immediately below this level is in the range of 1000 to 1200 p.s.f., therefore the allowable soil pressure which may be used to design spread footings is 2500 p.s.f. Total settlement of footings mobilizing this soil pressure is estimated to be 1 inch.

Footings designed to the above value may be large and uneconomical to construct, therefore consideration should also be given to the use of a piled foundation.

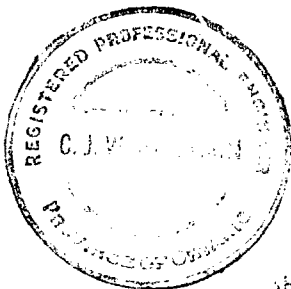
Piled Foundation.

The piles will develop the greater part of their capacity from skin friction, therefore it would appear that timber piles will be the most suitable.

The skin friction developed by a nominal 12 inch diameter timber pile, 30 feet in length, will be 40 tons. A factor of safety of 2 or 2.5 is usually applied in the design of piles, and as the end bearing component has been ignored due to variations in the tip diameter of timber piles the factor of safety may be taken conservatively as 2. The 40 ton load is therefore the ultimate capacity of the pile and the corresponding working load will be 20 tons.

The foregoing estimates of length and bearing capacity are only theoretical predictions, therefore in practice the piles should be driven to a satisfactory set in accordance with an accepted pile driving formula, such as the Hiley Formula.

It is estimated that consolidation settlement of a structure supported on a timber foundation will be about 0.5 inch.



Yours very truly,

DOMINION SOIL INVESTIGATION LIMITED.

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

CJWA/mm.

APPENDIX 'A'.

THE STANDARD PENETRATION TEST.

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-inches 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 is one originally developed by 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

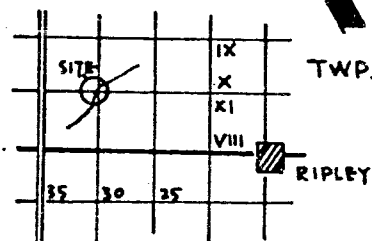
APPENDIX B

INSITU VANE SHEAR TEST

In soft to stiff clays, and particularly sensitive clay soils such as frequently occur in alluvial deposits, it is difficult to obtain reasonable undisturbed samples for the determination of the undrained shear strength. In order to overcome this difficulty, the vane test was developed as an in-situ method of measuring the shear strength.

The apparatus consists of a 4-inch long by 2-inch wide rectangular 4-bladed rotating vane attached to a thin rod, which is pushed into the undisturbed soil below the bottom of the borehole to the depth at which the test is to be made.

A torque is then applied to the vane and the maximum torque when failure occurs is recorded. The vane is then rotated 10 times to remould the soil and after one minute the torque test is repeated. The shear strength of the soil can then be calculated from the torque and the dimensions of the vane, and the sensitivity of the material estimated from the ratio of the original torque to the final torque after remoulding.



(21) KEY PLAN

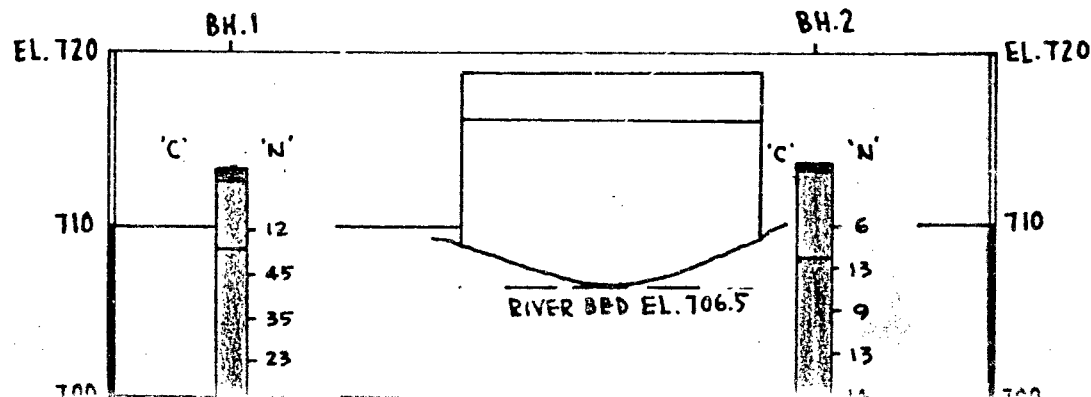
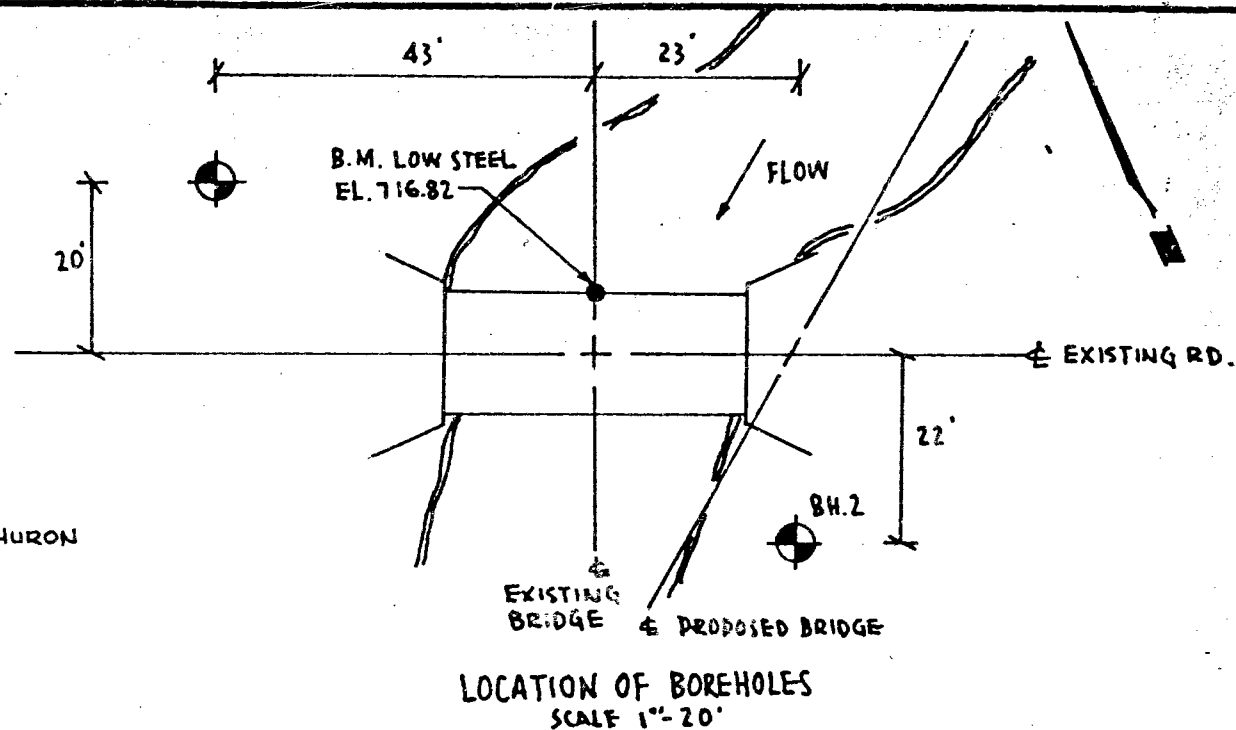
LEGEND



TOPSOIL



SANDY SILT, FILL





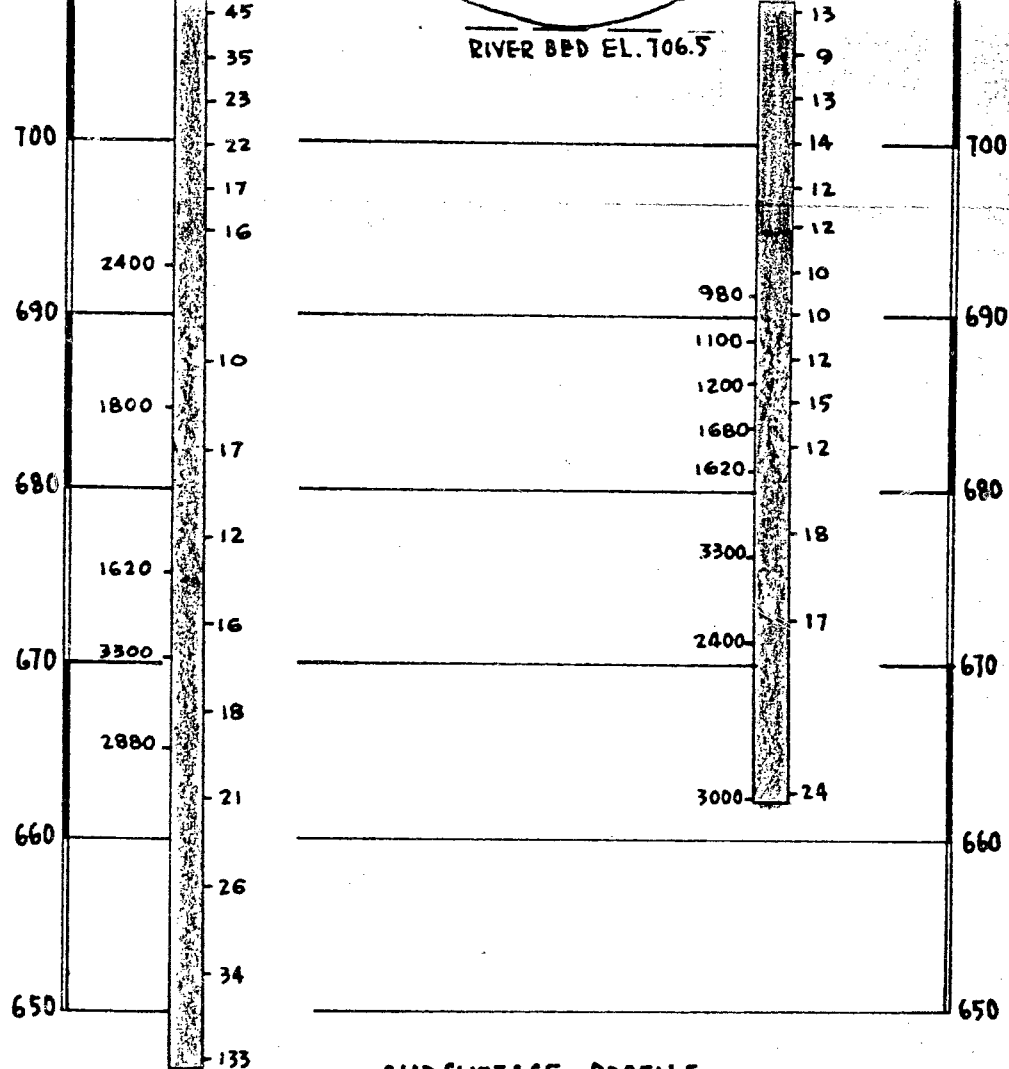
SANDY SILT, FILL



STIFF TO HARD
SILTY CLAY, TILL

'C'

SHEAR STRENGTH
IN PSF



LOG OF BOREHOLE..1.....

Our Reference N^o 8-8-L7.

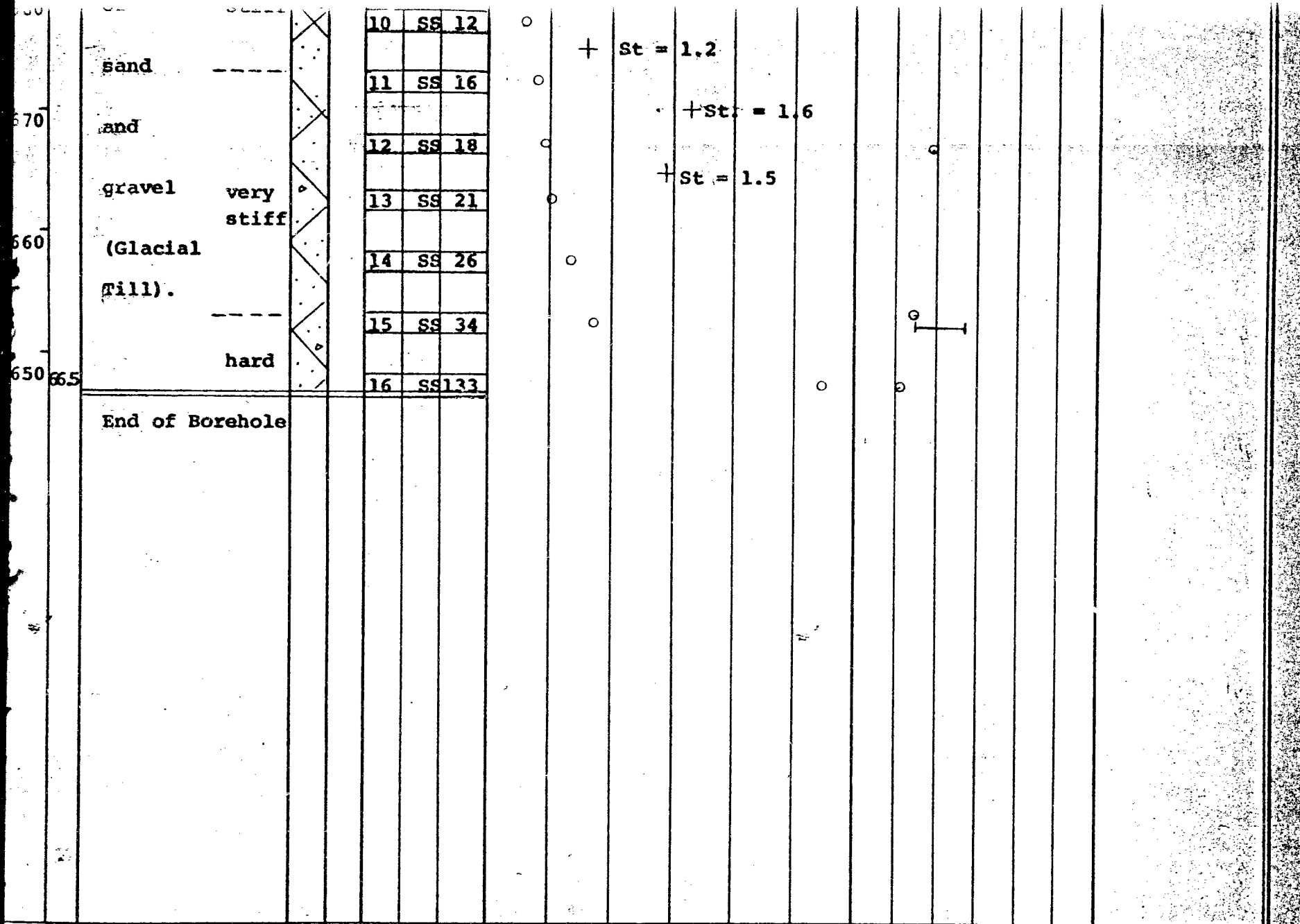
Enclosure No. 2.

CLIENT: B.M. Ross & Associates Ltd.,
PROJECT: Bridge No. BR-241.
LOCATION: Lot 31 Conc. 10-11, Twp of Huron,
DATUM ELEVATION: low steel, El. 716.82

DRILLING DATA

Method: Washboring.
Diameter: Bx(3-inch)
Date: August 15&16, 1968.

SUBSURFACE PROFILE				SAMPLES			PENETRATION RESISTANCE Blows / Foot					WATER CONTENT %			REMARKS	
ELEVATION Ft.	DEPTH Ft.	DESCRIPTION	SYMBOL	GROUND WATER	NUMBER	TYPE	'N' Blows / Foot	20	40	60	80	100	PLASTIC LIMIT	NATURAL		LIQUID LIMIT
								UNDRAINED SHEAR STRENGTH 100 lbs/sq.ft. + FIELD VANE TEST • COMPRESSION TEST					W _p	W		W _L
								10	20	30	40	50				
732.00		Ground Surface.														
		7" Topsoil.														
710	4.5	Sandy silt (Fill)			1	SS	12	○								
					2	SS	45			○						
		brown grey.			3	SS	35			○						
					4	SS	23			○						
700		Silty			5	SS	22			○						
					6	SS	17			○						
		clay			7	SS	16			○						
		very stiff								+	St. = 1.5.					
690		containing			8	SS	10			○						
		traces								+	St = 1.5					
					9	SS	17			○						
		of														
680		stiff			10	SS	12			○						
										+	St = 1.2					
		sand			11	SS	16			○						

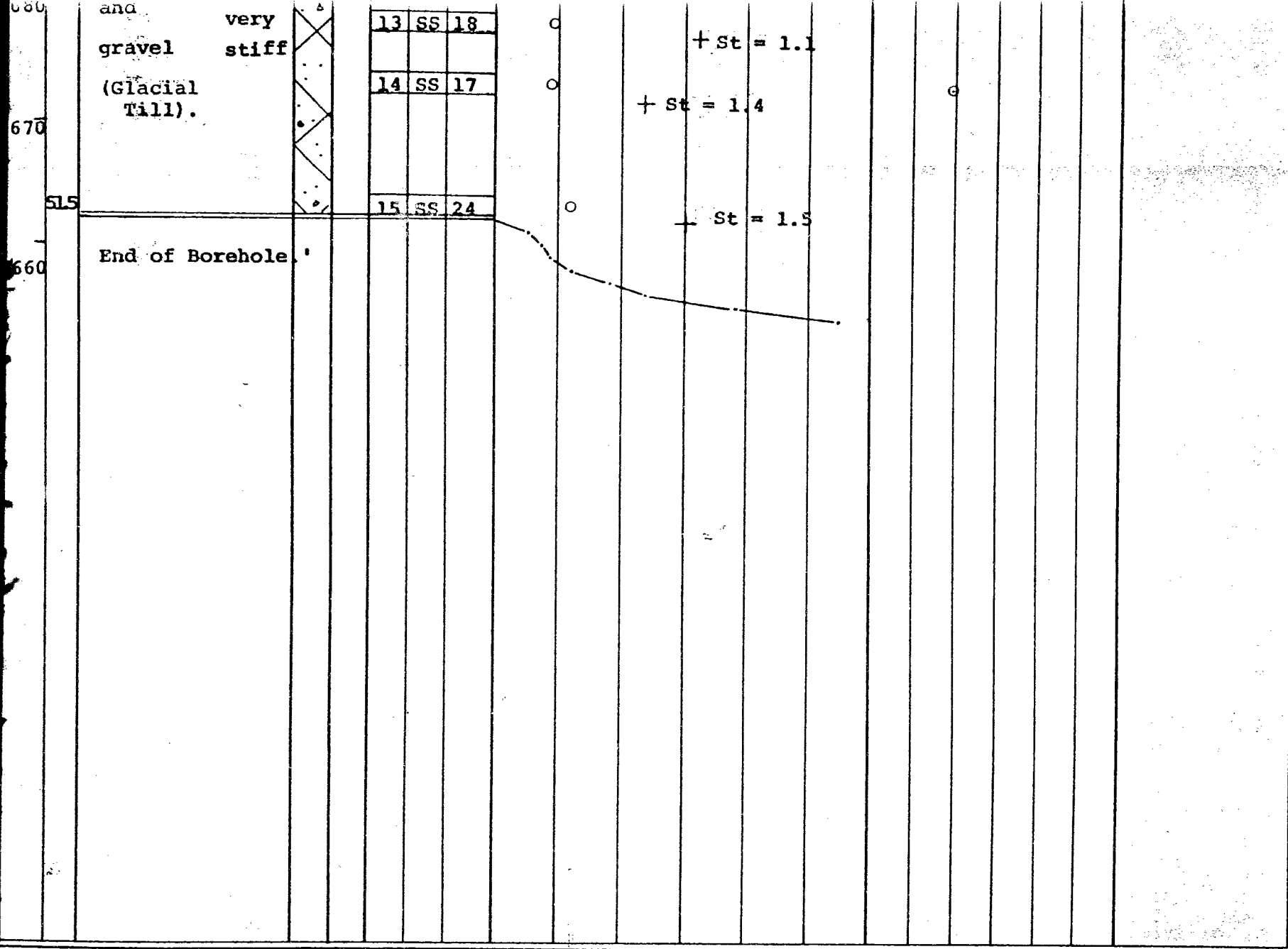


VERTICAL SCALE: 1 inch to 10 feet

DOMINION SOIL INVESTIGATION LIMITED

MADE:

CHECKED:



VERTICAL SCALE: 1 inch to 10 feet

DOMINION SOIL INVESTIGATION LIMITED

MADE:

CHECKED: