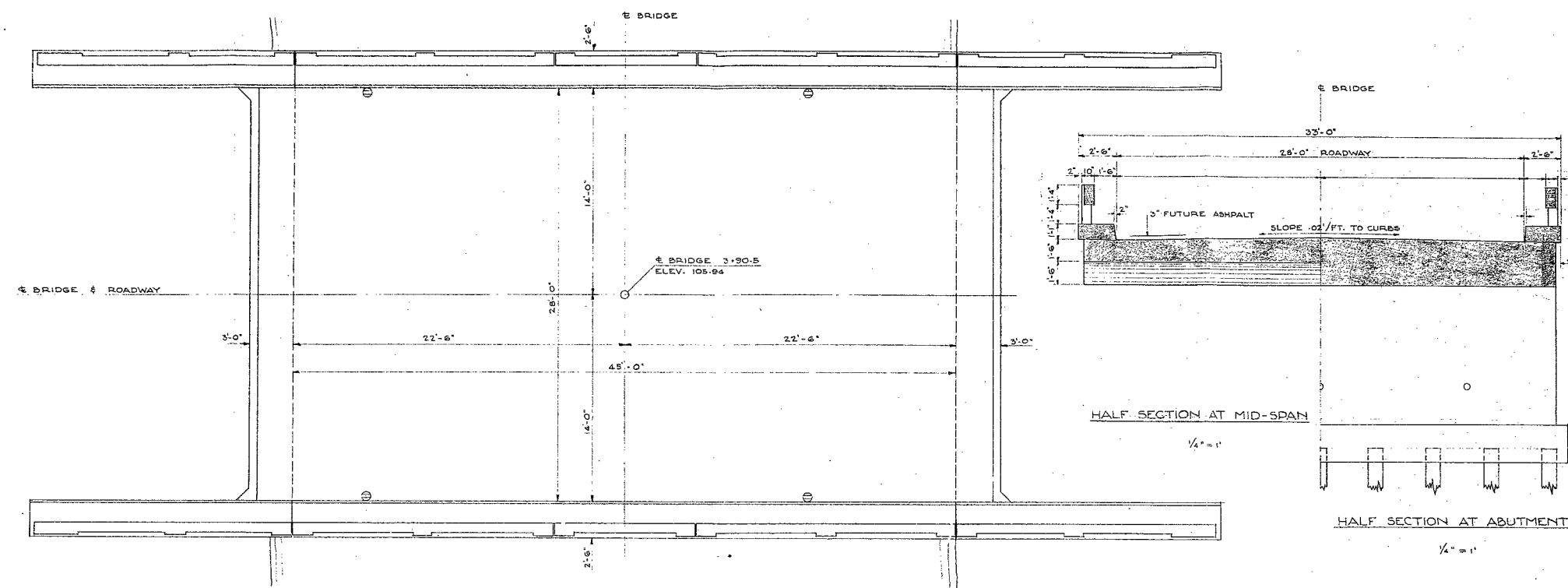


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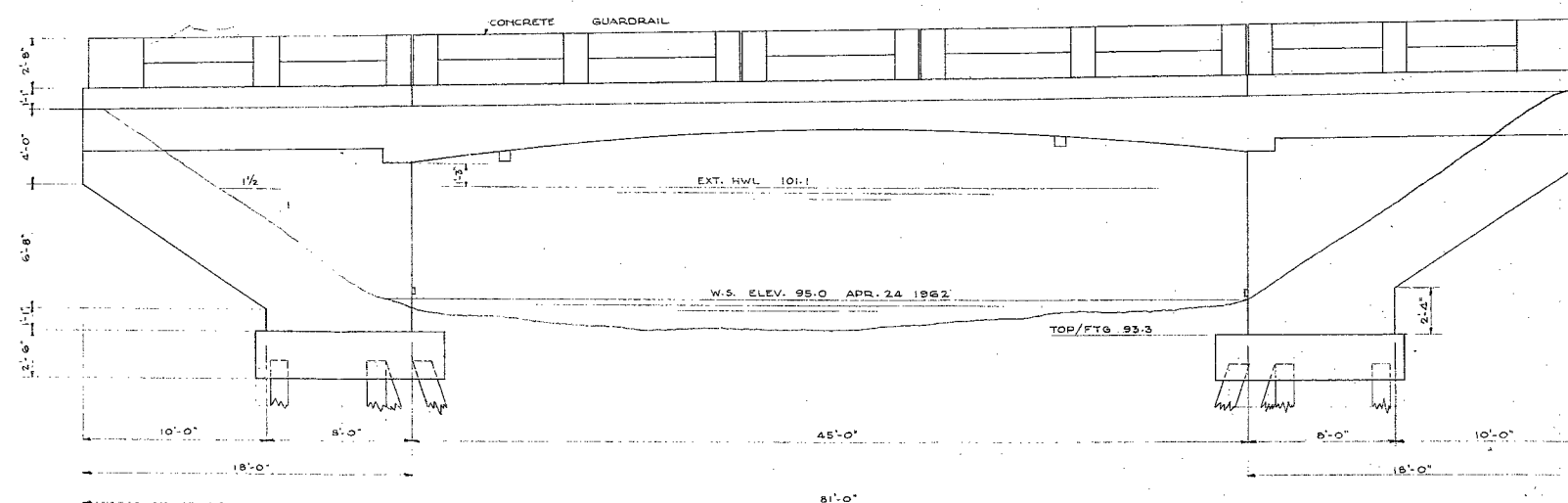
SOUTH RATHO BRIDGE

BLANDFORD TWP.

OXFORD CTY.



DECK PLAN
1/4" = 1'



WEST ELEVATION
1/4" = 1'



SOUTH RATHO BRIDGE		DESIGNED BY	V.R.A.
LOT 647 CONCESSION XI		DRAWN BY	V.R.A.
COUNTY OF OXFORD		CHECKED BY	V.R.A.
TOWNSHIP OF BLANDFORD		DATE	MAY 1/82
GENERAL ARRANGEMENT		JOB #1	16
V.R. ASTROP		DWG #1	2
CONSULTING ENGINEER			

BA 1551

STRUCTURE SITE No. 2A-30

MR. V.R. ASTROP
CONSULTING ENGINEER
4 Hughson Street South
HAMILTON ONTARIO

62 F 3-84

Report on
SOIL INVESTIGATION
for
SOUTH RATHO BRIDGE
TOWNSHIP OF BLANDFORD
COUNTY OF OXFORD

by
DOMINION SOIL INVESTIGATION LIMITED
363 Queens Avenue
LONDON ONTARIO

Reference No. 2-10-L4

October 1962

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INTRODUCTION

In accordance with a letter of authorization dated October 26th, 1962 from Mr. V.R. Astrop, a soil investigation has been carried out at a site in the Township of Blandford where it is proposed to replace an existing road bridge with a new structure.

It is understood that the new bridge will be of approximately the same span and in the same position as the existing one. The number and location of the boreholes were specified on a drawing (No. 1) which accompanied the letter of authorization.

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

I DESCRIPTION OF SITE AND GEOLOGY

The site lies in a shallow valley one-half mile to the south of the Village of Ratho, at a point where a township road crosses Horner Creek. The area is part of the Oxford Till Plain, a flat region covering the northern part of the county where the subsoil consists, in general, of heavily preconsolidated glacial tills. The region is drained by several small creeks which flow southwards to join the major rivers.

II FIELD WORK

Field work was carried out during the period 29th to 31st of October 1962 and consisted of 2 boreholes at the locations shown on enclosure 2. These were as close as practicable to the locations shown on the client's drawing. The holes were advanced by washboring and lined with Bx casing.

Standard Penetration tests were made at frequent intervals using a 2-inch diameter O.D. split spoon. These tests provided disturbed samples of the strata and gave a measure of their relative density or consistency. Dynamic cone penetration tests were performed adjacent to each borehole to provide a continuous record of soil density in the upper strata. One vane shear test was performed in borehole 1, but because of the presence of granular particles the results are of doubtful value.

The results of the field tests are recorded on geotechnical data sheets comprising enclosures 3 and 4. Elevations have been referred to the level of the deck of the existing bridge which is taken as El. 103.5 feet.

III SUBSURFACE CONDITIONS

Details of the stratification at each borehole appear on the data sheets, and a general picture is provided by the subsurface profile shown on enclosure 2. The following strata were encountered:

- (a) At borehole 1 only, the upper 10 feet of soil is a soft unconsolidated deposit of clay mixed with organics, sand and silt.
- (b) At borehole 2 only, the upper 7'6" of soil is a very stiff grey silty clay.

- (c) In both boreholes, a grey silty clay till containing 5 to 10% of gravel was found below the strata described above. This layer is much harder at borehole 2 than at borehole 1.
- (d) Both boreholes were terminated in a hard grey clayey silt till. This layer contains approximately 10% of gravel near the top, decreasing to 1 or 2% at the level where the holes were terminated.

A layer of water-bearing sand was found near El. 75 in the lower till stratum at borehole 1 only. When this layer was encountered, water rose within the casing to a height of 5 feet above ground level, indicating an excess head of 8.4 feet of water at that point. A static water level was recorded in borehole 2, after the completion of boring, corresponding to the level of the water in the creek, i.e. El. 94.3 feet.

IV FOUNDATIONS

In considering the most suitable type of foundation, it is noted that the soil conditions in the upper 20 feet are quite different at the two boreholes. The capacity of the soil to support spread footings has been evaluated on the basis of the field penetration tests, and the following values are considered suitable for design.

Elevation (feet)	<u>Maximum Gross Soil Pressure (p.s.f.)</u>	
	Borehole 1	Borehole 2
88	-	8000
87	2000	"
86	"	"
85	3000	"
84	"	"
83	"	10,000
82	"	"
81	"	"
80	10,000	"

Without making a much larger number of borings, it is not known over what area the conditions found in the two boreholes are representative. Footings should therefore be designed for the lower of the two figures given for any elevation. For a design pressure of 3000 p.s.f. it will be necessary to locate the footings at El. 85 feet, or 8 feet below the bed of the creek. For this soil pressure, assuming it is sufficient for the designed loading, the footings would be large, and there would be a possibility of differential settlement. A freely-supported structure would thus be preferable to a rigid frame.

Alternatively, footings could be supported at El. 80 feet, using a soil pressure of 10,000 p.s.f., but this would require an excavation 13 feet below the bed of the creek, and the use of considerably more material.

In view of the foregoing remarks, it is felt that the use of short timber piles will provide a solution which is cheaper and, technically, more satisfactory. Piles of 20-ton working load driven in accordance with the Hiley formula are expected to reach a satisfactory set at the following levels:

Borehole 1	Between Els. 75 and 80
Borehole 2	Between Els. 80 and 85

V CONSTRUCTION

If spread footings are used it will probably be necessary to brace the excavation with sheet piling in the vicinity of borehole 1 to restrain the soft unconsolidated clay deposit in that region. At borehole 2, no such difficulty is anticipated.

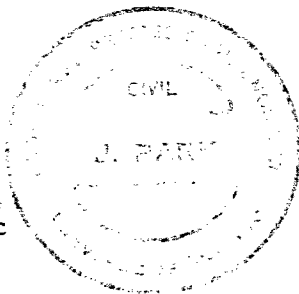
VI SUMMARY

1. The soil conditions at the two boreholes are quite different in the upper 20 feet. In borehole 1 organic material extends to 10 feet, and thereafter a gradual stiffening occurs. At borehole 2 the bearing capacity of the soil is high almost from the ground surface.
2. The foregoing conditions necessitate either very deep footings or very low soil pressures. If footings are located at a level higher than El. 80, a freely-supported structure should be used to accommodate possible differential settlement.

3. The use of short timber piles is proposed as a more satisfactory and probably cheaper solution.

VII REFERENCES

1. The Physiography of Southern Ontario by L.J. Chapman and D.F. Putman of the Ontario Research Foundation, University of Toronto Press, 1951.
2. Procedures for Testing Soils, ASTM, April 1958, pp. 186 to 198 (Unified Soil Classification System, by A.A. Wagner), London.
3. Terzaghi and Peck. Soil Mechanics in Engineering Practice, John Wiley and Sons, New York, 1948.



Encl.
JP/mc

DOMINION SOIL INVESTIGATION LIMITED

James Park, M.Sc., P.Eng.

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	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 :



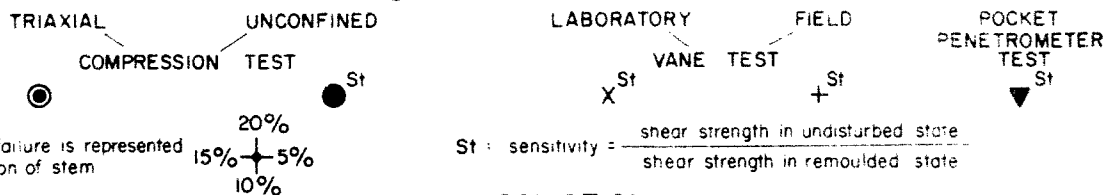
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SOIL PROPERTIES.

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

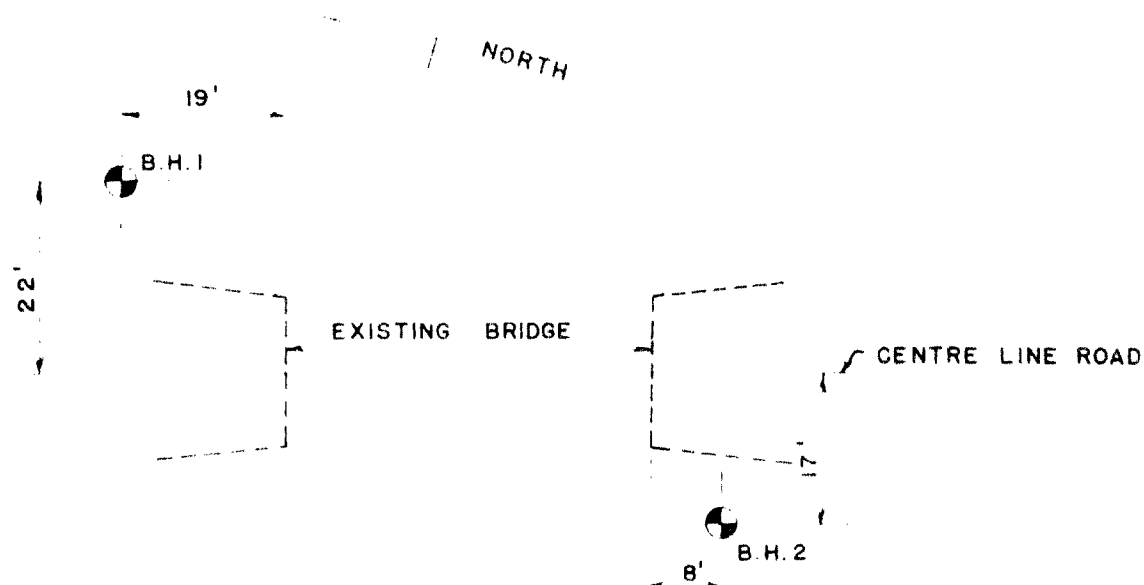
UNDRAINED SHEAR STRENGTH.

— DERIVED FROM —

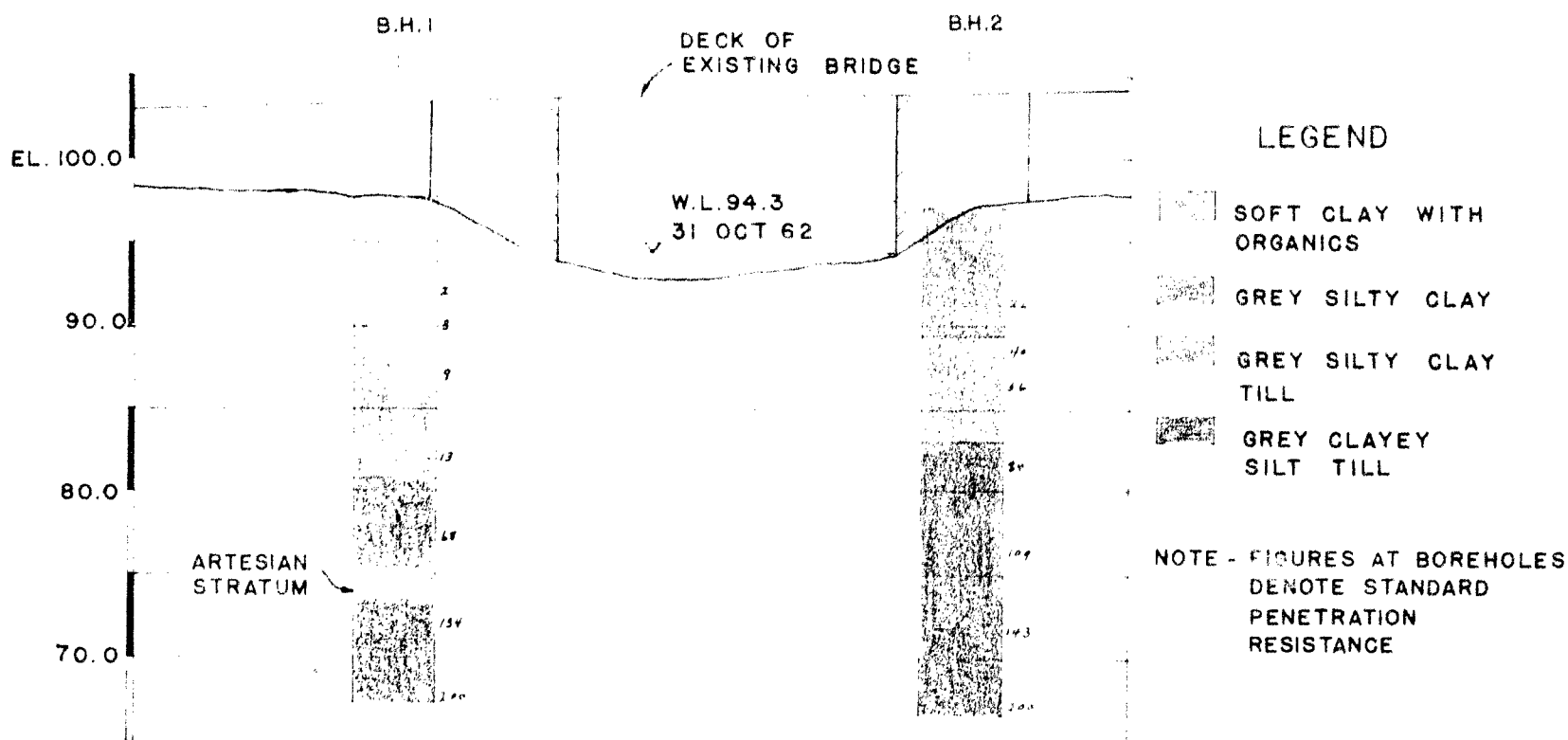


SOIL DESCRIPTION.

COHESIONLESS SOILS :	RD :	COHESIVE SOILS :	C (lb./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



LOCATION OF BOREHOLES
 SCALE - 1 INCH TO 20 FEET



SUBSURFACE PROFILE (LOOKING EAST)
 SCALES - HORIZ. 1 INCH TO 20 FEET
 VERT. 1 INCH TO 10 FEET

OUR REFERENCE NO. 2-10-L4

GEOTECHNICAL DATA SHEET FOR BOREHOLE ...1...

CLIENT: Mr. V.B. Astor

PROJECT: South Rafter Bridge

LOCATION: Township of Blandford

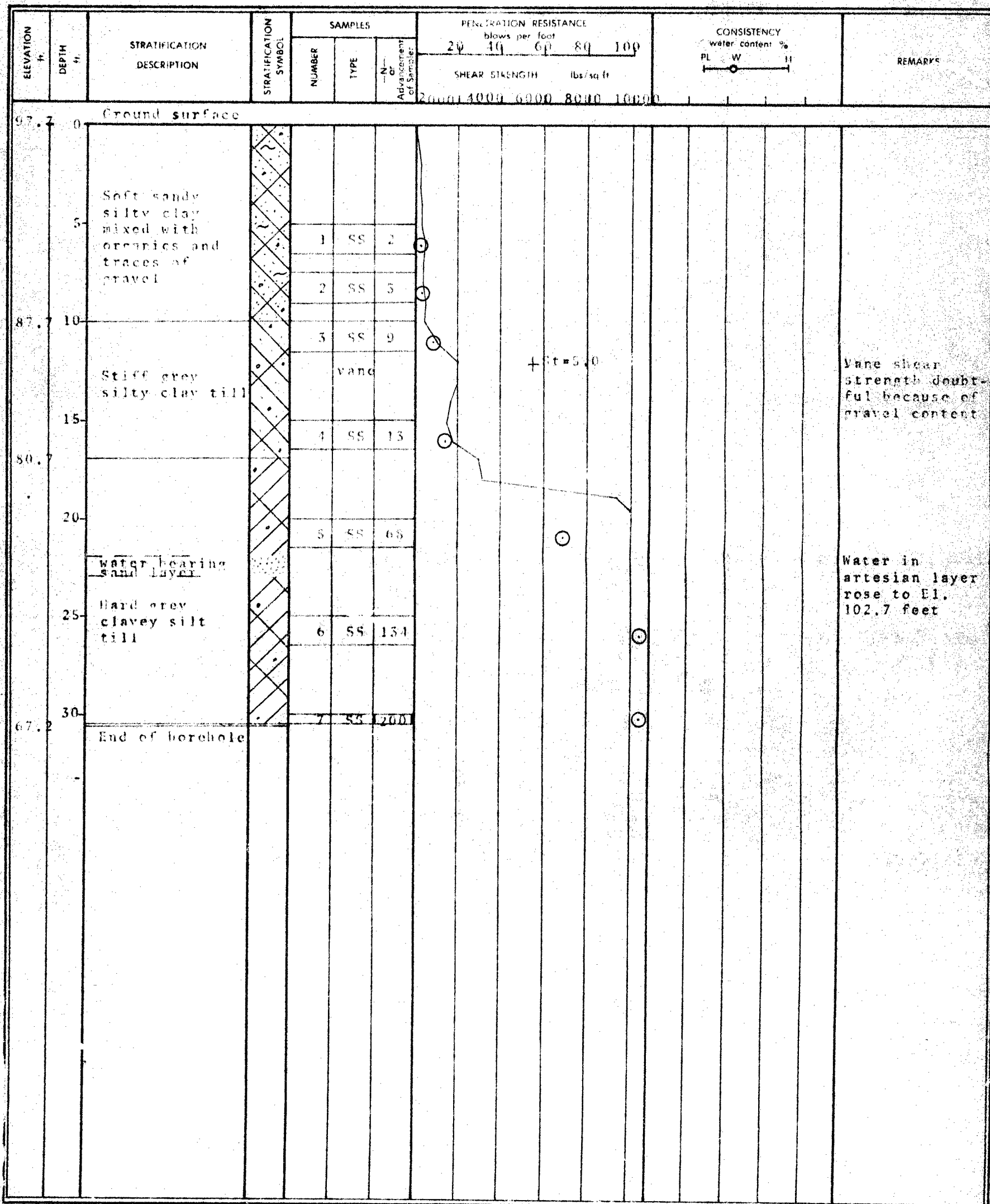
DATUM ELEVATION: Existing bridge deck 103.5 feet

METHOD OF BORING: Washboring

DIAMETER OF BOREHOLE: 8x (2-7/8")

ENCLOSURE NO. 3

DATE: 29 and 30 October 1962



VERTICAL SCALE: 1 IN TO 5 FT.

DOMINION SOIL INVESTIGATION LIMITED

MADE: MC

CHD: JP

GEOTECHNICAL DATA SHEET FOR BOREHOLE . . 2 . . .

ODP REFERENCE NO 2-10-14

CLIENT: Mr. V.P. Astor
 PROJECT: South Batho Bridge
 LOCATION: Township of Blandford
 DATUM ELEVATION: Existing bridge deck 103.5 feet

METHOD OF BORING: Wash boring
 DIAMETER OF BOREHOLE: 8x (2-7/8")
 DATE: 31 October 1962

ENCLOSURE NO. 4

ELEVATION ft	DEPTH ft	STRATIFICATION DESCRIPTION	STRATIFICATION SYMBOL	SAMPLES			PENETRATION RESISTANCE blows per foot					CONSISTENCY water content %			REMARKS
				NUMBER	TYPE	N or Advance-1 of Sampler	20	40	60	80	100	PL	W	LI	
97.0	0	Ground surface													
	5	Very stiff grey silty clay		1	SS	22									
94.5	10	Hard grey silty clay till		2	SS	40									
				3	SS	56									
83.0	15			4	SS	84									
	20	Hard grey clayey silt till		5	SS	109									
	25			6	SS	143									
66.5	30	End of borehole		7	SS	200									

VERTICAL SCALE: 1 IN TO 5 FT

DOMINION SOIL INVESTIGATION LIMITED

MADE: MC CHD: TP